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Development of Digital TV in Europe

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1 Digital TV market overview

1.1 Roll-out of digital services

The number of digital TV households in Denmark in July 1999 was 70.000 (3% of Danish TV households). The figure is not as high as expected but it indicates that digital TV is now part of the Danish media landscape.

- ✓ **Digital Satellite TV:** Started in Denmark in autumn 1998[1] with the provision of Canal Digital's digital satellite service.
- ✓ **Digital Cable TV:** Started in Denmark with the launch of Tele Danmark's digital cable TV service in spring 1998. STOFA, the other cable TV operator in Denmark started its digital services in late 1998.
- ✓ **Terrestrial digital TV:** Is not available in Denmark yet, but a digital TV pilot started in November 1999.

1.1.1 Satellite digital services

There are 470.000 DTH households in Denmark (19,7% of Danish TV households) and the number of households who subscribes to satellite services is 300.000 (12,6% of Danish TV households). The digital share of the DTH market in July 1999 is about 20.000 (0,08% of Danish TV households)[2].

The only digital satellite service-provider in Denmark is still Canal Digital. To avoid piracy, Canal Digital turned off the analogue distribution of its main premium pay-TV channel, Canal+ in February 1999, and offered free digital set-top-boxes to its 15.000 subscribers for a one-year period. The only precondition was that the subscribers agreed to continue the subscription to Canal+ in 1999. Apart from foreign services, the Danish Public Service channels DR1 / DR2 and the Danish advertising channel TVDanmark are available on Canal Digital's digital platform.

VIASAT, the other satellite TV service provider continues to provide TV services in analogue standard only and has no official plans for digitalisation of its services.

The two popular Danish TV channels TV2 and TV3 are not yet available in digital standard. TV2 is a public service channel, partly funded by licence fees and partly by advertising. It is a terrestrial countrywide channel and is not even available on the analogue satellite market. TV3 and TV3+ are foreign advertising channels[3] transmitted in Danish and targeted towards Danish people. TV3 and TV3+ are available on the analogue satellite market provided by VIASAT and also on the analogue cable market.

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[1] Canal Digital started transmission and marketing of their new digital services in June 1998, but the provision of services started first in October 1998

[2] According to Canal Digital Denmark, the total number of Canal Digital's digital-DTH-subscribers in all Nordic countries has been 62.000 at the end of July 1999.

[3] They are transmittet from London under British legislation.

1.1.1 Cable digital services

In 1998 1,7 million TV households were passed by cable (71,4% of Danish TV households) of which 1,3 millions subscribe to a multi-channel offer (54,6% of Danish TV households).

Tele Danmark Cable TV is the major digital cable TV provider. Tele Danmark Cable TV has already digitised its total network of 1,1 million households while Stofa, the other major cable TV provider, started the digitisation of its network in late 1998. Stofa is owned by the Swedish company Telia and has 300.000 households in its network (home passed) of which 50.000 households were digitised by July 1999.

Thus, the number of digital cable TV households (home passed) is 1,15 million (48,3% of Danish TV households). The exact number of the subscribers to digital services is not available, but it is close to 50.000, with 45.000 subscribing to Tele Danmark and 5.000 to Stofa in July 1999.

The subscribers of the premium pay TV channels have been given the opportunity to change to digital TV (without additional costs). In the areas where the network has been digitised, these channels are only transmitted in digital form and consumers' analogue proprietary boxes have been replaced by digital ones.

There are no indications of digitalisation of the remaining small and bigger SMATV networks in Denmark.

1.1.2 Situation of MMDS

MMDS is non- existent in Denmark.

1.1.3 Situation of XDSL

ADSL in Denmark is marketed primarily for high speed Internet connection.

After a trial period Tele Danmark started marketing a version of ADSL (ADSL 512) in June 1999. The data capacity of the connection is 512 Kbit/s down-stream and 128 Kbit/s up-stream. By the end of 1999 the service was available in the 4 biggest cities in Denmark (Copenhagen, Århus, Ålborg and Odense). According to Tele Danmark, the service will be offered to 80% of the Danish households within about a year.

The number of ADSL subscribers in Denmark is estimated to be about 2000 households by the end of 1999.

1.1.4 Situation of terrestrial digital television

Political discussions in 1998

Reports delivered in September 1998 by a working group formed by the Ministry of Culture recommended the introduction of digital terrestrial TV in Denmark as soon as possible using frequencies reserved for this purpose by the political Media Agreement in 1996. Recommendations in the report included provision of a pilot phase to gain technical and organisational experience. The focus of the political discussions following the report, however, shifted to a debate on the priorities in the use of the reserved frequencies, i.e., whether to use them for digital transmission or to expand the capacity for existing analogue services. This was provoked by a political disagreement on whether it is acceptable, that one of DR's two analogue services, DR2 – defined as a 'rather narrow cultural/ debate programme' - is only transmitted via satellite and cable. Some political parties (mainly the Right Wing Opposition) wanted to give priority to terrestrial analogue distribution of DR2 above the introduction of terrestrial digital TV.

The political system has not yet made a decision on the time horizon for the turn-off of analogue services. The above mentioned report estimated the simulcast period to be 10-15 years.

Trials in 1999

Eventually, a political compromise was reached and a decision made in the Parliament in December 1998 as a supplement to the political Media Agreement from 1996. It was decided to prioritise countrywide terrestrial digital TV and to launch pilots during 1999. The pilots will be based on a framework program presented by the Ministry of Culture in February 1999 specifying, e.g., the area and period of the trials, the technical goals and the organisation.

Area and period

The trials will cover the greater Copenhagen area (using transmitting stations in the locations Hove and Jyderup), potentially reaching about 50% of the Danish population. The trials started by the end of November 1999 and are initially planned to run for a period of at least half a year.

The technical goals

The transmitter network is specified as a Single Frequency Network (SFN) using a specific channel (channel 51) and including moveable supplementary transmitters. The issues to be tested during the trials include:

- ✓ The coverage for stationary and portable reception
- ✓ The influence of SFN on stationary and portable reception and on the need for frequencies
- ✓ The potentials in statistical multiplexing with respect to, e.g., the level of quality vs. the number of services in a multiplex, and regionally divided multiplexes

- ✓ The introduction of non-traditional TV-services such as EPG, enhanced text-TV and other interactive services
- ✓ Transmission of programmes in the 16:9 format
- ✓ Presentation of the potentials in digital TV to the general public – this includes the transmission of the existing public service programmes from the stations DR and TV2

Technical standard

The trials will use the ETSI standard for digital terrestrial TV, known as DVB-T. The level of quality is selected as Standard Definition TV (SDTV) – comparable to the currently used analogue PAL system.

Organisation

The public service stations DR and TV2 are jointly responsible for the trials including the choice of terrestrial network operator and supplier of equipment. To evaluate the trials the Ministry of Culture has formed a group including representatives from the parties involved, e.g., consumer organisations, the IT-industry, the telecom industry, other public authorities and universities.

The trials are expected to result in recommendations, e.g., on the choice of technology, level of quality, use of statistical multiplexing and plans for development of countrywide coverage including associated costs.

The actual planning of the trials started in spring 1999 and transmission of programmes will be launched in November 1999.

1.1.5 Market development

Digital TV is in its initial phase in Denmark. It mostly consists of pay-TV and only counts 70.000 subscribers[4]. The Danish digital TV market value amounted to 4,4 million Euro which only 0,4% of the total TV market and 1,4% of the total Danish pay-TV market. The value is insignificant, but digital TV is a visible part of the Danish media landscape. This is due both to the increasing number of people switching to digital services and due to intense marketing from the service providers.

Digital TV users are mainly the former customers of premium analogue pay-TV channels where the proprietary decoder boxes were replaced by the digital boxes, and foreigners who want to watch programmes in their native languages.

Development of additional digital services, like the provision of E-mail announced by Tele Danmark, and real electronic commerce, interactive services etc. as well as implementation of digital terrestrial network will have positive effects on the development of the market.
The following table shows some basic information on digital TV in Denmark in July 1999.

[4] DR1 and DR2 did, however, start satellite transmission of their services in digital form in 1996 and the satellite households with digital receivers have been able to receive these services.

Name of the service	*Ownership*	*Date of launch*	*No. of subscribers*
Tele Danmark Cable TV	Ameritech	Spring 1998	45.000
STOFA Cable TV	Telia	November 1998	5.000
Canal Digital	Canal+ & Telenor	Autumn 1998	20.000

1.1.6 Regulatory status

The Ministry of Culture has announced a Bill as an amendment of the law on radio and TV (cf. order number 208 of April 6, 1999) of October 29, 1999. The issues related to digital TV are:

- ✓ DR's and TV2's digital services are not covered by the same "must carry" rule as their analogue services. That is, only the digitalised SMATV/cable systems that distribute digital services are obliged to distribute DR's and TV2's digital services.
- ✓ SMATV/cable systems are only allowed to convert digital "must carry" services to analogue services if they simultaneously distribute the services in digital form. Otherwise they are not allowed to make the conversion.
- ✓ The digital trial is not covered by the "must carry" rule.
- ✓ Prohibition of using piracy decoders etc. will be extended to cover also ownership of piracy decoders etc. for pure personal use.

The Bill will be discussed in the Parliament during the beginning of year 2000.

1.1.7 Barriers to competition or market development

Different barriers to the development of digital TV can be identified:

Lack of frequencies for the terrestrial network: The additional frequency resources needed for the provision of digital TV in Denmark are scarce. Two main reasons for this scarcity can be identified:

- ✓ Being a small country, Denmark must share the frequency resources with several neighbouring countries. The bigger countries, covering large geographical areas, are not restricted in the same way.
- ✓ Local TV has a high priority in Denmark and many radio frequencies are allocated for this purpose.

This scarcity results, at least in the first phase, in the availability of only one countrywide Multiplex Block which is foreseen to carry only four digital TV services. In order to compete with the multi-channel environment of cable and satellite, four TV services seem to be far too few. In addition, two of these four services are dedicated to carry simulcast of the analogue public service channels, DR1 and TV2. This leaves the possibility only for two new services and gives little incentive for people to acquire digital set top boxes for the initial terrestrial distribution[5].

[5] According to a media political agreement of December 18, 1998 the Danish telecom authority (Telestyrelsen) has been asked to establish 4 countrywide multiplexes, one of them with the possibility of splitting in regionally defined programs.

The price of digitalisation of small SMATV: Digitalisation of SMATV networks requires upgrading of both the distribution network and the head station. This is still expensive and requires a certain minimum number of subscribers to carry the costs although there is a continuous decrease in prices.

Overspill: This is a copyright issue, but it might develop into a barrier. DR1 and DR2 are as public service channels provided free in Canal Digital's Digital satellite service to Denmark. This provision results in copyright issues in the form of overspill. Danes living in other Nordic countries must pay for the service (in Sweden, e.g., the service is priced at 140 SEK (15 Euro) per month). The copyright issues may occur if smart cards obtainable free of charge in Denmark are sold as grey market cards or provided to relatives etc. in other Nordic countries.

Piracy: This is another copyright issue which has been much debated and it has been argued that it is a barrier to the market development. The satellite service providers, Canal Digital and VIASAT have claimed that piracy is a serious barrier to their business development in Denmark. The Ministry of Culture has commissioned a survey to evaluate the problem[6]. The problem is almost exclusively identified in the analogue pay TV marked.

The survey, delivered in April 1999, concludes that it is not appropriate to create tighter rules for piracy. However, the demand for tightening the rules comes almost entirely from the Pay-TV broadcasters and the survey shows that the extent of the piracy problem is considerable (the level is around 200.000 users). A case for tightening the law could therefore be made, but that would require the following issues to be considered:

- ✓ It is unlikely that a demand side ban will be properly enforced. An ineffective prohibition can have precarious consequences for the public respect of law in general.
- ✓ Commercial activities related to the unauthorised access cards and codes are already illegal. A new prohibition will only relate to the few viewers that have obtained their unauthorised card in a way not prohibited by the current legislation.
- ✓ Prohibition of the sale of blank access cards or the hardware to write these cards is not deemed practicable.
- ✓ A complete digitalisation of the broadcast system and the associated encryption system provides the broadcasters with good instruments to counter piracy, although total elimination is deemed impossible.
- ✓ The hacking of the access codes is still dominated by enthusiasts and amateurs, but the area is being commercialised. The commercial sale of unauthorised access cards and codes are covered by the current law.

As mentioned above the Ministry of Culture has, however, announced a new law making personal use and possession of unauthorized access to pay TV illegal.

[6] The area is also regulated by an EU directive (98/84/EF) applicable from May 28th 2000. The directive sets minimum standards implying that commercial manufacture etc. is illegal in all EU countries. The directive does, however, not cover the use of illegally manufactured access cards. The member countries are allowed to have tighter regulation on the area.

1.2 Details of services

1.2.1 Number and type of services

In the following table the digital services available are listed. It is indicated whether the service is Danish or foreign and whether it is a commercial, a public service or premium pay-TV service. The foreign language channels target groups of foreigners living in Denmark and these programmes are in original languages. The foreign language channels consist of a variety of public and commercial channels.

Service Type	*Services in Canal Digital*	*Services in Tele Danmark*
Danish Public Service	DR1 & DR2	DR1, DR2 & TV2
Danish commercial TV	TV Danmark	TV Danmark
Foreign commercial TV transmitted to Denmark		TV3 & TV3+
Foreign commercial TV	Cartoon Network, Eurosport, Discovery, Adult Channel, TNT Classic Movies, VH-1, Sky News, Nickelodeon, Nordic Fox Kids, M2, National Geographic, Travel, CNBS, BBC Prime, Kanal 5, TV Norge, Animal Planet, TCC Nordic, CNN International, Nordic, Granada Good Life, MTV	Cartoon Network, Eurosport, Discovery, Adult Channel, TNT Classic Movies, VH-1, Sky News, Nickelodeon, Nordic Fox Kids, M2, National Geographic, Travel, CNBS, BBC Prime, Hallmark, ARTE, Fashion TV, MCM international, Muzzik, Bloomberg, World Net, BBC World
Foreign premium	Canal+, Canal+ GUL, Canal+ BLÅ & Erotica	Canal+, Canal+ GUL, Erotica, TV 1000 & Cinema
Foreign language		Turkish (4 TV & 3 radio), Balkan (6 TV & 4 radio), Italian (4 TV & 3 radio), French (4 TV & 3 radio), Spanish (4 TV & 3 radio), Asian (2 TV & 3 radio), Arabic (4 TV & 3 radio) & Tamil (1 TV & 3 radio)
Foreign Public service	TV Finland & NRK International	TV Finland, NRK International, SVT1, SVT2, TV , NRK 1, TV 2 Norge, ARD
Interactive	Kiosk (22 NVOD)	NVOD, E-mail, EPG, Game, Shop, billet net, event calendar
Others	Music	Radio channels, Music channels & Weather

Digital only services

The majority of the services in the table are available in both analogue and digital form. The services that are only available in digital form are

- ✓ The premium pay TV channels, Canal+, Canal+ GUL, Canal+ BLÅ[7] and Erotica,
- ✓ The Nordic public services channels, TV Finland and NRK international,
- ✓ Foreign language channels in Tele Danmark's cable TV
- ✓ Some of the foreign thematic channels.

Apart from regular TV channels that only are available in digital form, a number of new and innovative services are provided in digital form:

1.2.2 Details of the DTV offers

The digital TV services are provided in different packages. The packages contain a mixture of different services targeting different interests. Some of the packages addresses specific interests like thematic and foreign language channels. In the following some examples are provided.

- ✓ **Canal Local**. Free service, containing among others the public service channels, DR1 & DR2
- ✓ **Canal Entertain**. A mixture of different services from Cartoon Network to Adult channel.
- ✓ **Thematic channels**: Art, News, Children and foreign language channels.
- ✓ **Premium pay-TV channels**: Canal+, Canal+ GUL, Cinema and TV 1000.
- ✓ **Interactive services**: e.g., NVOD as described previously.

The marketing and advertising of DTV has mainly been focusing on two qualities 1) the variety of choices and 2) the high quality of digital TV programmes. Better and easier navigation and the availability of easy access to programmes have also been seen as arguments for the superiority of digital TV.

Pricing of Tele Danmark Cable TV

Tele Danmark provides its subscribers with set top boxes (the Selector box) on a rental basis for 50 DKK (7 Euro) per month under the following conditions:

- ✓ Access to digital services requires subscription to an analogue package (basic or extended).
- ✓ Access to the full digital service package requires subscription to the extended analogue package.

The cheapest digital package is a children's package with three children channels which costs 40 DKK (5 Euro) and the most expensive are the premium pay-TV channels Canal+ and

[7] Canal+BLÅ is a new service from Canal+. Canal Digital has announced that Canal+ BLÅ will contain popular movies, some of them in 16:9 format

Canal+ GUL at 200 DKK (27 Euro) per month. Canal Entertain, containing different TV channels for different ages and interests is priced at 90 DKK (12 Euro) and the foreign language packages are also offered for 90 DKK (12 Euro) per month. The price of NVOD varies for different films and is about 35 DKK (5 Euro), but, e.g., “Formula 1 from 7 different angles” costs 59 DKK (8 Euro) per show.

The prices for subscription to analogue services depend on the location, but as an illustrative example the cost per month for accessing to Canal Entertain may be:

Subscription to an extended analogue package:	140 DKK (19 Euro) - 170 DKK (23 Euro)
Selector rental:	50 DKK (7 Euro)
Canal Entertain:	90 DKK (12 Euro)
Total:	280 DKK (37 Euro) - 310 DKK (41 Euro)

Given the obligatory licence fee of 150 DKK (20 Euro) per household per month a Tele Danmark Digital Cable TV subscriber has to spend between 430 DKK (57 Euro) and 460 DKK (61 Euro) per month to access Canal Entertain.

Pricing of Canal Digital’s satellite TV

Canal Digital provides its subscribers with the set-top boxes on a rental basis for 59 DKK (8 Euro) per month, but it is also possible to buy the boxes for 4000 DKK (533 Euro). The cheapest digital package is the local package consisting of DR1, DR2, TVDanmark and Canal 5 which costs 40 DKK (5 Euro) per month. Access to only DR1 and DR2 is free. The most expensive services are the premium Pay TV channels Canal+ , Canal+ GUL and Canal+ BLÅ at 200 DKK (27 Euro) per month. The price of NVOD varies for different films, e.g., “Formula 1 from 7 angles” costs 59 DKK (8 Euro) per show. Canal Entertain costs around 129 DKK (17 Euro) per month.

As an example the cost per month to access Canal Entertain is:

Set top box rental:	59 DKK (8 Euro)
Canal Entertain:	129 DKK (17 Euro)
Total:	188 DKK (25 Euro)

A Canal Digital satellite TV subscriber must spend 338 DKK (45 Euro) incl. licence fee per month to access Canal Entertain.

Comparing this price with Tele Danmark’s price for access to Canal Entertain one must consider 1) The Canal Digital subscriber meets also costs to installation of a satellite dish and

A Tele Danmark subscriber can access approximately 25 additional analogue services.

1.3 Operators and market structure

1.3.1 Concentration of the pay-TV market

The digital TV market in Denmark is, as mentioned, still an insignificant part of the total TV market. The main players on the digital market are Canal Digital Stofa and Tele Danmark. The main digital premium pay-TV actor is Canal+, available both in the digital satellite and cable networks. No information is, however, available on the revenues from digital services in 1999. It has further not been possible to estimate Canal Digital's market share of the digital market.

Subscriber data is available showing the distribution of digital subscribers among the players as ratios of the total number of subscribers. Canal Digital has 0.12%, Stofa cable TV has 0.03% and Tele Danmark cable TV has 0,27% of the total number of pay TV subscribers as digital subscribers. These subscriber shares do, however, not necessarily indicate digital pay-TV market shares. Canal Digital has, e.g., revenues from both the DTH and the cable market and further may a subscriber be registred as a Canal Digital digital subscriber to get access only to the free public service channels, DR1 and DR2, creating no revenue to Canal Digital.

On the terrestrial market there are no pay-TV channels.

1.3.2 Agreements between satellite operators, cable operators and DTT operators

There is no agreement between satellite operators, as Canal Digital is still the only digital satellite provider in Denmark.

With respect to agreements between satellite operators and cable operators: Canal Digital Denmark continues to handle Tele Danmark's subscriber management services for its digital service offer. Canal Digital's alliance with Tele Danmark includes programming as well as distribution. Tele Danmark redistributes some of Canal Digital's digital packages in its cable network and Tele Danmark also handles the technical access issues. As a consequence of this agreement between Canal Digital and Tele Danmark many of the services offered by the two distributors are similar.

1.3.3 Vertical integration

A clear process of vertical integration in digital TV provision in Denmark cannot be identified. The industry is in its early stages and the two players, Tele Danmark and Canal Digital compose their services from different content providers. There is an example of a vertical integration in the satellite market, where Canal+ partly owns Canal Digital and offers its own TV channels (CANAL+ and CANAL+ GUL) in one of Canal Digital's digital TV packages.

1.4 Technical issues

1.4.1 Decoder issues

Nokia is one of the first set top box providers that has announced a NorDig box and Nokia has products on the Danish market for all three distribution forms, satellite, cable and terrestrial. Force Electronic in Denmark has announced that they will market a NorDig compatible set top box in the autumn 1999 and it has also announced products for all of the three distribution forms. Furthermore Force Electronic will offer a "combi" box called Force Duomaster that is an integrated analogue (D2-MAC) and digital (DVB) box. The box will be the first of its type on the Danish market.

Different manufacturers provide the set top boxes on the Danish market. They are listed by distribution form below and by product/ producer in the table.

Cable TV: Tele Danmark offers the set top box called "Selector" from the French Sagem with Viaccess CA and Open TV API. STOFA uses the same box with a software modification.

Satellite TV: Nokia, TRIAX and Philips have products on the Danish market. Canal Digital uses Philips boxes for their rental service.

Set Top Boxes

Name	Provider	CA	API	Free to air compa-tibility	16:9 compati-bility	Integrated Modem
SELECTOR	SAGEM	Viaccess	Open TV	Yes	Yes	Yes
MediaMaster, S, C and T	NOKIA	Embedded Viaccess (+ DVB CI)	Open TV	Yes	Yes	Yes
Philips digital box	Philips	Conax	Media Highway	Yes	Yes	Yes
Force duomaster	Force Electronic (autumn 1999)	Conax (+ DVB CI)	Media Highway	Yes	Yes	Yes
Force Dmaster S & C	Force Electronic (autumn 1999)	Conax (+ DVB CI)	Media Highway	Yes	Yes	Yes
Force Dmaster T	Force Electronic (late 1999)	Conax (+ DVB CI)	Media Highway	Yes	Yes	Yes
DVB-63S	TRIAX	Embedded Viaccess (+ DVB CI)	Triax EPG	Yes	Yes	No
DVB-65S	TRIAX (Fall 1999)	Embedded Viaccess (+ DVB CI)	Triax EPG	Yes	Yes	Yes
DVB-40S	TRIAX (Fall 1999)	Embedded Conax (+ DVB CI)	Media Highway	Yes	Yes	Yes

1.4.2 16:9

Distribution of services in the 16:9 format has been one of the arguments for the introduction of digital terrestrial TV in Denmark. The terrestrial pilot in Denmark will contain programming in 16:9. Tele Danmark Cable TV has announced that some sports events will be transmitted in 16:9 and Canal Digital's newly introduced channel, Canal+ BLÅ will according to Canal Digital contain movies in 16:9 format. The possibility for transmission in 16:9 format is, however, not dominant in the marketing of digital TV in Denmark.

As it is shown in the following table the number of 16:9 TV sets in Denmark has more that doubled from 1997 to May 1999, but at a rather low level.

16:9 TV sets (Thousand sets)

As of 31 of December	1994	1995	1996	1997	1998	May 1999
16:9 TV sets	0	4	10	19	30	45

Source: *BFE*

1.4.3 Portable reception

Portable reception has been an often-used argument in the discussions on the introduction of digital terrestrial TV in Denmark. The public service broadcasters have often argued for a terrestrial digital network, as it is the only distribution form that can provide services for portable TV. The change in the pattern of TV consumption is a central point in this argument: People will increasingly watch TV in the kitchen, bedroom, etc. and they do not want a lot of TV sets, complicated cabling or different satellite dishes in their house. They prefer portable TV with "in-house" antenna. Furthermore, according to the arguments people are also expected to use TV more and more out of the house, e.g. on the beach, on vacations etc. and they do not want to carry satellite dishes and receivers around.

Portable reception is recognised as one of the issues to be tested during the digital TV pilot in Denmark.

1.5 Conclusion

Digital TV is available on the satellite and cable TV market in Denmark. 1,15 million cable TV households can potentially subscribe to digital services and 50.000 do actually subscribe to these. Out of the digital subscribers, 20.000 subscribe to digital satellite services.

Terrestrial digital TV has been introduced in 1999, starting with a pilot period. A key issue for investigation is efficient use of frequency resources as scarcity of resources for countrywide digital TV is considered one of the main barriers for the development of terrestrial digital TV. Two main reasons for this scarcity can be identified:

- ✓ Denmark is a small country, where the radio frequency allocation must be co-ordinated with the neighbour countries.
- ✓ Local TV has a high priority in Denmark and many radio frequency resources are allocated for this purpose.

Already today many digital services are provided, e.g., more than 50 services in Tele Danmark's cable TV. New innovative services are provided in digital form, among these, E-mail, showing sports of events from different camera angles simultaneously and several thematic services and programmes in native languages targeting groups of foreigners in Denmark.

On the digital satellite market, apart from the foreign commercial broadcasters, the national public service channels DR1 & DR2 and the advertising channel TVDanmark are available. Furthermore, the number of Canal Digital's NVOD services has been increased to 22, and Canal Digital has announced a new digital service, Canal+ BLÅ, mainly containing movies. The services from Canal+ (Canal+, Canal+ GUL and Canal+ BLÅ) are only available in digital form in Denmark.

The Ministry of Culture has announced an amendment of the law on radio and TV in Denmark. The law will, when (if) it is accepted by parliament, influence the development of digital TV services in different ways. The law will, e.g., make the personal use and possession of unauthorized access to pay TV illegal, an issue given high priority by the pay TV actors in Denmark. Another issue is that digital "must carry" will only be required in digitalised SMATV / cable systems and that it is prohibited to convert the digital "must carry services" to analogue if the system does not provide the digital service simultaneously. The objective is to ensure that digitalisation of SMATV / cable systems is demand led.

The market share of digital TV is not high, but as mentioned above, the infrastructure for digital TV and new services have been developed. The majority of cable households have the possibility of subscribing to digital services, practically all of the population can subscribe to satellite services and the digitalisation of the terrestrial network has started. There are services available only in digital form but there are also actors who claim that they will remain analogue, at least in the short term. The variety of services has been increased and through this the competition in the Danish TV market has been intensified.

2 Key figures for the Danish market[8]

2.1 Country fundamentals

As of 31 December	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
Population (millions)		5.200	5.220	5.250	5.280	5.310	
Households (millions)		2.340	2.360	2.370	2.390	2.410	
GDP (billion Euro)		128.000	138.000	145.000	150.000	156.000	

2.2 Equipment

As of 31 of December	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
TV households (millions)		2.300	2.300	2.340	2.370	2.380	
TV households (% of total households)		98.3%	97.5%	98.7%	99.2%	98.8%	
TV households with 2 TV sets or more (millions)		0.600	0.770	0.950	1.100	1.300	
TV households with 2 TV sets or more (% of TV households)		26.1%	33.5%	40.6%	46.4%	54.6%	
TV households with 16:9 Television sets (millions)		0.000	0.004	0.010	0.019	0.030	
TV households with 16:9 Television sets (% of TV households)		0.0%	0.2%	0.4%	0.8%	1.3%	
VCR households (millions)		1.200	1.340	1.410	1.500	1.700	
VCR households (% of TV households)		52.2%	58.3%	60.3%	63.3%	71.4%	
Digital STB households (millions)		0.000	0.000	0.000	0.000	0.052	
Digital STB households (% of TV Households)		0.0%	0.0%	0.0%	0.0%	2.2%	
IDTV[9] households (millions)		0.000	0.000	0.000	0.000	0.000	
Digital TV households (% of TV households)		0.0%	0.0%	0.0%	0.0%	0.0%	
Digital households[10] (millions)		0.000	0.000	0.000	0.000	0.052	
Digital households (% of TV households)		0.0%	0.0%	0.0%	0.0%	2.2%	

[8] Until 1998 all amounts are in ECU

[9] Integrated Digital TV Set

[10] Sum of Digital STB homes and digital IDTV households

2.3 Television market estimates

Millions Euros	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
Analogue TV Market							
Public funds (only licence fees)		316.840	337.930	339.810	364.300	376.570	
Advertising		165.180	182.470	204.380	226.340	249.800	
Subscription		100.000	121.000	127.000	191.000	294.000	
Total analogue TV		582.020	641.400	671.190	781.640	920.370	
Digital TV Market							
Public funds		0.000	0.000	0.000	0.000	0.000	
Advertising		0.000	0.000	0.000	0.000	0.000	
Subscription		0.000	0.000	0.000	0.000	4.400	
Total digital TV		0.000	0.000	0.000	0.000	4.400	
TV Market							
Public funds		316.840	337.930	339.810	364.300	376.570	
Advertising		165.180	182.470	204.380	226.340	249.800	
Subscription		100.000	121.000	127.000	191.000	298.400	
Total TV market.		582.020	641.400	671.190	781.640	924.770	

2.4 Details of the pay-TV market

Cable

	1993	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
Home passed (millions)		1.700	1.700	1.500	1.600	1.700	
of which digital (millions)		0.000	0.000	0.000	0.000	1.150	
Home passed (% of TV households)		73.9%	73.9%	64.1%	67.5%	71.4%	
of which digital (% of TV households)		0.0%	0.0%	0.0%	0.0%	48.3%	
Analogue basic subscribers (millions)		1.170	1.270	0.950	1.000	1.300	
Digital package subscribers (millions)		0.000	0.000	0.000	0.000	0.048	
Analogue basic subscribers (% of TV households)		50.9%	55.2%	40.6%	42.2%	54.6%	
Digital package subscribers (% of TV households)		0.0%	0.0%	0.0%	0.0%	2.0%	

Satellite

	1993	1994	1995	1996	1997	1998	1999
Satellite households (millions)		0.240	0.270	0.390	0.430	0.470	
Satellite households (% of TV households)		10.4%	11.7%	16.7%	18.1%	19.7%	
Satellite subscribers (millions)		0.239	0.245	0.252	0.274	0.300	
Satellite subscribers (% of TV households)		10.4%	10.7%	10.8%	11.6%	12.6%	
of which digital (millions)		0.000	0.000	0.000	0.000	0.004	
of which digital (% of TV households)		0.0%	0.0%	0.0%	0.0%	0.2%	

Terrestrial TV

	1993	1994	1995	1996	1997	1998	1999
Analogue Pay-TV services							
Pay-TV subscribers (millions)		0.000	0.000	0.000	0.000	0.000	
Pay-TV subscribers (% of TV households)		0.0%	0.0%	0.0%	0.0%	0.0%	
***Digital TV services**							
Homes covered (millions)		0.000	0.000	0.000	0.000	0.000	
Homes covered (% of TV households)		0.0%	0.0%	0.0%	0.0%	0.0%	
IDTV households (millions)		0.000	0.000	0.000	0.000	0.000	
IDTV households (% of TV households)		0.0%	0.0%	0.0%	0.0%	0.0%	
Pay-TV households (millions)		0.000	0.000	0.000	0.000	0.000	
Pay-TV households (% of TV households)		0.0%	0.0%	0.0%	0.0%	0.0%	