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Abstract

Today the ICT cluster is the edge of the Finnish economy. It had a total turnover of EUR 34,1 billion in 1999 and employed 146.000 people. The media sector is a part of the ICT sector with a turnover of 5,5 billion EUR, but is still a relatively important employer with 41.000 persons. The three main components of the media sector are print media, electronic media and recorded media. The share of print media (newspapers, magazines, books and printed advertising materials) is 75 per cent.

It has been the scope of this strategic project to identify the core technologies which have a mayor impact on the diversifying media industry in the time perspective of the next decade, i.e. to the end of 2010. Digitalisation and new telecommunication technologies are essential factors in the development. Digitalised information can easily be revised, stored, compressed and distributed. Not only the production and the way of action are changed, but also the products and the services themselves. New distribution channels, information carriers and terminals offer the end users a variety of new alternatives, like digital television channels, services and electronic books.

The utilisation of ICT technology leads to structural changes across the traditional boarders of branch and market segments. Some hardware suppliers have already become active content providers, and many more intend to come. The spectrum of technologies utilised and further developed by the ICT cluster increases continuously. The markets have until now been created by technology push, but market pull is growing in importance. The end user is not interested in what technology for data transmission the channel utilises, or the components of the terminal, if only the services are attractive enough in relation to the price, reliable and easy to use.

ICT will remain the driving force for technology and economy for the next decade. After that it will slowly merge deeply into different applications. Therefore, it is important to identify new solutions in the field of basic industry, services and administration. The most critical challenges to the media industry today are the demand on rapid structural change, overcapacity in the printing sector, ability to increase the efficiency of the business processes and the ability to develop new, attractive products and services. This requires significant investments in research and development, but also in training and education.

Preface

The project reported here aimed at identifying the core technologies which have a mayor impact on the diversifying media industry in the time perspective of the next decade. The results have been crystallised in plans for how to take the selected technologies into possession on the VTT level. These ideas are further presented in the Appendix. Parallel to this project, research activities dealing with innovations and technology forecasts for the media industry have been carried out as commissions from the National Technology Agency (TEKES). Some of these results have also been included in this report.

The project has been followed by a Steering Committee. Project Manager has been Mr *Ulf Lindqvist* and the other members of the Project Group are Ms *Helene Juhola* and Mr *Timo Siivonen*. Mr *Caj Södergård* (multiple media and media convergence), Mr *Olli Nurmi* (premedia and colour management), and Mr *Hannu Linna* (information carriers and DP technology) have contributed to the technology survey with their expertise.

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List of Terms

The Attention Economy

The attention economy can best be described as the way that services and goods will increasingly be made available to individuals in return for their attention: either their agreement to disclose personal details of their online activity, or to watch/receive ever-more targeted advertising and marketing.

Content Information value created for an end user

CRM Customer Relationship Management

Cross media

A mixing of media platforms to create a total media experience

CtC Computer - to - Cylinder

DM Data Management

ICT Information and Communication Technology

iDTV Interactive digital television

JDF Job Definition Format

Media convergence

Development towards parallel use of digital content in different media and/or towards media companies offering multiple media services. The convergence may occur on different levels, such as technology, production, business and company.

MHP Multimedia Home Platform

MMS Multimedia Messaging System that is used in mobile communications

Multimedia

Includes static (text, images) and dynamic (audio, video) and hypertext information.

Multiple media

Combinations of content gathered from the content repositories and delivered to the customer via multiple electronic media together with or without printed media.

PDA Personal Digital Assistant

PoD Print on Demand

Roadmap Roadmap is an extended look at the future of a chosen field of inquiry. Roadmaps may be retrospective (= how to reach a given target) or prospective (= building up technologies until new targets appear). The most concrete level of the roadmap is product management roadmap.

Technology Foresight

The foresight programmes bring together key people, knowledge and ideas to look ahead to help prepare better for the future. Foresight projects are in areas, where science and new technologies could have major and possible disruptive impacts, both on the economy and society.

UMTS Universal Mobile Telecommunication System

VOD Video on Demand

Value chain

All activities creating additional value during the entire life cycle of a product or a service from investments to selling

Virtual value chain

All the information needed to manage the value chain

WLAN Wireless local area network

1 Introduction

The ICT (Information and Communication Technology) sector once lifted the Finnish economy back on the track after the depression in the early nineteenth. The focus was transferred from production based on raw materials, energy and capital investments to an economy based on knowledge and skill, where economical growth was driven by innovations.

Today the ICT cluster is the edge of the Finnish economy. It had a total turnover of EUR 34,1 billion in 1999 and employed 146.000 people. Hardware production stands for half of the turnover (16,3 billion EUR) and employs 43.800 persons, while the corresponding figures for software and service are 8,6 billion EUR and 42.000 people. The telecommunication service has a turnover of 3,7 billion EUR and 19.000 employees. The media sector, finally, has a turnover of 5,5 billion EUR, but is still a relatively important employer with 41.000 persons.

The three main components of the media sector are print media, electronic media and recorded media. The share of print media (newspapers, magazines, books and printed advertising materials) is 75 per cent, electronic media (radio, television and on-line information services) 19 per cent and recorded media (phonograms, videos, CD-roms and DVDs and cinemas) 8 per cent.

The dynamics of the ICT sector is based on an efficient utilisation of digitalisation. Digitalisation has its strongest and most direct impact in branches with immaterial products and services. The media sector is one of these branches. Therefore, the media branch is a pioneer. At the same time, it is also a strongly growing sector during the next decade.

The utilisation of ICT technology leads to structural changes across the traditional borders of branch and market segments. Some hardware suppliers have already become active content providers, and many more intend to come. For instance Sony possesses entertainment business in Hollywood, Philips produces disc records, and Nokia is strengthening its connections to the media industry.

One example of connections across traditional branch borders is the board seat in General Motors offered to the CEO of Nokia. One examples of international cross ownership is the connections between Alma Media in Finland and TV4 in Sweden.

The media branch is strengthening its service functions and customer administration. E.g. the Sanoma WSOY corporation possesses not only distribution channels for printed products – like Rautakirja, Leijonajakelu, and the Academic Bookstore – but also electronic distribution channels. Moreover, new players are entering the ICT-field, such as finance houses – combining the banking and the insurance sectors –, energy suppliers developing "electric" telecommunications, and electronic commerce which already has a connection to electronic publishing. The globalisation process and international multi-branch companies bring their own flavours to the development.

Digitalisation and new telecommunication technologies are essential factors in the development. Digitalised information can easily be revised, stored, compressed and distributed. Not only the production and the way of action are changed, but also the products and the services themselves. New distribution channels, information carriers and terminals offer the end users a variety of new alternatives, like digital television channels, services and electronic books. Therefore, globalisation is fastest in branches with digitalised products and services. Examples of these are music and financial services in the media branch. On the other hand, the process also shows paradox features, e.g. the most successful item in eCommerce is the traditional printed book.

The spectrum of technologies utilised and further developed by the ICT cluster increases continuously. The markets have until now been created by technology push, but market pull is growing in importance. The end user is not interested in what technology for data transmission the channel utilises, or the components of the terminal, if only the services are attractive enough in relation to the price, reliable and easy to use.

According to the alignments recently announced by the Finnish Ministry for Trade and Industry a broad use of ICT technology in the entire society is a central national Challenge for the next few years. The core question is to what an extent the traditional industry, the service sector and the public sector will learn to utilise the new technology. Manufacturers of mobile phones, the furniture industry, biotechnology companies, the welfare sector, the forest industry, the judicial system as well as the food industry can all improve their efficiency and extend their services by utilising the ICT technology. It is only essential to identify the technologies with the highest potential for each branch.

An inventory of the technologies – both existing ones, those under development and those just being planned – as well as a multi-angular analysis of the rapidly changing media sector will help the Technical Research Centre of Finland and its units to identify future opportunities and to evaluate their roles in building new solutions for the industry and the society.

It has been the scope of this strategic project to identify the core technologies – also others than ICT –, which have a mayor impact on the diversifying media industry in the time perspective of the next decade, i.e. to the end of 2010. Different possible development tracks of these technologies have been analysed; at the same time their probabilities and penetration times have been estimated. The results have been crystallised in plans for how to take the selected technologies into possession on the VTT level, which includes both specification of strategy, core competence needed, co-operation and directing of research.

2 Technical trends in the media field

The two main driving technical forces are the information processing technology and the information transfer technology. In the field of Information Technology (IT), the efficiency has grown rapidly (The Moorean law) at the same time when the prices have been stable, or even declined. The development in the field of Communication Technology (CT) is similar. Development in data transmission technologies, like fiber optics, satellite communication and WLAN, have supported the diffusion of network communication. The technological base behind the progress of Information and Communication Technology (ICT) is the digitalisation of information. Some other development steps, like miniaturised terminals and durable batteries, have supported the mobility of communication systems.

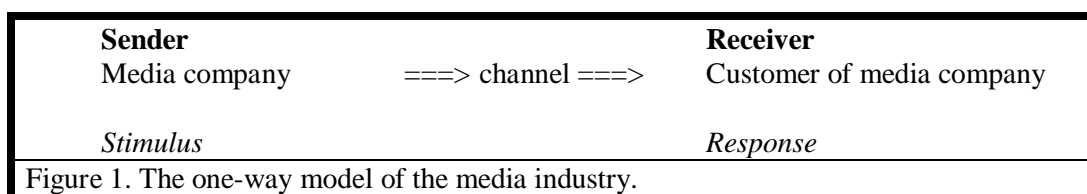
In the future the ICT will be merged into the communication equipment and systems. Similarly many other special technical sectors will be more as applied technologies to practical problems of media field. Like these are e.g. nanotechnology, sensor technology, intelligent agents, knowledge based systems and ubiquitous electronics.

The technical development in the Information and Communication Technology (ICT) during the last decade, and the integration of the media industry as one inseparable part of the ICT sector, has resulted in a total media convergence. At the same time the roles of the content providers, the network operators and the electronics suppliers have become more diffuse and overlapping. This will obviously result in a restructuring of the media field, the ownership and in a totally new value chain for the content business. This, in turn, has dramatic consequences for many institutions in the society, e.g. the trade unions.

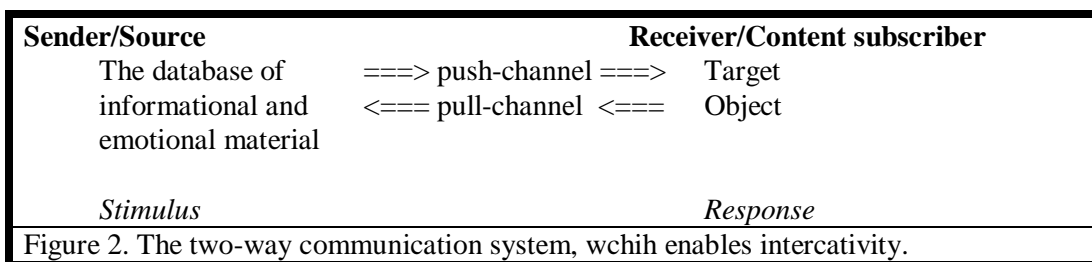
Every business starts from the actual, or latent needs of customer. The business idea is based on the process: how to satisfy these needs. The primary needs that the media industry satisfies, are

- information, including education (usually rational needs)
- entertainment (usually emotional needs)
- advertising (rational and/or emotional)

The very simply one-way model of the media industry (mass communication) process is that there is stimulus of the sender, which has response to the receiver (Figure 1).



More sophisticated and modern model is two-way communication system, where the receiver gets or calls for (push or pull) informational and/or emotional material (content) from the database (Figure 2).



Information has several different effects on the society. It is for instance a entertainment source and a strong opinion force on the citizens. In the business field it is the factor of production. This feature is more and more important.

To serve the future media industry, one must understand the structure and the needs of the integrated ICT sector. A value chain has been developed for better understanding of interactions between business and technology, especially emphasising the interactivity between users and producers. The components of this value chain are: content generation, digital content management, customer relationship & transactions management, distribution and delivery, usage environments, advertising and promotion management, overall integration and process management.

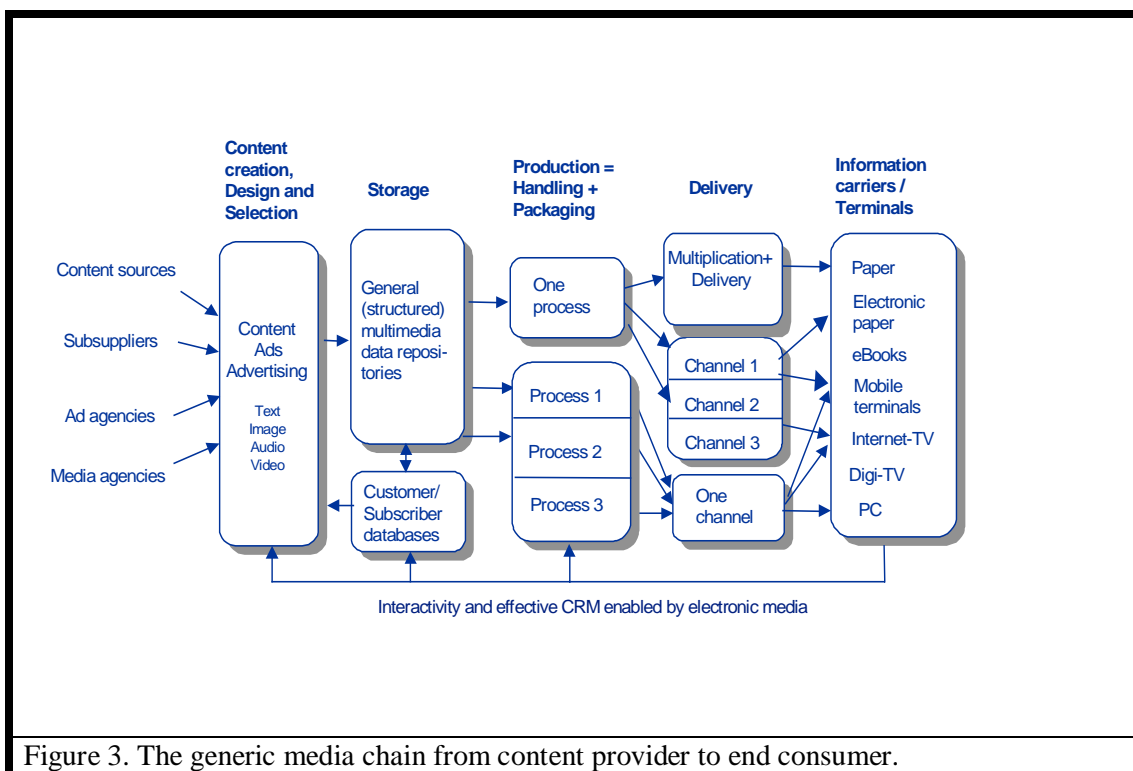


Figure 3. The generic media chain from content provider to end consumer.

The new value chain enables multiple use of the content on a variety of "information carriers" after storing in a generic and structured form, processing and delivery (Figure 3). The media convergence also enables the integrated use of different media, and an optimisation of the media choice according to content, target group and consuming situation. The Internet has been the core of the integration. These questions are analysed in many research projects of the Institute; the Integrated Multimedia Environment IMU (Figure 4) is one example of this.



Figure 4. The multiple media environment IMU of the Institute.

In the following the current and expected mega-trends in the media industry are analysed more in detail from a technological viewpoint. The corresponding changes in the market structure are analysed in Chapter 3.

2.1 Further digitalisation of the value chain of media production

Content will be created synergetically for different media and all the content (assets) is in digital format. This is an obvious development trend especially in the large media companies that cover all media channels. In spite of the fact that all different media platforms and information carriers set different requirements for the content visualisation and layout the cost efficiency requires rationalised content production. This is realised by multi-channel editorial offices and new technological tools that support highly digital, multimedia workflow.

Conventional photography will be superseded by digital photography in premedia processes. This creates new demands for the management on the production chain. Digital photographs should have fixed metadata that shows exactly when and where the picture has been taken. Otherwise it is hard to prove that the photo is original and not for instance manipulated. There should be a globally accepted metadata standard for digital photographs, but it certainly takes a lot of time before different producers have agreed upon a common standard.

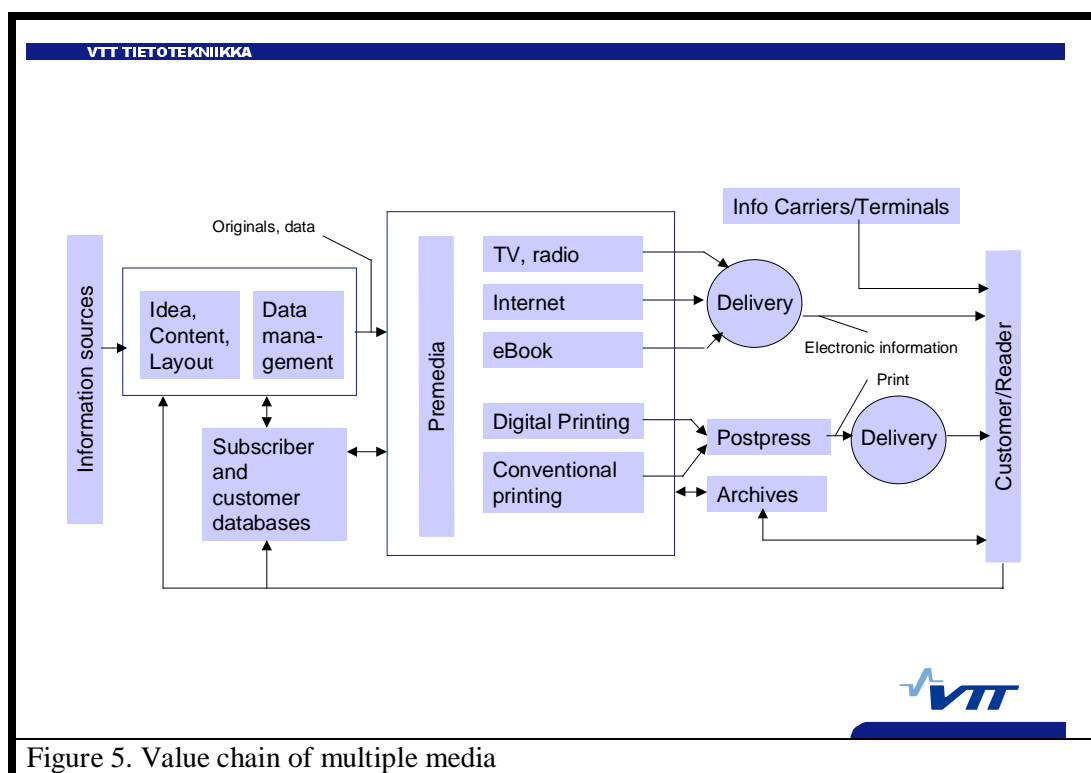


Figure 5. Value chain of multiple media

The workflow will be managed by JDF. The print job will be managed by the web based systems. Content and digital asset management is based on databases and the reproduction will be completely digital. Automatic colour management gains ground but skilled operators are still required especially in the production of high value products. In certain product types (some digitally printed products, newspapers) the whole production chain up to the printing will be completely automatic.

The printing production chain will be distributed so that premedia processes take place in networked environments supported by intelligent software and the printing itself will be done as near to the end user as possible. Only the mass production will be printed in centralised printing centres, but their number will noticeably decrease.

The only stages that remain physical are printing and finishing processes. High productivity is of utmost importance and sophisticated control systems will be needed to manage these operations which are becoming more and more complex. The demand for shorter runs and targeted, customised products sets high requirements both for the machinery and the materials and methods used. The target values for the productivity and efficiency are taken by benchmarking the best possible companies, which will not necessarily be media companies.

Printers have to develop their products and services in order to serve the customers better with integrating themselves into customers' value chain. This can include database services for the customer's content and asset management, electronic, interactive services connected to the printed products and fulfillment services concerning the logistics. This covers both the information logistics (content, assets) as well as the management of inserts, deliveries on demand and printing on demand in conjunction with the production and packaging line of the customer. Value can be added also by finding out new characteristics and features of print product that can be produced in the printing process. This

sets challenges to study more deeply what features customers appreciate and what are their effect. The quality of printed product is much more comprehensive question than only the technical quality.

More emphasis will be put on studying the usability of different media in varying contexts. End user's media environment will consist of several parallel used media. Publishers and content providers have to be aware of the strengths of each media and also to know the principles and factors affecting customer's media choice. This knowledge is important not only for the publishers but also other players of the value chain. Also the most important partners like the paper industry is very interested to know the behaviour of the media user much better than today. Who knows the customer, manages the business.

2.2 More and new information carriers and end-user terminals

Digitalisation, networking and wireless communications enable the production of new types of electronic publications. For example, most of the daily newspapers in the United States have electronic versions, which are very popular in some cases. The lay-out of printed newspapers has changed to resemble more the Internet version, as an example frames in printed editions. Many special magazines, like trade journals, are delivered only by the Internet. Also the archives of libraries are rapidly becoming digitised. These are some of the reasons why electronic publishing is expected to be the most profitable publishing sector in the future. At the moment, most of the electronic publications are read on the CRT screen of a PC, but the developing display and computer technologies enable the manufacture of light, portable information carriers. PDA's, tablet-PC's and mobile digital TV's are examples of new end-user terminals.

The electronic book is defined as a simple and easy-to-use hand-held computer which is specially designed for the reading of text. Programs have also been developed to read electronic books with palmtop and laptop computer. The success of hand computers has paved the way for electronic books, but also technical advances such as the development of electronics, batteries and displays have enabled devices. Nevertheless, the most important element is the Internet which allows a fast, cheap and easy distribution of book files which can be bought from the virtual bookstores of the Internet. Also many publishers have produced an electronic book version of their magazines.

New technologies are being developed for the production of flexible, thin displays for electronic books and newspapers. The most attractive aspect of these new displays is that they can be manufactured cheaply from low-priced materials. Some of them are called electronic paper, because they aim to have the same convenience, lightness, readability (angle-independent readability), whiteness and contrast as conventional paper, and even a similar touch and look. The other advantage of electronic paper is that it is also a memory display – but one which uses so little electricity that small batteries would suffice in a portable device for a month. These projects have considerable credibility, as we can see by the active involvement of several telecommunication giants.

The ultimate goal is to develop books or newspapers which look like traditional publications, but can be erased and re-written. An electronic newspaper could be re-written at night, for example, and you could take it with you in the morning. Similarly, all the books you have ever read could be loaded onto your electronic book and re-read whenever you

like. The industry believes that products like these could be commercially viable within five years.

New technical solutions are needed for electronic books to produce the same reading enjoyment as traditional books do, but it seems quite obvious that technically more advanced and economically more attractive devices will be introduced in the near future. The many financial benefits for publishers, consumers and writers will promote the development of electronic book technology. This will require that publishers adopt the new way of distributing their publications and that the technology develops as expected. All in all, it is very difficult to predict a time when the electronic and printed book will truly compete with each other, but it seems quite inevitable that very successful electronic books will emerge in the course of time.

2.3 Multiple media publishing

It is a common view that tomorrow's media production – especially news media - will increasingly work across multiple media simultaneously and in real-time¹. The multiple media service must not necessarily be produced by a single company, but can be provided by a co-operation between companies, like the current NewsOk.com operation in Oklahoma². Media production will be more content-driven and less product-limited. It is more and more important to create news packages or services – preferably around brands, where particular elements of content are placed where they will be most. At the same time each distribution service should integrate with all the others to create as comprehensive media experience as possible³. The print media is suitable for convenient reading and high quality images, mobile media as a constant companion for ubiquitous access to time-critical information or for entertainment and interactive communication, PC for high volume information services and games, and digital TV for interactive quizzes and shopping, just to name a few opportunities. Special groups like visually impaired and dyslectic people need information in audio form.

In addition to placing a piece of content into the appropriate media, users also have a need for “overlapping“ content. They need to access the *same* media content a from the media platform at hand at the moment, be it traditional print, a computer, a television set (both static and mobile), a PDA's, or in the future electronic eye glasses, or electronic paper. In this scenario, technology is central to convert content more or less automatically to suit the various platforms. Most current web newspapers are examples of this “shovelware“, as they republish the content of the paper newspaper as such. Whether a complete newspaper article is suited to be viewed on a digital television set is still an open question. Publishing in several channels might become crucial for the economy of especially smaller content producers as a means to enlarge their audience.

¹ [http:// http://www.newsplex.org/](http://www.newsplex.org/)

² [http:// http://www.ojr.org/ojr/lasica/1027636058.php](http://www.ojr.org/ojr/lasica/1027636058.php)

³ This mixing of media platforms to create a total media experience is sometimes called cross-media.

2.4 Print media production; higher efficiency and more added value

The trends are: smaller target groups and increased number of items, shorter deadlines and higher quality demands.

The printed mass media products will be produced in large-scale production units with highly automated production equipment. The production has to be smooth and efficient with short lead times and high quality. The prepress material will be send digitally to the printing plants. The importance of logistics will increase.

On the other hand on-demand production and customising will increase in small-scale production. Digital printing will allow targeting the message to smaller target groups.

With more product versatility it is essential to deepen the co-operation between the printer and the customer to create more added value to the customer. Beside production planning and tracking the customer may provide data from his CRM-system to the printer to create mass personalised products.

The premedia production will change its form to asset management, where digital material is processed into media products that are published in one or several channels. This trend calls for new tools to planning and estimating the impact of the products.

Networked companies will carry out the pre-media production. In these units the process and the project management and colour management are essential. The customer will be integrated in the premedia production. He will be able to track the production in real time and finally accept the results by remote proofing.

2.5 DP technology and data management in targeted, on-demand, personalised and customised media

The most important digital printing methods are electrophotography and ink jet. The basic principles of these methods were invented over a hundred years ago, but the final breakthrough came in the computerised office environment. In conventional printing, basically, all the copies contain the same information. In digital printing the image is generated without an original, straight from a computer. The benefit of this is that every printed sheet can be different. There are several applications which can only be executed by using digital printing:

- 1) Short runs are economically viable.
- 2) Printed products can be customised, personalised and coded individually.
- 3) On demand production is feasible.
- 4) Distributed printing is possible but expensive at the moment.
- 5) Easy updates can be produced.

Digital electrophotographic printers were developed during the 1970's and the first digital printing presses came onto the market in the 1990's. Electrophotography is a very complex – and expensive -printing process, especially in colour printing. At the moment, electrophotography is the main digital printing technology in the high quality publication production.

It took thirty years to develop a digital printing press based on ink jet principles – the first model was commercially released in summer 2001. Ink jet printing is the only non-contact printing method and because of this, it is the most ideal of all the printing methods. As an example a 360 page book can be printed in 8 seconds (year 2002). Also, multi-colour printing can easily be carried out as the different process colours can be ejected directly onto the printing surface.

Table 1. The present level of DP technologies

Printing method	Maximum speed	Resolution
Electrophotography	4000 double sided A4 sheets/hour (0.17 m/s)	800 dpi
Continuous ink jet (CIJ) technology	2200 pages per minute (9 m/s)	300 dpi
Drop-on-demand (DOD) ink jet	1 m/s	600 dpi

At the moment, more than 10 % of all printed products and less than 20 % of books are produced by using digital printing. It has been predicted that digital book production will reach 30 % share of total production in 2003. Moreover, it has also been forecasted that more than half of all printing will be digital globally in 2015. The main reason for the slow increase in market share is that the printing costs of electrophotographic digital printing are much higher than in conventional printing. The printing costs of high-speed ink jet printing are only one tenth of electrophotographic printing, and this cost ratio may even increase in future. It can be assumed that ink jet printing will replace electrophotographic printing, when the technology reaches the same image quality level – and this will happen in the near future. Drop-on-demand ink jet printing has already become the most dominant technology in high quality low end printing, so it can be predicted that ink jet systems are the technology of the future, especially in high-speed digital colour printing applications.

2.6 Interactive web-service gives additional value to media products

“Traditional” media products – be it a print product, a television program, or a movie theatre film - are noninteractive in the sense that the user (reader/watcher) cannot influence their content or appearance. Web-based services - on the contrary – are by their nature interactive, because the user is all the time actively selecting the content.

A clear additional value can be created by supplying traditional media products with web extensions. Almost every print newspaper has nowadays a web site, which offers the web version of the daily newspaper. Up-to-date online news are also very common. In addition, the web site might provide access to archived issues or articles of the newspaper as well as to plus content that has not been published in print. The bigger newspapers like Aftonbladet in Sweden might offer audio and video clips. Voting about news related issues is also common as well as catalogue services covering e.g. housing and cars. Discussion forums are not so common on the newspaper side.

In addition to newspapers, web sites are central to TV-companies. As news gathering organisations familiar to working in real time, the web is the perfect medium extension for them. They primarily provide online text-based news in addition to program information. They are also in the position to provide streaming media versions of their own broadcasts, which are becoming more and more important as the bandwidth to the homes is growing. Discussion forums commenting on broadcasted television programs are a very interesting extension that has met clear success. This discussion or watcher feedback can also be a part of the television program- normally as e-mail or SMS messages, but in some cases even as video phone calls.

It can be expected that the newspaper and television journalism will become closer to each other as their web extensions – that are very much common – become more and more important. However, the two forms of journalism will retain their distinct characteristics, because print and television appeal to different human needs.

2.7 The media convergence obscures the limits between content providers and consumers

New technology has continuously lowered the publishing threshold. This was already the case in the 1980's, when Desktop publishing (DTP) made it possible to produce a near-to-professional print publication on Macintosh computers. The distribution of the print had still to be cared for by professionals. Over time it turned out that mere technology does not secure that the result is professional – the design skill and basic knowledge of typography are still important. Self-publishing requires professional help. One example is the ready-made templates and cover design application services to self-publishing of books. This has to be kept in mind also when forecasting the future.

Desktop video is now doing the same to video productions as DTP made to print twenty years ago. Professional level productions can be produced with digital camcorders on normal PC's equipped with video editing software like Adobe Premiere. This trend will surely strengthen during the years to come as digital video and powerful PC's continue to spread among the population. Home studios for news production are becoming available as well. However, it is an open question, how much these multimedia creations are of value to others than the creator and his/her close environment.

The original vision of the invention of the web was to blur the division between content producers and consumers. Every web-user should also be an author. Because of the choices made by the browser makers, the vision did not materialise and the web is currently very much a read-only medium. Nevertheless, the web is a medium with a relatively low publishing threshold as the high amount of home pages shows.

As a result of the development in video capturing and multimedia editing and the web development it is probable, that broadcasts in audio and video over Internet will become more common during the coming years. The great spread of webcams is an example of this. Events like junior plays in ice hockey can be broadcast over the net, even if the potential audience can be counted in tens, because the costs are low enough.

2.8 Internet services via Digital television

Digital television is currently mostly one-way, because the return channel over the phone line or cable is by the rule missing. This is true even if the two-directional technology has been with us for years, primarily in satellite and cable broadcasts. The missing return channel has made it impossible to offer Internet services over television. Over all, it is an open question, how interactive a television watcher wants to be – television is after all “lay back” medium, whereas the interactive PC is a "lean forward" medium.

The new set-top boxes based on the Multimedia Home Platform (MHP) will most probably accelerate the provision of Internet services to the television. In Finland, e.g. banks have already developed paying applications for MHP based digital television. The interactive services will be of two types:

- applications that are coupled to the running tv-programs (e.g. guessing the outcome of sport games)
- applications independent of television programs like buying, gaming and banking.

In the long run, it is probable that the consumer will demand more or less the same Internet services to be accessible from the television as from the PC. This will demand automatic formatters that lay out the content in a form that suit the “lay back” type of television user interface.

2.9 Integration of eCommerce into media

The Internet use is increasing all the time. Digital TV will serve a medium both for communication, interactive entertainment, high capacity data transmission and eCommerce. The media houses as well as the operators have created portals where both content services and eCommerce can be accessed. At the moment eCommerce is still taking it's first steps and media houses have not had too good experiences on integration of eCommerce and media services.

It started by selling the books, but has enlarged the selection to electronics, home ware etc. Some value added features, like profiling of the customers and the assessments of the books written by the readers have shown the way to other companies. The future plan is to include also the selling clothes into the business concept.

The most promising results have been obtained by the direct marketing companies. They have still the printed catalogue to catch the customers attendance but they also give the eCommerce service where one can make comparisons and get some more information about the products. Some experiences show that the direct marketing company can double it's income by giving services both with the catalogue and the Internet. By creating some special services like virtual me for fitting the clothes via Internet the income can still be increased.

Amazon has been the pioneer and the reference of eCommerce. It started by selling the books but has enlarged the selection to elctronics, homeware and so on. The future plan is to adapt also the selling of clothes into the business concept. It has taken several years for Amazon to get the income and the expenses in balance. The most critical problem has

been the functioning of the back office processes which means the efficient integration to the logistics and to whole-sellers like Ingram or Libri. The value added services like profiling of customers and the assessments of books written by the readers have paved way for similar kind of applications of other companies.

In the future printed products as well as the electronic media products will provide an access to the eCommerce activities. Advertising in the internet will increase and gives opportunities to create links to the suppliers of the goods. New mobile phones with MMS features will increase possibilities for mobile advertising. Digital TV gives many different possibilities for commercial activities. Printed products can serve as interfaces both to the web and digital TV via different markings and codes that can be read by the remote controllers or mobile phones and automatic links to the suppliers web sites will be created. The payment procedure can be automated.

2.10 Security and Digital Rights Management

Copyright management and more generally digital rights management can be divided in three sub-areas

1. Intellectual Property Asset creation capture
2. Intellectual Property Asset management
3. Intellectual Property Asset usage

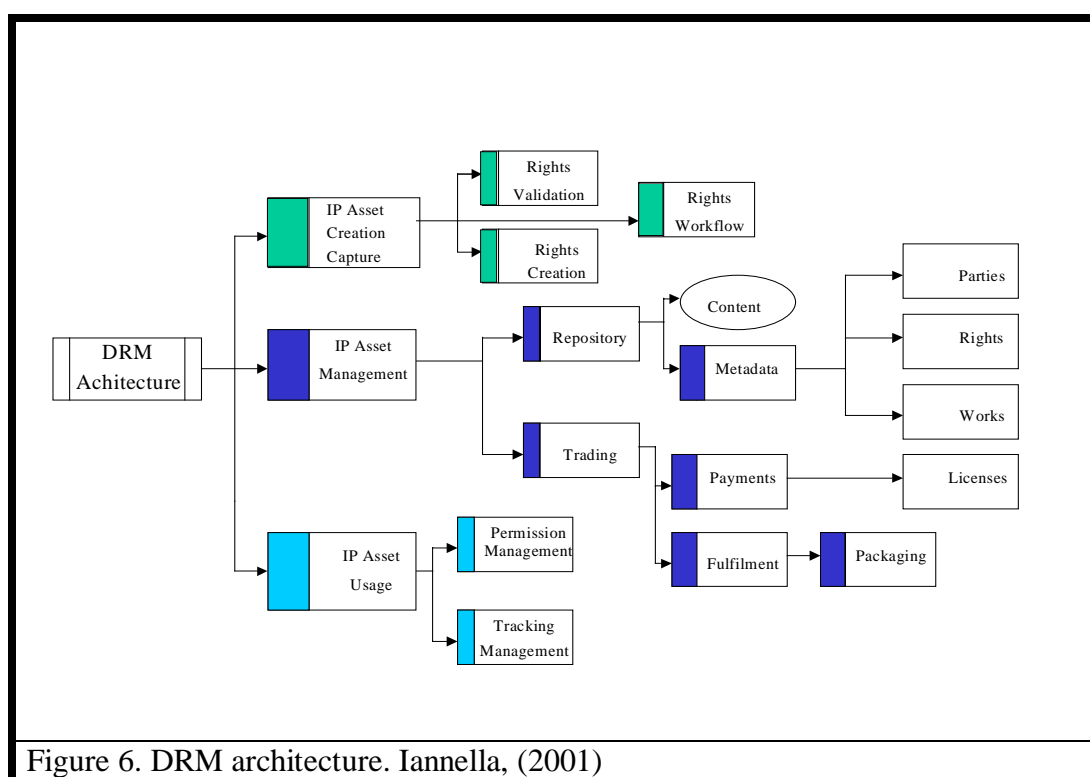


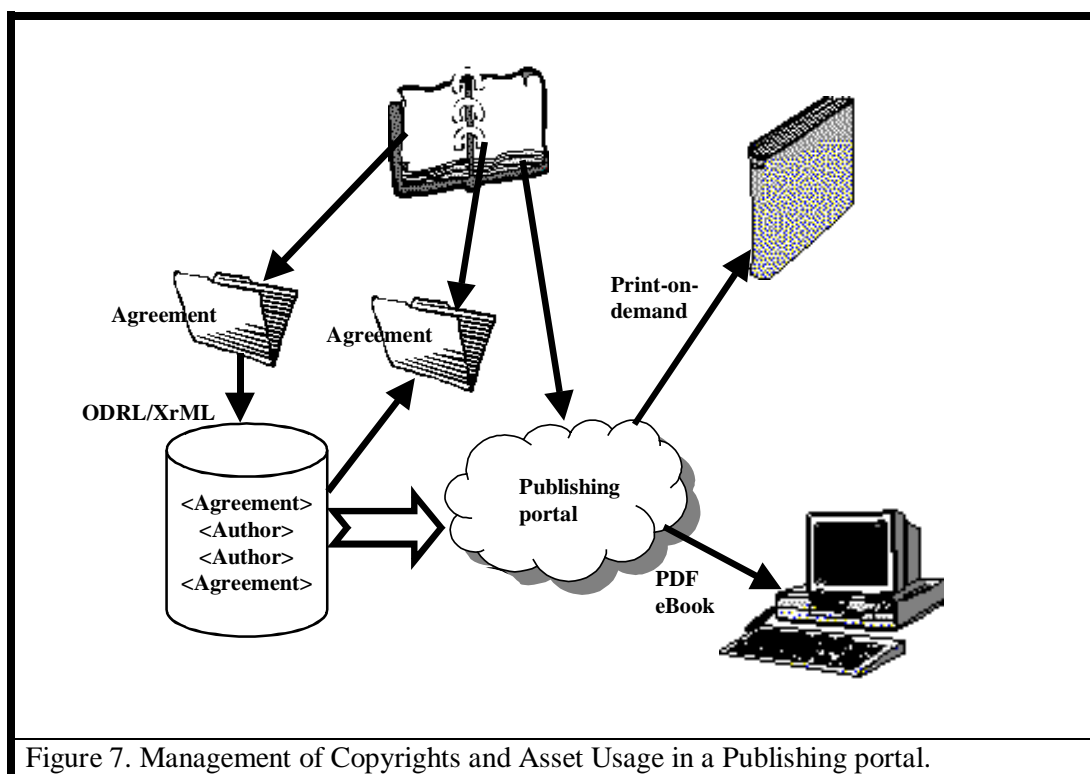
Figure 6. DRM architecture. Iannella, (2001)

The first stage contains the rights definition and validation. IP Asset management includes the metadata creation where the authors, their representatives and rights are indi-

cated and saved together with the content in data repository. Another part of IP Asset management is the trading and management of payments and formats. The latter mentioned describes whether the content can be published in digital form, in printed form, can it be copied etc. The IP Asset Usage takes care of the access to the asset and tracking of the usage.

Copyright protection and controlling correct content usage is easier with printed media than with electronic media. With printed documents, it is easy to see the difference between the original and the copy. There are also laws and practices for copying; for example schools pay copyright fees for copying textbooks. In digital world copies cannot be distinguished from the original and copies can easily be delivered further without deteriorating the quality. This means that digital publications have to be protected against non-desirable usage. This is usually done with restricting the access to the content. There are some solutions to handle the whole copyright management issue, but they are quite expensive and complicated. Another serious drawback is the inflexibility on the user side, the most considerable ones are that the user is often tied to certain equipment, and may be obliged to download additional software. This decreases the flexibility and makes the usage sometimes quite tedious.

Most demanding task is to manage the modular content as user defined aggregations. In this case, the output contains sections from different copyright owners, perhaps with different terms. This will be more and more important when the user will be able to customise the final product by selecting proper pieces of content from the data repositories of the publisher or a broker.



The structuring and multiple use of the content seems anyway to be the trend in the publishing sector end thus sets requirements to manage the copyrights both legally and technologically

DRM is one of the key features that has to be solved in order to create really profitable electronic content services. Content creators want to be sure that they will not lose their income by providing their content in electronic format. The situation is still a bit fuzzy, technology develops fast and the regulations develop gradually afterwards. DRM systems and software will certainly be an area where hackers and system developers compete with each other and completely safe solutions will be difficult to develop. Another aspect which causes embarrassment is the demand for free knowledge society without too formal and stiff copyright protection systems. Some experts think that it will be more beneficial to deliver the information and knowledge freely than to try to protect and sell it. This can be called the Linux way of thinking.

The challenge and opportunity of mobility

The studies made about the use of training material show that an important feature from the learners' point of view is the excellent mobility of the printed material when compared to fixed PC based systems. Other important feature of the printed document is the easy access to any part of the document. This can be assumed to be the state of the art also more generally.

The development of mobile telecommunications and terminals will anyway change the balance between printed and electronic communications much faster than in the past.

Transmission of speech continues to be the main service in the mobile world. Today SMS messaging is well-established especially in northern European countries. Multimedia messaging and handsets supporting MMS have been introduced in summer 2002. SMS messages contain only text (160 characters). An MMS message comprises of still image, audio and text. MMS messages can be even person-to-machine. Mobile content services such as short news flashes are available, but their success has been limited. These rather expensive services are a complementary to traditional news sources and attract mainly mobile business users.

Another natural set of mobile services is location-based services that have started to establish their position in various markets.

When the bandwidth of UMTS network is available, transmission of video is a candidate for a killer application especially in the form of video telephony, but also in consumer market entertainment applications like online-games and mobile television, which are expected to be popular.

Mobile businessmen are an important user group while mobile networks provides the access to various company applications. Group-based personal services can be offered to mobile workers, such as salesmen.

While the development of telecommunication networks seems to be blurred at the moment, the confidence in Wireless LAN has increased. Companies and other organisations are deploying WLANs instead of wired LANs. Also, many public places, such as airports, shopping centres and hotels have WLAN operators covering these so-called hotspots. In consumer side, WLANs are being installed in homes for broad band network access. One future vision is that WLAN and UMTS networks are seamlessly used together.

An interesting new telecommunication segment is what is called the "Internet of things". This means that physical objects – be it product packages, paper and other media plat-

forms, various domestic and business devices – have their own digital identity (such as bar codes or rf-tags) and they are able to communicate their identity to human user or other objects.

In order to serve the future nomadic user in a best possible way context aware solutions will be developed. Context can be location based but in the future also time, customer habit, situation etc. based. Context can be defined automatically by analysing different factors and signals of the user environment so called social context. This can be done by the help of the mobile devices and the ubiquitous computing embedded in the user environment.

At present mobility is mostly used in person-to-person or person-to-few communications. In ten years time publishing (one-to-many solutions) will be feasible. More and more important will be also mobility in production environments and machine-to-machine automation.

2.11 Other important technology trends

There are just around the corner considerable number of other potential technologies. All of the technologies of the year 2010 are not yet invented. Some of the potential technologies will probably not realise.

In the field of Information Processing Technology and software industry there are e.g.

- *Ubiquitous Computing (UbiComp)*, where the intelligence is integrated into the equipments and systems. UbiComp can be described as invisible computer so that the computer is so embedded, so fitting and so natural, that we use without even thinking about it. This improves the human interaction significantly.
- *Ubiquitous Communication (UbiCom)*, which means that the vehicles or things have embedded memory that can be activated by an equipment containing the computer power (for instance RFID tags).
- *Intelligent agents*, which surf more or less actively in the net and help the user to find information, entertainment, advertising, products, services e.t.c. which are needed or desired. This is linked to the Artificial Intelligence Technology.
- *Database technology*, which is the key technology to manage and process information e.g. for tailored and personalised purposes.
- *Datamining* which is an important tool to manage enormous amount of information for the purpose of recognising needed information.
- *Compression* of data, especially of pictures and video clips, for storing and transmission.
- *Voice recognition* for input, especially for journalists but also for document production, and for indexing of media.
- *Voice syntheses and voice output* e.g. for blind persons communication, and SMS to car drivers.

- *Multilingual* information and media publishing systems. Automatic or semiautomatic realtime translation.
- *Image and video understanding*. Automatic extraction of useful knowledge from visual data.

In the field of Communication Technology and data transmission there are e.g.

- Complete *optical network* for broadband and high-speed data transmission.
- *Location Technologies* for supporting several mobility applications in the field of information industry.
- *Data electricity* where the data transfer is realised through electric wires. The data electricity will be used e.g. for the internet connections in the free-time cottages, if it will be true.
- *Haps* (High altitude platform stations) which is the flying antenna in airship or aeroplane 20-50 kilometres above the earth. Haps will probably be cheaper, and will probably enable more effective use of radio frequency than satellites and aboveground links, if it will be true.

In the field of the Hardware Technology; equipment, terminals and other information carriers there are e.g.

- *Nanotechnology* and *organic materials* for minimise the dimensions and costs of electronic equipments, especially for mobile communication purposes, also enable new applications.
- *Tablet-PCs*, *PDA*s, *e-Books* and other portable terminals for media content receiving and/or communications.
- *Mobile Digital TVs* etc. for mobile and user-friendly communication.
- New *display* technologies, flat and bending displays, coloured and matt surfaces etc.
- New *batteries and energy sources* which support the break-through of mobile communication devices.

3 Market Trends in the Media Field

3.1 Globalisation

Globalisation and technology push are today essential megatrends. Globalisation has many dimensions, but the most important factors are economical. The economical globalisation refers to increased international trade, the internationalisation of the capital and investment markets, and to a fast extension of the companies and their investment activities across the national borders.

In the culture globalisation appears among others as a convergence of national cultures and a global distribution of the western (American) values. The spread of information technology and globalisation are strongly merged phenomena. The ICT technology has enabled a global decentralisation of the activities of the enterprises. On the other hand, multinational companies distribute their solutions in information technology, and the global competition is the root of new ICT innovations.

The branches differ strongly from each other regarding globalisation. Earlier it was considered important that the companies acting in traditional industry sectors should be kept under national control. In the Ninetieth the world changed, the markets are now almost totally global and the structure of the companies is becoming multinational.

The media sector represents an extreme in globalisation. Though the traditional printed media may be national, the digital media is impossible to control by national measures, and it is principally free from the shackles of national borders and cultures. The content is partly national, or even regional, but also easy to localise. Although the "new media" field in principal offers equal opportunities to success to all individuals with a high enough level of skill and education, in practice it favours individuals with English as mother tongue and American enterprises.

The language is also an obstacle for e-commerce. Most web sites are in English. Nevertheless, 80 per cent of all net-shopping is made in the buyers own mother tongue; the visitor stays – according to statistics – twice as long and is three times more likely to buy from a net-shop in his own language.

The impact of globalisation and digital economy are first and most directly seen in sectors, where the delivered product or service is immaterial and easily transferable into a digital form. Media, and more generally content, are such sectors. However, in the long run the impacts are seen in all areas. The companies concentrate on managing the logistics of their value chain. In the information Society not only the physical value chain should be managed, but also the virtual one.

The virtual value chain consists of the information created in and between the different steps of the physical value chain. Managing the virtual value chain is today an essential competition edge.

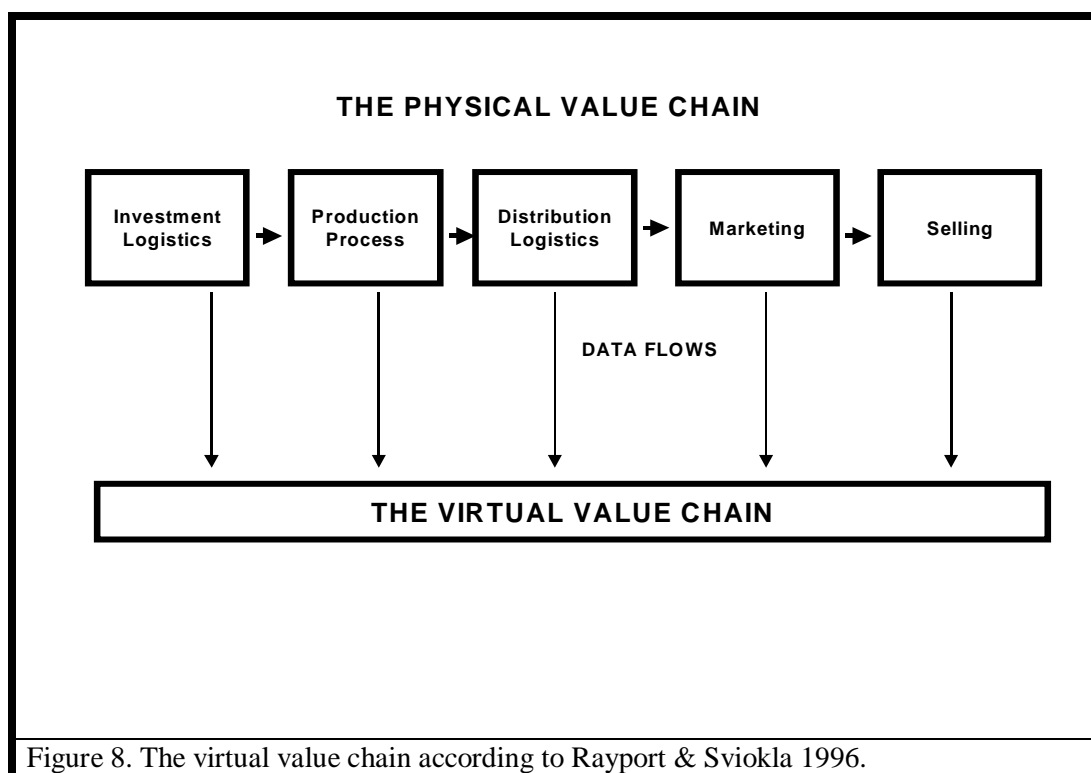


Figure 8. The virtual value chain according to Rayport & Sviokla 1996.

It is obvious, that national cultures and traditions play an essential role in the adaptation to and application of the global technology push. The social pull vary strongly from one culture to another, and so does the readiness to utilise globalisation. In Europe we must distinguish at least between the Teutonic (Nordic and German), the Anglo-Saxon (UK and Finland), and the Roman (France and the Mediterranean) cultures.

The Finnish scholar system has received international recognition, and so has the literacy ability and habits of Finnish youngsters. This, in combination with a high penetration of the Internet, enables a fast adaptation to use multiple media. The obstacles for multiple media are obvious much bigger in the Roman culture because of lopsided focusing on television as the dominant media, and because of linguistic limitations.

The globalisation has a levelling and unifying effect on national cultures. On the other hand, nationalistic counter-reactions are also foreseen. The competitiveness map of the European Commission predicts a reduction of local inequality thanks to a decentralisation of the economy by utilising the ICT technology. This also enables a global localisation of contents and services (GloCal-isation).

At the same time we also face a diversification of the mass culture, when more and more sub-culture groups and one-subject movements are formed. These groups have their special demands for content. The supply is expanding with the number of channels available. For the Ad agencies it becomes difficult to reach a big audience by one media, but at the same time, it becomes easier to reach a specific target group over a tailored channel.

The globalisation brings new challenges for the trade unions. The future opponent in the negotiation for a collective agreement is not necessarily the national federation of the industry, but may be large multi-national enterprises or their international federations (See Figure 9). The trade unions will need persons with good knowledge of language (espe-

cially English), and experience of international legislation, agreement praxis, negotiation techniques and other skills.

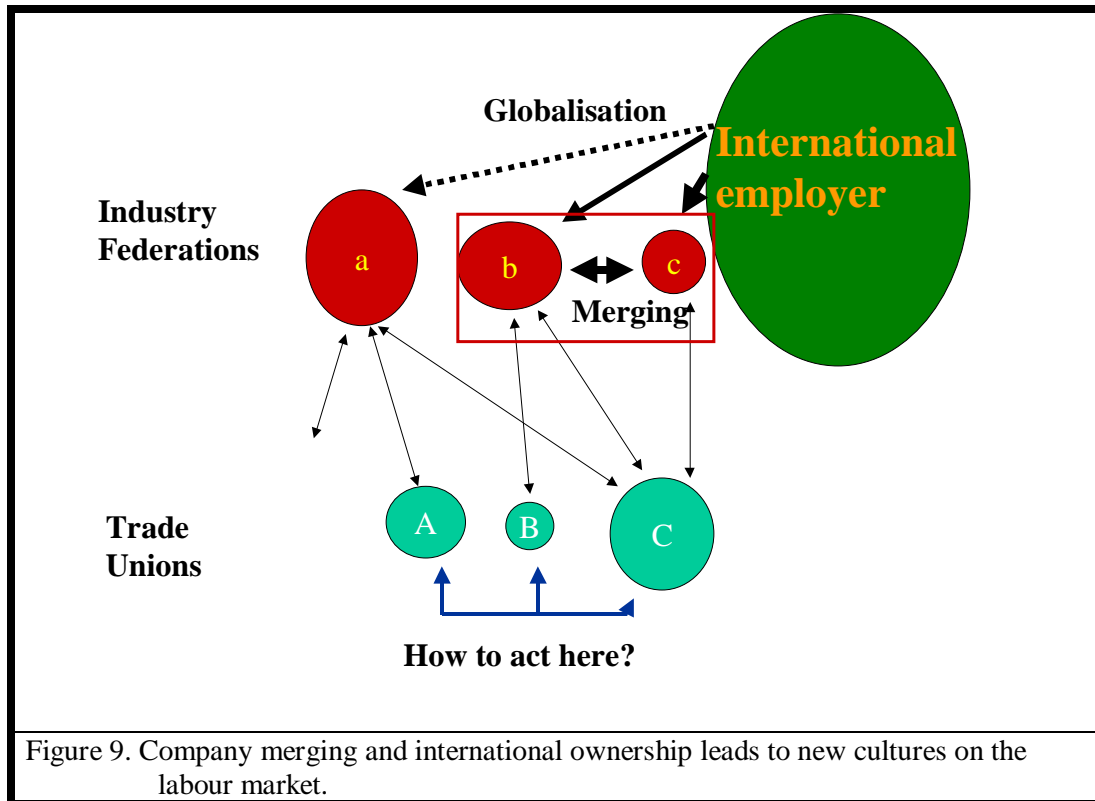
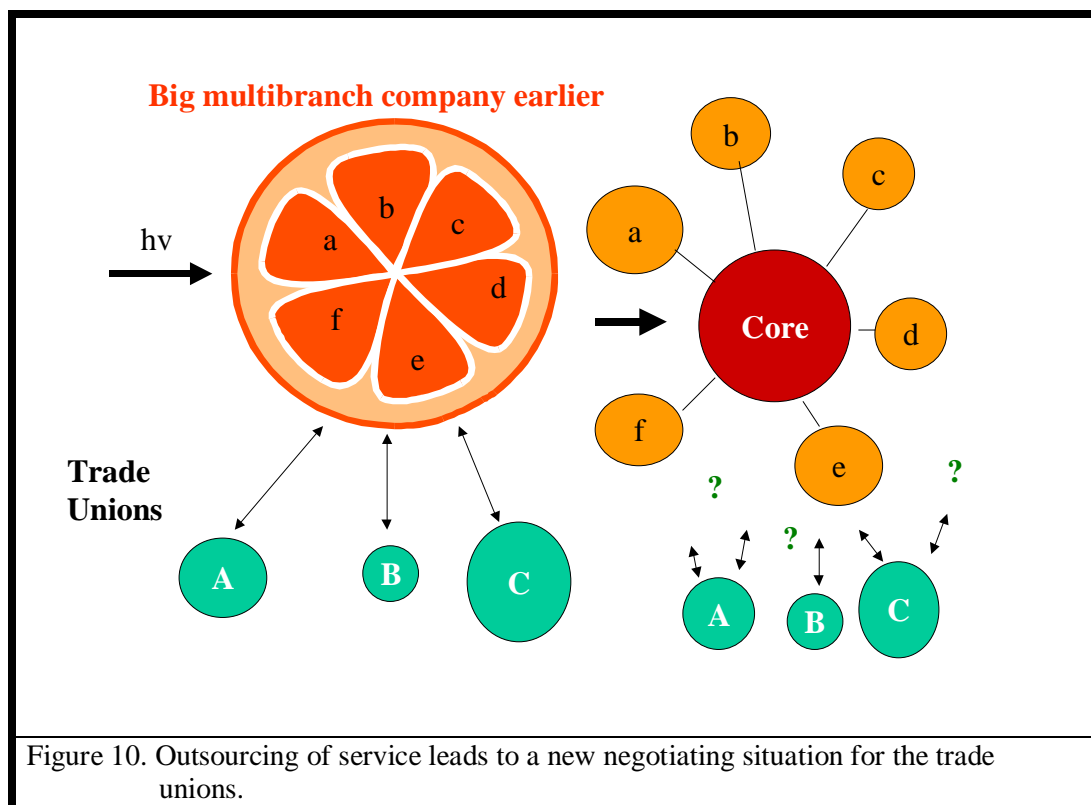


Figure 9. Company merging and international ownership leads to new cultures on the labour market.

The trade unions are facing new challenges, as their future negotiation partners may be large multi-national enterprises or their international federations. At least in Finland the trade unions have already taken an active role in the restructuring of the sector, and develop their service to their members to fit future demands.

The restructuring of the big companies with outsourcing of service and logistics and focusing on core business is another new challenge for the trade unions. While the unions earlier negotiated directly with the company, their members have now been split up on a lot of small subcontractors with limited economic resources. In a future depression the subcontractors is a buffer for the big company, and they have to adjust their capacity to the market situation by denouncing their personnel (See Figure 10).



3.2 Media market development

Traditionally the world consumption of printing and writing paper has been an indicator for the development of the media market. It is strongly related to GNP, and has so far grown constantly by 4 per cent annually. The forecasts for the paper consumption are, according to *Jallinoja* (2002) still very positive. The total consumption was 324 million tons in 2000, and is expected to grow by 2,6 per cent annually up to 475 million tons in 2015. However, both consumption and growth vary strongly between countries, but so far the introduction of new media has had only a marginal impact on the paper consumption.

Relatively the main growth in the paper consumption appears in Asia, China, Latin America and Africa. The forecasts are surprisingly optimistic also for Western Europe, Northern America and Japan, although the newspaper consumption has not grown in the US during the last decade.

The forecasts of *Jallinoja* are based on the historical causality between GNP and paper consumption. Also FAO (Food and Agriculture Organization of the United Nations) trusts on the same causality. On the other hand, *Hetemäki* and *Obersteiner* have suggested that this causality has vanished during the last decade (Figure 11). The difference between FAO and *Hetemäki* in the year 2010 (more than 6 million tons) is nearly the total newsprint production in USA.

The crucial point for the further development of the world media markets is Asia and China. Like many developing countries have skipped railways when building up their new infrastructure, China could also step directly into the Internet and mobile age. However, this is probably less likely to happen, since it requires a tremendous investment in

hardware and also a political liberalisation of the system. Therefore, China may open a wide market for "low quality" printed media of extremely high circulation. This will open new possibilities also for the European over-capacity in printing of newspaper quality.

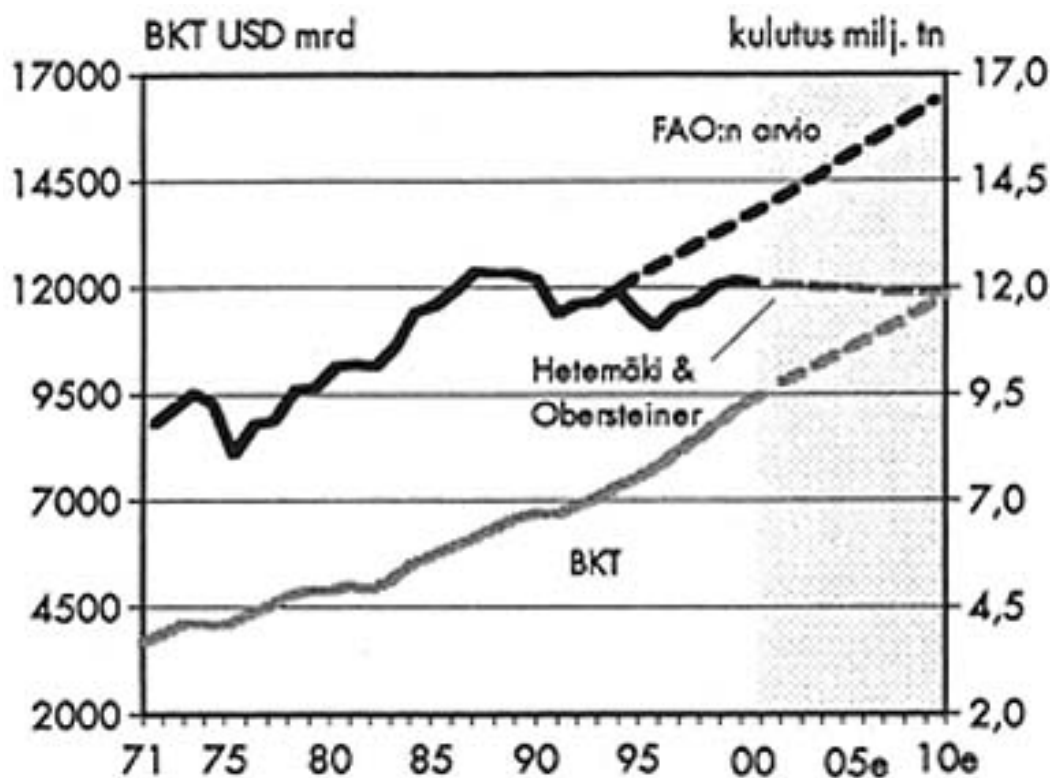


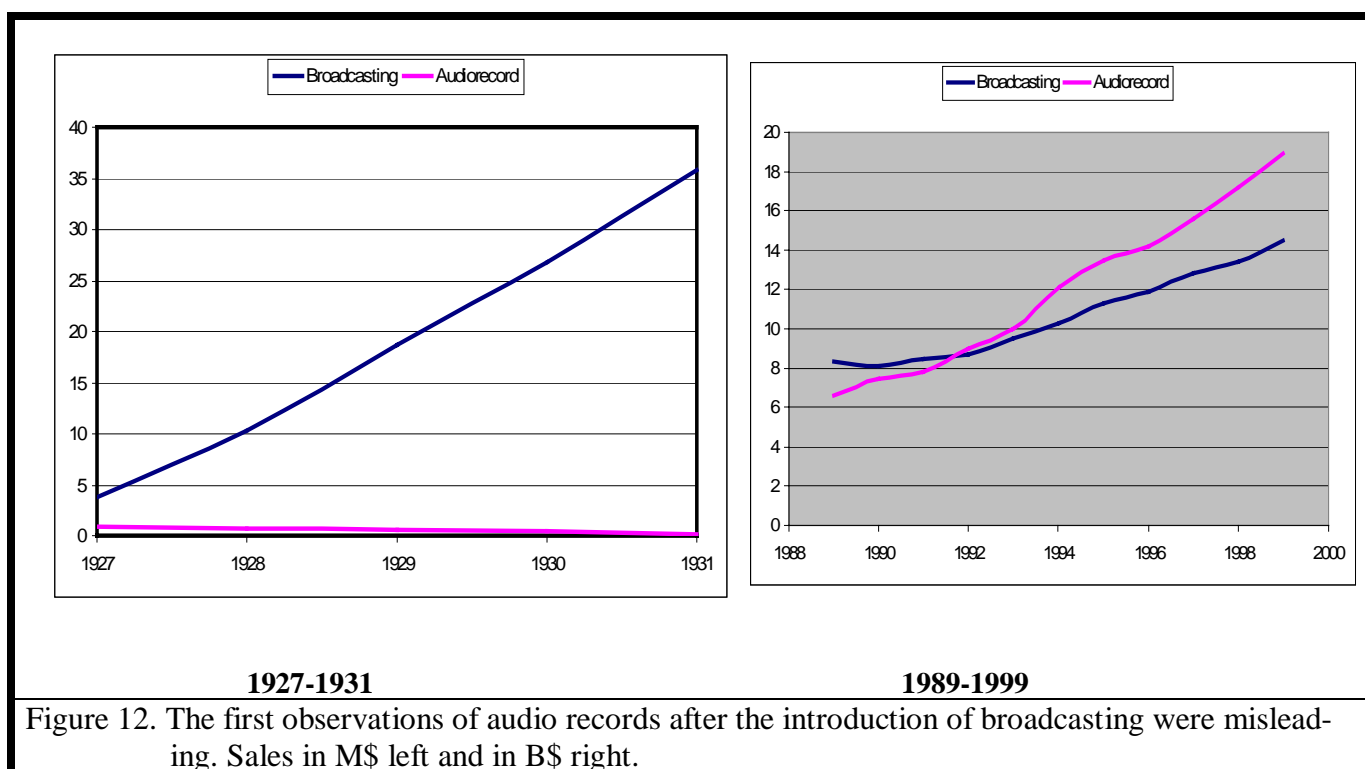
Figure 11. The consumption of newsprint and the development of GNP in USA (Hetemäki and Obersteiner, 2001).

American forecasts predict a much faster growth for digital printing compared to Europeans, *Delmontage* (2002). According to this study based on 150 expert interviews traditional printing is losing market shares from 80 per cent 2002 to only 50 per cent in 2006. The rest is taken over by Presses for Direct Imaging (15 %), Toner-based Digital Presses (10 %), Networked Digital Printers (5 %), Virtual Access Media Printers (25 %) and others (5 %). New digital media will compete strongly for catalogues, manuals and newsletters, but only weakly for newspapers, packages, direct sale, postcards and books. Therefore, also the sale of equipment and materials for traditional printing is decreasing, with the exception of CTP processors.

From a European standpoint especially the breakthrough of mobile phones and wireless Internet has been the main driving force in the ICT sector. 3G and 4G of mobile communication service offers the platforms for performance and access in combination with the Internet.

The critical factor will be the content itself, since the consumer is the king. The consumer will not automatically adapt all the media available. For instance HDTV and audio Mini-Disc did not conquer the markets. On the other hand, the most profitable business area for the telecommunications – the SMS messages – perfectly surprised them.

Therefore, technical functionality and economic potential do not predict the success of a media alone. Also human needs, consumer behaviour, communication habits, cultural and sociological factors as well as national and regional traditions must be taken into account. In fact, the first reaction may be strongly misleading. An example of this is the impact of broadcast radio on the sell of audio records and gramophones during the first years, Figure 12. The first statistics indicated a total collapse of the sell of audio records in the U.S.A.; today the sell of audio records over there passes the turnover of the broadcasting companies.



Electronic publishing is an essential part of the new value chain not only in the media sector, but also in the entire ICT sector. It will find applications in Business-to-Business (B2B), Business-to-Consumer (B2C), Consumer-to-Consumer (C2C) and even in consumer-to-Business (C2B) services. The latter includes the formation of new globalised societies of focused interests. In this value chain the role of the publisher as the content provider will change dramatically. He may become a node in the new network of societies, but he may also be overstepped completely.

The new value chain also creates new forms of content combination, such as edutainment (education and entertainment), infotainment, etc.

Also regarding Digital Television (iDTV) Europe has a strong position with an anticipated growth of connections up to 350 millions in 2006. This will enable a wide t-commerce in addition to other services like pay-TV, gaming, education, and information. However, the introduction stage has been slower and more fumbling than expected.

Like the stock value of the ICT sector itself, the introduction of a new media often creates a "hype" phenomenon, when expectations and consumer behaviour do not fit. In the long run a stable growth often appears after a while. A typical hype cycle is presented in Figure 13, and contains basically five development phases, i.e. Technology trigger, Peak of inflated expectations, Trough of disillusionment, Slope of enlightenment and the Plateau of productivity. In the figure the content technologies of today have been plotted.

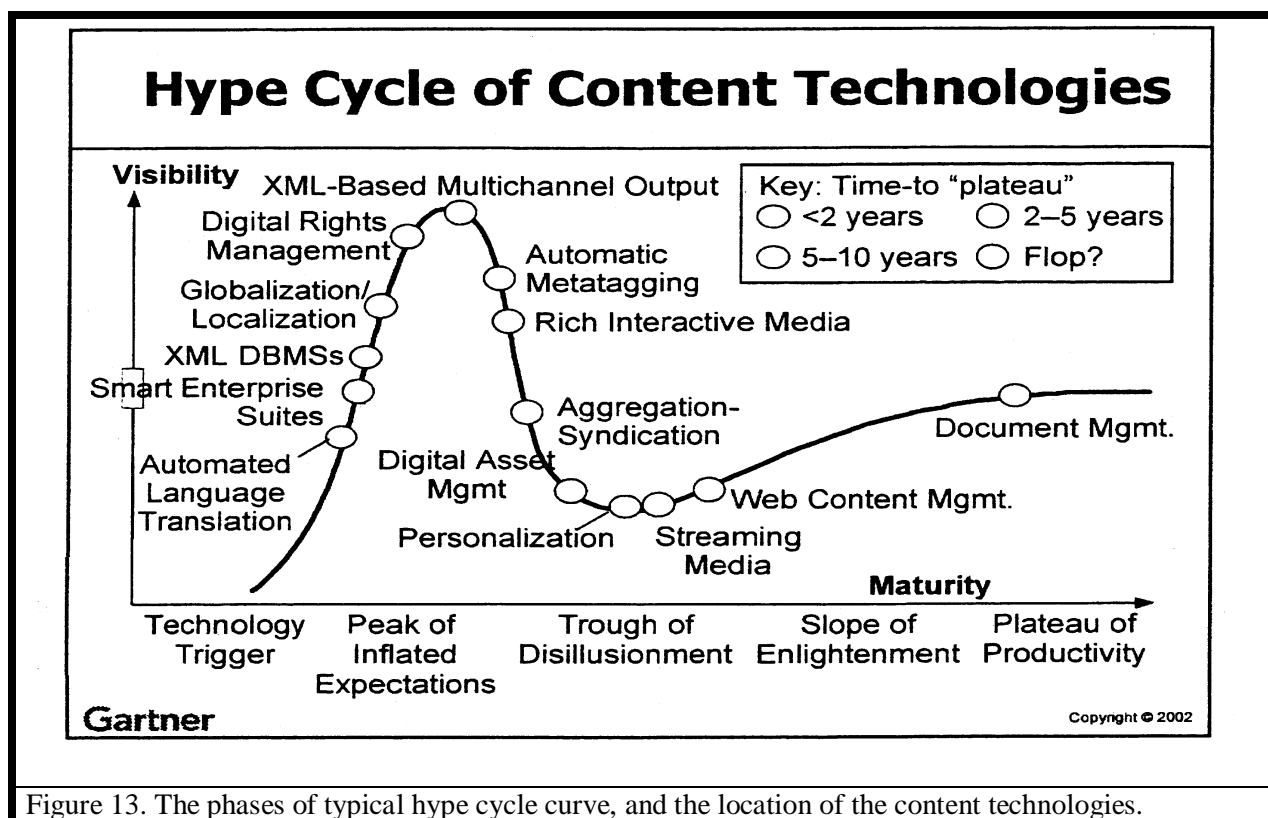


Figure 13. The phases of typical hype cycle curve, and the location of the content technologies.

Other technological progress is made in the field of handheld devices and lightweight laptops with high-resolution liquid-crystal displays and PDAs. Also new options for data storage for mobile multimedia, metadata structures, content filtering and retrieval will offer new possibilities for media convergence.

A prerequisite for an unlimited use of the new techniques is, however, interoperability and consolidating of open standards. In this category we also include the upgraded Internet communications protocol IPv6. In fact, the entire expansion of these technologies depend on global approval of standards and de facto standards of protocols.

From our studies so far we may conclude, that the technical conditions for a complete media convergence are already there. There are also technical possibilities for a further convergence between the players of the ICT sector. However, it depends more on economical, market-oriented and owner-structure related factors to what an extent and at what time schedule the convergence really occurs.

In the following the new service opportunities and their applications in B2B and B2C are analysed more in detail.

3.3 Types of communication and communication channels

One way to consider communication, is to categorise it based on the type of sender and receiver. The two main types are business and consumer. Thus we can combine four communication categories: Business to business (B2B), Business to Consumer (B2C), Consumer to Consumer (C2C) and Consumer to Business (C2B). C2B-communication has not yet any real volume, and the potential seems to be rather marginal. The table 1 presents these four types, and channels which can, or could be used for communication.

In case of B2B-communication are needed rational services, like real time databases and datamining software services. In case of B2C-communication typical content is like news and weather, information of sport and cultural events, games, betting and advertising. In case of C2C-communication the most potential services are type of SMS and MMS.

Table 2. The communication channels categorised into four main communication types.
 Note: *, **, *** is the potential for the channel, +, ++, +++ is the relative use of channel today.

	B2B	B2C	C2C	C2B
Newspapers	*/+	***/+	**/+	*/+
Periodicals	**/+	***/+	**/+	*/+
Free newspapers and periodicals	0/0	***/+	**/+	*/+
Free periodicals for advertisers	*/+	***/+	***/+	*/+
Printed catalogues	**/+	***/+	0/0	0/0
Printed tailored advertising on demand	***/0	***/0	***/0	*/0
Tailored and personalised documents	**/+	**/+	**/+	**/+
Manuals	***/+	***/+	**/+	0/0
Directories / Yellow pages	**/+	***/+	*/+	0/0
Greeting cards	*/+	**/+	***/+	0/0
Posters (incl. bulletin boards in shops)	*/0	**/+	**/+	*/0
Print + web	***/+	***/+	**/0	*/0
Radio	0/0	***/+	**/+	*/0
TV (one way)	0/0	***/+	0/0	0/0
TV (interactive two way)	**/0	***/0	*/0	*/0
TV chats (with or without SMS etc.)	0/0	**/0	***/+	*/0
Internet	***/+	**/+	**/+	*/+
eMail	***/+	**/+	**/+	*/+
Phone call	***/+	*/+	***/+	*/+
SMS (Small Message Service)	*/0	**/0	***/+	*/0
MMS (mobile phone + SMS + photo)	**/0	**/0	***/0	*/0
CD-audio, CD-ROM, DVD	**/0	**/0	0/0	0/0
eCatalogues	***/+	***/+	**/0	*/0
eBook, eInk etc.	**/0	**/0	0/0	0/0

3.4 Media industry development

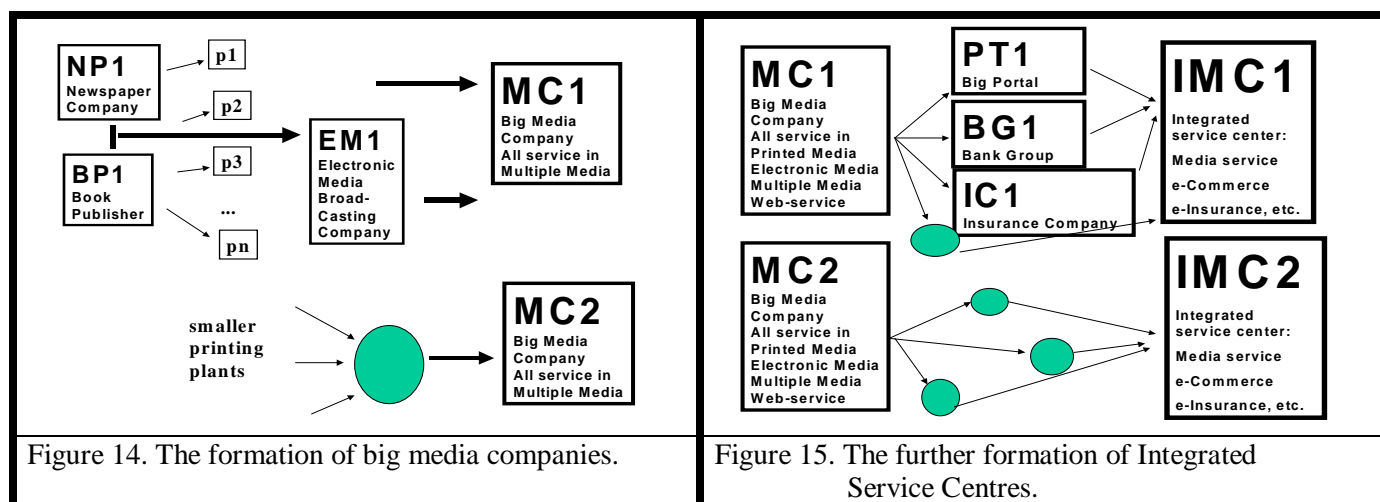
In this chapter we try to describe the alternative futures of the media industry and the whole ICT sector. The ability for a technical convergence has already resulted in a partial restructuring of the industry. These changes in the market place are first analysed. Thereafter three scenarios for the future ICT sectors are developed.

3.4.1 Convergence in the media market place

The merging between media is an international phenomenon. Leading media companies search to offer a complete and all-round multiple media service, covering both printed media, electronic media and new media. A prerequisite is that the giant possesses distribution chains with enough capacity.

One possible model for the development is presented in Figures 14 and 15 (based on examples from Nordic countries and the US). In the first step a big publisher - e.g. a newspaper - (NP1) company merges another company - e.g. a big book publisher - (BP1), and buy up a number of smaller printing shops (p1...pn) in order to offer their customers full service in printed media. After merging a big electronic media company (EM1) a new "media giant" (MC1) is established, which can offer a complete variety of media. In the same way other "media giants" (MC2) are created.

In the next step the media giants obviously will form alliances with leading telecommunication operators - i.e. possessors of leading market place portals (Figure 15). This alliance can also include significant providers of other services, such as a leading bank group, a leading insurance company, a leading marketing group, etc.



Many other industrial branches have gone through the same kind of "metamorphose", which is likely ahead of the content industry, and will affect electronic publishing. The paper industry, the car industry and the shipyards are all examples of this development. The most significant merging process so far in the media field is that between Time and Warner Bros, and their further merge with America On-Line to AOL Time Warner. However, this merge has not been a success story. In this case the problem has been that the

customer have not been eager to use Internet based content and especially to pay for it. Another obstacle has been the copyright management of the content owners. The owners are not willing to put the content into the web, because they are afraid of loosing the copyright fees.

The merge between content providers and leading broadcasting companies is a complex process, that is not necessary irreversible. The established media giant may face cultural, traditional, historical and even human obstacles, which may split the giant back into smaller companies with different business ideas.

During the last decade the message to the printing industry from one of its most prestigious "trend-making" events, the Comprint Conference, has been "join the electronic media, since you cannot beat them!". This year the signals were more sever than ever before:

- Printing continues, in some areas it may even grow, but to most readers and publishers it is just one alternative among others.
- Therefore, the printing industry should create an additional value to their customers by extending its service to cover most of the value chain. This requires new innovative solutions.
- The global over-capacity in the printing industry makes the innovative service a must; only the innovative companies will survive and expand.
- New production management systems make the customer a product designer, who follows the entire work flow in real time. This calls for closer and more open co-operation between the printer and his customer.

According to *Birkenshaw* (2002) the Ad market share of the printed media is declining slowly and is now about 50 per cent. The market share of the digital media is increasing from 2 to 9 per cent in 2005. The development of the media market is strongly related to GNP. With extended customer service prices should be based on customer value rather than on production costs.

3.4.2 From production centric to service centric

In the next few years no growth is expected in the printing market. This is most critical for the offset printers, who must manage high investment costs, declining markets and falling prices at the same time. For the publishers the digital media offers plenty of new possibilities. Personalised digital ads increase in volume, but classified ads lose the competition to on-line ads. Classified advertising in print is severely affected by the Internet, and this will continue as wireless technology becomes more widely adapted.

The reproduction houses must expand their service towards archiving and digital asset management (DAM). This means that the customers must have access to their archives, and remote proofing becomes a trump. Newspapers and magazines should utilise their brand names when expanding into digital media. For advertising campaigns on-line monitoring will become common standard.

According to the study of *Rose et. al.* (2002) the printing industry is going through a metamorphose. In 2007 only 40 per cent of the printers are still in business as such, more than one third offer multiple media services, and one third is out of business. Also this

study predicts a growth for digital printing, but not based on technology push, but on innovative new products and services.

As the printing house turns into a media company, also the organisation must be restructured. Special attention should be paid to the information flow in the whole organisation. A prerequisite for success is a flexible and service minded personnel which is open to changes.

The general conclusion of this is, that the media branch is changing from a production centric sector into a service centric one offering a wide brand of multiple media services. The social pull will replace the technology push as the driving force for development and restructuring. The market pull is a part of the social pull, but the social pull also includes the social demands and the legislation decided on a national or European level.

One essential point will be the future position of the national broadcasting companies. Traditionally they have a strong position in most EU countries. If this position will be broken down by deregulation and anti-trust directives on a European level, this will lead to a commercialisation and a total restructuring of the electronic media market. However, this development will be dictated by controversial political decisions, not by economic factors.

3.4.3 Big media companies vs. small specialised producers

The reorganisation process

In the course of time, the companies are moving to centralised, and after a period back to decentralised organisations. Sometimes the scale of economy is the leading doctrine of consultants. Some other time the lean organisation is number one. Sometimes companies with diversified activities are in fashion, some other time specialised firms. The final truth is not founded.

Scale economy and "small is beautiful" -ideology

In the long-term the development seems to go to major companies. The big ones get increasingly bigger. The empirical experiences support the theory.

The development also in paper and printing industry leads to consolidated companies. The gravure printing industry in Europe e.g. has economical problems. The main reason for that is the size of the companies. They are too small. In Europe works more than 20 gravure companies meanwhile in USA there are only four companies. It is expected that the fusion of gravure companies will take place in Europe.

In the Northern countries the media companies are rather small compared with the European level, to say nothing of world ranking list. The Swedish Bonnier was the biggest Nordic media company and was among the 20 biggest media companies in Europe until SanomaWSOY in summer 2001 bought VNU magazine publishing business in Holland. To day SanomaWSOY is the biggest media company in Nordic countries, but still not yet among the top ten in European level.

One of the greatest advantages of big company is linked to the marketing force. Big company can build a well-known brandy. It is important in marketing, but also in recruiting well-educated specialists. Another advantage is the production costs of mass production.

The big companies have in addition enormous resources e.g. R&D -activities. The ability to take risks is notably better than in small and medium size companies.

The most important attribute of small firms is innovativeness. This has been proved many times. The innovativeness is more and more important for the companies in the future. The business environment round the companies will change non-stop. The small companies are much more flexible to change activities if it is needed. This has been seen especially in the cases of new technology companies. On the other hand the absurd expectations of the new media and ICT companies has now failed. The hype is over. But what is the next hype?

"Small is beautiful" is not a slogan when we discuss innovative companies. Therefore big companies work closely together with innovative small companies.

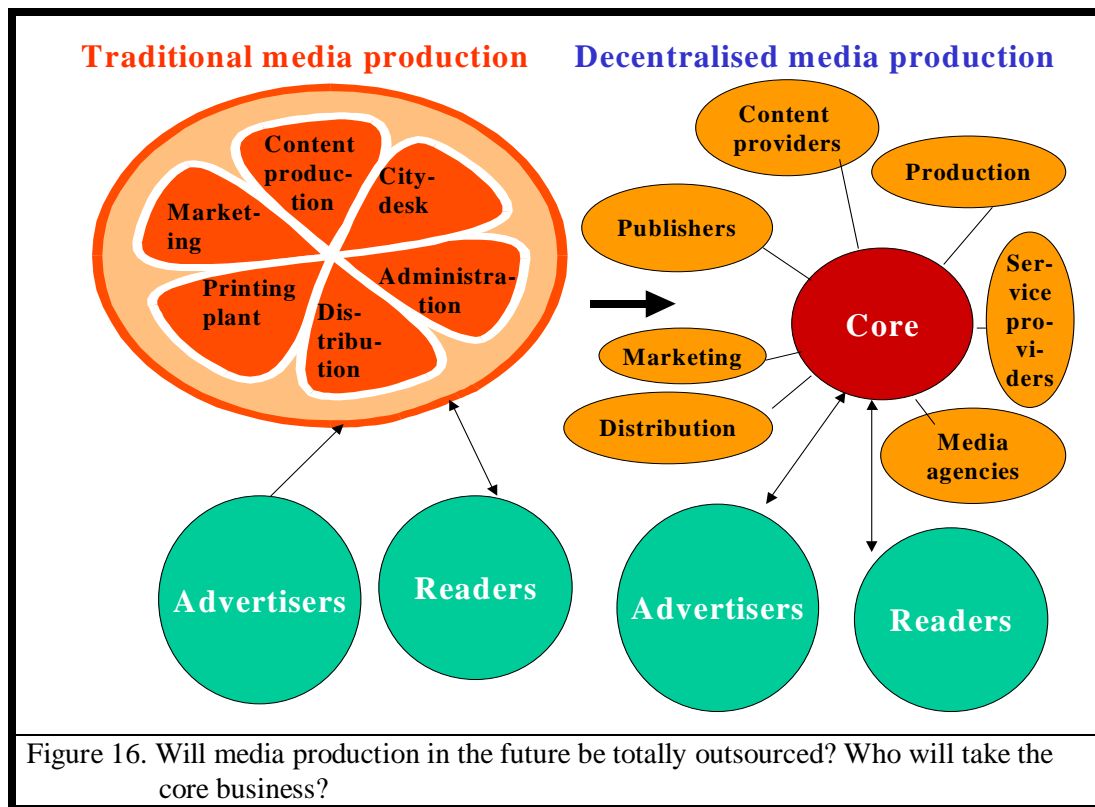
Outsourcing

Outsourcing is ideal solution to combine the brand of big company, and the flexibility of small companies. The shipbuilding industry e.g. has long time followed this strategy. The small subcontractors are very effective and flexible utilising the work force. The car industry has great and established brandies, but as a matter of fact, most of the car factories are assembly plants. The components are produced in specialised factories outside the big car factories.

The same logic has come to media industry. For example traditionally the broadcasting companies dominated the whole chain. YLE had its own TV-theatre, radio symphony orchestra, distribution network etc. Today YLE has outsourced the distribution network and even sold half of it to France Telecom. The private TV-channels have only few own productions, like news and weather. Most of the programs are produced in small independent media companies. Those have creative atmosphere and they work flexibly. The broadcasting companies only package and market the programs. Also many magazines use free-lance journalists for the same reason.

In printing industry outsourcing is increasing within printing factories, likewise between printers and customers. For instance, in some printing factories service and maintenance is outsourced, as well as some special operations like finishing. There are also firms which take care of digital asset management and file transmission.

Small subcontractor companies are really excellent buffers against conjunctures. During the economical depression the big company does not give an employee notice itself. The subcontractor companies do this on behalf of the big company. This is the culmination of the flexibility.



Concentration and outsourcing at the same time

In media industry there are two mainstreams at the same time. One is organic growth, to cluster together with other companies, to contract strategic alliances, make fusions, and look after growth by some other means. This leads to growth of turnover and growth of market share. The aim is to earn superior profit and to increase shareholders' value.

Another way to this target is to outsource such activities, which are not on strategic level and belong not to core competence. Outsourcing gives flexibility, especially when the operational environment changes and in economical depression, improves profitably and lightens the administration. At the same time the company focuses on the core competitiveness.

3.4.4 Convergence in the ICT sector

The media business has become an integrated part of the ICT sector as a consequence of the technical development. It follows, that the whole ICT market space is changed, as the new players search for their role and the old players want to expand their position. The ICT space can be presented in a three-node-graph (Figure 17), where content, service and hardware are the nodes. The electronics suppliers, the network operators and the content providers (publishers) all have their own corners in the diagram, but also the printers and the electronic media providers match in it.

Each player aims at expanding his market, to find new contact areas to new customer groups, but at the same time also to offer his customer new forms of service. The development of additional service is, in fact, a prerequisite for each player to survive.

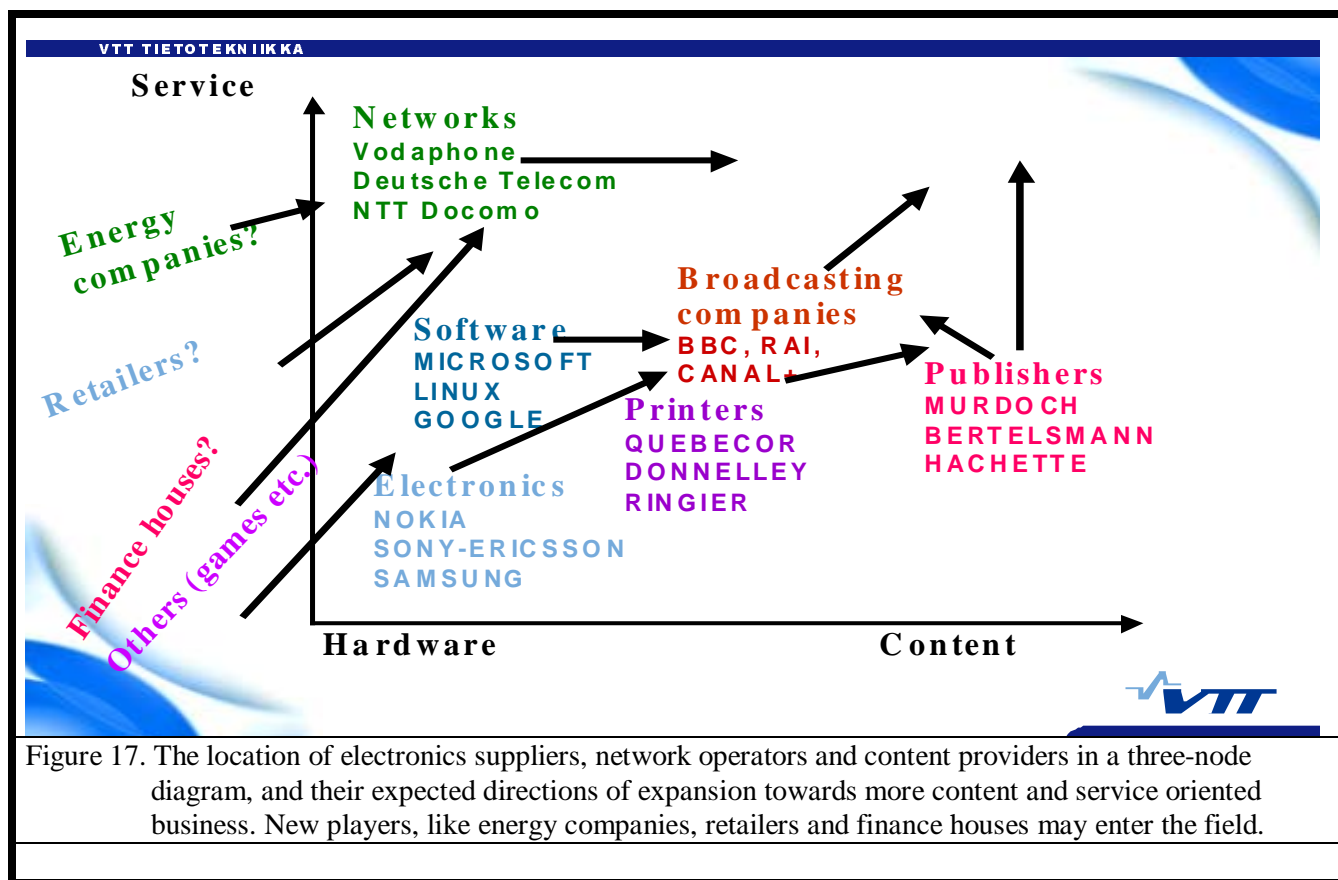
The telecommunication operators create new service plazas, and new media companies – often SMEs - offer new information services and games over the Internet. For the telecommunication operators the content service has become a must, if they want to increase their volume and market value. A part of this strategy is also to integrate amusement service, games and betting.

The national telecommunication operators are losing their traditional position in a monopolised system, where inter-continental cables and infrastructure could be renewed continuously with short redemption time. Today the investment cycles are expanding, the branch has been opened for a free competition, and the entire ICT field is being restructured. The content and service providers are building up their own infrastructures by-passing the operators.

Also the leading manufacturers of mobile phones show an increasing interest for the content market, since the performance of the new generations of mobile phones is not needed for conversations but for distribution of multimedia content. The available European content is so far limited, and a significant increase of the supply is becoming a prerequisite for the further technical development. The polarisation may continue in searching for alliance partners, although this is not necessarily the case. Such a strategic alliance has already been established between Ericsson and Sony, and a close co-operation announced between Nokia and Sega.

New players, like energy companies make the figure more complex, finance houses – i.e. banking and insurance corporations - and retailers, who penetrate the same market space by competing or forming alliances with the conventional players.

The strategic changes in the ICT field and especially in the media field and the field of electronic publishing is the focus for several projects carried out by our Institute. Also searching for innovations in the media field has been carried out utilising the fact, that each player is looking for developments helping him to progress in the decided direction.



On the other hand, the latest news indicate that the merge between amusement and the Internet has failed. The merge between the biggest American Internet company AOL and the biggest media-amusement giant Time Warner did not reach its goals. The distribution of information and amusement via the Internet was no success. The other part of the fusion concept – advertising for amusement via the Internet – was never realised. Based on these experiences, the competitiveness of the new media against the traditional distribution channels of news, documents and entertainment is very weak. The desired convergence did not happen, the fear of piracy is obviously too strong.

Also two other media and entertainment giants, Walt Disney and NBC, have given up their ideas to distribute their products via the Internet.

Obviously AOL, but also other companies believing in a merge between the Internet and the entertainment industry, underestimated their customers' view. And when the merge between entertainment and the Internet failed, the American opportunities are hardly better in mobile media, where the USA are far behind Europe and Asia.

The future of the media industry and its position in the ICT sector is still open. One possible development track is presented in Table 3, where the estimated industry control is expressed in terms of relative shares. However, the key question is how the restructuring will proceed, and what kind of alliances will be formed.

Table 3. One possible development trend for dominance in the media sector.

Player	1994 Estimation by Arthur Little	2000 Predicted by Arthur Little	2002 Estimation by VTT	2010 Predicted by VTT
Content Owners	25-35 %	30-40 %	15-25 %	20-30 %
Aggregators and Resellers	45-50 %	25-35 %	40-50 %	40-50 %
Data Transporters	5-10 %	5-10 %	5-15 %	5-10 %
End-User Technology developers	10-15 %	20-30 %	10-20 %	20-30 %

3.4.5 Media and security

The free press is traditionally an important factor in the western democracy. Liberty of the press has been guaranteed in the constitutions in most western countries. The national broadcasting companies have traditionally had impartiality obligations, but in turn also a monopoly position in the society with a guaranteed public financing. This situation is today being changed via deregulation and similar policy. A complete commercialisation of the media business is an obvious threat to the traditional values of the society, which has already been seen in Italy.

After September 11, 2001 the role of the media in the war against terrorism has also been in focus. The realistic on-line exposure of the tragedies turns the act of terror into a video game for the whole world. The media gives the terrorists the publicity they want, and help them to reach their goals. At the same time it creates a permanent trauma for the relatives of the victims.

The question is risen to what an extent the future media can be used as a weapon in the hands of terrorists. The same goes for the entire ICT sector. It is obvious that the terror attacks in Washington D.C., Moscow and in the Philippines hardly could have been performed without extern co-ordination utilising mobile technology. For this reason, security will become an important part in the future media and ICT societies.

4 Future Trends

4.1 Roadmapping

4.1.1 The roadmapping technology

Science and technology roadmaps are used in industry, government and academia to portray the structural relationships among science, technology, and applications. Roadmaps are employed as decision aids to improve co-ordination of activities and resources in increasingly complex and uncertain environments. A roadmap is an extended look at the future of a chosen field of inquiry composed from the collective knowledge and imagination of the brightest drivers of change in that field. A science and technology roadmap provides a consensus view or vision of the future science and technology landscape available to decision makers. Generically, a "road map" is a layout of paths or routes that exists (or could exist) in some particular geographical space. The practise of roadmapping typically involves social mechanisms, and is both a learning experience as well as a communication tool for roadmap participants. To be most effective, roadmapping and other management decision aids need to be fully integrated into the strategic planning and business operations of the organisation *Kostoff, (2001)*.

4.1.2 Roadmaps for Communications Technologies

Since Media Technology today must be considered as a part of the ICT sector, the roadmaps created for the communication technologies by Sipilä et al. (2002) are important background materials. The following three tables summarise the expected developments in three different neighbour fields, i.e. Wireless networking and related technologies, Network Service, and Smart human environment.

Table 4. Summary of wireless networking and related technologies.

Technology	2000	2002	2005	2010
• Services	2G (GMS) Voice SMS	2,5 G (GPRS) e-mail Data Internet	3 G (UMTS) Low-rate video e-commerce Location and context service Personalisation Adaptivity	4 G Full video Multimedia VR / Telepre- sense Service automa- tion
• Network	Cellular WLAN	Pocket mode	all-IP + WLAN Adaptive cover- age and capacity Hybrid network IPv6	Personal area network PAN Ad-hoc Multi-hop Active
• Terminals	Essentially for speech & SMS Colour display	Internet-capable	Multi-mode	Wearable Reconfigurable Programmable Voice controlled In-scrollable, non-rigid displ.
• Transmis- sion	TDMA, FDMA, CDMA 2-level modula- tion BS receiver di- versity	8-PSK modulation (EDGE)	WCDMA Multicarrier (OFDM) UL/DL assy- metry BS transmit di- versity	Multiple anten- na technology MIMO Ultra wide-band Multi-level modulation

Table 5. Roadmap of the network services.

Technology	2000	2002	2005	2010
• Service		Internet Roaming for mobile phones; mobile users	Seamless multi- media service for mobile human	Seamless hard real-time service for mobile users in heterogeneous network envi- ronment
• Architec- ture		Client server Agent architec- tures	Publish- subscribe Multi-agent ar- chitecture	Peer-to-peer Swarm intelli- gence

Table 6. Technology roadmap for smart human environments.

Technology	2000	2002	2005	2010
<ul style="list-style-type: none"> Personalisation 	Electronic identification Web-services using customer profiles	Profile-driven Table 4-2. Roadmap of the network services. Services with learning features	Trusted biometric identification Personalised context-driven services	Digital me

General trends in information storage capacity (GBt/in²), computer efficiency (TF/s) and mobile data transfer (MBt/s) also have an impact on the developments in media technology. These are summarised below according to Pletscher (2002).

Table 7. Technology roadmap for smart human environments.

Technology	1991	2000	2006	2010
<ul style="list-style-type: none"> Storage capacity 	1 GBt/in ²	1000 GBt/in ²		400.000 GBt/in ² (Theoretical)
<ul style="list-style-type: none"> Computer efficiency 	1 TF		1000 TF/s	
<ul style="list-style-type: none"> Mobile transfer 				30 MBt/s

4.1.3 Roadmaps for media technology

In the following we present a roadmap for media technologies in a time perspective toward 2010+ using the same technology (Table 8). The roadmap has been developed for nine selected strategic core competence areas of the media research field. These fields are all considered to be strategically important. However, they represent a priority in our planning, and shall, therefore, be seen only as examples. The roadmap serves in the first place the strategic orientation of media research field at VTT Information Technology, and companies may have different strategic priorities.

One focus area represents personalised, context sensitive media services, broadcast systems and community media and media production. Enabling technologies are vital for the test and pilot system development that is our main way to proceed towards productisation. Personalisation will develop from the user profiles to automatic diagnosis of the environment and awareness of the social context. In broadcasting systems interactive and mobile TV are interesting developments we will be actively supporting. Ontologies and semantic web will be widely taken into use also in practise until 2010.

Print media production will be done in networked companies (virtual factories) where many functions have been outsourced. Most print products will be mass personalised giving higher value to the customer. Closed loop control of colour management of print media will be realised. Colour management of electronic media can be solved by adaptive displays. The role of distribution and logistics is emphasized and intelligent, real time systems will be developed also for media industry during next eight years period.

Table 8. Roadmap over media technologies

Technology	2002	2004	2006	2010+
Personalised, context sensitive multiple media	Electronic identification Web-services using customer profiles Location based services	Profile-driven services with learning features Wearable embedded sensors	Trusted biometric identification Personalised context-driven services Personal navigation guides (enhanced reality)	Digital me Awareness of social context
Broadcast systems	Digi-tv Mobile tv in pilot phase	MHP breakthrough IP television is commercially emerging	Analog radio spectrum is released for digital use Mobile tv (TV-Anywhere)	3D-television in pilot phase IP-television established
Community media and media production	XML based systems available, but in isolated Environments	Semantic web and web services emerging in commercial applications	Integrated XML based applications	Semantic web based integrated applications in use
Print media production	Rationalisation of printing companies	Tracking and job ordering via web logistics	Automated workflow	Virtual factories
Colour management for print media	On-line density measuring devices	Closed loop density control Colour management systems integrated	Closed loop control for printing process Integration with premedia	Closed loop control in every press
DP/Ink-Jet	< 10% Small editions of ads and books	10% Small editions of ads and books	15% Personalised Print on Demand, Smart logistics	25% Intelligent high quality PoD, Tailored newspapers
Printed electronics	First experiments	Strong R&D activities in conducting polymers	First commercial products	Most common mass manufacturing method
Material web management	R&D activities	R&D activities, some features (IQT) in use	First prototypes	First closed-loop systems in use

Distribution and logistics	Prototype for electronic newspaper delivery book	First systems in practical use	Intelligent and adaptive delivery book	Real time intelligent tracking and optimising
	Rf-id used in special industrial cases	Coding/RF-ID tracking taken into use for logistics	RF-ID also in consumer goods	Real time intelligent management of logistics

Ink-jet printing gains ground in many areas from publishing to printed electronics. Tailored newspapers will be cost effective in 2010 and intelligent packages with printed sensors and tags will be in general use also in low cost consumer products. Electronic paper will be used also in the publishing products. Printing will be the most common method to produce low cost electronics. Data management of the whole production chain will be in everyday use and the closed loop control of material web management of printing presses will be launched.

4.2 Future scenarios for the ICT sector

4.2.1 The future table

The scenarios hereafter have been created with the aid of future tables. The first step is to define phenomena that have - or might have - notable influence on the ICT sector. These are called sectors. Next step is to create some alternative futures in each sector. One sector could be e.g. the future of EU. This sector might include alternative futures like "EU will disband" and "The United States of Europe". All the sectors and all the alternative futures compose the future table. There is a checklist, called PESTE (Politics, Economy, Society, Technology, Environment), which assists that no essential sector and alternative is missing.

The next stage is to define some generic futures. In this case the generic futures are "The presumable future", "The stagnated future" and "An integrated future without barriers". Then you go through the future table and choose in each sector the corresponding alternative. Thus you create the frames of the written scenarios.

The process itself is not sequential like preceding summary, but iterative. The following scenarios have been created in this method. The future tables are not included in this report, only the written result.

4.2.2 The presumable future

The presumable future describes the world such as it would be in the year 2020 if the current and anticipated trends will continue. Thus the world will not include any really massive surprises.

Politics: Europe, Finland in Europe

The core of Europe in 2010 is the union of independent states, not the federal republic of European countries. The union has expanded to the east. The decision-making is in the slow lane, because of the large number of the member states - though well foreseeable. Although the economical inequality is somehow diminishing, Europe is in tree floors. Finland is among the other Nordic Countries in the third floor. The southern European countries are in the second floor and the eastern European countries on the ground floor.

Although Finland is 2010 still known as sparsely inhabited "country of forest and mobile phones", is the structure of business diversified. Beside the telecommunication, forest and metal industries there are growing energy- and environment sectors as well as biotechnology and medicine industries. Though the share of these are still slight compared to the forest and telecommunication industries. The unemployment is still a problem, the rate is 5-8 percent. The inhabitants live rough in two categories, but thanks to the social security and the social safety nets, the coexistence of the two groups is undisturbed.

Economy: the media and telecommunication industries and economical integration

Some few giants, which are significantly owned by foreign companies, dominate the Finnish media industry. On the other hand these media companies are partly owners of foreign or multinational companies. In the content industry operates several small-sized firms. They are networked among others and work as subcontractors for big media companies.

In the field of telecommunication industry there are some giants and several small networked companies. The ownership is concentrated and multinational although there are still some local small telecommunication companies. The big companies operate fluently in EU without concerning the borders of separate countries.

ICT has shaped large entities, where the conventional borders between separate branches have disappeared. Although this development started from the technological convergence, the driving forces of the convergence are business aspects, like supply of services to the customers, not so much the synergy of technologies. The development of economical integration is still in the year 2010 unfinished. So the situation is moving. On the way to convergence are besides media- and telecommunication industries among others banking and insurance companies and domestic and international chains of stores.

Technology

More than half of the homes are equipped with broadband communication lines. The share of copper has dropped to two thirds of the connections. The share of Digital TV is more than 15 per cent and the share of mobiles 10 per cent.

Great majority of new buildings are equipped with fiber optics. Until the year 2010 the share of fiber optic is not yet more than ten per cent. The old copper wires are technically workable. More and more of the new buildings are equipped with wireless local area networks to replace the conventional networks in the flats. The share is still marginal.

People use several different terminal equipment, each one for its special use. Digital TV is strong as TV channel, but it has not reached the dominant position as channel of E-

commerce. The urban young and busy people adapted the E-Commerce, other people only a little.

Daily newspapers offer extensive web versions. Web gives background (archive) information, fresh news, and incremental e-Commerce services. Web version publishing is profitable, though the profit is rather low. Most newspapers offer too mobile services (news, weather, list of events, e-Commerce etc.). The volume is small and economic results not really profitable. In big multimedia companies the newspaper and television journalism have come closer to each others as their web extensions are more and more important.

Social

The people are active ("lean forward") with PC. TV is mainly used as a passive ("lay back") equipment to receive entertainment and information. The magazines, newspapers and books are transcendent as media content distribution channel. The share of print media in consumer market is still more than half. The share of electronic media, that is to say radio and TV, is a quarter. The share of network mass communication is about ten per cent. The rest is for communicators and other mobile equipment as well as E-Book and other new platforms. Reading print media, especially in case of newspapers, is becoming gradually elitist.

Ecology

The environmental points of views in business is self-explanatory. The eco-label gives not any more the same special imago as earlier.

4.2.3 The stagnated future

"The stagnated future" describes the situation in the year 2010, where the branches and the companies have turned back to the basic business. The hype of ICT –convergence was at an end over, in the beginning of the new century, and left behind only smoke-emitting ruins. This does not mean that information technology is over. It has been the dynamo of world economy more than 20 years, but the absurd expectations for ICT has fallen through. ICT had after this collapse more instrumental value than previous absolute value. Essential is to solve ICT to basic industry and service sectors. Thus the convergence, which seemed to be inevitable, got lost before 2005.

Politics: Europe, Finland in Europe

EU has, after extended to the east, paralysed by decision making. The dream of new uniform Europe has faded. Partly this depends on living standard and other gaps between EU countries. There is no real signs that these gaps would close up.

The economical equality of citizens in Finland is higher than in most other EU-countries. The unemployment rate is however next to 10 per cent. The forest and communication industries are still important for Finland, but in addition there are other branches like environment, welfare, biotechnology and food industries. Thus the structure of Finnish industry is rather multipolar.

Economy: the media and telecommunication industries

The media industry is clustered in two-three camps. The ownership is concentrated, chained and mainly domestic. The companies operate also abroad, but there is no massive invasion abroad. The telecommunication industry is concentrated and mainly domestic. The companies also have some ownership in foreign telecommunication companies.

The companies have concentrated on their own know-how branch after adventures and rambles in other sectors. In the year 2010 the companies work deeply in their basic business. The business know-how is strong and the knowledge and anticipation of the needs of customers is extensive and valued asset for companies.

Technology

About half of the homes are wired with broadband connections. There are many separate terminal equipment at homes. They are used mainly for practical use. For example the surfing in network has lost its brilliancy. Actually, more and more people want to be disconnected from wired and mobile systems. Successful and busy people use the mobile terminals. Most people are not willing to pay rather high sums of mobile services. Digital TV succeed finally on the market as usual TV-channel, but not actually as interactive two-way communication system.

The home connection systems are based 80 per cent on copper. Optical fibre and mobile connections have both share of ten per cent. "Data electricity" through electric wire was not succeed, despite of many promising tests.

Many newspapers offer web services as supplementary versions to the printed newspaper. This is only just profitable for publishers. Some special (economy, sport etc.) newspapers and periodicals offer mobile services but not really profitable. The use of web- and mobile versions is concentrated to young and wealthy professionals.

Social development

In Finland lives the highest educated nationality in the world. Immigrants come to Finland to both ends of the pyramid, to top and bottom. Well educated immigrants come to information- and biotechnology- and such companies, where specific skills are needed. On the other hand Finland needs less educated nursing, contributory etc. labour force.

The rise of reading started ten years ago from the cult book Harry Potter. Suddenly there were "Harry Potters" here, there and everywhere. Also newspapers and magazines created the visual image that attracted to the popular taste. Although the reading did not increase much, the long time decreasing stopped and even turned to slight growth. Internet did not replace magazines and newspapers. It offers supplementary information and tailored advertisement.

E-Commerce works but with rather few product range. Daily food market in net is marginal. Shopping is not only one way to buy something. Shopping is also a social event on free time. Thus the E-commerce was a disappointment.

Ecology

The environmental norms are rather tight. Sometimes the companies found the environmental norms too hard and thus weaken competitiveness compared to other countries, especially outside EU.

4.2.4 An integrated future without barriers

"An integrated future without barriers" scenario describes the world where the technological convergence led to very tight integration of many separate branches. The telecommunication industry predicted that the basic business, transfer bits from point to point, is not profitable business for a long time. The end-user terminal industry came to same conclusion. In both cases the solution was the content ("Content is King"). Thus the media industry came within this integration.

The first stage was in-fighting war between these three industries. The second stage was to create new ownership structures. This new cluster consists of hardware and software industries, media and telecommunication industries, as well as some other branches like retail trade, banking, insurance and gaming.

Politics: Europe, Finland in Europe

The hard core of Europe is EU, which in practice is the same as NATO, without USA and Canada. This coalition follows the economic policy where market forces is allowed to operate very free. In practice there are lot of conflicts between the companies and the EU. The officials in Brussels try to set up regulations and the companies try to avoid them.

The economical position of EU countries vary much from country to country. Finland is among the rich EU countries. The wealth within Finland varies much. The rate of unemployment e.g. is on the level of 20 per cent. This has led to some grassroots actions type "Robin Hood movement". These are however only marginal phenomena without serious threats against community.

The official economic policy In Finland encourages to entrepreneurship, which has increased efficiency and GDP. The structure of industry is multiple-pole. Nokia is not any more dominating. Forest industry lost already in the 1990's its leading position. There are several conglomerates, which allocate the resources and results skilfully between various countries. The tax authorities are the losers in this process.

Economy: the media and telecommunication industries

In the media industry there are only a couple of big international companies. These are part of international conglomerates. In content creation the big companies use small and flexible subcontractors. The big companies race the content creators really hard. Also telecommunication industry is very centralised and mainly owned by the foreign companies. Like media companies, they operate extensively in Europe.

The insight, that pure data transmission, or manufacturing of end-user terminals, does not lead to any profitable business, led to enormous reorganisation of several branches. What is needed, is attractive content. All this intertwined initially to digital technology and its applications. At the same time the companies realised that the same tube, which is used for content transportation, is suitable for many other services to consumer. The companies learned to know the consumer habits, and the companies came near to the purse of con-

sumer. So began the huge integration and internationalisation process. The power moved from governments over to big multinational companies. Even the bureaucrats of Brussels seemed to be toothless against the big companies.

Technology

Almost every home is wired with broadband network. The share of copper connections have dropped to less than half. Fiber optics and Digital TV have both share of about a quarter. The "data-electricity" (data transmission through electric wires) stands for some per cent.

The LAN technology is very common in the new buildings. Digital TV made successful breakthrough as TV-system, and partly displaced also PC-internet connections. Digital TV is easy to use and very versatile for surfing. Mobile devices are also in common use. The charge is rather low because of the massive volume. The losers are however out of this lifestyle.

The publishing technology has turned strongly from one-way print (text, photo, graph) to multimedia and interactive web. Web- and TV-journalism are coming up each others. Development of printing and publishing technology is nearly stagnated.

Social development

The educational level in Finland is very high, but the problem is that the well educated experts emigrate abroad to the countries, where the taxation is on "tolerable level". The taxation rate is, although reductions, still one of the highest in EU. Some problems have followed from immigrants from other EU countries, especially from eastern Europe. They trample wages especially on the work tasks, which do not demand special education and skills. This causes some racist reactions.

The reading of newspapers, magazines and books has collapsed. The share of print media decreased dramatically. Network and mobile communication shapes together with radio and TV the main source of information and entertainment. There are still some persons who are heavy readers. Most of them are retired senior citizens and belong to the elite. Some network publishers offer extra services as printed matter for those consumers who have purchasing power.

Respect for copyrights is not considerable. Some private persons and companies steal ideas and media content from other media companies, authors, composers and other creative persons. At the beginning this made the media business livelier, but later the creativity diminished. The attempts, to protect the creative work technically, have for the present failed.

E-Commerce works well. It is connected partly with Digital TV, partly with mobile communication. It has become part of everyday life.

Ecology

The citizens are worried about environment and think that companies and authorities underestimate the pollution problems. In spite of this worry, the same citizens dump the garbage and used domestic appliances even near the parklands.

4.3 The limits of dematerialisation

The immaterialisation has been considered as one of the biggest advantages in e-commerce and in the Information Society. The change of the production, marketing and distribution processes into a non-material form is often more environmental friendly, efficient and economic. The impact of immaterialisation has been studied in several EU projects. The virtual value chain is today seen as the key to managing the physical value chain.

However, every value chain contains a critical point, where the bits are turned back into atoms. Independent of how advanced the e-business chain is, the logistics of the physical delivery must be functioning perfectly. In most studies of e-commerce, attention has been paid to security issues regarding payment and personal information, easiness to use, illustrative multimedia interface, and the use of multi channel environments.

It is obvious that the information value is becoming an increasing share of the total value of a product or a service. In the new e-Economy the products and services can be divided into three main categories dependent on the share of the information value:

- Traditional manufacturing, where e-Business has a strong impact on marketing, selling and customer service, but only a marginal one on the delivery itself,
- New forms of business, where the product or service itself is available in digital form, and where e-Business has a strong impact on the entire industry structure.
- Between these extremes we find a form of e-Business, where the goods are still in material form, but where the new economy has a clear impact also on the delivery structure – like health care, energy sell, selling of books and retailing goods, traveling, etc.

The impact of e-Business on the restructuring of the industry is schematically presented in Figure 20. The dematerialisation and materialisation processes become critical in this third form of e-Business. In this form, customer service – including marketing, selling, ordering, product specification and verification of order performs virtually on web. Nevertheless, the material goods are delivered by partly traditional logistics.

In the materialising interface at least the following risks must be considered:

- The logistics and storage of products must be planned to fit the needs of a flexible and global ordering system.
- In some cases production on demand (like printing of books) must be included in the delivery system.
- In some cases – like in electric energy delivery on a spot market – no storage at all is available, and the system should allow for direct delivery on order.
- Especially in healthcare the service must be able to alarm and to switch over to a materialised first aid, whenever fatal data are received.
- The delivery structure must be flexible enough to react on individual demands.

- Product and service description must be sufficient and selling, as the customer does not come in touch with the product before delivery.

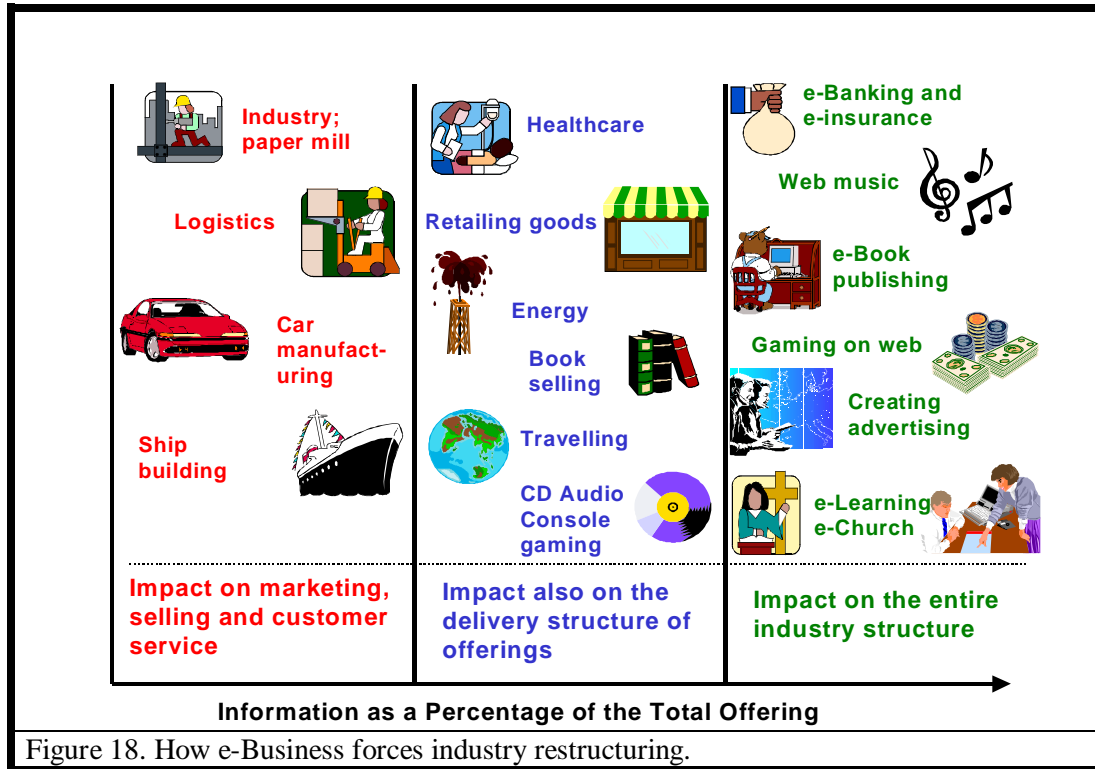


Figure 18. How e-Business forces industry restructuring.

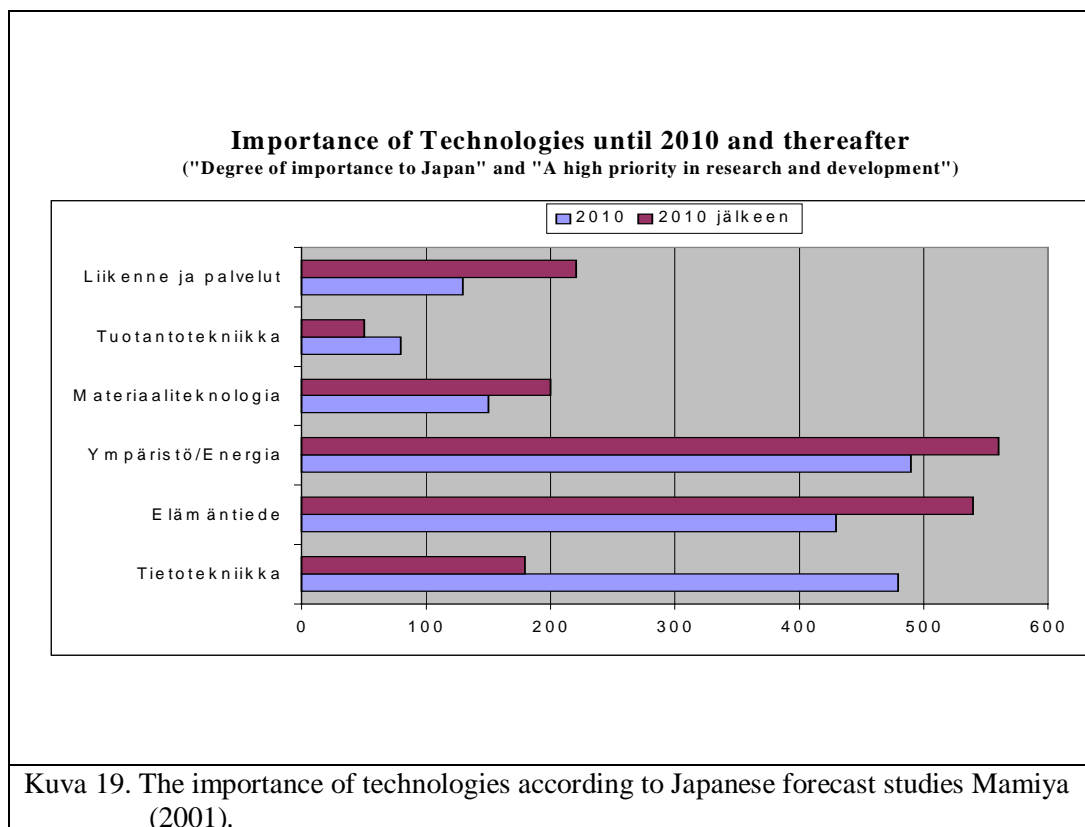
5 Technology Forecasts for the Media Industry

According to the Japanese technology forecast studies ICT will remain the driving force for technology and economy for the next decade. After that it will slowly merge deeply into different applications, though it remains all the time present. New areas of technology, like life science, environmental technology and energy will get more gravity scientifically, economically and politically, but they will contain the ICT solutions as important integrated elements. This is illustrated in the diagram in Figure 19.

Based on the outcome of the study the Japanese government support the following four steps to reach a leading position in ICT in five years: 1) Development of an ultra-rapid network infrastructure, 2) Support to e-commerce, 3) Development of e-government, and 4) Training of high level experts. However, critical comments have also been raised against this strategy for not applying ICT to the basic industry and for neglecting the problems of ICT.

A corresponding foresight study in U.K. lead to future focusing on two aspects of media, i.e. ITEC (Information Technology, Electronics and Communications including publishing, music industry and digital content), and ICM (Information, Communications and Media). This foresight study also emphasises the "Attention Economy" of the future. This makes services and goods available to individuals in return for their attention, and provides increase in Consumer to Consumer (C2C) business.

Data processing and telecommunication speed increases, costs come down, equipment are miniaturized, battery power increases and information security is improved. Storage capacity is doubled every 18 months according to Moore's law. As the storage capacity in 1991 was 1 Gbt/in², was it already 1000 Gbt/in² in 2000. Utilising nano-technology the theoretical capacity limit is obviously 1 digit (0/1) per atom. However, according to Pletscher (2002) the cellular thickness limits the capacity to 400.000 Gbt/in². Moore's law expects this capacity to be reached approximately in 2013.



Computer power is increasing at almost the same rate. The Deep Blue computer of IBM, that beat Garri Kasparow in chess in 1997, had a power of 2,5 TF (1 TF = 1 trillion operations per second). According to Pletscher (2002) a computer power of 1000 TF will be reached in 2006 using "blue genetic technology".

It is obvious, that the technical prerequisites for an integration of the content chain to form new brands of multiple media, but also for a convergence of the whole Information and Communication Technology (ICT) industry already exist. However, technology push alone has not power enough to trigger the convergence. It depends on the estimated business potentials, ownership structures and preferences, which kind of companies and alliances finally will be established. Therefore, it is still open who will manage the value chain from content providers to end consumers.

On the publisher side we will see a formation in and around some big (international) blocks like SanomaWSOY, Bonnier, Schibsted, Bertelsmann. On the other hand, we will see many new companies offering Niche products of "new media". The survivors will be 1) Innovative driven and trimmed multinational firms, 2) Firms with aid of strategic alliances with other actors, 3) Small local firms, and 4) Firms focused on specific target groups.

Printing will be out-sourced to some specialised companies, like Quebecor, Hansaprint etc. The number of printers will drop dramatically.

Finnish information will be easier available on the Internet and from open data banks thanks to more efficient telecommunication networks, searching machines, media servers

and information storage in generic form for different platforms and information carriers. Language technology will also help national content to access globally.

On the other hand, increased information (over)flows will make it more difficult to draw international attention to national content. VTT should help the Finnish content providers to reach these goals. Success factors will be a) High class content, b) High standard meta-data, and c) Innovative attractions in form of products and services.

Among the focus areas defined within the technology strategy of VTT Tools for the Information Society, ICT enabling techniques and Telecommunication Systems will have a direct impact on the future of media technology and, hence, on the future of the Finnish media industry. Printing technology is one interesting tool for producing Intelligent Systems but also Innovative Materials. It is of importance that the media technology outlook is taken into account, when strategies are developed for these focus areas of VTT.

The media technology outlook is already included in the strategic planning of VTT Information Technology, where multiple media, visual quality control, functional publishing, virtual reality and mobile multimedia represent core technologies. The roadmaps for media technology toward the year 2010 developed as a part of this project directly serve the further strategic planning and focusing within these core technologies.

6 Conclusions

The main outcome of this media technology outlook until 2010 can be summarised in the following main observations:

- Data processing and telecommunication speed increases, costs come down, equipment are miniaturized, battery power increases and information security is improved. Storage capacity and computer power are doubled every 1.5 years according to Moore's law. Storage capacity will obviously reach its theoretical maximum of 400.000 Gbt/in² around 2013. Computer power will reach the level 1000 TF in 2006.
- Media technology is an integrated part of the ICT sector. ICT will remain the driving force for technology and economy for the next decade. After that it will slowly merge deeply into different applications. Therefore, it is important to identify new solutions in the field of basic industry, services and administration. This requires close co-operation between the research units of VTT, and understanding of its customers' needs.
- The technical prerequisites for an integration of the content chain to form new brands of multiple media, but also for a convergence of the whole ICT industry already exist. The final structure of the global ICT sector and the position of the value chain of the content industry is still open. It depends on the estimated business potentials, ownership structures and preferences, which kind of companies and alliances finally will be established. Theoretically any of the players can integrate the entire sector via virtual value chains.
- The most critical challenges to the media industry today are the demand on rapid structural change, overcapacity in the printing sector, ability to create new business models and increase the efficiency of the business processes and the ability to develop new, attractive products and services. This requires significant investments in research and development, but also in training and education. Without these investments there is the threat that the media companies will have a lack of technical and strategic knowledge, and will be strongly dependent on external suppliers.
- Developments will result in new applications in media technology, such as general use of mobile multimedia services, integrated media products and services, digital printed tailored newspapers, manufacturing of electronics using printing technology, intelligent systems for distribution of newspapers and other printed products and software and systems for colour management and quality automation.
- Technology for creating, storing, editing and distribution of content and managing languages will open new possibilities for innovative new media products and service forms to reach a global market in a short time period. On the other hand it will be harder to be observed in the information overflow of the new Attention Economy. What is needed, is sophisticated services and attractive content to all the consumer groups and subgroups, and elegant wraps for communication systems. The growing demand of attractive content means that the importance of media industry will increase. The consumer is not buying a TV set because of the equipment itself, but for watching TV programmes. One strategic goal should be to help Finnish companies providing sophisticated and attractive products and services.

- The integration of e-commerce into media is a key question not only for the future of the media sector, but also for the electronic economy. This requires that both security and copyright issues can be solved on both a legal and technical level.
- Emerging important areas are development of technologies and tools for the content production and management. Understanding of customers' rational and emotional needs, media choice and user experience of different media will be key areas of interest in the future.
- In summary most of the relevant technological R&D for media industry in Finland is related to the application of the newest ICT. New service, more functional products, new, intelligent operation models and quality and process automation are based on the use of ICT. Development of new information carriers can be done more independently although it will also be very much ICT driven in the future.
- The R&D has to be focused on selected niche-areas in order to reach world class results. Most innovations are either Niche applications or based on customers' needs.

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References

1. Birkenshow, J., Future roles of print and digital media in the Internet age. . Comprint International, April 22-24, 2002, Lisbon.
2. Delmontagne, R., The impact of digital technologies on pre-press output carriers. Comprint International, April 22-24, 2002, Lisbon.
3. Hetemäki, L and Obsteiner, M. (2001). US Newsprint Demand Forecasts to 2020: Classical and Bayesian Approaches. International Institute of Applied Systems Analysis (IIASA), Interim Report IR-01-070.
4. Iannella, Renato, Digital Rights Management (DRM) Architectures. D-Lib magazine. Vol.7, no. 6 (June 2001)
5. Jallinoja, K., World paper market and industry trends. Comprint International, April 22-24, 2002, Lisbon.
6. Kostoff, R.N., Schaller, R.R., Science and technology roadmaps. IEEE Transactions on engineering management 48(2001)2, p.132-143.
7. Lindqvist, U., The restructured media field sets new demands on technical research. Graphic Arts in Finland 29(2000)2, p. 3-5.
8. Lindqvist, U., Siivonen, T., Södergård, C., Mediainnovaatioiden identifiointi. Tutkimusraportti TTE4-2002-5, Espoo. (In Finnish)
9. Lindqvist, U., Rouvinen, P., Siivonen, T., Ylä-Anttila, P., Digitaalisen median teknologiaohjelmat 1996-1999. TEKES Teknologiaraportti 21/2000.. Helsinki 2000, 45 p.
10. Lindqvist, U., Siivonen, T., Integration and convergence in the media field. 29th IARIGAI Conference, Lucerne, Switzerland, September, 2002.
11. Mamiya, K., The Seventh Technology Forecast. Future Technology in Japan toward the Year 2030. NISTEP Report No. 71. July 2001. 586 p.
12. Pletscher, W., Industrial future research at IBM. Presentation after the 29th IARIGAI Conference, Switzerland, on September 11, 2002.
13. Rose, M., Striewe, F., Müller, S., Treichel, H.-R., Liebtruth, H., Müller, A., Subburayalu, R., Bachem, C., Florian, P., The horizon of print and publishing; Opportunities in the media economy. Comprint International, April 22-24, 2002, Lisbon.
14. Silvennoinen, P., Strategic R&D across the value chain of information and communications technologies. A paper for the 66th International Conference on Technology Policy and Innovation, August 12-15, KANSAI, Japan.
15. Sipilä, M., Communications Technologies; The VTT Roadmaps. VTT Research Notes 2146, Helsinki 2002, 81 p.
16. Sjöholm, H., Teknologiastrategian laatiminen yliopistoissa ja tutkimuslaitoksissa. TEKES, Helsinki, 2001, 32 p. (In Finnish)

17. U.K. Foresight-study <http://www.foresight.gov.uk/> & ITEC Group Report: Information, Communications and Media Panel.

Appendix 1: Strategies of VTT and VTT Information Technology

Text The key goals for VTT for the strategic period 2003-2007 are growth, profitability and internationalisation. These goals should be achieved in an operational environment, where

- Welfare in the society is based on knowledge, safety and human-oriented technology,
- Sustainable development will be emphasised and new environmental regulations will appear,
- Global networking will increase between business as well as between R&D players, but in a more deliberate manner, regional and local networking will increase,
- There will be changes in demographic structures, and
- Predictability will decrease.

The main focus of the R&D activities of VTT is on applied research. Strategic and applied research and product development can intensify the innovation process. The merging of technologies is a common development trend. The combining of several research fields requires multidisciplinary knowledge. This is promoted by new operational models that reach over institute borders. The strategic technology themes and the operational concepts – knowledge portals – aim at VTT-level synergy.

The technology strategy includes eight areas of technology selected as VTT-level focus areas, and each of these areas is further divided into 3-6 operational areas. The targeted benefits, as well as short and long-term goals, have been set for each focus area. The focus areas are presented in Figure 20.

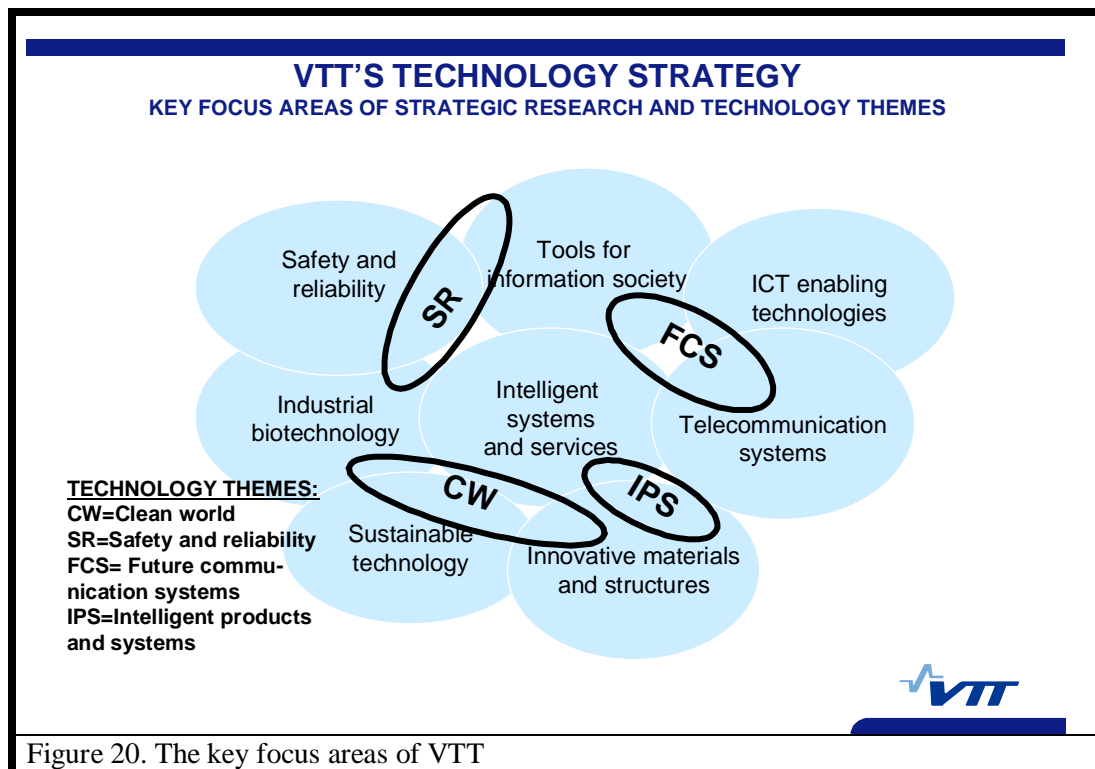


Figure 20. The key focus areas of VTT

The key focus areas of the technology strategy aim at the following benefits:

- Effective utilisation of information and communication technology (ICT) for individuals, industries and society,
- Within the development of ICT enabling technologies, microelectronics and software production are particularly expected to create opportunities for new innovations,
- Telecommunication systems development aims at improving the speed and reliability of data transfer, creating new mobile services and new business opportunities with the help of optical technologies,
- The introduction of intelligent products, services, systems, processes and production methods will make the products and systems more functional and user friendly and increase flexibility in production,
- Safety and reliability technologies aim at risk management and a high level of safety and reliability in society and industry,
- The new functionality of innovative materials and structures offers significant added value for different industries,
- Sustainable development technologies save raw materials, energy and natural resources and help reduce emissions,
- Biotechnology-based, effective and environmentally friendly production processes and materials are developed for both the traditional and new, knowledge-intensive industries.

VTT Information Technology is one of the six research institutes of VTT, Technical research Centre of Finland. VTT Information Technology performs research and development in the following fields: Microsensing, Microelectronics, Telecommunication, Networks, Information systems, Media technologies, and Human interaction technologies. The interrelationship between the research areas can be illustrated in key to the ICT sector; see Figure 21.

According to our vision the new innovations in the ICT sector are the driving force of the global economy. The focus of the strategic research of VTT Information Technology are on ICT enabling technologies (microelectronics, intelligent sensors, information management), Tools for information society (e-business, logistic networks, remote sensing, virtual reality), Mobile Internet technologies, Multiple media, Intuitive interfaces, Telecommunication systems and Intelligent systems and services.

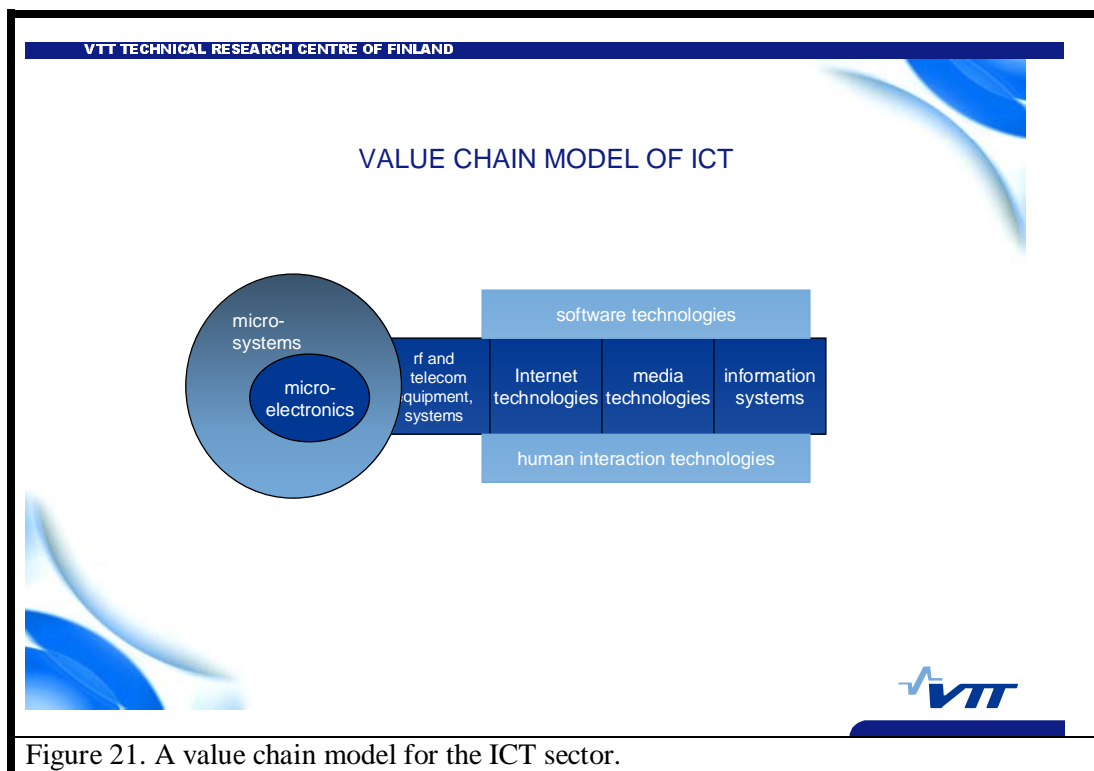


Figure 21. A value chain model for the ICT sector.

The core technologies of VTT Information Technology are presented in Figure 22.

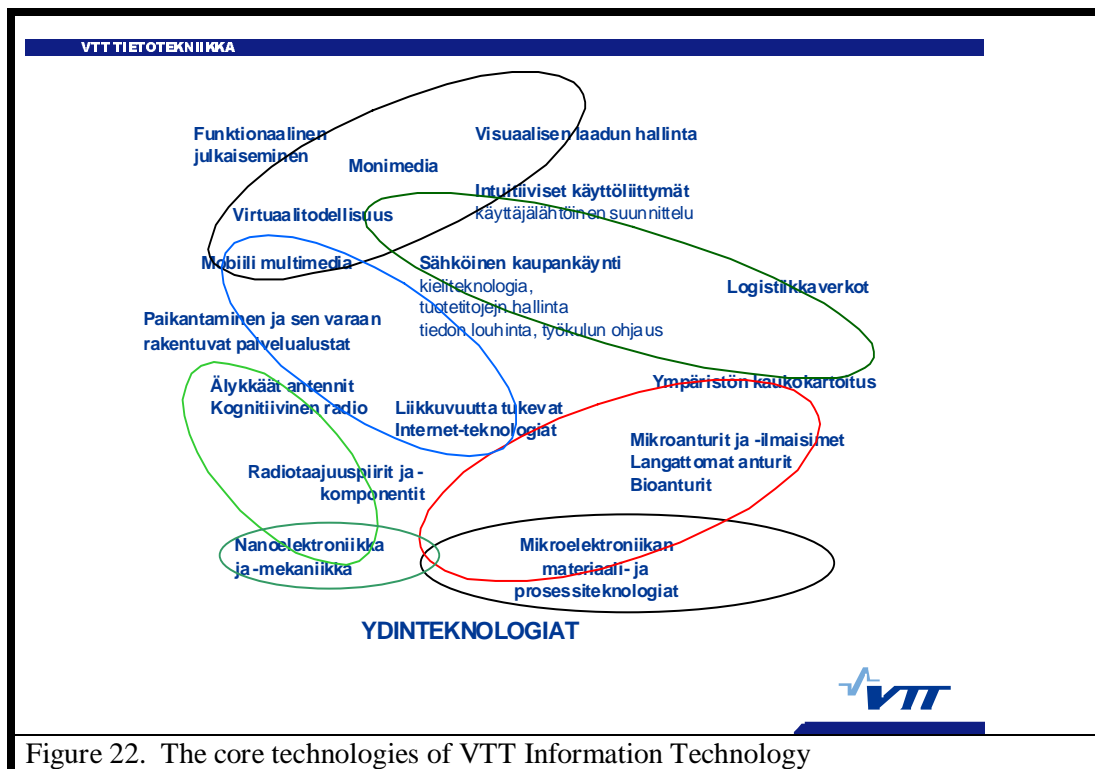


Figure 22. The core technologies of VTT Information Technology

Appendix 2: Development of a Technology Strategy

The process to develop the technology strategy is made up of four sequential stages. First stage (Part 1) is the starting meeting, where the business ideas and vision will be defined. The second stage (Parts 2 - 9) - the process itself - is made up of nine steps. When the strategy is defined, it has to be presented to the organisation. This third stage (Part 10) gives also feedback. The fourth stage (Part 11) is the implementation into the organisation. This method has been developed by TEKES (*Sjöholm 2001*).

1. The business idea and vision

The business idea and vision of the research organisation:

- What is the essential scope and competence of the organisation?
- What is the mission briefly?
- What is the vision alias collective dream of future?

2. Survey of customers' standpoints

The surveys of customers standpoints will be performed through interviews of media industry, as well as of other interest parties. The subjects of interviews can be categorised as follows:

- expectations for the research work
- future development of branch
- needs for co-operation
- needs for competence
- technological progress

3. Survey of research personnel

In principle similar survey as above. There are lists of questions, what should go through (e.g. *Sjöholm 2001*).

4. Trends

Trends could be categorised into some main groups. Recommended groups (likewise best practises) are:

- technology trends
- customers and markets trends
- global and generic trends
- trends of the branch

- trends of environmental aspects

5. Technology Roadmaps

Technology roadmaps describe, how the needs of customers, and how the technologies to satisfy these needs, will develop in the future. The Technology Roadmap is presented in chapter 4.1 on practical level.

6. Area of operations and markets

List of research organisations areas of operations. What type of customers the organisation has and what are the references?

7. State of competition, and partners in co-operation

List of real competitors and partners in co-operation as well as lists of potential competitors and partners.

8. Investments and growth areas

Research institutes identified areas of growth. It has to be remembered, that usually complement of new research areas mean, that some old areas have to be given up.

9. The Pyramid of Technology

The technology pyramid defines and segments the know-how of research organisation very concrete, simplified and illustrative. The pyramid consists of four levels. The top is very sharp. The lower the sector in question is, the broader it is.

- The top on international level: the cutting edges (2-4 items)
- The second on national level: the leading technologies (2-5 items)
- The third level defines the key technologies (3-5 items)
- The fourth level defines accessory technologies

The challenge is to create such a dynamics that some technologies climb from the key technology level to the leading technology level. Correspondingly some technologies from the leading technology level will climb up to the top level. On the other hand there must be readiness to give up some "old" technologies, or to move them to partners as accessory technologies.

10. Presentation to the research group, feedback

The needs of modification and timing for the modification after getting feedback from the personnel.

11. Implementation

Implementation includes information to the personnel as well as to the partners, especially to the industry partners.