



**ITU NEW INITIATIVES WORKSHOP ON
THE REGULATORY ENVIRONMENT FOR
FUTURE MOBILE MULTIMEDIA
SERVICES**

**Document: MMS/06
25 July 2006**

Mainz, 21-23 June 2006

**THE REGULATORY ENVIRONMENT FOR FUTURE
MOBILE MULTIMEDIA SERVICES**

THE GERMAN ICT MARKET

ACKNOWLEDGEMENTS

This case study has been prepared by Bitkom. *The Regulatory Environment for Future Mobile Multimedia Services – The German ICT Market* is part of a series of Case Studies produced under the New Initiatives Programme of the Office of the Secretary General (OSG) of the International Telecommunication Union. The ITU New Initiatives programme is under the supervision of Lara Srivastava <lara.srivastava@itu.int> of the Strategy and Policy Unit (SPU) of ITU. It has been prepared for a workshop held 21-23 June 2006, in Mainz, Germany, hosted by the German Federal Network Agency. For more information, see <<http://www.itu.int/osg/spu/ni/multimobile>>.

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**THE REGULATORY ENVIRONMENT FOR FUTURE MOBILE MULTIMEDIA SERVICES:
INFORMATION AND COMMUNICATION TECHNOLOGIES IN GERMANY:
STATUS QUO AND PROSPECTS**

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1 MANAGEMENT SUMMARY

The scope for distribution is becoming increasingly narrow. Politicians and society need to focus once again on the roots of growth. Innovation is the most important source of economic growth. As cross-sectional technologies, information and communication systems are crucial innovation drivers. Germany would be well advised to tap into strategic growth fields in these segments in order to be able to play a leading role at international level.

The ICT industry is one of Germany's most important industries, employing around 750,000 people, generating revenue of EUR 134 billion and accounting for exports worth more than EUR 50 billion. By international comparison, Germany has a very strong position in a large number of technological areas, for instance, in application software (particularly in corporate divisions), software engineering, security and chipcard technologies. These are examples of innovation areas that offer excellent growth opportunities for and in Germany.

Germany will only manage to play a leading role in international competition in the long term if comprehensive use is made of the innovative potential of ICT-driven technologies. The ICT industry has the potential to create 120,000 additional jobs in Germany in the years to come. Another 250,000 jobs can be created in the application industries. Whether and to what extent these jobs will be created depends hugely on the extent to which the ICT industry is supported or restrained in terms of policy. A wide range of countries such as Ireland, Israel, Taiwan and South Korea have proven that policies can play a crucial role in turning the ICT sector into a growth engine of national economies which has a pull effect on international markets.

Policies must not be oriented to short-term activism, but should pursue long-term goals. The long-term motto must be to start here and now in order to accomplish one's goals over the next ten years.

1.1 Objectives of a strategic innovation and ICT policy

1. The aim must be to position the ICT sector more effectively as the driving force of innovation and growth of German industry by implementing an inherently consistent, coordinated set of medium and long-term measures. Although the ICT industry accounts for 6 percent of gross domestic product (GDP) at the moment, it certainly has the potential to rise to over 8 percent.

2. Sufficient use has not yet been made of the potential offered by the ICT market for growth and prosperity in Germany. Sustainable growth rates can be achieved in the German ICT market particularly if measures are taken in the areas of tax, structural and competition policy.

3. High-tech companies and above all small and medium-sized companies need to be promoted in market segments exhibiting strong growth in such a way that they have the potential to become international technology leaders. Measures in research policy and growth finance in particular must ensure that German companies become and continue to be competitive at international level in fields of technology that have yet to be defined.

2 INFORMATION INDUSTRY AS THE DRIVING FORCE OF UPSWING

Modern information and communication technologies (ICT) have become increasingly important for the German economy. The ICT sector's importance for the German economy as a whole has clearly increased over the past decade. While in 1994, ICT contributed only 4.7 percent to the GDP, this figure amounted to 6.8 percent in 2004. As far as gross value added is concerned, ICT, with its €87 billion has surpassed mechanical engineering and the automobile industry and now occupies the top rank. This trend will continue

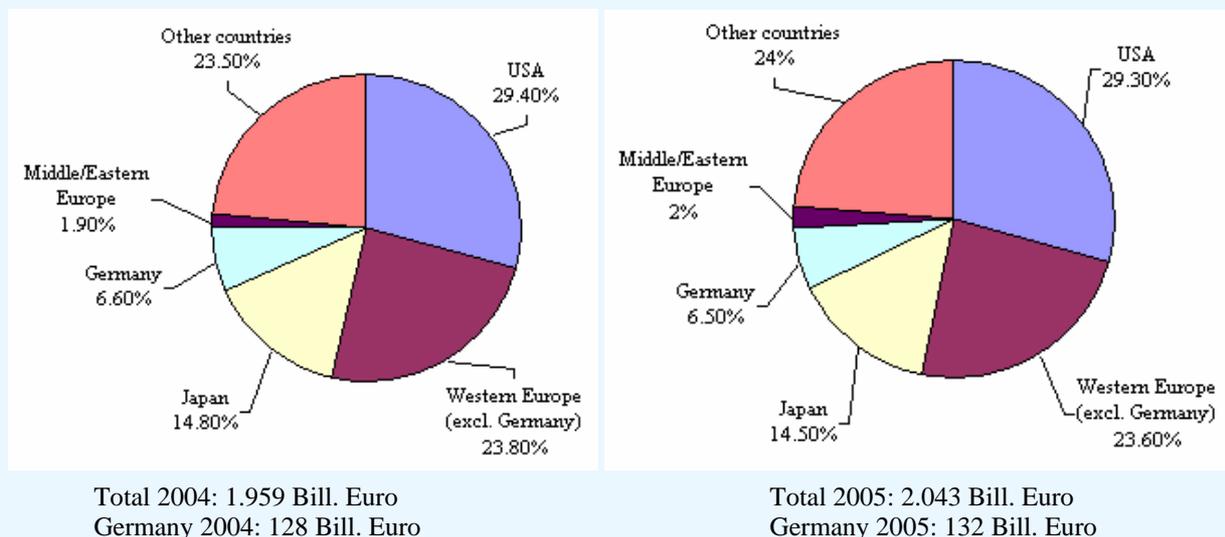
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in the coming years, since the ICT sector is clearly growing more strongly than the economy as a whole, and thus remains the driving force for business activities. The volume of the ICT market is expected to grow by 2.4 percent to approx. €137 billion this year, following a €134 billion result in 2005. In addition, ICT also has a share in the valued added produced by other sectors.

The number of people employed is correspondingly high: in addition to 750,000 people employed in the ICT sector itself, approx. 650,000 ICT specialists are working in the applications industries. ICT exports have more than doubled in the past 10 years, and Germany has now become an ICT net exporter.

The information society in Germany continues to develop on a high level. The trends and prospects of the information society are pointing in a positive direction. The global information society is currently preparing for another quantum leap; mobility, networking and convergence are developing ever more rapidly.

Figure 6.1: Germany still one of the leading IT and Telecom markets worldwide
Global market for IT and Telecom in percent 2004-2005



Source: EITO

Picture: TNS Infratest Business Intelligence

2.1 Internet usage

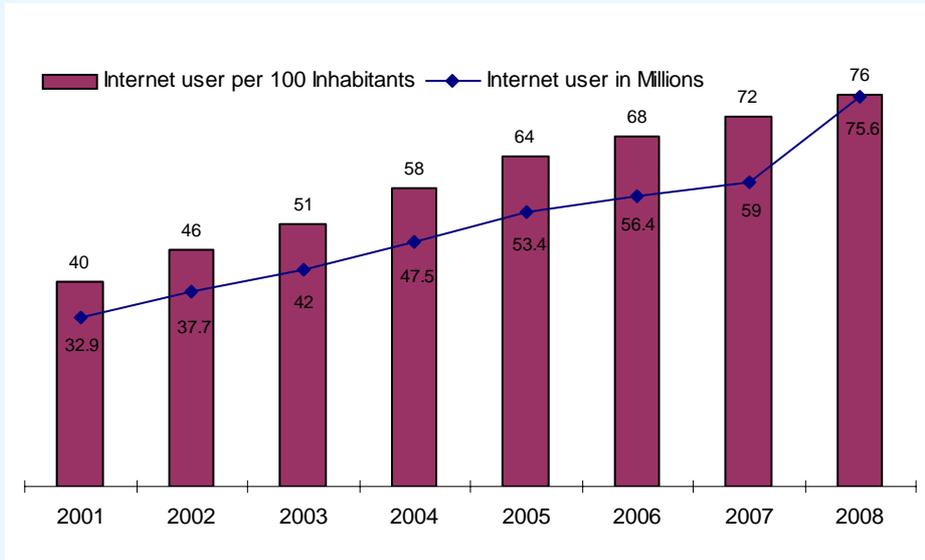
In 2005, more Internet connections were available in Germany than the European average, and a higher proportion of the population was actually using the Internet. With 94 percent of companies (with at least 10 employees) and 62 percent of private households having Internet access, Germany was above the average in the European Union (EU – 15) in the year 2005.

At the end of 2005, 95 out of every 100 inhabitants in Germany had a mobile phone contract, and 2.3 million people were using the new UMTS technology. Important factors for more growth are online services and e-commerce; in 2005, e-commerce was already generating revenue of EUR 320 billion, which makes Germany the number one in Europe.

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Figure 6.2: In the year 2008, 76% of the people will use the Internet in Germany

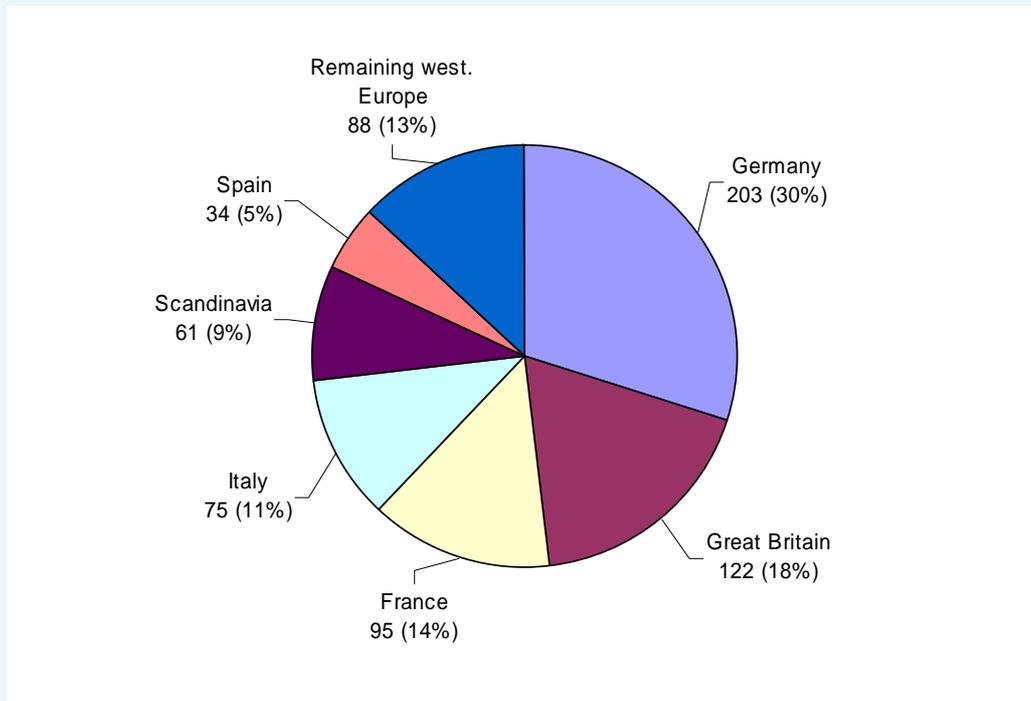
Germany: Internet user in percent of the population and in Millions 2001-2008



Source: EITO

Picture: TNS Infratest Business Intelligence

Figure 6.3: Shares in e-commerce in Western Europe



Western Europe in total: 680 Mrd. EURO

Source: BITKOM/EITO 2005

2.2 Digital convergence

Mobile phones and the fixed line telephone network, the Internet and TV are growing together (key word: triple and/or quadruple play). Information and services are available anytime and anywhere. Providers from what used to be separate markets are now competing for access to the same customers.

This convergence of the media has been a topic of discussion for many years, but now thanks to broadband technologies it has become a reality for the end customer. The further extension of transmission paths – key words are the extension of optical fibre cables and the digitisation of TV cables – will open up large growth potential for innovative services in the years to come.

For instance, in the future, TV programmes will be received not only via “traditional” means, namely cable, satellite or terrestrial transmission (DVB-T), but also via the Internet and mobile phones. Digital convergence will not only combine the sectors of traditional telecommunications and the media, provoking major changes there – as we can see from voice-over IP –, but will gradually penetrate all other business sectors too. Sectors of our national economy which have been separate so far, will be networked and this will result in new diversification and synergy processes, generating new services and business models.

New technologies, such as radio frequency identification technology (RFID) will optimise valued added chains in the trade, logistics and health sectors and open up new markets. Germany is especially well positioned with regard to the development and application of new solutions in this area.

2.3 IT research

Research and development in the ICT sector are and will continue to be important: by the end of 2006, the Federal Government wants to continue developing the new research programme IT 2010, together with the science and business sectors. Combined research is to be expanded, the utilisation of research results in Germany is to be improved, guaranteeing at the same time that project promotion and IT research activities within the institutional research landscape fit together seamlessly.

Whereas the USA spends 2.6 percent of its gross domestic product (GDP) on research and development and this percentage is around three percent in Japan, only 1.9 percent of GDP is spent on R&D in the European Union. Germany is well above the OECD average, spending 2.52 percent of GDP on R&D. However, in absolute figures, this corresponded to a difference of USD 310 per capita compared to the United States. In order to enhance Germany’s international competitiveness, measures need to be taken to make promotion programmes more attractive and to motivate industry to invest more.

Europe’s research, development and innovation capacities in international competition are to be strengthened as part of the Europe 2005 action plan. The “Barcelona objective” of raising expenditure on research and development in Europe to three percent of gross domestic product by the year 2010 is binding on the European Union and the Member States.

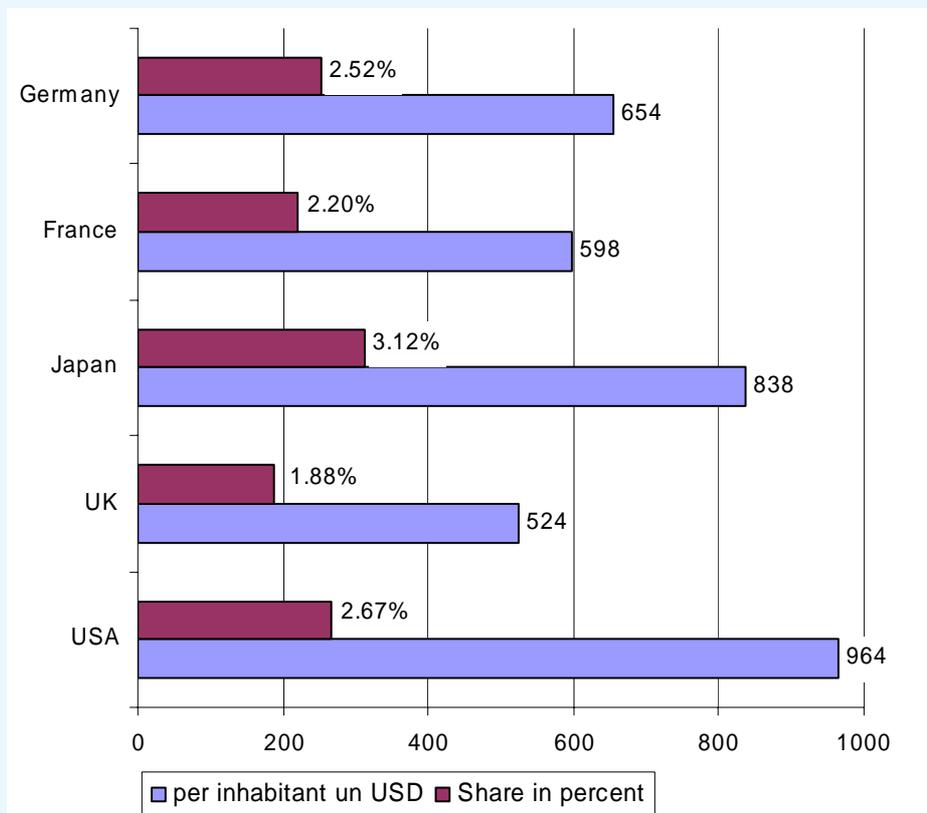
2.4 E-government

E-government is another important driving force for additional growth in the ICT sector and for the transformation of Germany into an information society. The Federal Government, the Federal States and the municipalities are promoting the expansion of e-government services involving all levels of government. E-government has the potential to promote a cultural change through the use of new technologies, to contribute to the consolidation of budgets and the reduction of bureaucratic costs in Germany. Individual municipalities have already achieved remarkable successes, although others show a great need to make up for lost ground.

2.5 IT security

Our society which is marked by the use of information technologies also faces new risks. In view of global networking, IT security problems can lead to disturbances and failures in vital information infrastructures. This is where there is a special need for action.

Figure 6.4: Share of research on gross domestic product



Source: OECD/BITKOM

2.6 Information Society Germany 2010 (iD2010) – a programme to realign ICT policies

Despite all positive trends and prospects, a glance at countries abroad however reveals that the transformation of Germany into an information society could advance even more rapidly. In many business areas – whether it be entertainment, SMEs, health or civic services – the application potential of ICT and the new media has not been fully exploited up to now. This means that we could achieve even stronger growth and more employment through better development and use of ICT

The Federal Government's ICT policy will therefore play an exceptional role with respect to the issues of innovation, growth and employment. The government will continue to promote actively the development processes of an information society by modernising the legal and technological framework conditions, promoting research and market-oriented developments in a targeted way.

ICT policies will be closely linked to Germany's high-tech strategy, as announced in the coalition contract and further discussed at the Cabinet meeting in Genshagen. The Federal Government will establish its strategic targets and measures in the area of information and communication technologies and the digital media in its "iD 2010 – Information Society Germany 2010" programme by summer 2006 and make this the foundation of its political activities.

The Federal Government's programme forms part of the reorientation of the Lisbon Strategy and supports the EU in the implementation of the "i2010 – A European Information Society for Growth and Employment" strategy.

Important fields of activity within the programme are:

- the distribution and the provision of broadband Internet to as many users as possible;
- the promotion of ongoing digitisation of transmission paths for radio and new services;

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- a competitive and sustainable telecommunications regulation strategy and a modern frequency policy
- the modernisation of media regulations in accordance with the requirements of digital convergence;
- a reorientation of multimedia technology promotion towards further digital networks;
- an improvement of IT infrastructure security and targeted action against the abuse of new technologies and digital media;
- the provision of state-of-the-art online services and e-government infrastructures for the business sector and for the public and participation in the information society and a strengthening of the necessary media competence.

The Federal Government will continue its positive partnership with companies, associations and other social groups in order to pursue and intensify the implementation of these political goals.

3 THE CURRENT SITUATION OF BROADBAND ACCESS IN GERMANY

3.1 The importance of broadband access for politics and industry

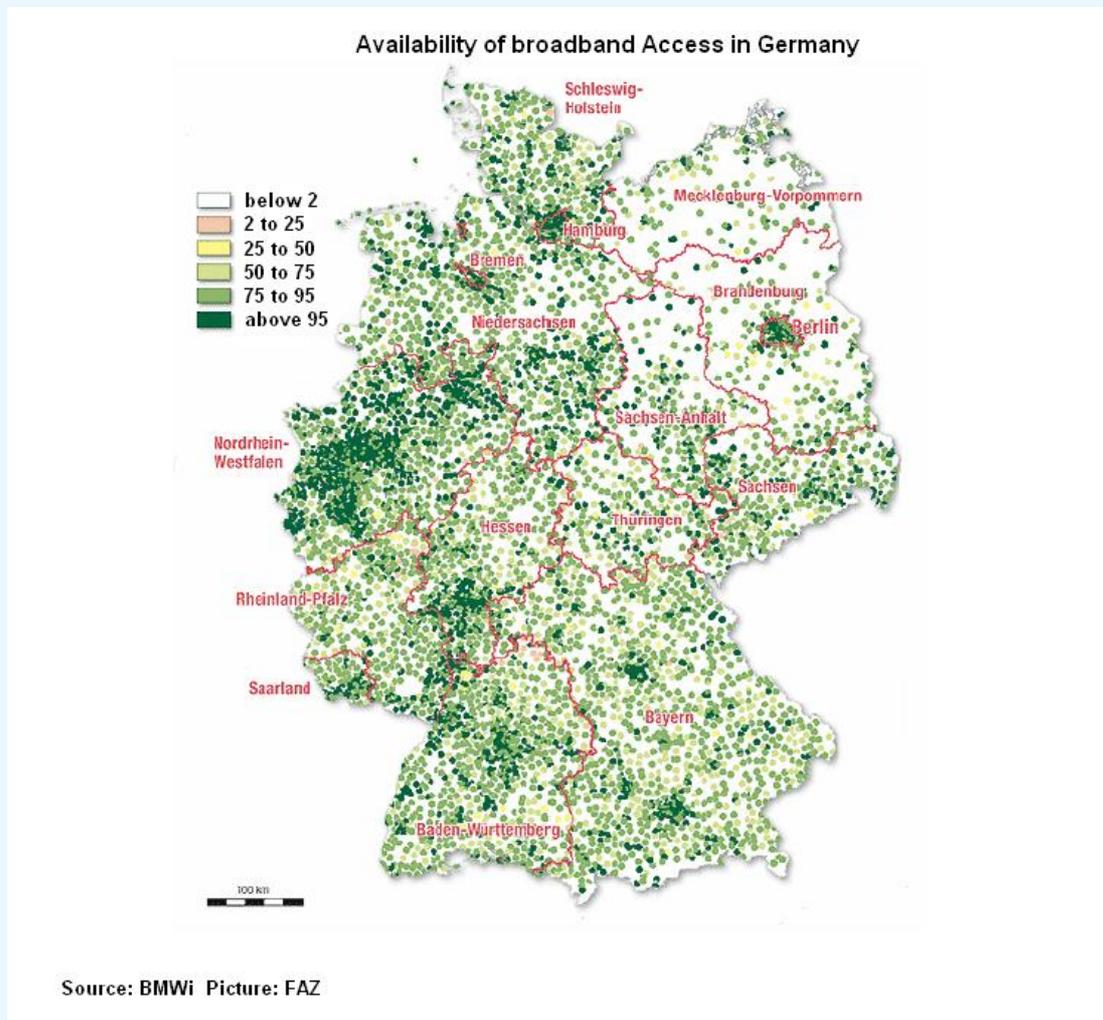
The economic and political expectations regarding the distribution of fast Internet access in the corporate sector and mass market are extremely high in all industrialised countries. Broadband access is deemed to be a key cornerstone in the development towards an information society. In the past few years, government programmes were therefore launched in all of the Member States of the European Community in order to press ahead with the penetration of broadband access and to intensify the use of broadband by public institutions, companies and private households.

This also applies to relevant political initiatives in Germany. The “German Broadband Initiative” launched by the Federal Government and the D21 initiative in 2002 created a platform early on to initiate a dialogue between industry, science and politicians to make broadband infrastructures the most important access technology. More intensive broadband usage, greater competition in the broadband market, better nationwide access and the promotion of innovative electronic services are the key contents of this policy. They are a focal point of the “Information Society Germany 2010 action programme”. According to the ideas expressed in the “concept for medium-term nationwide broadband access”, the Federal Government assumes that by 2008, 98 percent of all German households will have broadband Internet access on the basis of fixed network, cable network and radio-based connections. Given the current market dynamics, it does not appear unlikely that the target pursued by the Federal Government up to now of achieving at least 95 percent nationwide coverage will be surpassed.

The intensive efforts to speed up the dissemination of broadband can be attributed to the fact that the availability of high bit rate accesses and new services is considered to be important location and competitive factors. On the one hand, broadband Internet access is one of the most important growth drivers in the telecommunications sector which shows added value intensity and profitability, counteracting the gradual loss of importance of fixed networks due to growing competition, market saturation, price erosion and substitution by mobile communications. They give network providers, Internet service providers and content providers the opportunity to offer new services in the field of innovative broadband applications (e.g. VoIP), for integrated and grouping together of different services (e.g. triple play) as well as the distribution of attractive content to customers direct. Enhanced availability and ever higher bandwidths, affordable prices, cost control by flat rate offers and always-on functions are some of the most important drivers of broadband Internet penetration.

The positive effects associated with the penetration of broadband Internet are having a major multiplier effect on all sectors of the national economy and hence on the economy as a whole. Broadband Internet is enhancing and expediting communication and data exchange in the entire national economy and is contributing crucially to process optimisation of those parts of the added-value chain involving the distribution of goods and services, as e-commerce shows: Germany plays a leading role in the electronic business not just within western Europe, accounting for 30 percent (EUR 203 billion in 2005).

Figure 6.5: Availability of broadband access in Germany



Source: BMWI

Picture: FAZ

Broadband Internet is credited with playing an important role as a catalyst for macro-economic efficiency and productivity enhancement. Studies conducted in the USA estimate that broadband services in the USA contribute over USD 500 billion each year to the macroeconomic added value. Once full market penetration has been achieved, GDP there could rise to over USD 180 billion. According to these studies, full nationwide coverage could lead to the creation of more than 100,000 permanent jobs each year.

The OECD estimates that broadband Internet in European countries will account for at least one third of anticipated productivity growth in the years to come. It is estimated that the macroeconomic value contribution of the transition to a mass market in respect of broadband access would be several EUR 10 billion per year.

If the positive macroeconomic effects of broadband Internet are broken down into the regional effects of broadband Internet, the emphasis on the special integrative effects on remote rural regions becomes apparent. Broadband Internet is considered to be a particularly suitable infrastructure technology for giving important growth impetus to rural areas. The contribution of broadband telecommunications infrastructures and services to regional development is sometimes estimated higher than, for instance, the relevant effects of traditional transport infrastructure systems.

3.2 DSL as a reference point for alternative broadband access technologies

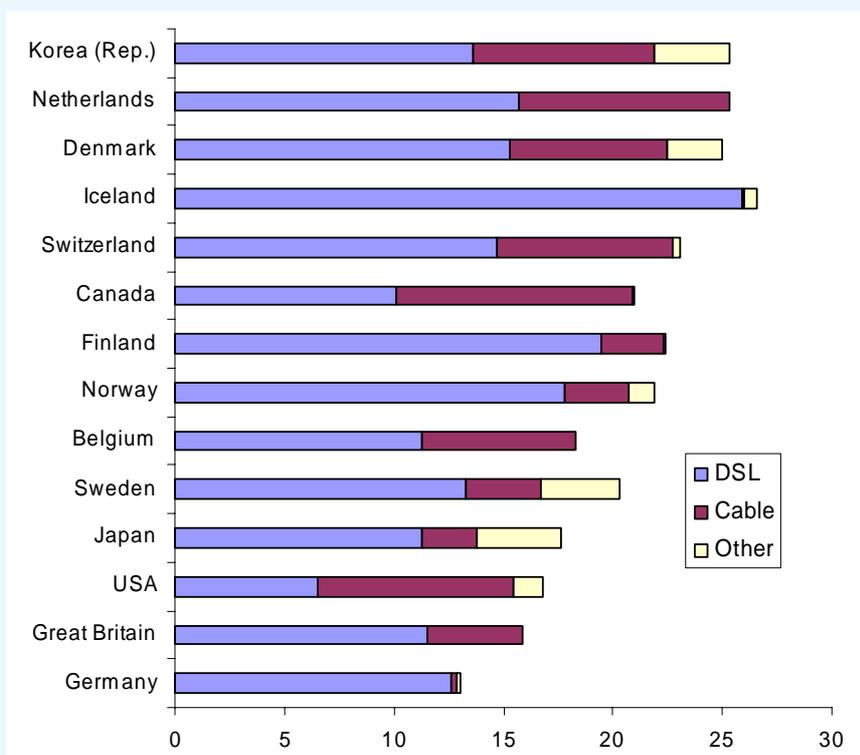
The discussion about the availability of broadband access technologies has been marked by DSL technology in Germany since the broadband Internet market emerged. It is true that alternative broadband accesses are currently being implemented in technological terms and are being supplied in Germany also via

- TV broadband cable (cable modem),
- Power lines as well as wireless via
- Public Wireless LAN (PWLAN),
- WiMAX,
- UMTS (HSDPA) and
- Satellite.

Nevertheless, DSL technology is, so to speak, the natural reference point for competitive access technologies both in terms of nationwide supply and broadband availability and price structure of the DSL services offered by these systems. Wherever DSL is available, alternative access technologies will find it difficult to gain a foothold. Although the market for broadband access is still a young, very dynamic market, DSL technology accounts for around 97 percent.

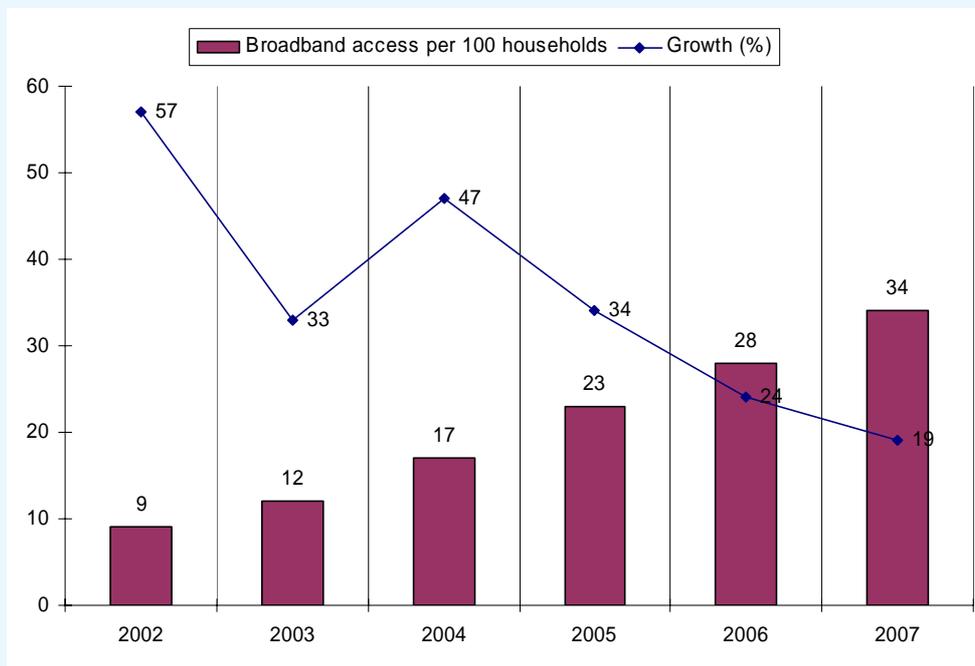
Since DSL was introduced in 2001, two-digit growth rates in the upper area have been recorded year-on-year. The number of broadband accesses rose from 1.9 million in 2001 to 6.9 million by the end of 2004. It is anticipated that the number of broadband accesses will top around 10.7 million by the end of 2005, corresponding to overall market penetration of about 27 percent, with around 39 million German households having broadband access. In an international comparison of connected subscribers, Germany will hence rank fourth by the end of 2005 behind the USA, Japan and South Korea. By the end of 2007, the DSL market is expected to grow on average by 27 percent a year, with the total number of broadband connections topping 16.4 million.

Figure 6.6: Broadband availability per 100 inhabitants in June 2005



Source: OECD

Figure 6.7: Prediction broadband access in Germany



Source: BITKOM/EITO

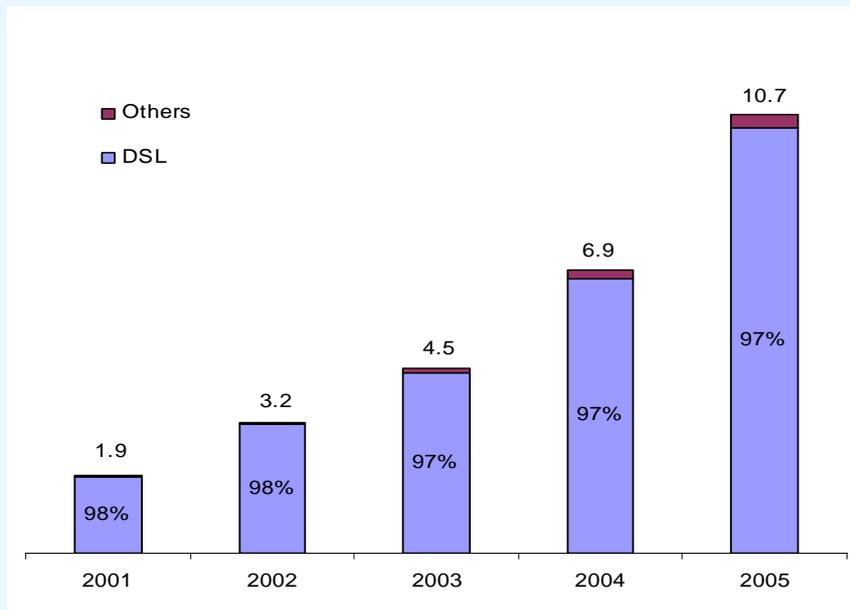
Picture: WIK

There is no standardized definition of the term “broadband” at international level, yet it is generally agreed that this means an Internet connection with a download speed of at least 356 kbit/s and an upload speed of 128 kbit/s. Bundling of ISDN channels as broadband is hence ruled out by definition.

The main causes for this dynamic growth of DSL lines can be found in the regulatory area, on the one hand. The Telecommunications Act (TKG) established a regulatory framework that promotes competition, which guarantees in particular efficient sector-specific access and price regulation. With the unbundled local loop and so-called line sharing, competitors have access to important products in the upstream market for broadband access. The Federal Network Agency reduced the prices for access to the local loop and for line sharing just a few months ago. The rates charged in Germany now compare very favourably to those charged in other European countries.

Since July 2004, the incumbent has also given its competitors the opportunity to resell T-DSL lines on a voluntary basis as part of a resale offer. By the first quarter of 2005, 465,000 DSL lines had been implemented by competitors on the basis of resale alone. The Federal Network Agency is currently investigating whether the prerequisites are met for stipulating that further products and services be made available in the upstream market, so-called bit stream access. This product is being used successfully by competitors to provide their own broadband services in the end customer market in countries like Spain, Great Britain, France and Norway.

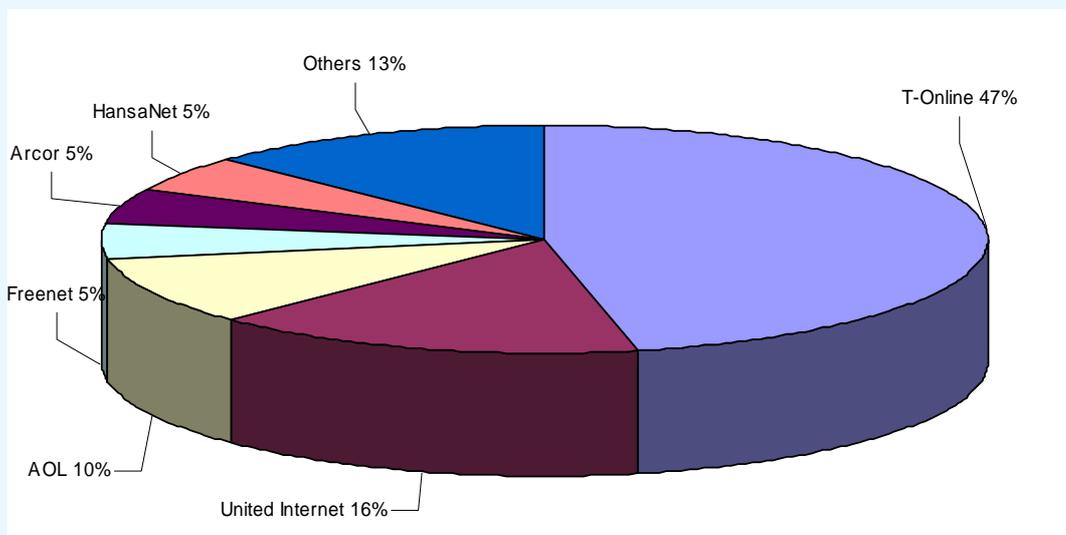
Figure 6.8: Broadband access in total (Millions) and share of DSL (%)



Source: BNetzA

Another reason for the dynamic growth of the DSL market is closely associated with the upstream market which is attributed to stiff competition in the market for ISP services. There are particularly high incentives for the incumbent and the competing service providers registered with the Federal Network Agency in the present market phase to gain as big a share as possible in the rest of the market for broadband access which is yet to be distributed as the crucial steps paving the way for future distribution are currently being taken. There is evidence that aggressive strategies are hence being taken to attract new customers in order to secure crucial shares in this market segment which offers such intensive added value. Germany has only tapped into one-third of this market segment's potential which is estimated to encompass between 65 percent and 75 percent of all households.

Figure 6.9: Competition In Broadband Access In Germany



Source: Point Topic, WestLB Equity Research

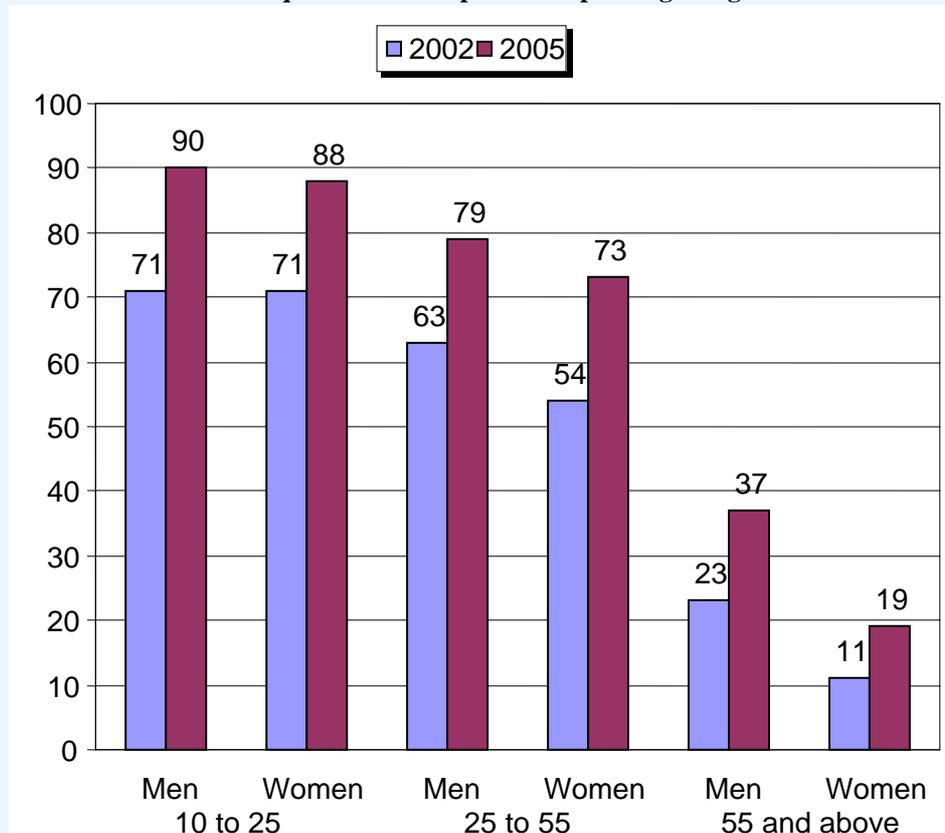
Picture: WIK

The stiff competition in the ISP market has led not just to a low level of prices in the ISP market by international comparison, but also to products and services in the end customer market that offer rising quality standards which are reflected in particular in rising transmission rates (1, 2, 3, 6 Mbit/s etc.) with prices frequently remaining the same. Whereas the bandwidth of the average DSL line had a download speed of 768 kbit/s two years ago, hardly any lines offering a transmission speed of less than 2 Mbit/s are sold to private households in the fixed network area. Continuous investments in the modernisation of network, for instance by ADSL2+, means at the same time that ever higher bandwidths are becoming available to a steadily growing number of customers. The service provider, for instance, has been offering its customers download speeds of up to 20 Mbit/s and upstream speeds of 600 kbit/s since October 2005 for EUR 69.98.

The cost-effective structures of products and services are accompanied by the penetration strategies of a large number of service providers that involve subsidised terminal equipment components (router, WLAN equipment) in the end customer market, also reducing equipment and changeover costs to a minimum. By offering a wide range of scaleable tariff models (time or volume contingents, flat rates), full use is simultaneously being made of the various customer segments in the broadband market, for instance, small and medium-sized enterprises (SMEs), Small Offices and Home Offices (SOHO) as well as a wide range of user segments in private households which as normal users, sporadic users or low users have not yet shown any particular affinity with the Internet as a medium.

A third reason for the rising penetration numbers of broadband Internet is Germany's growing electronic media competency. This process which media researchers describe as "demographic normalisation" involves groups that have been under-represented up to now in terms of Internet usage turning to this medium in growing numbers, with both people who have little formal school education, senior citizens and women gradually becoming active Internet users. The share of adults who meanwhile use the Internet has risen from 28.6 percent in 2000 to 57.9 percent (2005). Despite this already high level of penetration, media researchers have indicated that there is still untapped potential for future growth rates in individual socio-demographic groups.

Figure 6.10: Internet use in the first quarter 2005 in percent depending on age



Source: Statistisches Bundesamt 2006-15-0137

A glance at the availability of DSL in absolute terms in relation to the number of households frequently conceals the fact that it varies greatly from region to region. While DSL is available in nearly all densely populated urban areas, the broadband atlas published by the Federal Government in July 2005 documenting the geographical availability of various access technologies and their providers does show “blank areas” for a large number of rural regions and areas (formerly close to the border). i.e. areas that do not have a DSL supply. By international standards, Germany holds a good position with an average penetration rate of 55 percent for rural regions compared to France (45 percent), Italy (40 percent) or the United Kingdom (40 percent). Nonetheless, this figure highlights the fact that considerable parts of suburban, small town and rural regions are supplied with DSL lines.

This is due to the lack of economic efficiency resulting from the excessively large spread of demand on the one hand. The existing regional supply of broadband accesses nearly always reflects economies of density, in other words, the actual and anticipated data volume, the density of which varies from region to region. The investment decisions made by market players based on this have led to products and services with varying regional distribution and availabilities as well as to different end customer prices. In principle, the best supply is found in densely populated large city regions where competitive DSL services are available at attractive prices offering high speeds and where broadband access is sometimes available using alternative systems such as broadband cable.

Any further expansion of the availability of wired broadband access in hitherto unpenetrated areas is associated with very high marginal costs. Deutsche Telekom, for instance, assumes that expanding DSL on its network for the remaining 10 percent of households that have not yet been penetrated would require the same investment as it would to penetrate the other 90 percent.

On the other hand, the lack of development in this area is due to technological restrictions ensuing from a range of problems associated with DSL technology. With DSL it is generally possible to achieve a transmission rate of at least 384 kbit/s on a length of copper wire of up to 4 kilometres between the customer’s modem and the DSLAM in the main distribution frame or distributing box. By deploying new technologies, this distance can gradually be increased in small steps to around 5 kilometres. DSL technology is not, however, able to bridge distances greater than that. Experts estimate that more than a million connections cannot be serviced with broadband Internet in Germany because they are too far away from an exchange, unless expensive development works, e.g. using outdoor DSLAMs, are carried out. In areas where DSL is already well-developed, more than a million connections cannot be serviced with DSL because the distance between the DSLAM and the DSL modem is too great.

3.3 Alternative broadband access via radio

For the following comparisons of different radio systems, two variables are of particular importance: on the one hand, the size of the area covered by a system’s radio cell and, on the other, the number of users that can be serviced in this cell. Whereas the size of a radio cell depends to a significant extent on the available transmission power and the carrier frequencies used, the number of users that can be serviced depends on the service mix as well as on the transmission technology used, that is to say, the type of modulation, the channel coding and the frequency spectrum.

In order to compare systems, “standard users” of the same type will be used as a starting point in the following. A system’s “standard user” makes use of a streaming service with a useful data rate of 768 kbit/s (in the downlink, after channel decoding). If a system’s radio cell is, for example, able to service a maximum of two such users simultaneously, in other words, provides a sum data rate of at least $2 \times 768 \text{ kbit/s} = 1536 \text{ kbit/s}$ but less than $3 \times 768 \text{ kbit/s} = 2304 \text{ kbit/s}$, and in doing so covers an area of 1 km², this corresponds to a potential user density of 2 per km². Assuming a circular area, this corresponds to a radius of 564 m. Depending on the population density in the region that is to be serviced, it may be too small or oversized. In densely populated regions, it may be necessary to establish smaller radio cells in order to meet the demand (traffic offered per area). By contrast, in less densely populated regions, it may perhaps be possible to meet the demand with larger cells. We will look at two scenarios as an example:

a. “Standard region 1” represents an urban environment with a typical population density of 2000 inhabitants per km² (e.g. Hamburg/Bremen, in round figures). It is assumed that 10 percent of the population use the system under review as customers. Of these 200 users, 10 percent, in other words 20, are

online in the busy hour. A statistical mean of 60 percent of these users at the same time request the data service with the above-mentioned rate of 768 kbit/s, while the remaining users temporarily require no data. This is equivalent to 12 standard users who are active at the same time. The Erlang B formula that is applied to connection-oriented transmission is used as an alternative for the dimensioning of the cell. If the offered traffic was 12 Erlangs with a permitted blocking probability of 1 percent, 20 bearer channels would be required to cover this demand. This figure should be interpreted as an upper limit as with packet-oriented transmission the data throughput of a cell can be optimised taking into account different services categories. Accurate measurement of these effects requires expensive traffic theoretical modelling that does, however, extend beyond the rough deliberations in question here. Thus, the number of cells and the size that is needed to service an area of 1 km² under the relevant conditions is derived from the number of bearer channels that are provided in the system for each radio cell.

b. “Standard region 2” models a rural environment with a population density of 80 inhabitants per km² (Mecklenburg-Western Pomerania/Brandenburg, in round figures). Here, too, it is assumed that 10 percent of the population use the system as customers and that, of these customers, 10 percent are online as users in the busy hour. Of these users, 60 percent simultaneously require a data service with a rate of 768 kbit/s, which would be equivalent to an offered traffic of 0.48 Erlangs. With a blocking probability of 1 percent, 4 bearer channels would be required in this case.

The two different standard regions are therefore characterised by the requirements of 20 bearer channels per km² (standard region 1) and 4 bearer channels per km² (standard region 2). A further important variable for comparing systems is the so-called “spectral efficiency”. The term spectral efficiency is not clearly defined in the literature. It is generally used to characterise a transmission technology and indicates how effectively the relevant technology utilises the frequency spectrum that is available to it, in other words, how much useful data can be transmitted on a frequency channel at a certain frequency bandwidth. Hence, spectral efficiency is indicated in kbit/s/Hz or, in cellular systems in which only one cell is examined, in kbit/s/Hz/cell. What is not predefined in this regard is the type of measurement of the quantity of data transmitted. For instance, the maximum data rates that are achievable by the physical layer under ideal conditions can be examined, but only the data rate that is on average available to users in an interfered environment. If, in the following examinations of individual radio technologies, figures for spectral efficiency are quoted, they relate to the sum data rate that is actually provided by a system’s radio cell (after channel decoding).

In all systems, there is a large discrepancy between theoretical maximum data rates in relation to standards and the data rates that are actually achievable under real physical transmission conditions, taking peripheral economic conditions into account. An example of this is current UMTS-FDD systems. Here, theoretical data throughputs of up to 5.616 Mbit/s per cell are possible (no channel coding, spread factor 4, 3 parallel spread codes). At a frequency bandwidth of 5 MHz, this would be equivalent to a spectral efficiency of 1.1232 bit/s/Hz. In-depth theoretical investigations, however, reveal a median spectral efficiency of at most 0.3 bit/s/Hz in networks that are running at full capacity. This is equivalent to a sum data rate of 1.5 Mbit/s, which is to be allocated to all users. This means that only two standard users’ requirements could be met. Therefore, it may perhaps make sense, for economic reasons, to limit the maximum data rate that is available to a user. In current UMTS networks, this upper limit is 384 kbit/s, which means that approximately 4 users can be serviced simultaneously.

If the number of users increases, in the UMTS-System, the sum data rate is spread over the users so that, for instance, 10 users can be serviced with 150 kbit/s. Generally, the rule that applies in respect of the different system standards is that the sum data rate which is available in a network running to capacity may differ by factors from the theoretically available rate.

3.3.1 Wireless LAN

The term “Wireless LAN” (WLAN, Wi-Fi) refers first of all to any systems that facilitate radio-based data transmission within a local computer network extending over an area of a few 100 m (Local Area Network). In the narrower sense, WLAN refers to a wireless network based on the IEEE 802.11 standards family. Within this family, there are different standards with modified radio technologies and data rates. At present, the 802.11b and 802.11g standards, offering nominal (theoretical) data rates of 11 Mbit/s or 54 Mbit/s

(including the packet header) per channel, are used in almost all systems operated in the ISM band at 2.4 GHz, which is not subject to a spectrum allocation requirement. Proprietary solutions that modify the 802.11b standard offer higher data rates (e.g. 22 Mbit/s). Modifications of the 802.11g standard with higher data rates are also available. However, these systems, because they are incompatible with other manufacturers' systems, are more often than not unsuitable for public operations. The 802.11a standard is designed for systems operating in the 5 GHz band, which is subject to a spectrum allocation requirement, and likewise offers nominal maximum data rates of 54 Mbit/s. In all systems, the maximum net data rate that is actually achievable for the user is approximately 50 percent of the theoretical maximum rates.

A handover to other WLAN systems is not planned. Therefore, although WLAN terminal devices are portable between different networks, they do not facilitate mobility.

3.3.2 WiMAX

Radio systems that are intended to cover a larger area such as a district with each base station are specified (Metropolitan Area Network, MAN) in the IEEE 802.16 standards family. As with WLANs, there are also several standards with different technical characteristics in this area. The key distinguishing feature of the standards is the planned frequency range and associated operation with a line-of-sight connection (frequency range from 2.5 GHz, particularly for radio relay systems (point-to-point) or for wirelessly connecting base stations to the core network (backhaul)) or without a line-of-sight connection (realistically up to approx. 6 GHz, also for provisioning end users). The current and most-used standard for radio transmission, 802.16-2004, includes the major elements of the earlier 802.16a and 802.16d standards.

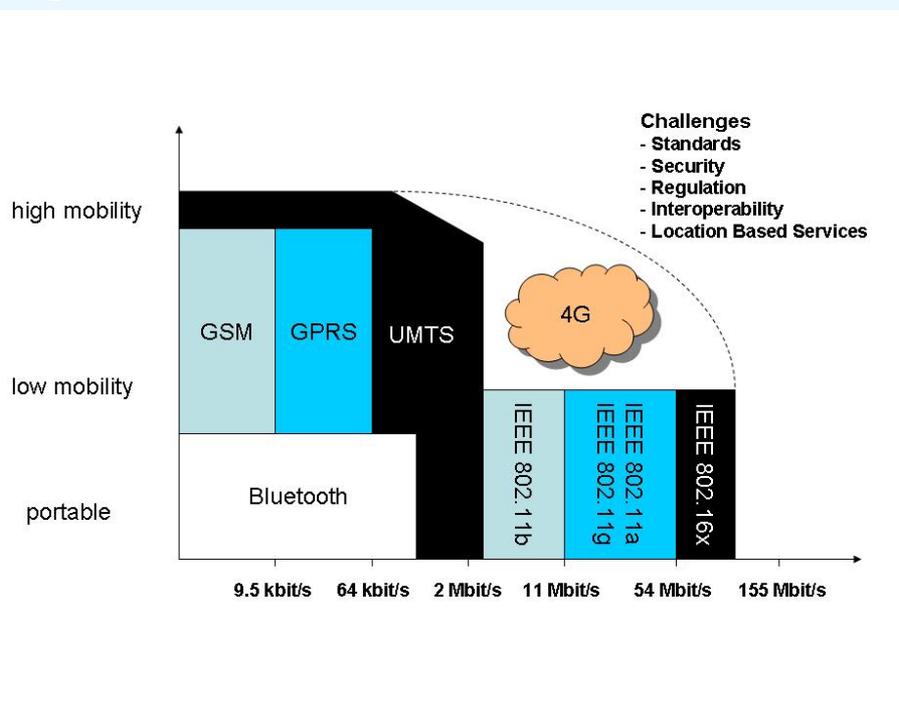
The term "WiMAX" (Worldwide Interoperability for Microwave Access) encompasses all radio systems that are linked to the 802.16 family. However, the term is generic and can also be used for proprietary systems. The WiMAX Forum will be launching a certification programme in the near future under which only systems that are fully compatible with an 802.16 standard can carry the "WiMAX Forum certified" logo.

Both TDD and FDD are specified as duplex systems, while FDD is preferred in the paired spectrum. WiMAX based on 802.16-2004 facilitates both single carrier modulation and OFDM with 256 subcarriers. Depending on the channel quality, different modulation systems can be used. 64-QAM is used for the highest data rates 64-QAM and QPSK or BPSK is used under poorer transmission conditions. The channel coding is effected by means of two chain codes (folding code and Reed-Solomon code). Alternatively, turbo coding can be used. WiMAX or pre-WiMAX systems that are currently being operated in Germany (not fully standards-compliant) use paired frequency bands with a 3.5 MHz bandwidth in the 3.5 GHz range. The mobility of WiMAX terminal devices is limited to the range of a radio cell, with no handover planned until future systems based on 802.16e appear (from 2006 onwards).

Theoretically, if a large number of frequency channels are bundled with a line-of-sight connection, very high data rates in the 50 to 70 Mbit/s range per cell can be achieved. However, for an assessment of capacity, the significant factor is the data rate that is actually achievable when operating a single 3.5 MHz frequency channel in the 3.5 GHz band without a line-of-sight connection. In favourable cases, a sum rate of up to 10 Mbit/s per cell can then be achieved. However, simulation results in heavier load scenarios suggest reduced sum rates of approx. 3.9 Mbit/s per cell.

Against this backdrop, in 2004, the Federal Network Agency relaunched the debate on frequency allocation and published "Key Points for the Allocation of Frequencies in the 3400 – 3600 MHz Range and Hearing on the Planned Allocation Procedure" for comment. Furthermore, in July 2005, it conducted a hearing to enable it to provide frequencies for the German market as rapidly as possible. The frequencies designated as broadband wireless access (BWA) in the above-mentioned frequency spectrums are expected to be available at the end of 2006.

Figure 6.11: Challenges



Source: dacor GmbH/WIK

The Federal Network Agency is pursuing a technology-neutral and flexible approach in relation to the allocation of BWA frequencies in order to avoid placing obstacles in the way of the dynamic development of new wireless technologies.

3.3.3 UMTS/HSDPA

The UMTS mobile networks that are currently being operated comply with UMTS FDD Standard Release 99 and offer the possibility of mobile voice and data transmission. Two paired 5 MHz frequency channels are used to separate the up and downlink, whose carrier frequencies are in the 2 GHz band. The modulation system used is W-CDMA in conjunction with QPSK, and folding codes and turbo coding with rates of 1/2 or 1/3 are used for channel coding.

This system is extremely flexible: besides connection-oriented transmissions with different data rates, it also offers the option of running packet-oriented connections – likewise with different data rates. The system provides full mobility as part of its coverage. The current maximum data rate provided to the user is 384 kbit/s and the total data rate is approx. 1.5 Mbit/s.

The extensions for high data rates (High Speed Packet Access, HSDPA) specified in Release 6 of the UMTS Standard are due to be deployed in 2006. A distinction is made between HSDPA for the downlink and HSUPA for the uplink. Through the adaptive deployment of the 16-QAM higher-level modulation system and adaptive turbo coding with rates of between 0.15 and 0.98, the aim is to provide theoretical but unrealistic total data rates of up to 14.4 Mbit/s per radio cell on a downlink shared channel. However, depending on the current quality of the radio channel, the load of the cell, the distribution and mobility of users, data rates of 2 – 3.5 Mbit/s are more realistic. This total data rate must be allocated to all the users of the respective radio cell.

The usual mobility provided by the UMTS mobile communication system is also to be supported in HSDPA connections, however it needs to be noted that the data rates that are achievable for an individual user can fall sharply the further one moves away from the base station. Initially, only data rates of no more than 384 kbit/s will be provided for the uplink.

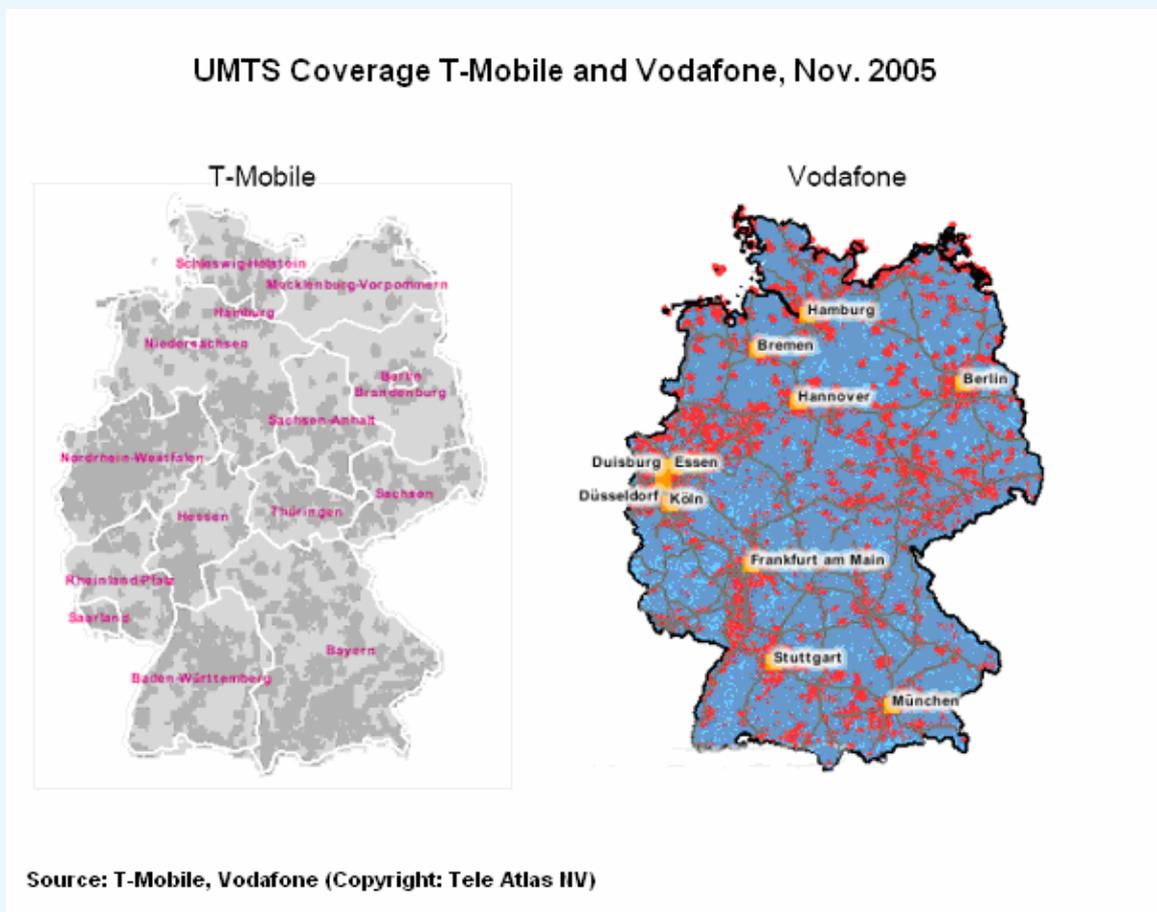
- Frequency planning, coverage and capacity
 - a) Nationwide coverage

The operators of UMTS mobile communication networks in Germany are currently only using a paired 5 MHz band (5 MHz for the up and 5 MHz for the downlink, respectively). The cell radius of a typical UMTS radio cell is approx. 500 m (0.785 km²), which means that, arithmetically, 2.55 standard users per km² can be served. Consequently, the spectral efficiency of the system is 0.31 bit/s/Hz.

In all the radio cells, the UMTS/HSDPA transmission system will be operated on the same carrier frequency as the other UMTS services. The result is mutual disturbance, reducing the achievable rates both for conventional services and on HSDPA connections. To date, no scientific research into the negative interaction that occurs in the effective operation of an actual network has been carried out.

At a data rate of 2 – 3.5 Mbit/s, which is probably the maximum that can be achieved with HSDPA, two to four users could be served with a data rate of 768 kbit/s. This would increase spectral efficiency compared to conventional UMTS transmission to approx. 0.7 bit/s/Hz or to 5.1 standard users per km².

Figure 6.12: UMTS Coverage T-Mobile and Vodafone, Nov. 2005



Source: T-Mobile, Vodafone (Copyright: Tele Atlas NV)

- Frequency availability and regulation

Currently, only the four mobile network operators T-Mobile, Vodafone, E-Plus and O² own frequency allocations for UMTS/HSDPA applications in the so-called UMTS core band at 2.0 GHz in Germany. Before other frequencies are re-allocated in the UMTS extension band at 2.6 GHz and in the frequency blocks that have been returned by, or requested back from, Mobilcom and Quam in the UMTS core band due to non-fulfilment of the provisioning requirement, the Federal Network Agency will develop a policy which includes all the relevant UMTS frequency ranges.

The written hearing conducted in the summer of 2005 revealed a high demand for the available spectrum. At the same time, the comments reflected the complex and widely diverging interests in the market: the four mobile network operators stated their frequency requirements for future expansion of capacity, two new companies were interested in entering the UMTS mobile communications market, while other companies wanted to use UMTS frequencies for BWA services. The Federal Network Agency then conducted an oral hearing in October 2005 to verify the heterogeneous frequency requirements stated in the written hearing. The aim was to identify the short, medium and long-term requirements as the basis for the UMTS policy.

3.4 The path to success

A major success factor in achieving macroeconomic effects will be the speed at which the market potential can be developed. In this regard, it will be important not only to press ahead with the expansion of infrastructure, but also, in particular, to develop the market for broadband services in a targeted manner. In order to highlight the macroeconomic importance of these services, the broadband market was for the first time structured into basic and additional services with the following segments:

- 1 Basic services: infrastructure, communication (VoIP, video telephony)
- 2 Additional services:
 - 2.1 Entertainment (Internet TV, VoD, gaming)
 - 2.2 B2C e-commerce
 - 2.3 B2B e-commerce
 - 2.4 Online IT services/business process outsourcing
 - 2.5 Home office/telework
 - 2.6 E-government
 - 2.7 E-health
 - 2.8 E-learning

A quantitative examination of the market segments confirms that major macroeconomic potential can be found particularly in the additional services, with the availability of the basic services being the essential prerequisite for this. However, despite the dynamic developments in 2005, deficiencies still exist in Germany, particularly in terms of laying the infrastructural foundations. There is insufficient infrastructural competition in Germany and, technologically speaking, it is dominated by DSL. Broadband access via TV cable as an alternative to DSL, which is common in other countries, still plays only a marginal role in Germany. The reason for this is the separation and partial fragmentation of the ownership structure at network levels 3 and 4. Mobile technologies – particularly UMTS – either do not yet facilitate broadband access or the relevant infrastructures are not yet well enough developed to achieve the relevant market relevance here. For this reason, broadband Internet, by and large, is not yet available nationwide at marketable prices. The use of existing services is very strongly differentiated according to customer categories. The greatest untapped potential in respect of productivity and growth can be found among SMEs: whereas the potential in large-scale enterprises have, by and large, been fully exploited, broadband penetration in small and medium-sized enterprises is still low. Here, it will be important to introduce these companies to broadband services such as e-commerce and online IT services in the near term and to consistently develop the range of broadband business services on offer.

However, it is not only in the corporate sector but also in the area of public administration that there is a need for action. It is a matter of specifically designing public services as broadband applications, particularly in the areas of e-government, e-health and e-learning. International comparisons show that e-health, for example, is already regarded in other countries as being an essential broadband segment today, while important public services in Germany are still in the planning phase. This highlights the need to position oneself as rapidly as possible in international locational competition.

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Against this backdrop, it is advisable to develop a specific market strategy for each services segment in order to tap into the existing market potential in a timely manner. On the one hand, service providers and IT providers have a responsibility here. However, it is also a question of infrastructure providers and the state laying suitable foundations to enable the relevant services to develop more quickly.

The study shows that, in international terms, Germany is in a good position in some services segments, but that in others there is still acceleration potential. An international comparison drawn between six selected countries highlights the fact that the success factors with regard to increasing broadband penetration can be reduced to two key requirements: low costs for the expansion of infrastructure (investment) as well as clearly identifiable benefits from broadband access and services from the customer's point of view.

However, the country comparison also shows that it will not be relevant to transfer these success factors directly to Germany. Dispensing with underground cables, for instance, when expanding infrastructure is not really realistic; specific starting conditions such as the high-density housing in Japan and Korea with the resulting low connection costs also make a direct comparison with Germany more difficult. In short, it is evident that business success will not be achieved until basic and additional broadband services are linked. The ten recommendations for action refer both to the creation of an efficient infrastructure and to the stronger implementation of specific broadband services. The goal of the recommendations for action is to focus more strongly on services in the future and to eliminate the division between the broadband network and innovative services that is often still perceived to exist today. They should therefore also be seen as a call to all the participants in the market to take joint action in this area in the interests of development:

- a) Recommendations for action with a view to developing an efficient infrastructure
 - 1 Improve the availability of broadband access via TV cable
 - 2 Press ahead with the competitive expansion of the optical fibre network in Germany
 - 3 Press ahead with the implementation of alternative means of access
 - 4 Increase broadband coverage by deploying stationary wireless technologies
 - 5 Improve market transparency by creating "quality seals"
- b) Recommendations for action with a view to developing the market for broadband applications in a sustainable manner
 - 6 Accelerate the development of broadband applications in the areas of e-government, e-health and e-learning and stimulate demand in a targeted way
 - 7 Set up joint support and communication projects to spread broadband penetration in SMEs
 - 8 Promote research in the area of broadband applications at universities and other institutions of higher education
 - 9 Integrate broadband applications into initial and advanced in-school training
 - 10 Further expand established products such as the (N)Onliner Atlas and the Broadband Atlas as a strategic platform for tapping into the market potential of offliners and narrowband users

We can now clearly see that the switch from narrowband to broadband technologies and the associated expansion of broadband applications represents one of the most sweeping changes in business and administration of the past few decades: broadband is an important basic innovation with significant positive effects for the economy as a whole. Processes, hardware and software technologies and also business models need to be reoriented as a result.

4 CONVERGENCE – A DEFINITION

“Convergence” is a term which we are continually confronted with, the meaning of which is not at all clear from the word itself, which is interpreted by many experts in completely different ways and which cannot be replaced or explained using synonyms. In particular, however, it is assumed that convergence is a megatrend in the ICTM industry, which may generate increased demand and, in addition, cost reductions. Of at least equal importance is the new functionality and the associated high level of convenience that convergent services bring.

In order to be able to tap this potential adequately, it is obvious that a uniform understanding of the term and its associated context is urgently required. “Convergence” means the integration of industries that up to now have largely operated separately from one another, but also meshing along a specific value chain or bundling of different services at the applications end. In technological terms, convergence is driven by the digitisation of all the value-added levels of electronic services, in other words, the presentation, transmission, storage, processing and creation of information.

Hence, convergence exists in different forms that also have different effects. Three are outlined here for clarification purposes

Horizontal convergence (industry convergence)

One of the most often quoted examples of convergent effects is the increasing meshing of IT4, TK5, consumer electronics and the media industry. The effects that can occur as a result of this meshing are far from trivial: one of the key questions in this regard is whether this will result in cutthroat competition or in the generation of multiplier effects. The expansion of media companies beyond the print sector into the film and sound broadcasting sector can be cited as an example.

Vertical convergence (value chain convergence)

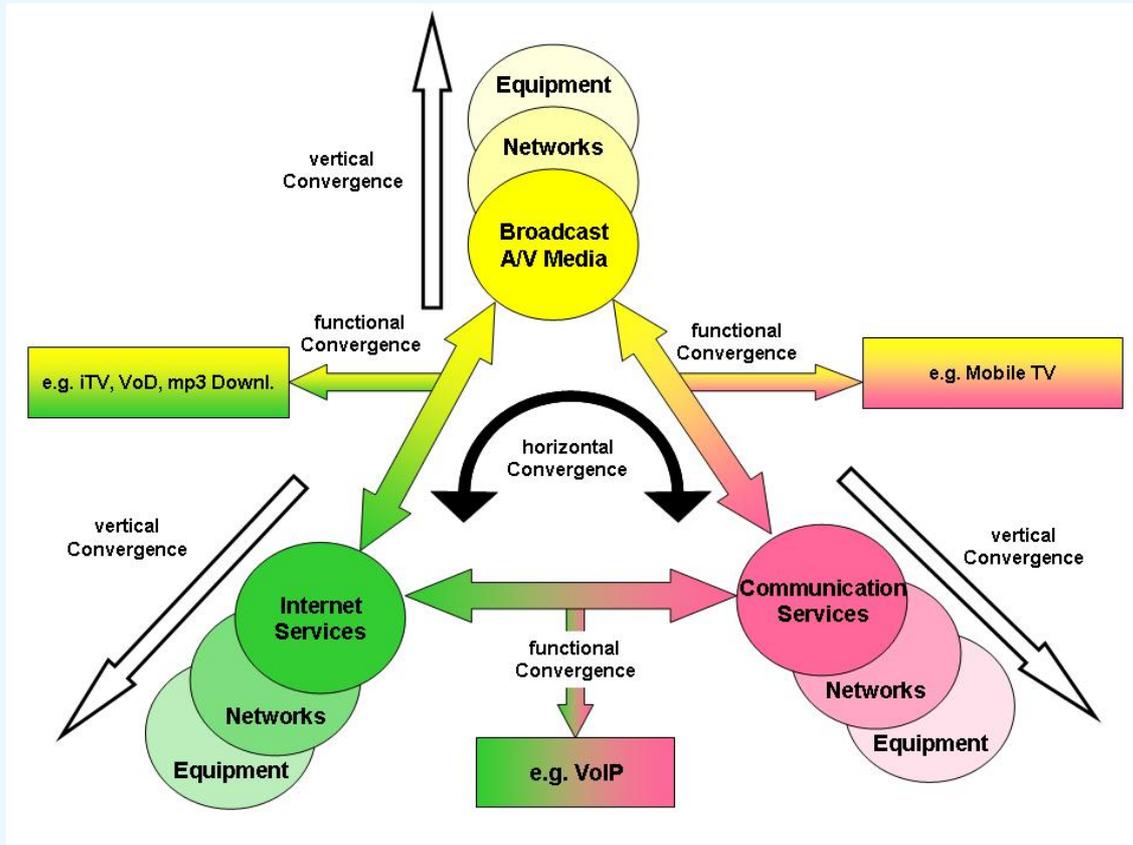
Vertical convergence describes the increasing integration along the value chain and the accompanying standardization in respect of a specific product segment, e.g. universal digitisation in TV production without discontinuity of media. The focus here is on cost advantages and new utilisation options and functions.

Functional convergence (convergence of applications/services)

At the applications and services end, there is evidence of increasing convergence between the major categories of communications, information, entertainment and transactions. We may assume that this meshing can trigger additional growth effects.

Diagram: Convergence of services, networks and end devices. The diagram shows a schematic breakdown of the value chain at three levels. The first level is content. This category includes text and image-based Internet services, language-based communication services and music and film-based broadcast media. The second level comprises the relevant networks that are used as transmission media, that is to say, telephone lines and mobile communication networks, the Internet and also transmission of the television signal via TV cable, satellite or terrestrial antenna. The third level is made up of the end devices via which a user can receive services: telephones and mobile phones for speech, Internet-capable PCs for text as well as television sets, DVD or MP3 players for the area of television and music. Integration within the levels is referred to as horizontal convergence. When companies try to serve upstream or downstream stages of the value chain themselves, this is termed vertical convergence: mobile operators, for instance, sell mobile phones under their own brand, television stations produce programmes themselves or broadband providers provide their own content for their customers. The end customer in particular notices product-oriented functional convergence: it is here that the boundaries between the individual sectors dissolve. To name a few examples: the Internet can transmit speech, music and films in high quality. These services have been available as “Voice over IP” and “video on demand” for a few years now. The mobile phone is becoming a real all-rounder: users can decide whether they want to use their mobile to make a call, play games, take pictures, surf the Internet, organise their schedule and soon even watch television.

Figure 6.13



4.1 The economic importance of convergence

The challenge of the issue convergence is to indicate where exactly and how convergence can lead to additional demand and hence business potential. As such, two aspects are of special importance:

a) On the one hand, a basic requirement for universal digitisation and beyond that – if and where possible – standardization and homogenisation, often referred to as “interoperability”. To achieve swifter market penetration, BITKOM’s Convergence Dialogue Group has been seeking to gain support for the development and dissemination of interoperable systems and the use of uniform standards since mid-2004. Standards are currently being developed in many areas. Socio-political and strategic decisions are providing the basis. It is not yet clear which standards will become established in the market. As with the acceptance of the VHS video format or the MP3 music format, consumers will also have a major influence on this decision.

b) On the other hand, the added value created and still to be created will have to generate customer benefits and adequate economic efficiency on this basis. Instead of progress that is based purely on technology, it is primarily a matter of the business opportunities that emerge as a result of convenient products and services which are consumer-oriented and which meet the needs of potential customers (e.g. user-friendliness).

There are a wide range of answers to the question of whether convergent services will gain acceptance in the marketplace. What these answers have in common is the fact that they refer to the following leading phenomena:

- the digitisation and accompanying performance expansion of base technologies,
- a sharp rise in the development of private digital content (for instance, due to cameras in mobile phones and the Internet) alongside professional content,

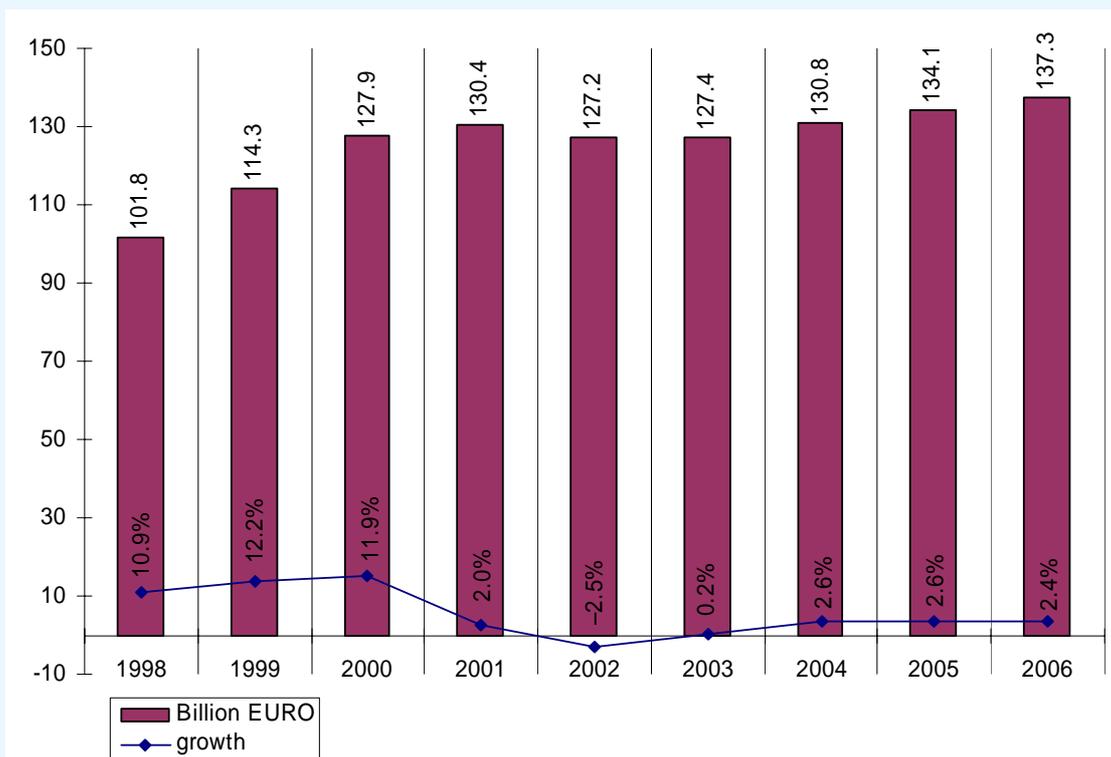
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- the removal of the 1:1 connection between the terminal device and the application,
- the spread of IP-based services and broadband availability,
- the diversity and spread of screen-based, high-resolution terminal equipment.

For years there has been evidence of an increasing spread of these leading phenomena. They are occurring independently of one another and are inexorably penetrating global markets. However, the combination of leading phenomena is the basis for the development of convergent services. As a result of achieving the critical mass, the structured and consistent linking of these technological aspects is leading to a convergence trend. Irrespective of the details in the answer to the initial question, we can therefore say that convergent services will play an important role in the ICTM market.

Technology convergence is a global phenomenon and a great challenge that no national economy can avoid. What is critical, however, is how each country deals with this challenge and whether it is the driver of this development or is driven by it. In what parts of the world convergence creates or doesn't create markets, growth and employment will depend on this. Hence, this phenomenon can also become a positive locational factor for Germany if a specialised service industry with its own national added value and international competitive edge is developed and is passed on to the market as a customer benefit through an attractive environment of technological progress.

Figure 6.14: German ITC Market 1998-2006



Source: BITKOM

Convergence is a strategically important issue with regard to maintaining and enhancing the competitiveness of ICTM industries and thus with regard to Germany as a business location in general. Convergence occurs as an ongoing process. It is a matter of tapping the market development potential that lies within it. Convergence also represents a new opportunity for small and medium-sized enterprises. Via the existing know-how in the development of base technologies, Germany can achieve an edge in competitiveness and expertise if the base technologies and the resulting leading phenomena are bundled into value-added products and services and are implemented in a user-friendly way.

Convergence means innovation in a highly complex field. This requires new forms of cooperation between companies and industries. The fragmentation of the value chain for electronic services that frequently still exists in Germany must be overcome. Convergence requires a new understanding of services on the part of ICTM industries. On the one hand, new customer-oriented electronic services must be the result of development and, on the other, new services in the area of systems and equipment integration, service, etc., are needed in order to successfully establish in the marketplace products and services that require explanation.

Three developments can be derived from these considerations:

1. As cross-divisional technologies, ICTM technologies have meanwhile penetrated nearly all areas of our business and private lives. They make products more intelligent – just think of electronic injection or brake assistant in cars or of embedded systems in mechanical engineering.
2. ICTM technologies have helped hugely to make business processes more efficient, by facilitating the universal digitisation of processes. The value chains in our national economy today are becoming more efficient as the controlling and accompanying information is now available electronically without media disruption. The main focus is on benefits to customers, for instance, the convenience of use and the simplicity. The automotive industry also provides good examples here. Individual customer data accompany the motor vehicle from the time it is ordered, while it is being manufactured right up until it is delivered (and afterwards through regular servicing). This means it is possible to deliver individually configured vehicles to the customer within a very short space of time.
3. ICTM technology advancement enables new digital value chains to be developed – wherever information and communication themselves become an independent product, just as the Internet has become accessible to everyone as a virtual, global information platform. This development is a highly complex one, as universal supply chains need to be developed for the first time for a new category of flows of goods and the services they facilitate. Reference is made here to the “enhanced digital supply chain”.

With the transition of today’s narrowband Internet to the Internet of the next generation, this trend will enter a new phase. It will also be marked by the fact that anyone will have access to broadband Internet. This will lead to the emergence of new services that will give users access to “virtual goods” in the form of data, images, films, software programmes etc., offering far greater value creation than nowadays.

This chain will open up the markets of tomorrow – if and when it is established. There is evidence to suggest that the consumers of tomorrow will satisfy their demand for electronic services and virtual goods on virtual digital service platforms which will contain much more content and be much more efficient than today’s platforms and above all will no longer be fragmented.

The individual, universal communication and information area will be integrated which users will be able to “take with them” in terms of time and geography, regardless of when, where and via what networks users log on. Users will, for instance, be able to use their usual and new electronic services and content according to the principle “anywhere, anytime, any device”, regardless of which medium gives them access to this technology (seamless mobility). This is conceivable in all usage situations – whether at the office, when people are travelling or are relaxing on the couch at home – always with the same, familiar, trusted and personalised user interface. The aim is for users always to have access to a homogeneous and identical service world using a web identity that is inseparably linked to their natural identity.

4.2 Barriers on the way towards a convergent society

There are still many barriers that need to be overcome on the way towards a world of integrated applications. One of the main barriers frequently mentioned is the inadequate harmonization of technical standards, both from industry to industry and across borders. Furthermore, it cannot be claimed that customers, and in particular private customers, are being encouraged to use convergent products and services, for instance, with a view to achieving clear added value, user-friendliness and an adequate price-performance ratio. Other factors are the lack of awareness of the government and the market players involved for the requirements of convergent developments and lack of competency beyond one’s own tunnel vision.

In order to be able to achieve high customer benefit with convergent services, content and applications need to be supplied on a wide range of terminal equipment. As the displays of this terminal equipment have very different resolutions, this content not only has to be supplied with meta data, but also has to be supplied in different formats (conversion). In order to be able to provide consumers with convenient services, simple user instructions should include interactive elements. The development of personalised products and services in particular calls for interplay between different industry segments and the harmonization of standards used. This is the only way applications can be established that follow users, for instance, when they switch from a stationary to a mobile end device. Services that enable film and music files received on mobile devices to be exchanged for higher quality online files are another example (synchronisation of terminal equipment).

4.2.1 Harmonisation and standardization

The most important basic prerequisites for convergence are universal digitisation as well as standardization and homogenisation of the underlying technologies. Despite global activities by standardization bodies, there are just a few isolated cases in which it has been possible to achieve the required interoperability by making full use of convergent effects within the meaning of creating a larger market or generating cost benefits.

Up to now, only the smallest common denominator of relevant parameters has been harmonized across the board, for uniform standards only exist at technical protocol level, but not in relation to user interfaces, navigation, terms and conditions of use or even service parameters.

4.2.2 Consumer perspective

For users (whose purchasing power is steadily growing) from the age groups of persons aged 39 and older, the diversity of ICTM products and services tends to be too technical, complex and unclear. New mobile communication devices which suppliers regard as user-friendly and mobile communication services are an ideal example in this context. The average user finds them too difficult to comprehend and tends not to use them for this very reason. This is why those responsible for marketing have said that the market is filled with uncertainty, confusion and trepidation due to the diversity and incompatibilities which people perceive as “chaotic”.

They say that impetus for growth can be expected in particular if a clear, measurable added value involving no complexities can be easily identified and if the majority of market segments is targeted rather than just freak segments and segment that are “en vogue”.

4.2.3 Digital gaps

Digital gaps are another barrier in the value added field. Broadcast and media technology in particular are to be universally digitised in order to be able to press ahead with vertical and horizontal convergence. In the areas of content generation, content and application processing, content and service distribution and presentation, “analogue” has not been replaced by “digital” in many areas. The comprehensive VHS archives in residential households serve as an example in the area of presentation.

4.2.4 Positioning of providers

Under the auspices of growing convergence, traditional competitive boundaries are becoming obsolete and are causing competitive disadvantages. Nonetheless, cooperation with companies of other industries in the value added field is usually considered to be a useful supplier industry in terms of costs and less of a strategic partnership.

Innovation management tends not to be systematically organised. In order to make the complex move towards planned convergence, innovation management based on cooperation should therefore be introduced alongside the coordination of potential activities so that this barrier can be overcome.

4.2.5 Capital markets

As a rule, stock markets have not honoured integrated concepts up to now as preference tends to be given primarily to simple, short-term, one-purpose business models with easily comprehensible monetary results (such as Mannesmann/ Vodafone/Arcor). By contrast, convergent strategies offering much better opportunities in the long term and that avoid the risk of disintegration tend to be ignored. On capital markets, the issue of convergence has been placed on the back burner as a subject of hype and up to now analysts have developed little imagination for the future promise of convergence strategies. For this reason also it is important that the ICTM industry sends out a positive message to capital markets by having a concentrated convergence initiative.

4.2.6 Competency in convergence

Executives and professionals require special skills in order to develop the potential offered by convergence, for instance, in the area of

- The dominating (mega) trends, avoiding tunnel vision also in other relevant sectors outside one's own working area,
- The generation of convergent products and services (service research),
- The modelling of products/services in accordance with customer needs (services engineering) and
- Securing the future viability of products and services through standardization (services standardization).

In Germany, there are only a few competencies and resources available in these areas. Even within the EU funding measures, only 5 percent of the research budget is available for service research. Likewise, the proportion of total corporate research and development expenditure in Germany accounted for by the service sector, at 8 percent, is too low when compared with the frontrunner USA's 34 percent. In order to press ahead with the development of the value creation field, competency in convergent products and services needs to be greatly enhanced.

4.2.7 Connecting links

In addition to the above-mentioned digital gaps, there are frequently so-called "missing links" along the value chain. Up to now, for instance, system integrators for interface management to the customer are only available in a few places. This means there is no integrator role in respect of customer interfaces – sometimes customers have to act as integrators themselves despite the growing complexity. For this reason, there is a demand for new specialists who will fill in the missing links along the value chain.

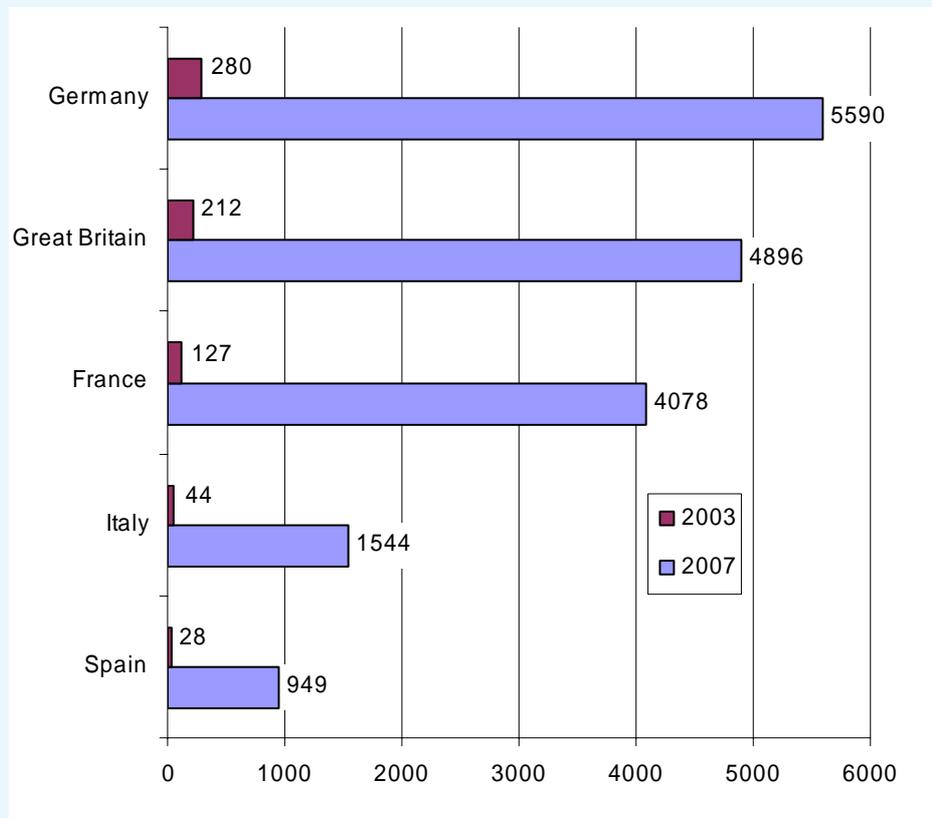
5 DRIVING FACTOR FOR MOBILE SERVICES

The revenue generated with mobile services is rising sharply. As such, the diversification of goods and services and also the growing trend towards digitisation is playing a major role. Due to the sharp rise in mobile access, consumers assume that residential services are almost the same as mobile services.

5.1 E-government

Germany is not tapping into the potential of e-government sufficiently. It is absolutely essential that the digitisation of administrative processes be pressed ahead with. Electronic services for citizens and companies enhance service and reduce costs incurred by the public sector. However, the online availability of the 20 most important public services available to citizens and companies is developing at a slow pace. According to the Statistical Office of the European Commission, Eurostat, 47 percent of services were available online in 2004, including the submission of tax declarations, job searches at employment agencies or participation in public invitations to tender. The previous year, only 40 percent of public services could be accessed online.

Figure 6.15: Mobile Commerce in 2004 and 2007 (in Million EURO)



Source: BITKOM, EITO

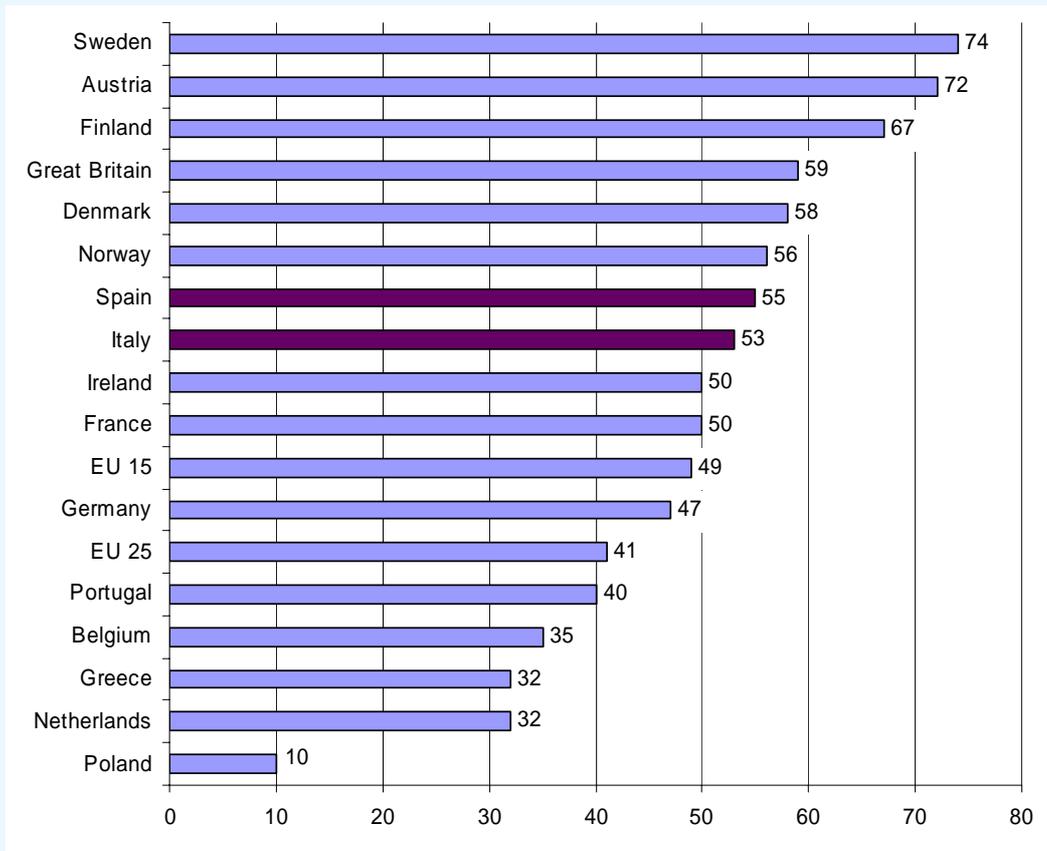
Picture: WIK

By European comparison, Germany is, however, below the average of the 15 EU core countries. Sweden ranks first with 74 percent of basic governmental services being available online, followed by Austria where 72 percent of government services are available online.

5.2 Download market records three-digit growth rate

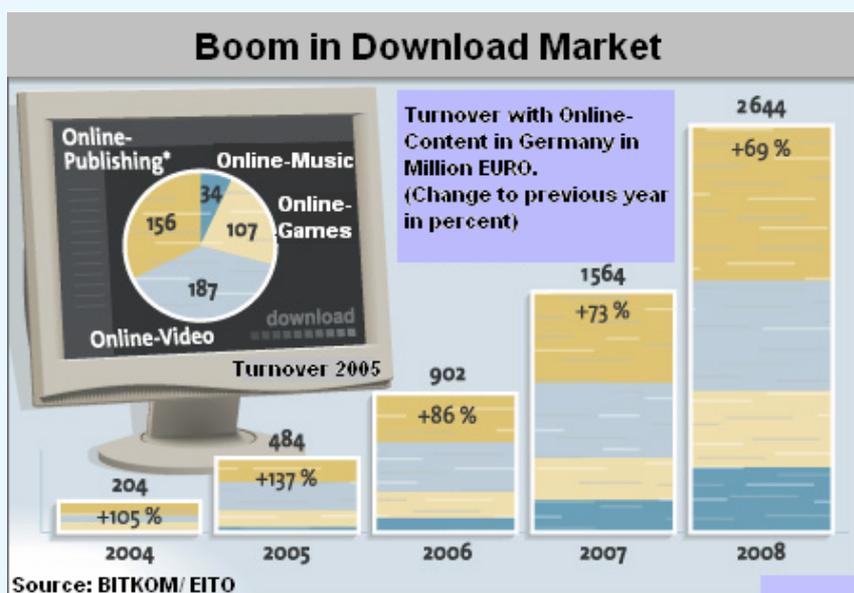
BITKOM expects to see a dynamic market growth for online content in Germany. The German download market is expected to grow by 137 percent to EUR 484 million this year. Having grown by 105 percent in 2004, the market growth has accelerated at a very high level. Within two years, the market is expected to reach a volume of way over EUR 1 billion. This data was published by the German Association for Information Technology, Telecommunications and New Media e. V. (Bundesverband Informationswirtschaft, Telekommunikation und neue Medien) (BITKOM). BITKOM refers to a recent study conducted by the European Information Technology Observatory (EITO). BITKOM combines music, games, videos, texts and images that are available online in the download market. They do not include pure software or content for the business sector. "The willingness to spend money on the Internet has risen greatly in private households", says BITKOM Managing Director Bernhard Rohleder when commenting on the results of the study. "The times of the freebie culture is coming to an end, at the same time the quality of goods and services is improving."

Figure 6.16: Online Availability of 20 basic governmental services 2004 (%)



Source: BITKOM based on EUROSTAT

Figure 6.17: Boom in Download Market



Source: BITKOM/EITO

Online videos account for more than one-third of the revenue generated at present, with sales topping EUR 187 million. The rising number of broadband accesses which make it possible to download large files swiftly in the first place is particularly striking.

The market for online music is still relatively small, with sales topping EUR 34 million at present, but it is set to soar in the years to come – reaching around EUR 420 million by the year 2008. So-called online gaming is also set to reach a similar scale by 2008 (EUR 495 million). In both segments, however, online sales – of CDs, CD-ROMs and DVDs – will continue to dominate. According to EITO, sales through traditional channels will total EUR 1.54 billion in the music market.

Text and image information will be the largest market driver for online content. In this segment, revenue is expected to reach EUR 156 million this year and to rise to EUR 1 billion by 2008. All in all, it is anticipated that by 2008 German end customers will spend around EUR 2.6 billion on online content.

5.3 E-commerce

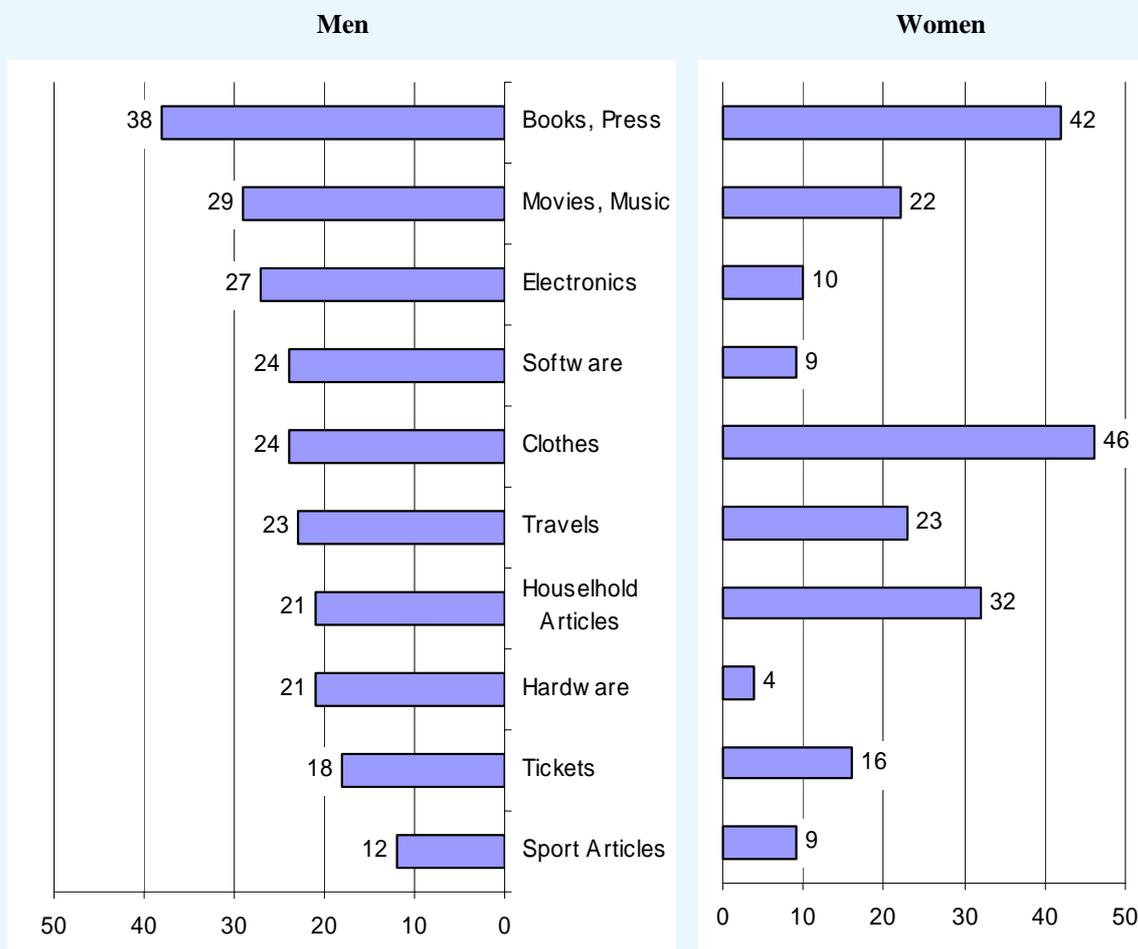
No need to walk anymore, buy online! Revenue generated in online trade rose to EUR 321 billion in 2005. This means Germany ranks first in Europe. Electronic trade is becoming more and more popular in Germany. In 2005, consumers (business-to-consumer) bought goods and services worth EUR 32 billion over the Internet. This represents an increase of 43 percent over the previous year. Business-to-business transactions account for the bulk of online trade at 90 percent. Total revenue generated with e-commerce rose by 58 percent to EUR 321 billion in 2005. This was the result of a study conducted by the market research institute “European Information Technology Observatory” (EITO) which had been commissioned by the German Association for Information Technology, Telecommunications and New Media (Bundesverband Informationswirtschaft, Telekommunikation und neue Medien e. V.) (BITKOM). In the opinion of market researchers, e-commerce revenue in Germany is set to rise to around EUR 694 billion by the year 2009, with private customers (business-to-consumer) accounting for EUR 114 billion.

This means that Germany consolidated its leading position in Europe in e-commerce last year. 30 percent of all goods and service sold via the Internet in Western Europe were sold in Germany in 2005. In addition to the rising number of Internet users, other factors indicate a positive trend for e-commerce. High security standards are creating greater confidence in online shopping, electronic payment systems are being accepted more and more for smaller amounts and mobile phones are creating an additional sales channel to PCs. The most popular products sold over the Internet are books, followed by clothing and sportswear as well as films and music. Electrical goods, travel tickets and software are also very popular among online shoppers.

5.4 Digital entertainment electronics continue to boom

Sales of flat screen TVs, MP3 players and play stations have risen. The market for digital electronic entertainment equipment has grown by 27 percent this year to around EUR 8.8 billion. Digital electronic entertainment equipment meanwhile accounts for almost three-thirds of the entire market. Analogue equipment only accounts for 27 percent. Digital technology has definitely taken over the market. The most important innovations in entertainment electronics nowadays come from the digital world. This applies, among other things, to flat screen TVs, MP3 players and play stations. By contrast, market researchers expect sales of analogue equipment such as tube television sets, video recorders or traditional Hi-fi components to drop by 16 percent to around EUR 3.3 billion in 2005. The overall market for entertainment electronics in Germany hence increased by 11.4 percent to EUR 12.1 in 2005. The latest survey conducted by the consumer research company Gesellschaft für Konsumforschung (GfK) and the European Information Technology Observatory (EITO) provides the basis.

Figure 6.18: Selected Goods and Services in E-Commerce 2005 (%)



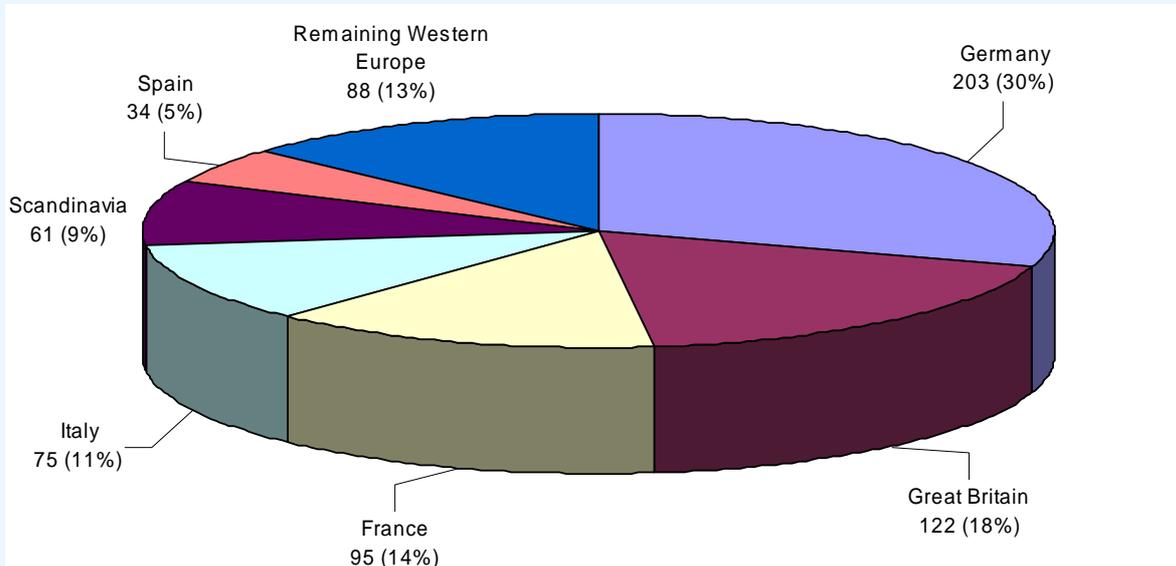
Source: Statistisches Bundesamt 2006-15-0145

Flat screen and projection television show the strongest growth, with revenue rising by 71 percent to EUR 2.6 billion in 2005. The rise in sales figures of flat-screen television more than compensates for the decline in tube television sets. This year, business with LCD, plasma and rear-projection TVs will outstrip the volume of sales of traditional TVs for the very first time. The revenue generated with tube television sets plummeted in Germany by 28 percent in 2005 compared to EUR 1.4 billion the previous year.

In the area of games consoles, new models and enhanced, graphically more demanding games are causing a sensation. Sales are expected to soar by 63 percent this year compared to previous years, reaching four million consoles. Turnover is rising by 37 percent to EUR 436 million. Mobile music players with digital technology are leading to legal download services for music on the Internet and smaller and increasingly efficient devices are boosting sales. In 2005, the market grew by 27 percent to EUR 575 million, with MP3 players accounting for 86 percent and portable CD and minidisk players accounting for the rest. All in all, 7.7 million portable music players will be sold over shop counters.

Figure 6.19: Germany still leading in E-Commerce in Western Europe

Western Europe: E-Commerce in Billion EURO and share on overall sales in percent 2004

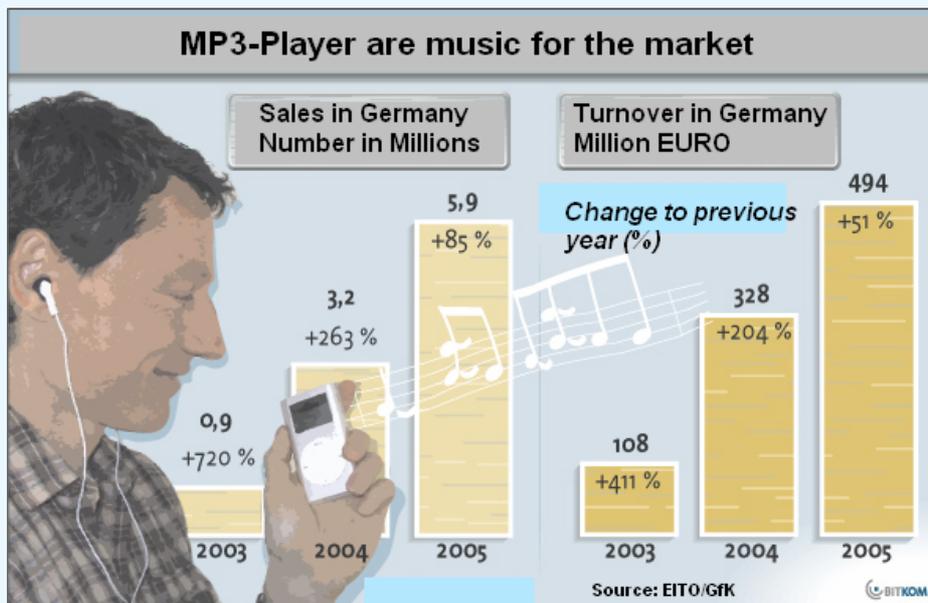


Source: BITKOM/EITO

Picture: TNS Infratest Business Intelligence

The market for digital cameras reached its peak this year. The number of digital cameras sold rose from seven million to eight million, although turnover is increasing more moderately due to falling prices – by 15 percent to EUR 2.1 billion. Consumers are not just benefiting from attractive prices with digital cameras, but also with flat-screen televisions, MP3 players and DVD recorders.

Figure 6.20: MP3-Player are music for the market



Source: EITO/GfK

5.5 Value-added services via radio networks

With the digitisation of terrestrial broadcasting (DVB-T Digital Video Broadcasting – Terrestrial), DAB (Digital Audio Broadcasting)) the question arises to what extent these transmission systems can and indeed should be used not just to broadcast “traditional content” but also for innovative, interactive television formats¹ and value-added services² for reception by mobile equipment (e.g. mobile phones or PDA with broadcasting reception technology). Through combination with mobile communication networks as a return channel, for instance, or for additional individual information and accounting, so-called hybrid networks, there is no end to the possibilities for new services. Relevant considerations are being undertaken both in Germany and in most European neighbouring countries. In Berlin, a project and field study on the development and testing of these services are already being implemented in Germany.

The digitisation of radio broadcasting facilitates much more efficient use of frequencies. New compression technologies – so far MPEG 2, in future MPEG 4 and others – make it possible to broadcast the same number of programmes using fewer and fewer frequency resources. The question should therefore be asked how this “digital dividend” should be used in future – whether it should be used exclusively to multiply the number of TV programmes broadcast using terrestrial systems or at least partly for new television formats and value-added services, for instance, on the basis of DVB-H / IP-Datcast.

Contrary to many European neighbours, the transmission capacities available in Germany are allocated by the authorities of the Federal Länder responsible for the media first and foremost to traditional television broadcasters.

In the majority of start-up regions, the plan at the moment is to have six multiplexes. This is also currently the national position of the Federal Republic of Germany for the Regional Radio Conference 2006. Of these six multiplexes, three will definitely be allocated to the public broadcasting corporations and two will be allocated to the two major private TV broadcasting companies. All other TV broadcasting companies and media services will have to share the sixth multiplex. According to discussions that have been held so far, a seventh multiplex may become available in a few conurbations in the near future.

This means that capacities for innovative services will only be available in a few of the DVB-T start-up regions. This also means that it will not be possible to launch a nationwide service in the foreseeable future.

As a result of the standardization process which has just been completed, innovative services and mobile terminal equipment will not become commercially available until 2006/2007. There is no point in launching pilot projects in all regions. However, in order to ensure that the path is not blocked for these innovative services, frequency resources should also be reserved for conurbations in 2004/2005 in respect of the allocation of DVB-T.

Sound business models are already emerging for these new services. This means that unlike DVB-T radio networks, industry will be able to finance network installation and network operation without any state subsidies. The aim is also to have much more dense network expansion which will facilitate mobile in-house supply and hence much better service for users.

The installation and operation of the network and indeed the development and sales of these new services are expected to give considerable economic impetus. The development of mobile communications has shown how technological innovations can make use of economic and labour market potential once there is a swift, harmonized environment that promotes competition.

¹ TV formats, for instance, within the meaning of interactivity, but not within the meaning of programme formats such as reality shows.

² The term value-added services is used in this context as a synonym for innovative audio and video services, that may come under the term “broadcasting” which is also used for media services and teleservices.

6 IT DEVELOPMENT IN GERMANY

Germany needs to continue avoiding a trend in the ICT sector in future that other technology industries such as the entertainment and optoelectronic industries have taken. With this in mind, Germany also needs to reduce its foreign trade deficit in the ICT sector and change from being a net importer to a net exporter in the medium term.

The job potential of the ICT industry needs to be consistently developed and used. By implementing relevant educational and labour measures, the number of jobs in the industry can be increased from 750,000 at present to 870,000.

Only by adopting an integrated and strategic innovation and ICT policy can Germany hold its own as a leading high-tech location and sustain its position as one of the leading ICT industries in the global market in the long term – by closely linking individual policy areas and political institutions, bearing in mind the relevance of all political decisions on innovation and ICT.

6.1 Cornerstones of a strategic innovation and ICT policy in Germany

The promotion of innovation needs to be declared a government objective. ICT policy is innovation policy. Germany's innovativeness will be a decisive factor in the prosperity of current and future generations. The obligation to foster innovation is therefore a task of national importance that needs to be declared a government objective. ICT and innovation policy need to be strategically designed and organised in a way that involves all themes and ministries. This will require clear institutional competency which is enshrined with the authority that is responsible for the guidelines of federal policy, namely the Federal Chancellery. In future, an innovation commissioner of the same rank as a Minister of State at the Federal Chancellery will coordinate and assume responsibility for ICT and innovation policy.

Innovation needs innovation elites – innovation elites need targeted support. The Federal Government needs to receive more competencies in the education sector as part of the reorganisation of the federal system in Germany. The Federal Länder should undertake to give universities more general autonomy. Course fees, among other things, should be allocated to universities alone and it should not be regulated how this money is to be used. Funding programmes are to be developed for children who are interested in technology and for particularly gifted children and young people, based on the models for children who are gifted in music and sports. In all larger cities, secondary schools emphasising natural science and technology are to be set up that provide special classes for highly gifted pupils. The ICT correlation should also be highlighted in neighbouring departments and curricula should be adapted so that a sound understanding of economic correlations is imparted even at school.

Research tasks need to be significantly enhanced, research policy needs to be professionally evaluated and the implementation of research results in products and services needs to be enhanced. ICT technologies and service drive innovation in all branches of industry. They need to be highlighted as such through public funding of research and development (R&D). The EU countries have agreed to raise capital expenditure for R&D to 3 percent of GDP. To this end, the Federal Government will need to increase its expenditure by at least 5 percent a year before 2010. Professional controlling of public research funding must make the allocation process and in particular the long-term return-on-investment transparent with a view to developing internationally successful technologies, establishing efficient industry sectors and, associated with this, creating additional jobs. Companies also urgently need a better overview of the spread of research competencies in Germany. Team work between science and industry needs to be enhanced so that the implementation of research results in products and services becomes more efficient. The instrument of combined projects has proven its worth in the ICT sector and should be expanded.