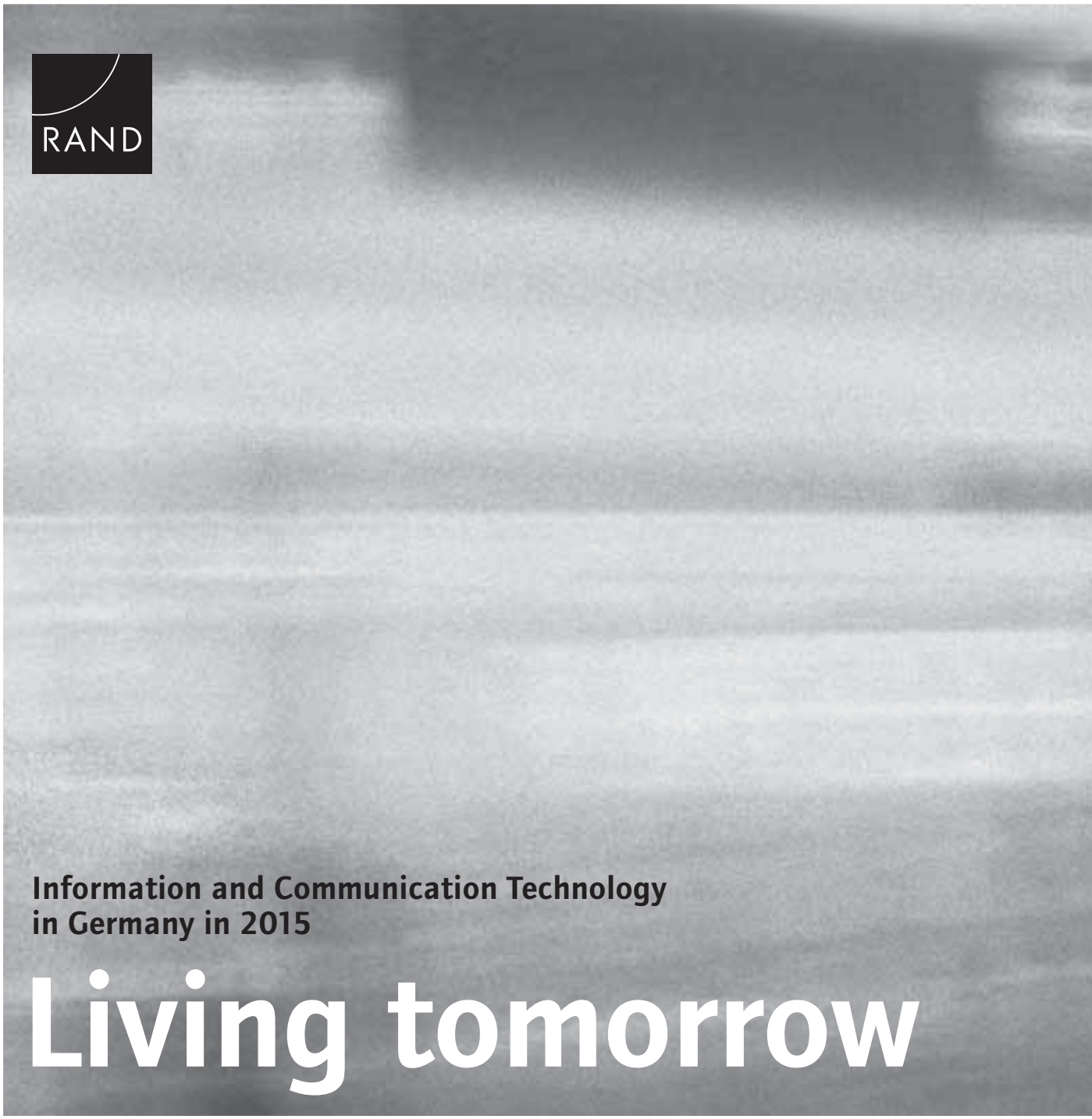

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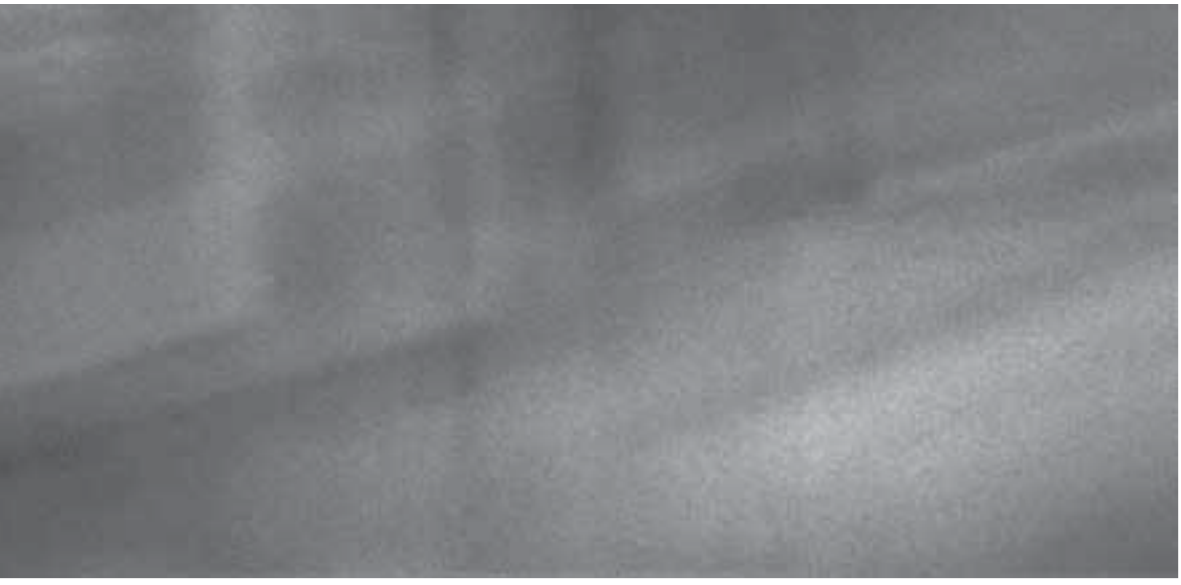


Dr. James A. Thomson
President and CEO
RAND

Dear reader,

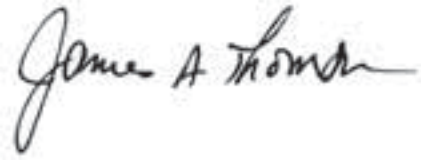
How will information and communications technology affect Germany in the coming years? This report provides one possible picture of the effect of these technologies on German society in 2015. It highlights social trends that are likely to emerge over the next ten years due to the increasingly pervasive nature of information and communication technologies. It then goes on to describe how ICT might affect family life, education, health, work, and government and public life. The report concludes by highlighting the concerns that could arise in Germany as a reaction to increased integration of information technology, and the challenges that need to be addressed to reap the benefits that ICT can offer by 2015.

In examining the issues presented in this report, RAND has applied analytical and research approaches that it has developed over its long history of "thinking about the future." Following a detailed literature review, RAND has collected the ideas, expectations, hopes and fears of global experts and citizens in order to provide a vision of a possible ICT future for Germany.

It is important to emphasize that this report does not pretend to prescribe the future of Germany and ICT in 2015. It wants, instead, to provide a basis for debate – about how people in Germany want information technology to affect their lives and to support their society.

I hope that you enjoy this report!

Regards,



Dr. James A. Thomson
President and CEO
RAND

Preface

This report provides a possible picture of how information and communication technology developments may affect Germany as a country and society in 2015. It highlights social trends that are likely to emerge over the next ten years due to the increasingly pervasive nature of information and communication technologies. It then goes on to describe how ICT might affect family life, education, health, work, and government and public life. The report concludes by highlighting what RAND believes to be social concerns that arise in Germany as a reaction to increased integration of information technology, and what challenges need to be addressed to reap the benefits that ICT will offer in 2015.

In examining the complex issues presented in this report, RAND has applied the analytical and research experiences development over its long history of "thinking about the future". Following a detailed literature review, RAND has collected the ideas, expectations, hopes and fears of 55 global experts and over 140 sources in order to provide a vision of a possible future for the country.

It is important to emphasise that this report does not pretend to be prescriptive about the future of Germany and ICT in 2015. It makes certain assumptions about specific technical and socio-economic developments between 2005 and 2015, which are discussed in the methodological annex of this report. It also deliberately avoids taking account of other trends that may have an equally important impact on society, like climate change, international stability, security and terrorism. It does not attempt to research the relationships between these developments and estimate their effects over the next ten years. This report is focused on information and communication technology. It is meant to provide a basis for debate, about how people in Germany want information technology to deliver the desired functionalities and conditions to suit their lives and to support the society they want to be part of.

Lorenzo Valeri, Martin van der Mandele and Constantijn van Oranje prepared this report. The research team also included the following researchers from RAND offices in the US (Santa Monica and Washington DC) and Europe (Cambridge, UK; Leiden, Netherlands; and Berlin, Germany): Silvia Anton, Edward Balkovitch, Tora Bikson, Maarten Botterman, Jonathan Cave, Jonathan Grant, Rebecca Hamer, Stijn Hoorens, James Paul Kahan, Lisa Klautzer, Alexander Ktenas, Andreas Ligtvoet, Miriam Shergold, Somi Seong and Robert Thomson.

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Although Deutsche Telekom AG provided the necessary funds for this initiative, the contents and views expressed in this report are RAND only.

For more information about this report, please contact

Dr. Martin van der Mandele,
President RAND Europe

Newtonweg 1
2333 CP Leiden
The Netherlands
Tel +31 71 524 5151
Fax +31 71 524 5191

mandele@rand.org
http://www.rand.org/randeurope/

Executive Summary

It is the year 2015. Over the last ten years German society has been profoundly affected by demographic shifts (mainly in longevity and fertility), social trends, global developments and new technology. Information communication technology (ICT) permits a new connectivity and closeness among circles of friends, family and people who share interests, allowing a much broader social and professional interaction, effectively overcoming distance. The environment in which we live and operate is much more visible through new screen technologies. People are empowered rather than smothered by the availability of vast amounts of information and services, which can be accessed anytime, anywhere, through a new range of mobile devices.

These trends affect German citizens widely: in private life, work, education, government or healthcare. Homes are hubs of connectivity and integrated services, as well as retreats from the torrent of information and communication. In a way the home is always with us too, as video-enhanced mobile devices and services allow continuous close contact with friends and family in ways never experienced before. These same technologies enable flexible working arrangements but sometimes blur the boundaries of private and professional life. Working itself is less location-bound and is mostly project-oriented. ICT allows independent workers to establish themselves and deliver high-end services through ad hoc teams.

The rising average age in Germany and a greater focus on both the needs and responsibilities of the individual has changed the way healthcare is organized and administered. ICT supports preventive healthcare and remote monitoring, allowing better diagnostics, reduced hospitalization and more patient-centred, individualized treatment. A similar focus is seen in education where individuals build their own studies. The education sector is a keen adopter of technologies that enable parents to be more involved with the progress and safety of their children in primary and secondary education. In secondary and higher education, technology enables work to be shared in team-based problem solving projects – the preferred method of teaching – and supports internationalization in education and research. eLearning tools are also used but are predominantly deployed in lifelong learning schemes.

ICT holds the potential to make interaction with government more intense and less time-consuming. People can be engaged in decision making by a transparent public sector that has reorganized itself to provide user-friendly services to the citizen. New forms of direct democracy may emerge, if information flows are managed well and if the tools are provided to effectively process and use the available data.

The vision this report inspires is of a world of choices and possibilities where individuals can design their lives to better fit their needs and desires: one where more user-friendly public and healthcare services are delivered faster and more cheaply; where citizens have the tools to participate in shaping their world; and where people interact more broadly with their circles of connections and more deeply with their families and close friends.

None of these developments are automatic. To reap the full benefits of ICT opportunities in Germany the concerns of individuals need to be addressed. People want to see their privacy respected and to have control over their personal data. They need support in coping with complexity and require systems that are reliable and secure. They want to be provided with the necessary ICT skills and knowledge so that they never feel excluded because of their social status or age. At the same time, Germany is expected to embrace global realities and strive to become a full knowledge-based economy. Whilst doing this, trust must be established and the threat of new dividing lines drawn by inequalities in skills must be mitigated.

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Chapter 1

New Ways of Looking at Life

It is 2015. Information communication technology (ICT) has delivered fresh technologies, innovative services, more powerful tools, better toys. Silent and transparent managers of information and data, or ubiquitous and highly visible sources of knowledge and entertainment, these developments have brought huge benefits and posed great challenges to citizens and society. Germany has gone through significant socio-economic and cultural change over the last ten years, at times led by technology, at others waiting for technology to catch up. This report provides a picture of where Germany and ICT are in 2015. This first chapter sets the stage, summarising in the following paragraphs issues that will be dealt in the remaining chapters in more detail.

1.1 ICT in 2015: an Overview

Back in 2005 the incredible success of mobile telecommunication technologies already allowed individuals to communicate and interact virtually anywhere on the globe. In 2015, this trend has continued, as individuals no longer think of ICT as just a way to communicate with each other. ICT affects how we work, study and enjoy ourselves, both within our immediate social circles and the rest of society. Data, information and complex multimedia content is readily available, practically everywhere, often close to free.

While connectivity has globalized, the convergence of technology platforms and channels has, paradoxically, led to an explosion in their diversity. Ease of access to communication and information is enhanced by the availability of portable devices through which individuals and machines constantly communicate among themselves either via voice or video.[1] There is no need to turn on or log in – these devices are "always on" – constantly available to receive messages, videos, information and data from other individuals and other devices. Their effectiveness is enhanced by personalized functionalities. They have better voice recognition, video functionalities and intuitive keyboards supported by better software solutions. As well as their basic function of communication, these appliances also provide almost infinite data storage capacity, either held locally or uploaded to internet servers elsewhere from where it can always be retrieved quickly and easily.[2]

It has not however been these additional and new functionalities which have driven the success of these communication devices in 2015. This has primarily been due to their significantly better overall usability and portability. Users from Germany as well as many other countries have in their hands or pockets what US-based IT and psychology expert Donald Norman once christened "information appliances".[3] These technology-based tools are easy to use, dependable and attractive. Although some early examples of information appliances were already around in 2005, their descendants in 2015 are far more intelligent. They adapt constantly to their users' profiles. They automatically assist their owners in their daily activities. Tim Berners-Lee, the inventor of the World Wide Web, called these tools "digital assistants" as they are able to handle appointments and other life commitments with minimal direct involvement from their users.[4]

These personal information appliances complement machines with similar functionalities at home or in the office. In 2015, personal computers are still with us. Different environments and levels of social interaction require diverse technologies and applications. Users still like the tangibility and physical reliability of personal computers which are as widespread today as televisions were in 2005, though in most cases, there is now little functional

1 For an interesting perspective, see "Innovation: Shape of the Phones to Come" The Economist Technology Quarterly, June 12 2004, pg. 3–4

2 A comprehensive overview is provided in International Telecommunication Union, Broadband Mobile Communication-Towards a Converged World, (2004, Geneva, Switzerland, ITU) available at http://www.itu.int/osg/spu/

3 Donald Norman, The Invisible Computer, Cambridge, Mass, USA, MIT Press, 1998

4 Tim Berners Lee, Weaving the Web, San Francisco: HarperCollins, 1999

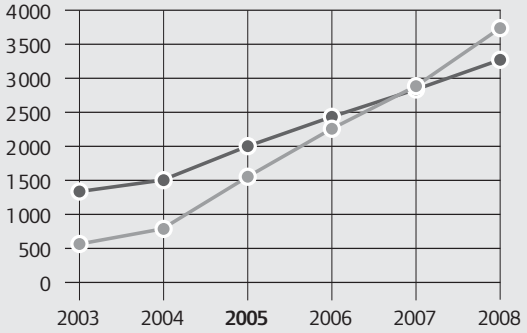
difference between the two. As in the case of portable "information appliances", personal computers provide internet access through different means ranging from cable, wireless and broadband. Users, in fact, do not care how they go online. They choose whatever suits their lifestyles and financial interests.

Today's personal computers are more sophisticated in appearance and functionality.[5] New and innovative video technologies have brought us thinner screens, in some cases, even foldable almost like a newspaper. High end users are able to access multi-purpose displays or even transparent, 3D holographic images projected over windows through which it is possible to interact digitally with other users. These new screens and videos are of course the instrument of choice for entertainment or creative work. There are still keyboards, but much enhanced through improved voice recognition and biometric systems. Especially for those with physical handicaps, these new tools are more enjoyable and effective, as they are easier to use both at home and professional environments.

As with personal information appliances, today's computer users do not have to worry about storing their data and information. Storage is a commodity, unlimited and almost free. Users, in fact, can save their entire digital content, information and data inside their machine, which can be a personal computer or an advanced digital TV, on their personal "information appliances" or directly on the internet to which they are always connected. In 2005 researchers from Philips Research in the Netherlands were predicting that "by 2015 individuals will be able to have their entire life in video images on a personal computer".[6] The main challenge, therefore, is not collecting and preserving data and information, but managing it. This is simpler as individuals can access and use sophisticated and individualized data management tools. These provide a comprehensive overview of their data and information irrespectively of their location. Users have strong safeguards over their data and can decide who has access, when and for how long. When more data and information is required, individuals use specialized, semi-autonomous, self-learning software agents. These sift through data, information, videos and other forms of content and deliver them directly to the users. This process is easy in 2015, as content is tagged with digital object identifiers or other metadata.[7]

Worldwide Sales of RFID Products and Integration Services

in USD millions



Source: Allied Business Intelligence, Inc., 2004

5 An interesting overview is available at "Make it Simple: A Survey of Information Technology", The Economist, 30 October 2004

6 Royal Philips, New Nomads 010 Publishers, 2000 available at http://www.design.philips.com

7 Interview with Prof. Eugene Spafford,. Centre for Research on Information Assurance and Security, Purdue University, USA

Both portable information appliances and personal computers do not work in isolation. In 2015, users are beginning to live and operate in "ambient intelligence" – electronic environments that are sensitive and responsive to the presence of individuals and objects. Interconnected, embedded systems, which are either invisible or integrated into the background, surround users. These systems can recognize people, learn from their behaviours and adapt to them. They are integrated with each other through common infrastructures. In ambient intelligence environments, the borders between the real and virtual worlds are blurred or, in some cases, merge. Appliances identify themselves, while users monitor them from a distance.[8] Some appliances initiate contact based on the preferences and profiles of their owners. Users always remain in control but set their preferences so that appliances react intelligently to specific behaviours or moods. Today's appliances react not just to preferences but also to value judgements that their users' voices and physical gestures express. The possibilities and consequences are vast especially now that IPv6 (internet protocol version 6), giving every item a unique IP address or electronic identity, has been implemented and widely adopted.[9]

In addition to total interconnection, one of the core elements of ambient intelligence is the spread of sensors, of which radio frequency IDs (RFIDs) back in 2005 were just the first expression. These are not just used for supply chain or inventory management. Users demand physical products with sensors because of their convenience. Clothes incorporate them so to provide new functionalities, especially if integrated with portable devices such as entertainment appliances. As futurist and investor Esther Dyson argued, the combination of sensors and personal information appliances has made "the physical world more visible"[10]. People know more about what is going on around their physical environment and react to it. They are able to be part of what Prof. Joseph Hellerstein from the University of California in Berkeley called "urban computing"[11]. In this context, ICT helps "familiar strangers" recognize and interact with each other to give each other a "sense of place" – perhaps to tell the user "this bar may look rough but it's actually full of people who work in the financial district" or "there are lots of parents in this park who you see near your kids' school".

Sensors, nevertheless, are not just for fun and convenience. They have safety and health justifications. Cars help drivers to avoid fatal mistakes. Parents keep track of their children, while doctors can monitor the sick and elderly from a distance.

Individuals are not the only ones affected by the new ICT world of 2015. If the right internal management structures are in place, organizations as a whole also benefit. New collaborative software solutions allow individuals to work better together from different locations. Communication is seamless thanks to video-based conversations routed like e-mail using voice-over-internet-protocol (VoIP) technology. Advanced data management and data mining tools, supported by sensor technologies, allow the identification and personalisation of new products and services. When more computer power is required to undertake new R&D or marketing activities, this is less complicated than it used to be in 2005 as solutions to issues like authorization and authentication of users and accounting have started to be effectively addressed. Organizations use GRID - web-based clusters of computing power, applications and information that enable say hospitals to aggregate patient statistical data and share

8 European Commission, "Ambient Intelligence: From Vision to Reality" Report by the IST Advisory Group, September 2003, available at http://www/cordis.lu/ist/fp5-istag.htm

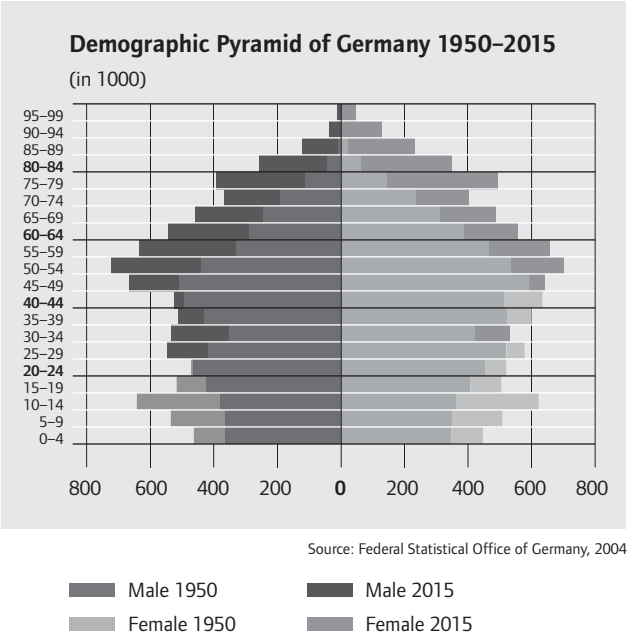
9 Interview with Prof. Wolfgang Prinz, Professor, Fraunhofer Institut für Angewandte Informationstechnik (FIT), Germany

10 Interview with Ester Dyson, Editor-at-large, CNET Networks, USA

11 Interview with Joseph Hellerstein, Professor, University of California, Berkely, USA

analytical techniques so they can tackle previously intractable problems. Organizations, moreover, also use these new technologies and services to communicate better with their clients and users.[12] They are allowed to enter their systems and manage their affairs as new security and identity controls are in place to prevent misuses.

As we have briefly indicated, in 2015 a set of new technologies and services is available that, if properly implemented and used, has significant benefits for individual users and organizations. However, in order to assess how these are influencing Germany, we need to look at where its population and society as whole are in 2015.



Source: Federal Statistical Office of Germany, 2004

1.2 A Picture of Germany in 2015

As ICT has evolved over the last ten years, so has German society. The population reached about 83 million between 2012-2015, but is expected to be down to 75 million by 2050 - the lowest level recorded since 1963. At the heart of this decline are the two major demographic trends of the last fifty years: low birth rates and an aging population.[13]

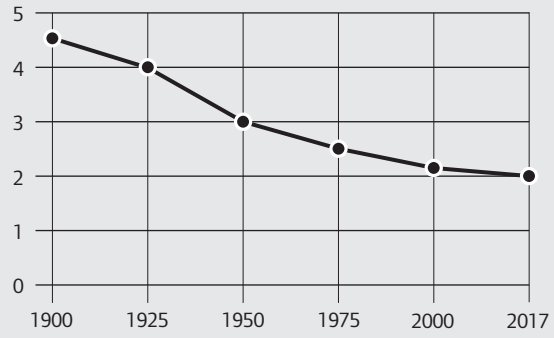
According to UN demographic data, in 2015 the number of children per woman is 1.34, only just ahead of Italy, the country with the lowest birth rate in Europe. Moreover, in 2015 women are having their first child even later in life, usually in their late twenties and early thirties. While fewer children are being born, people are living longer. This increased aging of the population affects the whole of Germany, but regions such as Eastern Thuringia, South West Saxony and Saarland are the most exposed with more than one third of their population over 60 years old. Immigration is helping to slow down the effect of low birth rates and an aging population. Still, it is difficult to predict its longer term effect on the overall demographic structure of the country.

12 An interesting and simple overview of the developments associated to GRID technologies see the GRIDCafe website prepared by CERN, one of the birthplace of the WWW, at http://gridcafe.web.cern.ch/gridcafe/. For a detailed assessment of the technical and commercial complexities associated to GRID, see the activities of the Global Grid Forum, an 5000 member organisation whose primary objective is to promote and support the development, deployment and implementation of GRID technologies within research and commercial environments.

13 Projections by the Federal Statistical Office of Germany available at http://www.destatis.de

A related development is the changing structure of the German family. In 2015, a growing number of households are single person – predominantly female. At the same time, childless couples have also increased to the point where over one third of all households have no children. The greying of the population also affects household economic and financial structures. The main income provider in over 20% of all households is over 70, while in only 2% of households is the main breadwinner under 35.

Number of Persons per Household in Germany



Source: Institut der Deutschen Wirtschaft, 2004

Today in 2015 two main trends are apparent: individual empowerment and self-reliance. At the core of these two trends is the fact that Germans now need to rely primarily on themselves more than the overall system to develop and achieve their personal and professional objectives. Individuals want to be more in control of their lives and decisions while also preserving their sense of community and interaction with family and friends. ICT technologies provide some of the tools to do so, in conjunction with changes in the overall socio-economic structure of the country. Although the following chapters will examine this in more detail, it is possible to highlight some of the core elements.

The traditional nuclear family remains most peoples' role model and life objective, but fewer individuals are actually managing to attain it. Relationships may often last a shorter time with an increased focus on individual freedom and independence.[14] Family members strive to remain together, but come under increased strain as diverging work or education commitments see them more and more dispersed geographically. In 2015, individuals have to look beyond their family networks for additional support in managing their life and activities.[15]

This trend towards individualism and self-reliance is particularly evident in healthcare. Between 2005 and 2015 the overall health system saw a decline in the involvement of the public sector and a rise in selective contracting between healthcare providers and insurance funds.[16] This changed not just how healthcare is delivered – individuals changed the way they managed their health. In 2015, we are being asked to be more responsible for every aspect of our health while still relying on the healthcare systems when necessary.[17]

14 Klaus Burmeister et alia, Europe and Germany in 2020: A Future Scenario, Z_Punkt: The Foresight

15 See in Horst Opaschowski, Deutschland 2020: Wie wir morgen leben: Prognosen der Wissenschaft (2004)

16 OECD "Economic Survey of Germany-2004", OECD Public Policy Brief, August 2004

17 For more information, Silke Tonshoff et alia, "Consumer Choice in Health Care: A Literature Review", RAND Technical Report-105-BF (2004)

This increase in individualism and self-reliance, however, does not just express itself in terms of a perceived decline in traditional family structures and changes in the healthcare systems of the country.[18] Approaches to entertainment and social life have also evolved by focusing on more individualistic approaches. As mentioned above, developments in ICT have created more opportunities for consumers to tailor applications and services to their personal preferences. Germans are being offered more attractive, customized products, from personalized broadcasting or news provision to personalized climate control in the home. In entertainment, the trend to individualism favours products which allow consumers to create individualized content or choose partners to play with.

Another area where an increased focus on individualism and self-responsibility is evident is education and training. In 2015, attitudes towards education are evolving, as it does not just provide the skills to enter the job market and achieve a specific social status. People looking to build the skills they will need to compete throughout their professional life think of education as a source of lifelong learning. This means that the education system has to provide Germans with the necessary infrastructures and methods to foster the continuous self-education through which they can achieve their personal objectives and interests.

Not only has self-reliance become a new paradigm for education in 2015. The world of work is also moving from an "industrial" model of fixed professional roles to a more "service" model centred on individual responsibility and flexibility.[19] In an increasingly global business environment, greater individual responsibility and flexible employment arrangements have led to more competition and sharing of entrepreneurial risks. In 2015, Germans look at the employment environment as a place where they can express their personal intellectual capacity in addition to being financially remunerated. This is leading to changes in the ways individuals operate inside organizations. Germans with the right professional skills are increasingly operating in flexible professional environments, where information is for sharing and the emphasis is more on innovation and creativity.

In 2015, commercial organizations themselves are evolving as they focus more on providing value added services and advanced manufacturing. The pervasive nature of ICT is not just changing the way organizations manage their work practices. It is also creating an overall environment that is more conducive to technological innovation. Organizations are reaping the benefits from the increased R&D spending and cooperation with research institutions and universities. Changes in tax and employment regulations also support this approach to science and technology by making it easier to establish innovative new companies by rapidly bringing together experts and employees from different fields. Established organizations also benefit from this renewed German attention to innovation as they focus on regaining their competitive advantage both in Europe and in the rest of world.[20]

As in other countries, the German public sector is benefiting from these new technologies to foster a more dynamic and reactive administration. It has the operational tools to simplify its activities and become more effective. It can tailor its services to support an increasingly individualistic and self-reliant citizenry. ICT solutions have provided new and often more enjoyable channels and forums through which government and citizens interact.

18 European Foundation for the Improvement of Living and Working Conditions, The Knowledge Society in Germany: Current situation and future trends. Available at: http://www.eurofound.eu.int/publications/files/EF0406EN.pdf, visited on: 11 November 2004

19 Bundesministerium fur Bildung und Forschung (BMBF), Innovation and Jobs in the Information Society of the 21 Century, July 2002

20 Andres Fuentes et alia, "Improving The Capacity to Innovate in Germany", OECD Economic Department Working Paper n. 407, October 2004

1.3 New Ways to Look at Life Through the ICT World of 2015

The previous paragraphs have provided an overview of where both ICT and Germany as a country and society are in 2015. Where properly implemented and used, the ICT world of 2015 has provided a set of new lifestyles and possibilities to Germans. These can be summarized in three trends:

> Always together

> Beautiful view

> Always informed

Always together
In 2015, ICT helps family and friends to stay in close touch even if professional interests or personal choices make it hard. It is possible to communicate more and better thanks to more advanced video and sound capabilities. Not that these new technologies have replaced the need for physical contact; however, they do make geographical separation more bearable. The same is true of work environments where colleagues communicate and cooperate better wherever they are in Germany or the world. Similarly, teachers and university professors are more engaged with their students, while new forms of education involving teaching and university personnel from other locations have evolved. Finally, Germans interact better and, in some cases, more openly with their public administrators and political leaders.

Beautiful view
Irrespective of their content, personal interactions have been enhanced by changes in screen technologies. This makes "always together" an even more pleasant experience. Personal devices all have improved screens, whether they are normal 4G phones or advanced home entertainment systems with large digital screens. Similar developments apply in work environments where individuals can "see" not only colleagues or clients better, but also data and information. Similarly, doctors can "see" their patients better.

A beautiful view, nevertheless, does not apply only to images projected over screens. The development of sensors has made Germans appreciate their physical environments more. Where the necessary controls are in place, sensors convey information about shops, buildings or other open air physical environments.

Always informed
In 2015 ICT allows Germans to be in close communication even when they are geographically far apart. Their interactions involve better information. New technologies and services provide them access to a vast and ever expanding common good of information, using innovative search engines and smart agents and, if needed, automatic translation tools. They are able to access better health data, learning material and information from the government.

In 2015, ICT solutions provide Germans with new ways to manage their lives, and new ways to hold on to their core values despite far reaching changes in society. In the next paragraphs, this report will examine in greater detail how ICT is affecting how Germans conduct their family and social life, get an education, look after their health, work, deal with civil servants and express their democratic rights.

Chapter 2

Family and Social Life

In 2015 the home has evolved into a fully connected environment where new information and communication technologies that let us communicate at any time, anywhere, with anyone have become a central feature of social and family life. This chapter examines how this transformation has fostered a new sense of proximity and continuous interaction between family members and friends, and changed the way people entertain themselves and engage in civil society.

2.1 Home

In 2015 ICT allows Germans to be home no matter where they are. When travelling, video-enhanced mobile phones and personal information appliances, chat boxes and possibly life-sized 3D projections allow individuals to be in continuous contact with their families. This is fundamental since home has become an even more important part of an individual's life. Home, in fact, is not just where individuals or families live; it is the place where Germans entertain themselves, work, study, monitor their health and interact with the government. Home is the place where individuals can build electronic bridges to the outside world or cut themselves off from its torrent of information and activity. At home, individuals can retreat, feel safe and enjoy their own individuality.[21] Through ICT, homes are comfort zones where temperature, aroma, entertainment and information are automatically adjusted to the desires of their inhabitants at any given moment.[22] This private environment is protected by security technologies ranging from advanced antivirus software and firewalls to biometrics, sensors and remote monitoring. These block not only physical intrusions but also spam, spyware and other electronic invasions of privacy.

The connected home is the platform for Germans to interact with their family members regardless of their physical location, through technologies like video-messaging, emailing, chatting and advanced forms of videoconferencing – for example featuring gaze recognition.

ICT, meanwhile, is not just changing how individuals communicate. It makes living at home easier. Most home appliances have embedded computer processing power and talk to each other and with the outside world through a combination of wireless and sensor technologies, although POTS (the "plain old telephone system") may be a reliable back-up infrastructure for emergency situations.[23] As they are all interconnected, householders can control all their appliances through a central home interface. But in addition, since many appliances also have the internet protocol (IP) addresses that once were reserved only for computers, their owners will be able to use the internet to monitor and control them from anywhere in the world.

The central home interface is also the master "docking station" for people living and working in the house. Its main processing unit is usually found next to the gas, water and electricity meters, from where it coordinates various services throughout the house that the family requires. It secures the building, monitors the food supply, does the shopping, handles personal messages, maintains diaries, builds preference profiles and stores large amounts of data like videos, music and yellow pages. Smart storage techniques and vastly improved storage capacity enable users to store and retrieve all the digital data they have ever used in their life. Conversations, movies, ideas – everything is tagged with metadata and stored in semantic databases.

21 Opaschowski 2004, p. 349

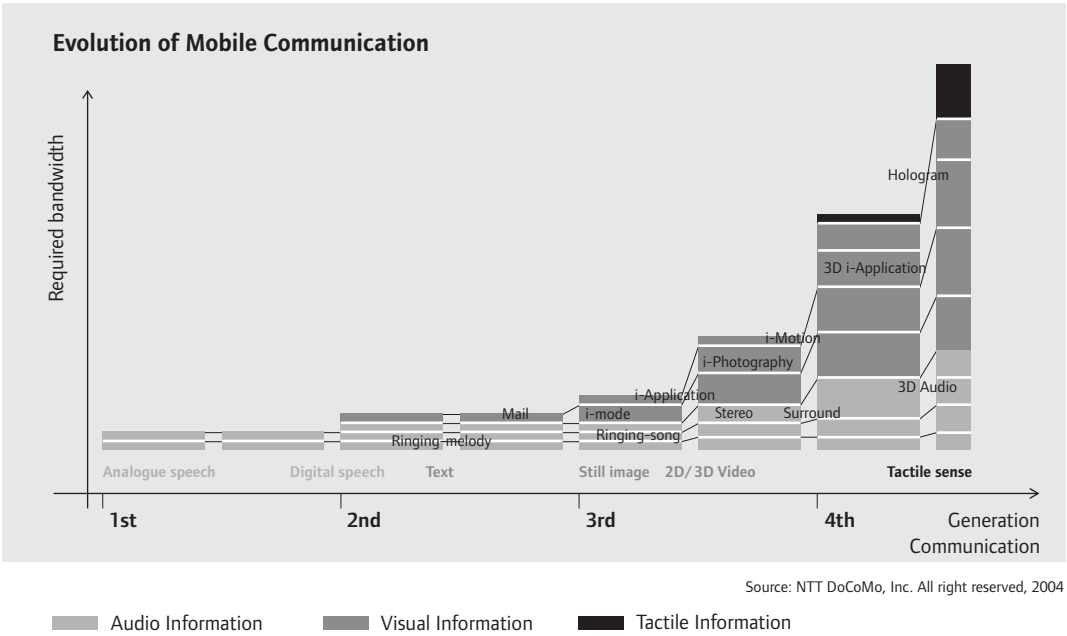
22 Roberto Saracco, "Information and Communication Technologies: "Disruptions to Look for and Their Impact on Countries Evolution Strategies", Report prepared for the EU project FISTERA by Telecom Italia available at http://fistera.telecomitalialab.com

23 For an interesting overview see the results of Project Oxygen currently at Computer Science and Artificial Laboratory, Massachusetts Institute of Technology (MIT) at http://oxygen.lcs.mit.edu

In 2015, the home environment responds to the movements of its inhabitants. At the front door, sensors and automatic recognition identify visitors. House keys are now RFID tags, combined with biometric checks, like face or voice recognition, and iris scans.[24] On entry, family members collect their messages and check the schedules and locations of other members. They can order food, look up digital television programmes, buy a video and check the latest scores on self-evolving community challenge games played with friends. This information can also be checked by mobile phone or other personal digital assistant. However, people also want the "coming home experience" and prefer the convenience of voice, combined with gesture recognition and wide screen interface.[25]

Germans do not care which platform they use at home to get access to data and information – the television or the personal computer both provide similar functionality.[26] They just choose whichever is most convenient and to connect seamlessly with other communication and information functions. Where a significant number of homes have installed such systems the network effect is driving them to link up to the physical neighbourhoods, as well as new digital ones.

The level of uptake and integration of these technologies in Germany, as in other countries, differs between households. Although the ease of use and the robustness of these technologies has overcome a great deal of initial resistance, not all households are fully up to date; in a significant number of German homes, the installed base of old technology is slowing the full adoption of the latest devices. There are also technophobes who worry about dependency and loss of control.



24 Sanja Sarma, "Integrating RFID" ACM Queue, vol.2, n.7 (October 2004) and "The Magic of RFID", ACM Queue vol.2 no.7, October 2004

25 K.Ducatel, scenarios for Ambient Intelligence in 2010 IPTS Publication EUR 19763 EN), 2001

26 For an interesting overview of the socio-economic and commercial implication of new digital TV and wide screen, see European Commission: "The Contribution of Wide-Screen and High-Definition to the Global Roll-out of Digital Television" European Commission Staff Working Paper, Brussels, 13 January 2004 available at http://www.europa.eu.int/information_society/policy/nextweb/digtv/ visited on 23 October 2004

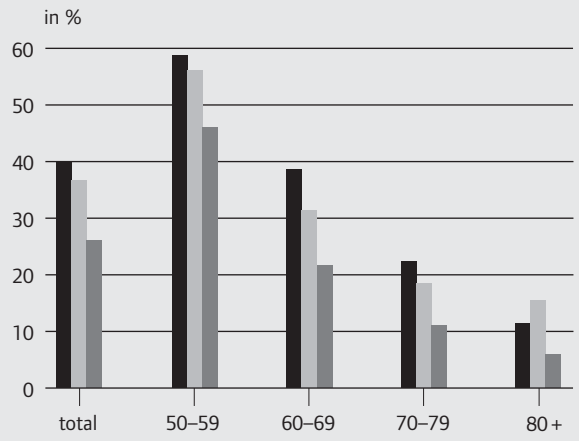
Different individuals and different families require different levels of service and want to manage their surrounding technological environment in a way that suits their life best. Many families prefer to keep separate the infrastructure which serves the needs of different family members in their various social and professional activities. Both the personal computer and the television are therefore holding their ground and it is the social setting which continues to define which is used for what activity. Personal computers and laptops are primarily used for work and although they can connect with a screen that also serves as a television, in practice this function is rarely used in the family home.[27] The television continues to be primarily a social entertainment tool, for games, video, music, and easy internet browsing. Its broad and intensive use by the family as a whole makes it relatively unattractive for work purposes.

2.2 Family

In 2015, the family is still the centre of a web of networks with which the individual is connected. As previously indicated, new technologies allow for much more frequent contact with geographically dispersed family members. Geographic distance can be managed through online interactions, although physical contact remains fundamental. Even in the hustle and bustle of modern life in Germany, where family members are more dispersed and many single households exist, new forms of intimacy and proximity are developing through ICT.

Through mobile communication devices with high definition video capabilities, visible contact between people becomes standard communication practice. Moreover, RFID tags, sensors and location technology make the family more aware of each other's whereabouts. Parents track their children on their way to and from school, to make sure they are safe and to chat to them during breaks. Through the master home interface, family members leave messages to tell each other where they are and what they are doing. Adult family members watch over the safety of their (grand)parents, making sure that they do not risk an accident without quality medical assistance nearby. Emergency buttons, always-on displays and location tracking enable the elderly to live at home longer in the virtual proximity of their relatives.[28]

Computer Use Among Over 50 years Old Citizens in Europe



Source: Senior Watch, 2004

Ever used computer
Regular computer user
Computer at home

27 Interview with Gabriella Cattaneo, DATABANK Consulting, Italy

28 Interview with Jun Kurihara, Senior Fellow, John F. Kennedy School of Government, Harvard University, USA

Information technology is bringing many improvements in safety, convenience, personal connectedness and control over the environment. However, it is also having other more indirect effects that – in combination with a variety of societal factors – influence the structure and behavioural patterns of families.

Increased mobility and high connectivity in the information age are among those factors that are enabling new work practices, of which teleworking is the prime example. People can now work from everywhere, with anyone, at any time, although this can blur the boundaries of private and working life.[29] Some individuals spend more time geographically separated and others manage to work more from home. However, those who work from home find time spent with the family is less compartmentalized and interruptions from work a potential cause of contention. Individuals, therefore, have to manage their time to suit their family circumstances and their needs and ambitions.[30]

In 2015, it is easier for both parents to combine work and household activities. The same applies to single parents. Nevertheless, it is important to emphasize that the ICT environment of 2015 is not the driving force behind changes in the traditional German family model. In 2015 less conventional family forms, whose first visible signs were evident in 2005, have established themselves as acceptable alternatives alongside more traditional models. In Germany, the trend has continued for couples to marry later (or not at all), want fewer children, have them later, and get divorced more often. Marriage is less important as a basic condition for the establishment of households. Single households and childlessness are more common.

In 2015 German is experiencing, therefore, the rise of a blended family. ICT helps support these alternative family structures, which are often an expression of increased individuality and the greater role of women in the labour force. Automation of domestic chores through intelligent devices and the possibility of constant communication is facilitating these social trends, but the distribution of provider and carer roles and domestic responsibilities is increasingly blurred.[31]

Traditionally unpaid family tasks, such as childcare, care of grandparents and cleaning, are being replaced by private services.[32] The internet serves as a recruitment and matching tool for support groups, help exchange, and volunteer placements, as well as a way of locating paid services. Running a household is easier when the person in charge can monitor young children or elderly parents via webcams, tags and biosensors. One-stop internet portals provide parents with easy access to information and services related to events, education, or shopping. The combination of the internet and better home interfaces provides a meeting place which links remote family members and enables the housebound to participate. Other means of communication via mobile, messaging, webcam or e-mail also compensate for physical separation where necessary. None of this obviates the need for face to face communication and physical contact, but it does allow more people to square the circle of conflicting family, social and professional commitments.

29 Peter Wipperman, "Modernen Helden. Die GQ Männerstudie" Trendbüro GQ 2002, pg.2

30 International Telecommunication Union, "Social and Human Considerations for a More Mobile World" February 2004

31 Matthias Horx, "Accent on the Future" Accenture/Zukunfunfsinstitute June 2003

32 Opaschowski, p.114

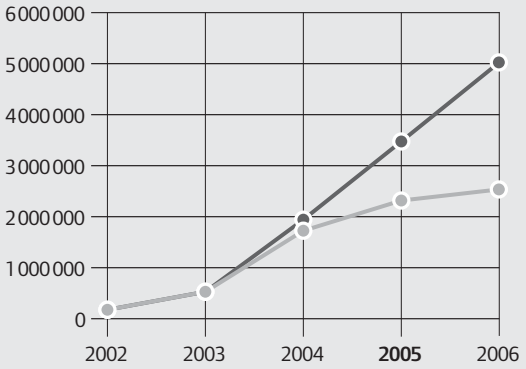
2.3 Social Life: Friends & Relations

Face to face contact and physical proximity is also highly valued in social relationships. As in the case of family life, the combination of different lifestyles and demanding work commitments make interaction more difficult. Consequently, in 2015 Germans spend more time connecting online and staying in touch electronically. New patterns of friendship are developing: a connection originating in the physical world might be maintained over long periods in cyber space; or the first encounter might take place online and then either remain virtual or eventually lead to an actual physical meeting. Increased workloads also make it more difficult for people to meet partners. Web-based services provide some initial solutions through online matchmaking, using smart agents to match personality profiles.

In 2015, Germans communicate with their friends through a variety of means and at diverse speed and depth. Chat and weblogs are used for most quick communication as people are typically most reachable online, even more than by mobile telephone.[33] This increase in the intensity of communication is driven by a generational change. In 2015, young Germans have much higher levels of comfort and confidence in navigating the new data spheres. As they age, they increasingly demand content with ever greater degrees of interaction. Beyond the circles of friends and family, mobile technologies can also identify "familiar strangers" – people one meets regularly at the same metro stops or street corners, without necessarily knowing their names. Their familiarity helps create a sense of place and community, which is enhanced by mobile technologies and which could change urban social interaction.[34]

Market for Wireless Games

in 1 000 Euro



Source: MGAIN 2002

Yearly revenue from network-based games

Yearly revenue from simple games

2.4 Entertainment

In 2015, ICT provides Germans with new ways of entertaining themselves. In particular, it allows them to enjoy themselves through different levels of personalization. Many continue to sit back and relax while listening to their favourite music or watching their favourite actor. However, interactivity plays a primary function. Germans make their own music channels and can also "log-in" to a virtual jam-session with other people. They can make their own films using animation and special effects technologies once reserved for commercial studios, using adusted gaming software to blend reality into virtuality.[35] When watching sports events, they can see them and replay them from every angle by focusing on individual players themselves. Viewers have their own remote controls with which they can view side projections, as the game or the event continues on the main screen.

33 "Special Issue: The Blogosphere" Communication of the ACM, vol.47, n.12 (December 2004)

34 Interview with Prof. Joseph Hellerstein, Professor of Computer Science, University of California, Berkeley, USA

35 Interview with Jen-Hsun Huang, CEO, nVidia, USA

Besides audio and video entertainment, the gaming section is the most dynamic in its development, in particular in the emergence of massive multiplayer role-play games. Gaming has become larger than the film industry with literally millions of fans spending evenings and weekends playing a role in a game where each one takes on a personal character and plays with (or against) every other player. The virtual worlds they play in may be based on current events, science fiction or underworld life and controlled by artificial intelligence of such sophistication that it is becoming difficult to distinguish between reality and virtual reality.

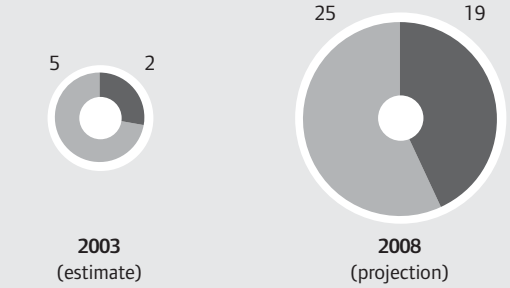
In 2015, Germans will also have the tools to create their own content. Software allows designing and sharing games, and making video and music. Every individual can become his or her own DJ, film maker and or game author and share their work with other like-minded individuals over the internet. Communities form around a specific game to which new modules ("mods") are added by players themselves to create more levels, more opponents and riddles.[36] Through changes in international copyright laws, artists encourage Germans to take their creations and use, adapt or combine them to create something new.

Another environment where individuals and family are provided with new opportunities for fun is the car. Music, games and videos can be downloaded to provide entertainment during travel. Programmes with tourist information are readily available in real time, providing "augmented reality" services to allow tourists to drive through historic sites, as if they were in a time warp. Sites beam an image to a receiver that it projects on top of the real world view as registered by miniature on board cameras. The projection can be provided on a handheld device, the inbound information systems or even on the windows.

In 2015, electronic entertainment is abundant. It is more inclusive and personalized. Mobile and wireless devices, more importantly, mean that entertainment is not just at home or in a theatre or stadium, but always with you if required.[37] The abundance of electronic entertainment, however, does not exclude more traditional pastimes. In 2015, there is still no virtual replacement for going to the theatre, cinema or the stadium. However, during these events, people may be doing more things simultaneously like connecting to check their gaming results whilst watching a sports event in the stadium. Sports and other outdoor activities remain popular.

Worldwide WiFi Revenue

in USD billions



Source: The Insight Research Corporation, 2003

Equipment
Services

36 An interesting case is www.marcprensky.com

37 Interview with Prof. Joseph Hellerstein, Professor of Computer Science, University of California, Berkeley, USA

Chapter 3

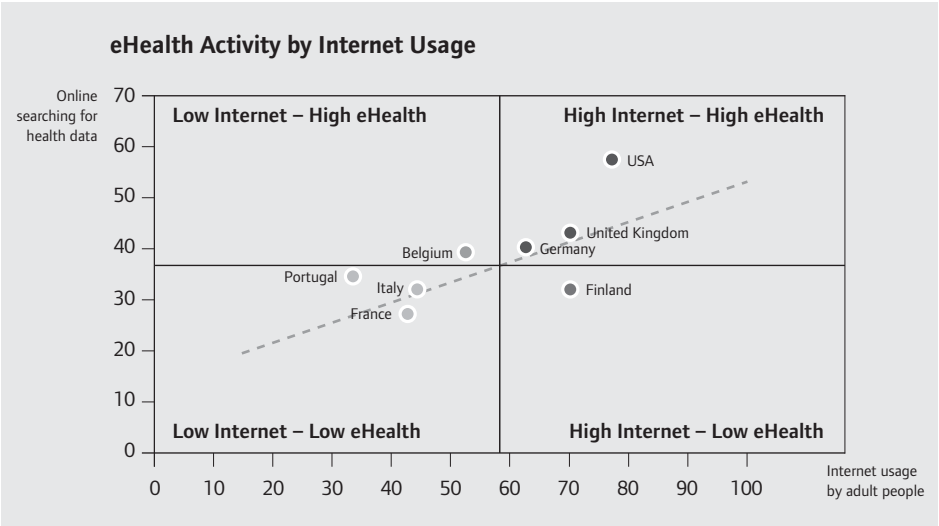
Health and Wellbeing

With the increased knowledge and possibilities that medical research provides in combination with the integration of various new information technologies, Germans have a different approach to health and wellbeing in 2015. This chapter describes the way ICT influences the development of medicine, supports surgical operations and changes the diagnostic process. It looks at the opportunities that arise when patients can design their own treatment and care, and examines the trend towards a more preventive healthcare system.

3.1 Diagnosis, Treatment and Research

In 2015 the first applications of nanotechnology and genetics in healthcare are emerging. Although the ethical debate about their use continues, individuals are seeing the remarkable benefits of these technologies in areas like tissue engineering and medication delivery.[38] Individuals are starting to be more comfortable with the idea of implants as they see the positive therapeutical impact of these devices. Meanwhile, diagnostics are being carried out at the molecular level and drug delivery can be achieved at nano scale. Surgical implements are miniaturized, implantable sensors monitor specific organ functions, and genetically engineered prosthetics and tissue are fully integrated in the human body to enhance functions such as vision and hearing. Treatment is altogether much less traumatic and more targeted. In addition to the development of sensors and other devices, information technology provides the computing power needed to identify markers (combination of genes performing certain functions), through high content screening and data mining.

In 2015, an operating theatre is not considered modern without a wide range of highly integrated ICT equipment. It has become a high tech temple, filled with sensors, advanced optical devices, high definition video and other devices to support the surgeon. High resolution imaging allows the surgeon to navigate an operation site from different angles and enables specialists in distant locations to monitor and advise during the course of an operation. For all the assistance provided by software programs, remote specialists, orientation sensors and positioning tools, surgeons prefer to remain in charge and wield the scalpel; but even this fundamental assumption is coming



Source: WRC/SIBIS, 2003

under pressure as a small but growing number of specialized procedures are increasingly frequently carried out remotely, by surgeons in another hospital – or another country.

Medicines are increasingly customized, allowing for more targeted and effective treatment, although not in real time. Characterization of the type of disease (e.g. a particular variety of cancer) and a full insight into the patient's personal condition might help doctors decide which of the many therapeutic approaches available is most appropriate. Increased individualized treatment, however, means that the costs of developing the "blockbuster" drugs once marketed so intensively by pharmaceutical companies now have to be recovered over a much smaller customer base. The German taxpayer therefore ends up shouldering most of the research and development costs, through direct subsidies and through the active involvement of publicly funded universities. These cooperate intensively with research institutes and the pharmaceutical industry to improve public healthcare. For example, anonymous patient data has become more widely available to the pharmaceutical industry to support drug discovery and development.

3.2 Healthcare System

In 2015, ICT is helping to make the patient more in control. Electronic patient records give people full control over their personal information. Individuals have been put in charge of their own bodies and personal wellbeing through the wide dissemination of medical knowledge and the availability of various health monitoring devices and technologies. This trend is supported and enhanced by the increased individualization of treatment, medication and medical insurance. In Germany, "healthy living" is the mantra of 2015 and ICT is helping drive the shift from treatment to prevention, from the hospital to the home, from state provision to individual choice. Individuals tend to choose where they want to be treated, based on cost and quality of care. Increased transparency of care providers and more knowledgeable, demanding patients have led to more competition in the health sector. People want value for money and compare service levels of institutions, departments and even individual medical practitioners. Clinics that now have to compete are keen to establish a reputation in order to attract patients and therefore tend to concentrate and specialize. Cost considerations also drive this trend towards the development of new competency centres, for example in hip replacements

Increased competition has also forced care providers to become more efficient. Healthcare cost savings are achieved through the concentration of medical services and the specialization of hospitals. Expensive forms of care are harder to get without evidence of their effectiveness. The need to reduce spending on health requires more prevention, a shortening of hospital stays and better ambulant care. The elderly are encouraged and supported to be as independent as possible and enjoy a longer, active, healthy lifestyle, for example by using automatic processes to assist in everyday tasks.[39] ICT plays a pivotal role in delivering greater efficiency and cost savings through a co-ordinated, secure linking up of different health institutions and administrations to facilitate data exchange.[40]

39 For an interesting overview see Bundesministerium fur Bildung und Forschung (BMBF), Futur: Der Deutsche Forschungsdialog available at http://www.futur.de

40 Anastasia Constantelou, "Civilising Technologies in Healthcare Provision: Experiences and Prospects in Europe", STAR/NTUA June 2002, available at http://www.databank.it/star/

3.3 Towards a Preventive Health Sector

In 2015, long term prevention is the key to keeping healthcare costs as low as possible in Germany, and the health sector has become characterized by a marked shift towards prevention and the responsibility of the individual patient. Prevention programmes aim to tackle health problems at their root, and rely on large scale public education for people of all ages. Patients need to be more self-reliant because families provide less care and because insurers penalize health conditions considered to be self-inflicted, e.g. obesity or smoking-related illnesses. This involves tailored prevention programmes, biometric monitoring, education, biogenetics and early warning systems.[41]

Delivery of e-Health Goods and Services

Domain/ type of service	2005	Future
A. Care		
General health information	Mature examples exist	Low – medium
Patient – provider e-mail exchanges	Some examples, no success yet	Medium
Personal health records	Emergent	Medium – high
Interactive personalised care plans	Emergent	High
Evidence based information	Emergent	High
Disease/population health management	Difficult to implement	High
Telemedicine applications	Emergent to advanced	High
Remote consultation	Emergent	High
B. Research and Innovation		
Biomedical databases	Some examples exist	High
Remote control of experiments	Emergent	Medium – high
Publication on the Internet	Relatively mature	High for bandwidth intensive media
Researcher collaboration	Emergent	High
C. Teaching and Learning		
Graduate education	Many examples	High for outreach
Continuing medical education	Many examples	Very high when linked to decision support
Patient education	Emergent	Very high
D. Evaluation		
Resource optimisation and utilisation e.g. best use of medication, error correction, protocol adherence	Difficult to implement because of fragmented systems and lack of integrated measurement of outcomes	High
Resource allocation, e.g. best use of laboratories, emergency services and specialty care	Examples for specific areas, e.g. emergency bed availability	High
Health policy outcome measurement	Difficult to implement because of lack of standard implementation and data capture at point of care	Very high

Source: OECD, 2004

41 Andreas Ligtvoet, "PRISMA-ehealth Strategies Paper", PRISMA/RAND Europe, April 2002, available at http://www.prisma-eu.org

Electronic body monitors – integrated in mobile phones or PDAs or worn like wristbands and watches – have become common. These devices continuously measure heartbeat, blood pressure, temperature and physical motion and are able to alert emergency services if required. They are enabled to direct emergency services to the patient or guide the patient to the nearest clinic. They also provide personal medical information for emergency treatment. These functionalities are widely used by people in particular risk groups and are becoming increasingly mainstream, even though many remain reluctant to be confronted by their medical condition and prefer not to be monitored all the time. On the other hand, heart patients, diabetics and people with a genetic vulnerability to certain diseases choose even more intrusive forms of monitoring by wearing in- or on-body sensors which constantly assess their health status.[42] Other sensors are built into specific locations, such as urine testers in toilets.

The results, which are accessible to patients as well as doctors, are making it possible to track changes in drug dosage, and alert doctors to irregularities. Continuous monitoring, carried out on displays at the doctor's surgery or at a telemonitoring centre, is more time consuming than the old system of periodic check-ups. However, it does make it possible to react to smaller risks and problems, making actual visits to the doctor less frequent and reducing the need for costly surgical operations and lengthy hospitalization.[43]

Although monitoring opens up new possibilities and limits known risks, it cannot yet provide a foolproof safety net. Microelectromechanical systems (MEMS – devices small enough to be implanted in a person's body that take samples, analyse them and submit the results to a remote health institution) have been in development for ten years but have still to reach patients.

3.4 Healthcare Provision

Health and wellbeing is primarily the responsibility of the individual. The interaction between (potential) patients and healthcare experts is not necessarily based on physical contact. Patients and doctors exchange information about treatments and provide data for research in virtual "clubs" and information platforms.

For daily health concerns people still refer themselves to a general practitioner (GP), who has a wider responsibility as gatekeeper. First diagnoses are mostly conducted over the phone or by means of 2-D video streaming or an advanced 3-D interaction system. A visit to the GP's surgery is complemented by a number of effective diagnostic alternatives online, especially for minor ailments. Smart computers, networks of GPs and/or specialized diagnostics centres located anywhere in the world provide around the clock service. e-Diagnostics force the patient to monitor and describe his or her problems in detail to allow accurate evaluations. This process makes the patient more aware of his body and general state of health. The accuracy of these consultations is strongly enhanced by the patients' electronic records offering a complete overview of their medical history including digital scans and DNA data.

For general healthcare provision patients are no longer restricted to the available capacity in their immediate surroundings. Remote consultation and transmural care and treatment is common practice, allowing health institutions to better balance their available capacity and reduce waiting lists. Immobile patients need not physically visit a doctor or hospital. The aging society is making maximum use of the technologies available to facilitate care, equipping the homes of elderly people and providing an integrated system of hospital and home care to enable them to live independent lives.

42 Jessie Scanlon, "Dream Machines", Wired Magazine, May 2004

43 Interview with Thomas Berlage, Professor, Fraunhofer Institut für Angewandte Informationstechnik (FIT), Germany

Chapter 4

Work and Business

In 2015, the way Germans work has changed. Work is seen as more than just income; it is a source of social interaction, learning, meaning and identity. This chapter provides an overview of how the world of work is different in 2015 and the part ICT solutions are playing in that transformation.

4.1 New Ways of Working

A major impact of ICT on working patterns has been to relax the need for physical presence or geographical proximity. Germans increasingly demand the flexibility to choose when and where they work and with whom. Companies, therefore, are adapting by adopting more decentralized structures and giving responsibility directly to individual workers. The most radical changes, nevertheless, are to be seen in knowledge-intensive companies that depend on continuous innovation to survive. Some have outsourced most or all of their activities to independent e-experts. Together these companies and suppliers function as a market, buying and selling services, without guidance or directives from the top.[44] The essential drivers behind successful German decentralized systems are capabilities, connections, and incentives. The three elements are available in Germany in 2015. Loose networks or electronically connected "swarms" of highly educated professionals form teams and disband as the need arises. These teams migrate (more or less together) from project to project, adjusting their configuration depending on the work at hand, drawing in the necessary expertise to do the job. Personal contact and chemistry, as well as shared work experience and synergies are important assets, but extended searchable biographies that include experience and skills also support the search for talent.

While increased work autonomy leads to increased motivation, purpose and self-reliance, it also requires a different style of management and a different type of control protocol. Independent German workers continue to rely primarily on their own networks and are less involved with their employers and clients.[45] They seek new ways to replace the benefits traditional organizations provide, such as support structures and services, but also identity and status. They tend to organise themselves around other characteristics in common, like profession, education and region. These are better expressions of their individual personalities than the relatively impersonal corporate organization. These networks are more than a talent pool. They may provide services to their members, like social and health insurance, social and professional contacts, peer to peer reviews, knowledge exchange and teaching. At the extreme they can be compared to mediaeval guilds but without the working practice restrictions – healthy competition between guilds protects independent workers' interests.[46]

In 2015, however, the majority of Germans still work in more traditional environments where flexibility and empowerment are less evident, but where people benefit from long term relationships, trust and shared experience.[47] Also many workers value the relative security of employee status and consider the office as the centre of work. Here people meet and exchange information. Random knowledge is picked up and experiences are shared through chance encounters at the water cooler or in the canteen. In order to know what is going on in the office, to understand informal structures and to bond with colleagues and clients, face to face communication and physical contact remains important.

44 Thomas Malone, The Future of Work: How the New Order of Business Will Shape Your Organisation, Your Management Style and Your Life, Cambridge, Mass, USA, Harvard University Press, 2004

45 Interview with Professor Luc Soete, Director, Maastricht Economic Research Institute on Innovation and Technology, Netherlands

46 Tomas Malone, The Future of Work, pp.86-98

47 Deutscher Gewerkschaftsbund (DGB), Zukunft der Arbeit – Zukunft der Gesellschaft DGB, January 2000.

But also in these German organizations the trend towards decentralization, democratization and increased flexibility continues. Again, this is particularly evident in professional service companies, which employ a rising proportion of the German working population.[48] Work centres on projects, driven by teams that adapt size and qualifications to the task required, seamlessly integrating external consultants and people at various locations as needed. With no objective reason to commute back and forth to the office at given times, people choose when they want to work and where. The steadily decreasing price of high tech appliances, for example large flat screens, means that workers no longer need to come into the office just to be able to use the technology. This trend is reinforced by the rising complexity of mobility, making working from home the more economic and preferred option. German companies also encourage this development as it leads to increased productivity and a reduction in demand for office space. Thus everyone can more or less adapt work hours and conditions to suit their personal needs.[49] Office design accommodates these changes as it moves towards shared workplaces and more fully equipped meeting rooms and social areas.

Obviously this has lead to a further blurring of work and private life. The place of work in social life has expanded. As more responsibility is bestowed on individual positions, demands on time have expanded and more people are expected to be available online more of the time – particularly in globalized sectors where the "48-hour day" prevails. Not everyone has benefited from this, and some are finding themselves working harder simply to keep their jobs. This is particularly true where skill sets even as they have expanded have also tended to become generic and interchangeable, leading to vigorous labour force competition. Those on the other hand with idiosyncratic or unique skills, particularly with a strong element of local knowledge, have more bargaining power.[50] In addition, as work life expands, there are more "second chances" – especially for those Germans with advanced skills. Along the same lines, there are more forms of "gradual retirement" as technology and experience have combined to facilitate societal changes that permit "more people to be more things". Another aspect of these developments is different models of what "working" means, and more chances (and sometimes the necessity) to reinvent oneself.

City	Sinus Milieu	Age	Scenario
Frankfurt a. M.	New Middle Class	14–22	Digital Fences
Frankfurt a. M.	New Middle Class	25–45	Glass World
Frankfurt a. M.	New Middle Class	55–62	Glass World
Cologne	Experimentalists and Modern Performers	14–22	Glass World
Cologne	Experimentalists and Modern Performers	25–45	Digital Fences
Cologne	Experimentalists and Modern Performers	55–62	Digital Fences
Berlin	Materialistic	14–22	Glass World
Berlin	Materialistic	25–45	Digital Fences
Berlin	Materialistic	55–62	Glass World
Munich	Well-Established	14–22	Digital Fences
Munich	Well-Established	25–45	Glass World
Munich	Well-Established	55–62	Digital Fences

48 Dostal, Werner and Alexander Reinberg Ungebrochener Trend in die Wissenschaft, in: IAB Kurzbericht, Nr. 10 und 27.8, Nürnberg, 1999

49 An interesting perspective is presented in "Zukunftsradar 2030 – Der demographische Wandel in Rheinland-Pfalz: Arbeitsplätze und Arbeit 2030," ZIRP Zukunftsradar 2030 web site, ZIRP, 2003.

50 Interview with Verena Weidmann, Head of the ARD office in Brussels, Vice-chairman ICT Committee of the German UNESCO Commission, Germany

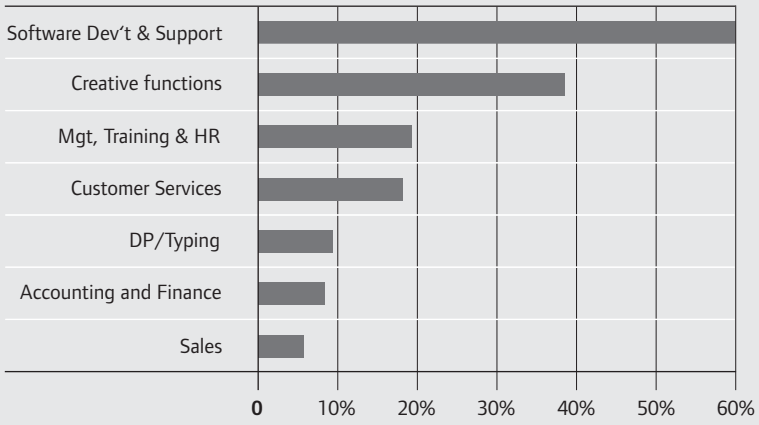
4.2 Motivation and Control

In 2015 Germans have more possibilities to work in different ways and to express their individuality in their approach to work. This implies that motivation varies strongly between workers and that traditional loyalty to the employer is being replaced by other loyalties to e.g. team members, clients, results, family, personal growth. German companies are having to find other ways to motivate and control their workers.[51] The focus is clearly on concrete output, as this is the only thing that is easily measurable. In manufacturing where individualism is less evident and control functions are traditionally more rigid, remote supervision by video has become more common.

Not only can employers no longer rely on the loyalty of at least most of their workers; also much of the knowledge that is built up in the process is retained by the employee or independent worker. This means that organizations need to ensure that they capture knowledge and monitor workers' outputs. As knowledge is a key strategic asset of every organization, huge efforts are being made to capture and disseminate it across the organization. One could compare this to harvesting the crop of ideas and learning that spring from the investment in human capital.[52]

Beyond measuring the output of work, German managers are finding it a challenge to control the work process and the flow and timing of projects with traditional means. Technology is intensively used to help manage dispersed teams of workers with different contractual relationships. This can sometimes make remote working more transparent and connected than traditional co-location. Now team members and superiors can continuously look over each other's shoulders, monitor progress, exercise control, and provide coaching and support. At times this can be overwhelming and not everyone feels comfortable in such a transparent work environment. Finding the right mix of interaction, transparency and privacy is not simply a matter of finding a "comfort zone" but requires a real mixture of different and complementary modes of interaction. For example, teams have to adopt conventions over when it is acceptable for a colleague in need of privacy to "retreat" – offline or behind a real door.

eWork by Function



Source: EMERGENCE European Employer Survey, 2000

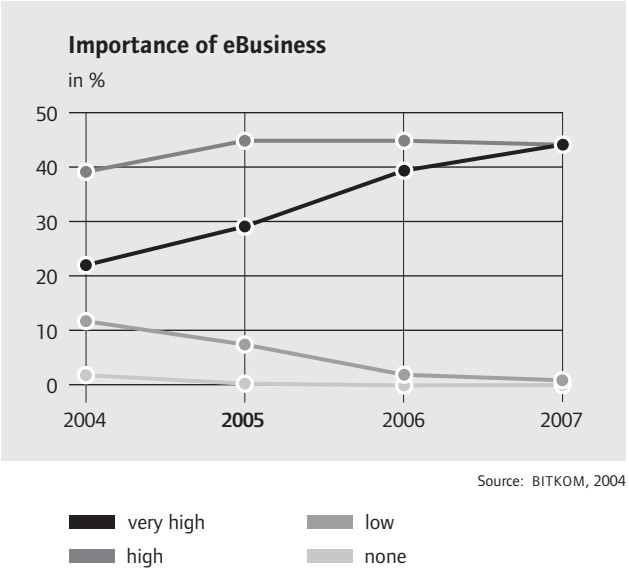
51 An interesting position is presented in Pfeiffer, Ulrich, Heik Afheldt, Dieter Bock, Gert von der groeben, Peter Hofelich, Karl Kauermann, Robert Leicht, Fritjof Mietsch, Thilo Sarrazin, "Deutschland in den nächsten 30 Jahren: Die Zukunft gestalten. Positionspapier zum Kongress des Managerkreises, Berlin, 3. Dezember 2001," Managerkreis der Friedrich-Ebert-Stiftung, December 2001

52 Mentzas, Gregoris, Dimitris Apostolou, Andreas Abecker and Ron Young, Process-centred and Product-centred Approaches. Springer-Verlag, XVI, pp. 208.

4.3 Technology Driving Change

In 2015, a host of technologies are changing the way Germans work and the design of the organizations in which they work. ICT allows for ever more empowerment of individual workers, sharing of information and knowledge across organizations, reducing the relevance of geographic distance, and enabling continuous communication over various platforms.

Distributed work teams pose additional challenges as they need to be effectively linked and be aware of what individual team members are working on, without being intrusive. They need to be able to drop in and out of each other's offices for quick consultations and also to share trivia and build personal relationships. Collaborative software, presence awareness technology and always-on wall displays supply these features. They provide a window into another workplace, giving the impression of co-location. As technology gets cheaper people can afford these devices in their homes, or employers provide them, reaping the benefits of productivity gains through distributed working while retaining control over workflows and processes.



Source: BITKOM, 2004

For all its quality as a professional communication channel, video conferencing is still a scheduled event and therefore largely unsatisfactory as a substitute for normal human contact and conversation. In order to approach the quality of face to face communication and direct human interaction video links need to be constant, high quality and simulate direct eye contact. This is achieved through gaze awareness in video communication, which allows interaction between people as if there were no electronic interface. It effectively captures facial expressions and eye contact thus providing extra "human bandwidth" in electronic communications. This is further enhanced by the improved image quality of high definition television and hi-fi audio and increasingly even 3D imaging. Some use of holographics has also found its way into the workplace, but it is still a gimmick, used for specific events rather than a day to day cooperative working feature.

The distributed nature of work, the heterogeneous composition of work teams – sometimes entirely composed of external workers – and the fact that innovation may take place anywhere have meant that knowledge management is increasingly emerging as an established function in German organizations – no longer falling uncomfortably somewhere under human resources or IT. Particular attention is still devoted to storage and access of information via different means.[53] However, knowledge capture depends less on individuals entering information in a knowledge management system – a great deal of that is now handled automatically, right where knowledge emerges.

53 Tuomi, Ilkka (2002) The Future of Knowledge Management. Lifelong Learning in Europe (LLinE), vol VII, issue 2/2002, pp. 69-79. Available at: http://www.jrc.es/~tuomiil/articles/FutureOfKnowledgeManagement.pdf
Visited on: 23 September 2004

ICT however cannot eliminate the desire of people to meet in person, and has never been good at capturing the highly valuable but uncodified information which they tend to exchange when they do. But even if ICT cannot create good human interactions, it can facilitate them by providing contextual information and non-intrusive signals that support users' "sense-making" processes.[55] Therefore, the most important advance in knowledge management has been the focus on human factors, and the shift from a techno-centric perspective to a non-technological, behavioural science perspective that emphasizes the social aspects of knowledge management in practice.[54] Technological advances meanwhile have become more targeted at overcoming issues to do with the social, political, and ethical acceptability of knowledge management systems.

Not only have technologies enabled natural interaction between German employees and these systems via multimodal interfaces that handle speech, images, gestures, and text, but sense-making also demands a certain degree of intelligence. Since this requires active exploration of unknown domains of knowledge, information systems are perceived as resources for knowledge construction and as tools that augment human thinking. For example, simple automated processing systems containing AI-inspired technology, such as social filtering, recommendation, and data mining systems have become increasingly sophisticated. In the semantic web (and a general reasoning) context, a system with "common sense" is able to properly respond to queries such as "What people does John know in company C?"[55] Additionally, mining tools allow peer-to-peer browsing in personal web logs for workers with appropriate skills.

4.4 Business Organisations

In 2015 ICT is also changing the way German organizations are increasing their international competitive advantage. At the core of this is the internal sharing of knowledge among employees. Through information sharing, employees are enabled to contribute to continuous innovation. The speed of technological change is pushing German organizations to adapt their organizational structures, modifying their decision-making authority by flattening the traditional pyramidal organizational hierarchy. Discrete company departments are replaced by alliances of talent and capabilities that form, dissolve, and reform to accomplish highly specific tasks.

The speed and depth of this process differs between sectors and organizations, depending on their uptake of technology, how well they integrate these technologies into existing processes and finally the redesign of processes themselves. Nevertheless, in 2015 most business transactions are totally automated due to integration or at least connection of business databases. The knowledge-driven economy thus leads to a global network of organizations linked via electronic networks.

Most German workers are supported by information technology and simple tasks are slowly being taken over by automatic systems. In the service industry of 2015, easy textual analysis and comparison of data is standard. It is more important for employees to be able to ask the right

54 Scholl W., König, C., Meyer, B. & Heisig, P. "The Future of Knowledge Management: An International Delphi Study." Journal of Knowledge Management, vol 8, no. 2, (2004) pp 19-35

55 Abecker A., M. Hefke and A. Maedche (2003) Final Version of Strategic Roadmap. Deliverable D4.2. VISION project. IST-2002-38513, 30th June, 2003. Available at: http://www.aifb.uni-karlsruhe.de/apollo20080/fzi/vision/vision/docs/D4.2_final.pdf , Visited on: 23 November 2004.

questions of data-mining programs and interpret the results accordingly. Another important role remains the human-to-human interface: the "back-office" is automated and the "front-office" is more pleasant and human, placing more emphasis on the interpersonal skills the front office typically requires.[56]

As previously indicated, the integration of information streams (both vertically and horizontally) with shared databases, decision-support software, expert systems, self-learning embedded procedures, mentoring software, and critical path management enables integration and streamlining of organizational processes. Thus, businesses can tap into each other's resources and provide better service to the end-customer [57] Web-based agents gather available information on offers and compare products to simplify the number of choices. The electronic agents of one party transact with their counterpart agents of another party to agree terms e.g. in electronic processing of import duties and paperwork.

Proportion of European Organisations using eWork

in %

Any eWork	49.0
Within the organisation	
Any eEmployees	11.8
Employees working in remote back-offices	6.8
Multi-locational teleworking employees	9.9
Home-based teleworking employees	1.4
Remote call centre in company-owned back office (outside own region)	1.4
Employees working in telecentres, telecottages or other office premises owned by third parties	0.9
Call centre employees in telecottage or telecentre	0.3
Outsourced	
Any eOutsourcing (outsourcing using a telecomms link to deliver work)	43.0
eLancers (freelancers using telecomms link to deliver work)	11.4
eOutsourcing to other region in own country	18.3
eOutsourcing to companies in other countries	5.3
Outsourced call centre	15.0
Outsourced call centre with telecomms link	11.1

Source: EMERGENCE European Employer Survey, 2000 (IES/NOP

56 Millard, Jeremy, "ePublic services in Europe: past, present and future," Danish Technological Institute, August 2004

57 Wagner Caroline et al. Europe, Competing: Market Prospects, Business Needs and Technological Trends for Virtual, Smart Organizations in Europe, RAND Europe, MG-195-EC, February 2004.

4.5 Mobility

Mobility underpins economic prosperity, and therefore has continued to rise.[58] However, in 2015 there are some significant shifts in traffic patterns, as changes in the nature of work and the labour force create different commuting trends. The use of ICT has not automatically resulted in less use of transport infrastructure.[59] Car use and general mobility now requires more sophisticated transport planning and management supported by telematics.[60] This includes monitoring systems which inform transport users of traffic jams and delays in public transport, linked to personal route planning systems that suggest alternative routes.[61]

In 2015, despite environmental campaigning, the car has lost none of its popularity in Germany. It is still considered the most convenient form of transport for the needs of the individual owner. Cars are still a place where Germans communicate by mobile phone, but today they are fully connected, integrated workplaces and entertainment centres. Voice recognition is the preferred way of communicating with the onboard information system.

Augmented reality helps drivers to navigate and make them more aware of their surroundings. Real 3D images of roads, intersections and indicators for important and interesting features like dangerous corners, or shops, are projected on head-up displays on the windscreen. Cars have robust and reliable sensor networks that provide self-diagnostic capabilities, warning the driver of defects and connecting to roadside breakdown service providers. Cars request access to particularly busy routes, and can be denied if the road is congested. The driver is provided with alternatives, which may include public transport or car sharing.[62]

Advances in public transport reflect increased demand for the comfort, safety and speed that ICT and telematics offer.[63] In 2015, large cities have introduced ICT-enabled public transport systems which facilitate transfers from bus to train etc. In 2015, it is normal to get travel planning information sent to your mobile or wireless smart card.[64] Combined trips – for example by underground, train, taxi and even rental car – are possible through an integrated payment system based on smart cards. The card is not necessarily personal and can be loaded via the internet according to the commuter's needs and used for other services, such as museum tickets or special discounts.

58 Pfeiffer, Ulrich, Heik Afheldt, Dieter Bock, Gert von der groeben, Peter Hofelich, Karl Kauermann, Robert Leicht, Fritjof Mietsch, Thilo Sarrazin, "Deutschland in den nächsten 30 Jahren: Die Zukunft gestalten. Positionspapier zum Kongress des Managerkreises, Berlin, 3. Dezember 2001," Managerkreis der Friedrich-Ebert-Stiftung, December 2001

59 Wagner, Petra, David Banister, Karl Dreborg, E. Anders Eriksson, Dominic Stead, and K. Matthias Weber , Impacts of ICTs on Transport and Mobility (ICTRANS). IPTS, European Commission, DG JRC, Technical Report EUR 21058 EN, June 2003

60 Bundesministerium für Verkehr, Bau- und Wohnungswesen, Mobilitätsoffensive: Handlungsempfehlungen für die Mobiliät der Zukunft, 2nd May 2002

61 BDI/Fraunhofer, Forschen fuer die Internet-gesellschaft: trends, technologieen, anwendungen BDI/Fraunhofer, April 2002, available at http://w4.siemens.de/ct/de/activities/inet_symp/downloads/ergebnisse.pdf, visited on 23 November 2004

62 Saracco, Roberto; Annaflavia Bianchi, Roberto Mura Dalla, and Gabriella Spinelli, "First report on Key European Technology Trajectories," FISTERA (D2.1), Telecom Italia, September 30, 2003, see also Anluain, Daithi, "Hydrogen Fuel Closer to Fruition," Wired, Septempber 2, 2004

63 Banister, David, Dominic Stead, Petra Wagner, Karl Dreborg, E. Anders Eriksson, K. Matthias Weber (2004) Scenarios for the impacts of ICT on transport and mobility. Paper for presentation at the STELLA Focus Group 2 Meeting 22–23 April, Budapest. 2002

64 Invest in Sweden Agency (2003) Better public transport service through wireless technology, July 2003. Available at: http://www.itsweden.com Visited in 24 November 2004.

Public transport is complemented by other arrangements, such as easily available hire cars and electronically coordinated sharing arrangements. Through the onboard information system drivers are linked up to commercial car pool schemes. Location awareness services indicate connected cars and help match supply and demand. Potential passengers signal their location, destination and desired arrival time and drivers can decide to pick them up for a kilometre/time fee, which is calculated automatically and invoiced through the passenger's mobile device. In parallel, services exist that provide cars for one off trips. As such they are pure "mobility enablers" without sophisticated communication technologies, except for a robust navigation system. Cars are positioned at strategic locations like shopping centres and business parks and can be taken by anyone connected to the mobility scheme. Especially in and around cities there is a big demand for such services. Here people prefer to use public transport and have very irregular demand for car capacity.

Chapter 5

Education and Knowledge

In 2015 ICT-based analytical skills define peoples' options in life. In turn the aggregate skill levels of society determine how competitive that society is. The value of education has therefore never been so high. Moreover, keeping up with the speed of technological change requires continuous investment in education. This chapter looks at the trends and especially the opportunities and challenges of integrating ICT in primary, secondary and higher education. It takes account of other important influences like globalization, competition in higher education and the need for continuous learning to keep pace with perpetual rapid change.

5.1 Primary and Secondary Education

Since Europe defined its goal of becoming the world's foremost knowledge economy, most member states including Germany have focused on education as a means to reach this goal. The results of these efforts are evident in 2015. With the help of new technologies, the school experience has changed into student-centred teamwork that promotes proactive learning and critical thinking, applied to real-life situations, using different modes of conveying information.[65] Such collaborative group and project-based education focuses on problem solving, more than acquisition of knowledge. In 2015 education as a whole concentrates on providing individuals with the analytic and intellectual capabilities to be both competitive and intellectually interested in expanding their general knowledge.[66]

The foundations for working in a knowledge society are laid in primary and secondary schools, although more and more children in Germany attend pre-school classes. Introducing multimedia in the classroom helps to capture the pupils' interest, and significantly increases the teacher's options. With the advent of a new generation of technologically literate teachers and the much reduced cost of ICT every class and often even every pupil has a fully connected computer. In turn this triggers German educational publishers and e-learning businesses to push for more new online teaching and learning tools.

With the widespread availability of knowledge through the internet the focus of education and the needs of the individual learner have gradually shifted. Teachers still teach basic background knowledge to children, but also give them the incentives and tools to explore their own interests; in other words a shift from "what is learned" to "how it is learned". Also increasingly important are the skills to get by in the daily world: "what is good for my health?", "how do I choose insurance?", "where do I look for a job?" and – most importantly – "can I trust this information?" On top of this, it is important that pupils are able to understand English.

In German schools, teachers have assumed the role of coaches, and help their pupils in developing a comprehensive set of capabilities for critical thinking, focusing on the so-called higher order thinking skills (HOTS[67]) at all levels of education. This new responsibility comes with an increase in the social status of teachers, as they are required to be at the forefront of educational development and qualified to work with the latest ICT-based tools. The teacher supports and monitors the groups' work and identifies the pupils that lag behind. He works to provide the continuity and the personalized guidance that group work sometimes lacks. Teachers are also the key intermediary between pupils and parents. They discuss with parents the design of personalized education strategies for their kids. They also make sure that parents, who are mostly very busy and short of time, pay due attention to their children's development.

65 Opaschowski, Horst, Deutschland 2020. "Wie wir morgen leben – Prognosen der Wissenschaft" 2004.

66 Interview with Marjorie Blumenthal, Associated Provost, Georgetown University, USA

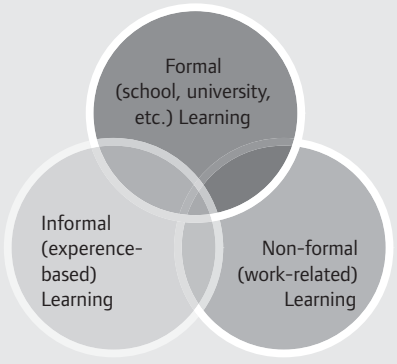
67 Turner, J.C., Midgley, C., Meyer, D.K., Gheen, M., Anderman, E.M., Kang, Y., and Patrick H.(2002) "The Classroom Environment and Students' Reports of Avoicance Strategies in Mathematics: a Multimethod Study". Journal of Educational Psychology, vol. 94, n.1, pp 88–100

Parents are now enabled to follow their children's progress in detail. Sensors and webcams in schools and classrooms allow parents to watch their children as they go about their daily activities. However most schools restrict continuous observation to preserve pupils' freedom to interact with their peers. Besides being able to see their children perform at school, parents are provided regular personality assessments and school reports by their teachers via e-mail and dedicated class websites. Here all the pupils' information, reports, peer reviews, teacher comments etc. are stored. Teachers use this information as individual "learning biographies" to maintain a record of what each child has learned and to identify where their interests lie. Based on this information they can help and guide children in developing their interests as well as choosing the appropriate medium to do so.

The teacher also helps pupils early in their school career to develop their choice of higher education and to adapt their curriculum accordingly. In particular in science and technology the uptake and quality is improved by supplying second chance routes that take into account the maturity of pupils and provide those who need it with more time. The teacher thus plays an intermediary role between the university and the pupil. To meet society's demand for well-educated specialists much larger numbers of young people have to study for degrees in higher education. Universities work with the schools – especially in technical subjects – to monitor aspiring students and advise what type of knowledge they need to possess to excel in their courses, possibly leading to more stringent entry requirements. For this purpose universities may get access to the "learning biographies" under strict privacy conditions and with permission of the pupil. In some cases teaching staff are seconded to top secondary schools for this purpose. Universities and colleges of further education also work to make access more flexible and develop specialized degrees and "à la carte" education to make higher education more efficient and encourage wider participation.

Beyond the "learning biographies" mentioned above a host of software applications have been developed to aid the learning process, distinguishing between visual and auditory modes of communication. Some topics may be well suited for learning in an entertainment setting such as a game (so-called edutainment) although not all topics are suitable for this approach. Filtering technologies are increasingly important to make sense of information overload, whilst other technologies help to simplify the search for information. For example the use of semantic tags enables pupils to formulate natural language questions for search engines. Video and sensory technology is also used to interact with work groups from other schools in Germany and even abroad. It is customary to include where possible international joint research projects in the curriculum.

Learning in Different Settings



Source: OECD, 2004

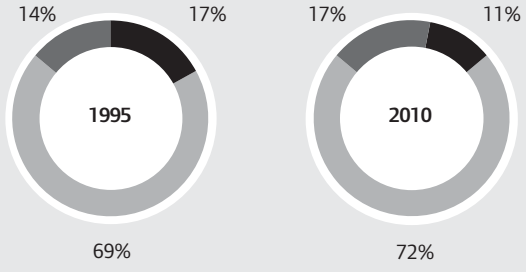
5.2 Professional Qualification

As in other areas ICT empowers the individual student. By now he or she is a consumer who seeks quality in education, a network of friends and contacts, and a clear school "brand". Students want to get the best research and teaching possible and, if necessary, move around to get it. ICT makes the supply of education more transparent; peer reviews and other ranking systems show students where the best classes and courses are. To distinguish themselves students look for universities whose brand acts as a certificate of the highest academic quality. This is particularly important at a time when CVs are overloaded with lifelong learning courses, providing little insight into the actual capabilities of applicants.

Also German universities are becoming more international. Frequent international exchanges and an international competition for and among high quality universities (the best students for the best universities), becomes a part of everyday reality in higher education. As the job market has become increasingly global, the hunt for talent in students and faculty has also become international. German students speak foreign languages (in addition to English which is more or less assumed as standard) and are likely to compete with other students from all over Europe and the rest of the world.

All higher education and particularly universities are having to adjust to these trends in order to survive. The old renowned academic institutions strive to establish themselves as the elite academic institutions of Germany, with or without help from the federal and state governments. They are doing everything to develop their brands: delivering the highest quality education and services to students; establishing links and other partnerships with research centres and foreign top academic institutions; and offering fast tracks into future employment in industry and government. Because of these crucial elements the elite institutions continue to offer the broad curriculum that is associated with traditional universities. Quality of teaching, quality of infrastructure, the brand and the right financial support together assure the essential platform for these universities to survive, excel and compete at a global level.

Changes in Professional Qualifications in Germany



Source: Institut der Deutschen Wirtschaft, 2004

without professional education
with professial education
with higher professional education

Universities and institutes of higher education that cannot aspire to this level are forced to specialize. As students shop for their education to suit their needs and interests they are prepared to travel to build a "curriculum a la carte". A large number of organizational obstacles to sharing classes across universities have been removed over time. Reputable faculties, departments, and even professors draw large crowds and may charge premium tuition fees. In time schools gravitate towards their areas of strength, building strong links with international institutions in overlapping academic fields, joining research efforts and linking up with industries that have an active interest in their research areas. Those German schools that manage this transformation process well are able to compete with the top global institutions. Obviously, as in the US in 2005, there is still demand for local, less ambitious institutes that provide a decent education for large numbers of students.

One important asset for academic institutions to compete effectively in the global market for talent is the available ICT infrastructure. Wireless connectivity is a highly desirable asset for students who are spending most of their time on group work. Students and faculty use this to connect to the digital library, where sources are identified according to internationally recognized "digital object identifiers". These allow automatic indexing of any form of content such as video, audio, text, statistics, etc.[68]
The availability of large research databases is an important requirement, just as are the necessary tools to search such data. Continuous video, voice and data links are essential to support study and research projects of geographically dispersed teams. Without the adequate ICT facilities it is impossible to attract leading researchers or for local researchers to take part in international science programmes and projects. In teaching, video technology is the essential tool to get foreign teachers to participate in programmes easily.

The emphasis on excellence and the dominance of English as the language of science enables such education at a distance. These foreign academics supplement courses given by the local professors. Faculty also take on a partial role as learning coaches, providing the students with problem solving tasks. These learning coaches are supported by software training aids that are aware of the learning biography that the student has built since primary school. They also help students to develop effective data search and analytic skills, which depend largely on structuring and formulating the problem correctly in order to be able to ask the right questions. These skills are becoming ever more important for all academic disciplines, but also in everyday professional life, as the amount of available data is nearly infinite.

68 For more information about digital object identifiers see http://www.doi.org

Besides faculty from foreign universities, also other third parties – like industry or government – play an important role in higher education. Specific degrees are getting shorter and more focused on practical applicability in industry, while others are focused more on a scientific career. Students may want to work more while studying – to combine practical experience with education. The teacher-coach may play an important role as intermediary between the future employers and the students. Industry is highly connected with higher education. Not only do companies commission much of their research there, they also provide money, courses and traineeships for students. With the permission of the student, employers have access to study results and can track the best students. The teacher balances the exposure to work and learning and consults students on work opportunities and the development of their curricula.

From the above it is clear that ICT influences the provision of education in many ways, though much of the delivery remains face-to-face in a physical school. Here people meet, exchange ideas, conduct physical research experiments, go to class and socialize. Building networks is nearly as important as education itself, and physical contacts remain crucial for establishing trust and familiarity, which is essential for building effective teams. As ICT enables teams to be assembled from a far greater variety of participants from multi-disciplinary backgrounds and different institutions, the need for face to face meetings also increases.

5.3 Lifelong Learning

It is no longer true that most skills learned at school last a working lifetime, even though the analytical basis is laid there. With developments in the world taking place at an increasing pace, there are very few people who can expect to have a permanent job for decades at the same organization. Even the few who do constantly face new challenges. Therefore, throughout their careers workers regularly have to learn new skills or update their topical knowledge.

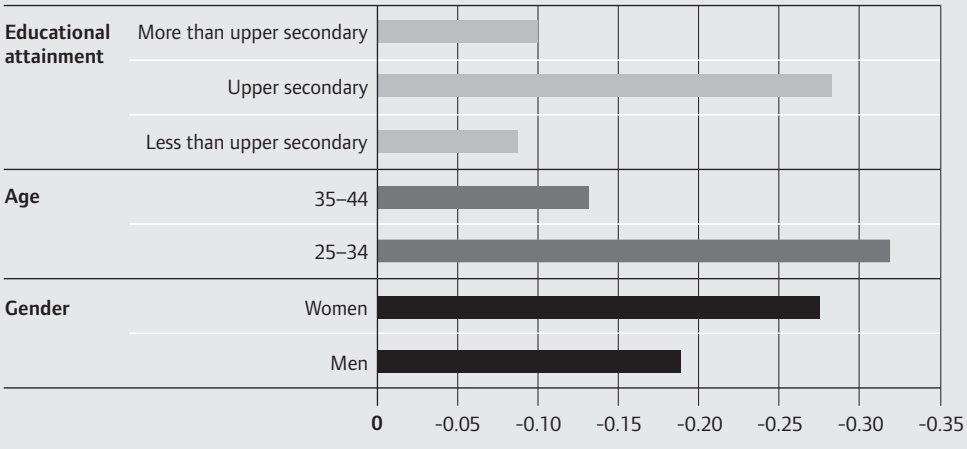
An important issue is re-training workers aged over 55, who often want to change gear but may still need to work until their seventies. On top of the learning aids and choices in curricula mentioned above, this is an issue of reconfiguring work according to (physical and mental) capabilities. In addition, employers and peers increasingly value older employees' experience. They are an important resource, as they carry the long term memory and much of the tacit knowledge of the company. Their input, which is unequalled by any knowledge management system, can be used very effectively for training and mentoring.

Whatever the professional setting, workers need to continuously update their skills. Nearly every job requires an understanding of ICT. A temporary break or unemployment can make re-entering a professional field difficult, as developments move on very rapidly. On the other hand, the many educational services online provide people the opportunity of a second chance in different professional segments. This is especially the case for

those people who do not need to learn new ways of thinking and understanding, i.e. the more highly educated segment of society. Those who can find out what they need to know using methods they have already mastered are likely to benefit most from these new distance learning opportunities. However "transformative learning" – i.e. learning that changes how people behave and think – is very difficult to achieve without actually taking classes.

The highest learning conception is characterized by commitment: to oneself, to the choices that one makes and to the goals one has. The drive of individual workers depends on this. The new motto could be: "living is learning and learning is living".[69] Qualifications are now the billboards with which workers signal their competence to peers, contractors and potential employers. As CVs present a patchwork of lifelong learning courses and activities, they are much more difficult to read. A diploma of a leading academic institution is still an important differentiator, but as a career progresses peer-to-peer review statements and assessments from professional human resource firms become more important. CVs are not enough and qualifications are continuously tested before engaging in longer-term relationships.

Estimated Reduction in the Probability of Unemployment in Europe through 10% Increase in Training



Source: OECD, 2004

69 Rebecca Hamer et alia, "Learning and teaching: a model of linked continua of conceptions". Paper presented at ISL conference Birmingham. Sept 2003

Chapter 6

Government and Democracy

Citizens are back in the driver's seat when it comes to government. Transparency and abundance of information allow citizens to monitor government performance in the areas that concern them. The citizen comes first and after arduous change programmes, the government is finally delivering the services the citizen needs, in a way that makes the citizen feel supported and respected. This chapter describes how ICT is deployed in the public sector and addresses the effects of ICT on public administration and democratic processes. It looks at the organization and provision of true e-government services and examines whether the potential that ICT offers is being delivered in practice.

6.1 Governance

The public policy process is greatly facilitated through the availability of improved tools for policy analysis, preparation and implementation. Continuous consultation of the electorate is now a real possibility. New forms of democratic participation have emerged to which political parties and civil society groups have had to adjust.

In 2015 the German institutional framework is still more or less unchanged. The accumulated and intertwined political and administrative responsibilities at local, regional, national and European level make the political process complex and difficult for the individual citizen to influence. Thus most structural complexities have stayed in place, and it is against this background that systems of e-government have developed.[70]

Concerns about a disenchanted but passive German electorate are stimulating government at all levels to try and bridge the gap with the electorate by drawing citizens into decision making processes. There is also some competition between countries, regions and municipalities to attract people and businesses by being more responsive to their needs. After a rather slow start, the Länder are beginning to compete to reduce the legislative and bureaucratic burden to foster investment and entrepreneurial environments. Such a drive is also visible at national and European level in light of economic challenges and the need to ensure legitimacy for policy making.

In effect more power has been moved to the individual citizen at the local level.[71] It is at this level that Germans have most control, and from here they work their way up the various levels of government to influence policy making. They are less concerned with institutional structures and constitutional barriers to change. Empowered by new information technologies, they can assert their rights more effectively and voice their concerns about specific topics, forcing government to adjust to their demands instead of the other way around. To further enable a more active role for the citizen, new monitoring and analysis tools have been developed that facilitate Administration-for-Citizen (A4C) and Administration-for-Business (A4B) services. These allow people to track how government agencies have acted on their input, which in turn can increase pressure for compensation for inconvenience and losses.[72]

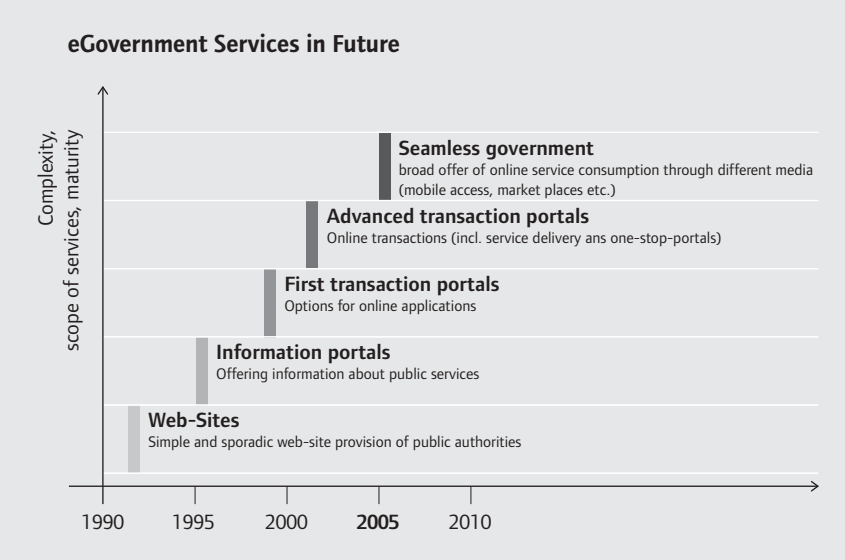
70 Arweck, Josef, Christof Baumgart; Thomas Briegel, Patrick Dieses, Heini Faßbender, Volker, Herrmann, Mirjana Jozik, Ulrike Kemkes, Stefan Kuppen, Thomas von Mitschke, Mistschke, Ullrich, Friederike Nagel, Martin Stuchtey, "Projektbericht Perspektive – Deutschland 2003/04. Die größte gesellschaftspolitische Online-Umfrage," McKinsey, Stern, ZDF, AOL, 2004.

71 Ulrich Pfeiffer, Heik Afheldt, Dieter Bock, Gert von der Groeben, Peter Hofelich, Karl Kauermann, Robert Leicht, Fritjof Mietsch, Thilo Sarrazin, "Deutschland in den nächsten 30 Jahren: Die Zukunft gestalten. Positionspapier zum Kongress des Managerkreises, Berlin, 3. Dezember 2001," Managerkreis der Friedrich-Ebert-Stiftung, December 2001

72 Interview with Paul Timmers, Head of Unit, E-Government, DG Information Society, European Commission

ICT has also facilitated evidence-based policymaking, which can improve government's effectiveness. Data sets on health, environmental, transport, or economic systems are more complete, accurate, reliable and detailed and can easily be analysed. Additionally, assessment of the effectiveness of policy interventions has become more robust. Monitoring and warning systems have also improved the prediction of catastrophes of various kinds (e.g. floods, terrorist attacks, earthquakes, thunderstorms, etc.) and responses are coordinated and exchanged with citizens via telecommunication and back-up infrastructure.

There is an obvious downside to the greater availability of information, as this also increases the avalanche of irrelevant information.[73] In combination with a more complex political context, the abundant availability of information has a counteracting effect on some people's willingness to be involved in the democratic process. The volume of information amplifies the complexity and makes it near impossible for the lay citizen to find what is really relevant. In the past, the press served as intermediary between politicians and people. Now the information stream is more direct, and new intermediaries are needed to sift, filter, evaluate and prioritize the mass of available data. Delivery of the right personally customized information at the right time in the right place is crucial to prevent information overload. Under some circumstances this highly valued functionality can be delivered by means of intelligent agents. However, it is more common for special interest groups to fill the gap. By monopolizing specific subjects, they control the information stream for their constituency and easily become the point of reference, with all the power that brings.



Source: Maria Wimmer, University of Linz, 2003

73 Interview with Matt Blaze, Associated Professor, of Computer and Information Science, University of Pennsylvania, United Stated

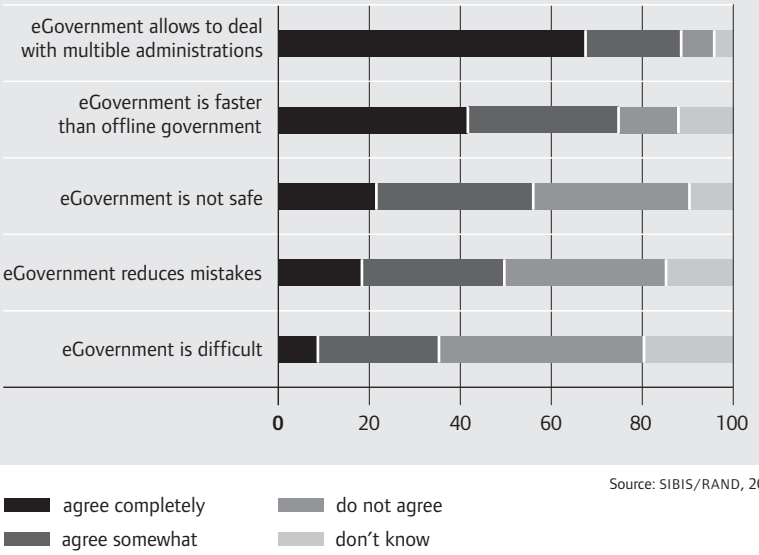
6.2 eDemocracy

Politicians and political parties actively use their online appliances to consult and inform the electorate. The internet is an ideal platform to rally support or express discontent with policies. NGOs, community organizations, and bottom-up governance partnerships are becoming increasingly important, whereas the influence and membership of traditional political parties is waning. This trend is reflected in a decreasing turnout at general elections, from which small interest groups manage to benefit disproportionately. The Federal Government is going to great efforts to engage the electorate in the regular democratic process. Important public meetings of local councils or the Bundestag are broadcast live and supplemented with relevant data and information. Viewers are able to comment on the proceedings and react directly. Daily surveys or local opinion polls ask the public to express their opinion on topical policy issues.

Notwithstanding the fact that citizens may be too sceptical, too overwhelmed or too short of time to engage more actively in the process of government, it is clear that they do possess the tools to voice their concerns and defend their rights. It is relatively easy for individuals and organizations to pool interests and mobilize support, which can directly influence policy making when linked to online consultation procedures. Politicians find it hard to define their role, as citizens use such consultations to interact directly with the civil servants dealing with a specific policy.

Therefore, the responsibilities and spheres of influence of German civil servants and politicians have changed, as well as the expectations of citizens. Representative democracy remains, but more direct forms of democracy allow the citizen to influence policy-making on specific issues and interests. ICT technologies in 2015 tend to favour determined and focused people and organizations. They are able to collect the necessary information through the services of special interest groups. German democracy may run the risk of becoming a "spectator democracy" where the political landscape is determined by changing loyalties, protest votes and disengagement, and where many voters feel powerlessness and irrelevant as interest groups push their agendas.[74]

Views about eGovernment in Europe



Source: SIBIS/RAND, 2003

74 OECD, "Engaging Citizens Online for Better Policy-making" OECD Policy Brief August 2003

6.3 eGovernment Services

Serving the citizen effectively is at the heart of how the German government perceives its role in society. The automation of most control processes and the increased transparency due to ICT has caused a paradigm shift in public services from over-regulated and supply-driven towards self-regulated and demand-driven, thus providing better services more efficiently to German citizens.

To benefit from these efficiency gains and to provide adequate service, the government expects and encourages German citizens and businesses to conduct their interactions with public authorities online. This requires a higher degree of engagement by users of government services, as they are invited to cooperate closely with public administration in shaping electronic interactions between administration, business and citizens. Interactions are further simplified by issuing unique identification tags for all public services. Such tags provide optimal security, as the government has clearly set out to lead by example in the field of data security and privacy protection. Tags carry personal data embedded in a credit card sized chip, which also records biometric features (e.g. fingerprint, iris scan, facial characteristics).

Following the eEurope Action Plan the German government has brought all its services online[75] by 2015. It took longer than expected to achieve the full technological potential. First old services and processes were brought online, to comply with European guidelines, without seriously rethinking them in light of new possibilities. Eventually the government addressed the cultural and organizational issues including the prevalence of entrenched legacy systems to develop the full set of interactive and integrated e-government services. Internet and wireless mobile devices have become crucial in the application and delivery of public services. Furthermore, e-mail, mobile communication and digital broadcasting via the internet are important channels for the government to reach every household or citizen, for example in emergencies. All public information and every public document is available online and can be searched for using metadata and smart search engines. Citizens can consult real-time statistics, geographically related information or performance indicators of public departments at any time.

In 2015, services and information have been publicly available for quite some time; the big advances in more recent times for e-government services have mostly been in user-friendliness and effective back-office integration. For example, paying taxes is no more difficult than paying a credit card bill.[76] Citizens and their electronic agents can personalize e-government services.[77]

75 European Commission (2002) eEurope 2005: An information society for all. An Action Plan to be presented in view of the Sevilla European Council, 21/22 June 2002. COM(2002) 263. Brussels, 28 May 2002, available: http://europa.eu.int/information_society/eeurope/ Visited on: 29 November 2004

76 Interview with Matt Blaze, Associate Professor, University of Pennsylvania, USA

77 Millard

Such customization is also clear in the way German government delivers its services. Governments are faced with the dilemma that, unlike banks or budget airlines, they cannot simply refuse to deal with expensive "customers", especially when these are precisely those who rely most on public services and tend to use the more traditional channels to access those services, such as the elderly, disabled, sick, poor or deprived. All citizens need to be addressed in a way that suits them best. Therefore, e-government services are delivered over various platforms – mobile, internet, and also traditional mail – and the front office may be a portal or a physical office where people can get help with the services they require. In the latter case German local authorities run service booths that accept requests and may even have representatives that provide these services on the doorstep for specific user groups.

e-Government services have helped reduce public spending for resource-intensive services, such as electronic filing and automated assessment of tax returns, job search facilities or application and delivery of official (e-) documents (e.g. passport) or (e-)certificates (e.g. birth, marriage). Savings are achieved in processing time of applications (productivity gains), space saving (replacing physical office space by virtual solutions), cheaper procurement prices[78] and reduction of administrative costs like printing and mailing of official notices.[79]

Real cost savings, and indeed real quality improvements have come from re-engineering the internal structures, resources and processes of government, not from simply moving services online.[80] Improving efficiency and providing seamless services across most government bodies has required the full integration of back office resources and processes. A one stop shop policy is delivered by separating the front office, which is designed to suit the needs of specific user groups (SME, elderly, unemployed), and the back office where the public good is produced. Back and front offices are linked through a platform – or mid office – that delivers secure communication and routing of requests.[81] Continuous feedback helps the front office to make the government truly responsive to user needs.

78 For example, the German BundOnline 2005 initiative showed that it will not take very long for investments in eGovernment to be amortized given that the investment costs of EUR 1.65 billion can be set against annual savings of EUR 400 million (Deutsche Bank, 2002)

79 Jansen, S.A. and Priddat, B.P. (2001) Electroinic Government. Neue Potentiale für einen modernen Staat. Stuttgart, Klett-Cotta, p.7.

80 eGovernment Workgroup of the Directors General, 2002, Value creation in eGovernment projects – an exploratory analysis conducted for the Danish Presidency of the eGovernment Workgroup of the Directors General, 2002, page 7.

81 eGovernment: The state of Affairs, Leitner, EIPA 2003

Chapter 7

ICT and Germany in 2015: Challenges, Concerns and Opportunities

This final chapter summarises the potential benefits described in previous chapters of a world that gives the individual more connectivity, freedom, influence and control, in part enabled by ICT.

It also describes the concerns such developments provoke: before setting out the key challenges that will have to be faced if Germany is to reap the benefits of the knowledge society, of which it is a wold leader in 2015, and avoid the dangers.

7.1 Vision and Benefits

In 2015, the potential benefits of the information age are generally acknowledged. As described in the previous chapters, there have been immense benefits to society across many areas: home, leisure, work, education, health, transport, government. Spanning these is a vision of society which has seen dramatic increases in flexibility in how and where people spend their time. This increased flexibility, combined with the new possibilities due to Germany's knowledge society of 2015, has led to equally significant shifts in the way people connect and relate: to their inner circle of family and friends; to more or less structured groups of colleagues, peers, enthusiasts or fellow supporters; to organizations including employers, hospitals, schools, government departments; and to the wider society as a whole, including the old and the disabled.

Flexible working, flexible living

Time spent working has been transformed. The most significant change has been the flexibility to work effectively anywhere and to interact more or less as if team members, customers and clients, employer and worker were meeting face to face. Actual proximity is still highly desirable, as are physical contact and shared experience. These remain essential for trust, comfort, familiarity and the sharing of random intelligence. ICT is complementary and increases people's options and reach. It is especially powerful in enabling functional contact, like work sessions, data sharing, cooperative work, etc. It does not replace traditional communication forms, though it might redistribute the amount of time spent face-to-face away from office colleagues and towards key clients, network partners and team members.

In particular however, more people are spending more time working from home than ever before. ICT unlocks the information and knowledge to empower individual workers and enable them to work together effectively from wherever they choose. Despite some mixed reactions to the resulting blurring of boundaries between private and work life – people in general prefer to keep their employers out of their homes, where they want to be in control themselves – for many people the choice is obvious: home.

In particular spending more time at home means greater flexibility to divide time between work and private life to better suit individual needs. The convenience that ICT brings to the home allows everyone to spend their private time more effectively and more intensely: communication is faster, technology has largely disappeared into the background or is extremely simple to operate, and daily chores are automated. The time saved has created more opportunities to play, go out, do sports, spend time with family and friends, explore nature or experience culture. Technology helps people be more individual but in a more

communal setting. For example, online entertainment is more interactive and inclusive. New generation games are made to be played together, and mobile and wireless devices mean that gamers no longer tend to lock themselves up in their rooms, but can take their game into the shared spaces of the house.

Connecting and Belonging

Greater technological connectivity and interactivity has created more flexibility in where and how people spend their time, which in turn allows them to take yet more powerful advantage of the opportunities that ICT offers to connect. People can communicate meaningfully with their broader family and friends, as if they were always present. The closeness that ICT can provide infuses society with a new sense of belonging and a new intensity of communication, and breaks down geographical distance to allow individuals to be "always together".

People belong to circles of family, friends and colleagues, but also circles of interests, hobbyists, gamers, etc. Circles widen and deepen, independent of location and time. Information previously only available to intimate friends and family can now be shared broadly with anonymous or virtual third parties. This ease of communication offers tremendous opportunities for stepping across boundaries, meeting new people, exploring different cultures, finding interesting work, literally having the world at your fingertips. ICT provides independence through endless knowledge produced anywhere in the world and shared across the globe, mostly for free. Each individual is at the centre of ever-widening circles of contacts, knowledge and engagement, deciding how much to be part of other peoples' worlds and how much to let them into his.

Including the excluded

ICT has brought new opportunities to groups of people who previously struggled to stay as connected and included as they wanted.

The elderly, who in 2015 make up an ever increasing percentage of the population, have been particularly affected. New ways of communicating allow them to be surrounded by family much more than before. ICT not only increases mobility through remote healthcare, it also allows people who are retired to stay in touch with the world around. Where traditionally at retirement people's networks and information flows were disrupted, now the elderly can remain fully informed and continue to contribute to society. The wealth of knowledge that the elderly possess can now be deployed more actively. In times of rapid change it is more important than ever to tap into the long-term memory and knowledge of society, particularly when it comes to government.

The disabled have also found that ICT has opened up many new opportunities for them. Better healthcare technologies have alleviated many actual disabilities – better prosthetics, improved hearing and seeing aids – but ICT has also made the disabilities in many circumstances less important or even irrelevant. It has become much easier for the disabled to get an education, find work, and make friends.

7.2 Concerns

If the promise of ICT is greater flexibility and opportunity, the reverse of the medal is equally simple: loss of control. There are many different aspects to this one overriding concern, and often they are mutually contradictory. These apprehensions are shared across generations and throughout the country.

Too little online privacy

Germans across the board are very anxious to defend their privacy, which all too many feel is disappearing at an alarming rate. Once data is in the public domain, it is generally perceived to be out of control: anyone can use it for analytical, commercial and sometimes criminal purposes. Cyberspace is perceived to be infested with malicious spammers and hackers who break into and damage information systems, getting access to data and private files.

As a result, Germans want a direct say in who collects and owns their data, and above all in how it is subsequently processed. They want control over who enters their social or professional circles. The problem they face is deciding to whom to entrust themselves for protection from these threats – institutions, the government and employers all inspire a degree of mistrust. Government and official agencies are seen as too ready to use national security as a justification to infringe on privacy. Workers fear that ICT gives employers greater power to monitor their performance and intervene in their work.

Loss of intimacy

Germans are communicating more with people at a distance than they did in the past, and through various media; face-to-face conversation seems to be losing ground as the predominant method of communication. Families are particularly wary of losing contact with their children and worry that the increasing physical disconnect of electronic communication erodes their ability to bring up their children with real closeness and warmth. They are also concerned that ICT – and typically new internet-based entertainment – keeps children from playing outside, developing their creativity, exploring culture and taking physical exercise.

Lack of reliability

At a basic level, there are concerns about about e simple mechanical robustness of information technology and the resulting potential for chaos. Virus attacks, software glitches and hardware failures all cause serious disruption to individuals and organisations. People are understandably hesitant to fully trust and depend on technology that may fail in critical moments and bring complex systems to a grinding halt.

The death of solitude

People crave intimacy and social contact, but at the same time they need some private space every now and then. The pervasiveness of connected devices that allow Germans to communicate continuously and to be reachable 24 hours a day is a source of pressure that individuals must learn to manage. Smart computing, knowledge management systems, filtering software, ambient intelligence and sophisticated search engines provide some support, but in the end people have to make their own decisions and determine their own boundaries. Many people dread this challenge and may be overwhelmed if they have not acquired the skills to manage their time and their communications effectively.

Too fast

Another concern associated with the way people communicate is the speed and the effect of peer-to-peer influence. The internet can be a very effective tool to mobilize large groups of people rapidly, sometimes for positive purposes but also to spread hoaxes, disruption, confusion and sometimes even hysteria. On internet time, communication is so fast it requires fast reactions, in business, in politics and in life. Time for reflection and critical think-

ing may be a luxury. People caught in this trap, say critics, become too concerned with short-term issues, no longer take sufficient time for each other and expect everything to be delivered just in time.

Too complicated

Even in 2005 there were signs of sharply divergent attitudes towards the continuing flow of new technologies – for instance the widespread longing for simple, usually country lives – manifest in the proliferation of lifestyle television shows and magazines devoted to gardening and home decoration. This trend has amplified. Life may have become more comfortable and convenient because of ICT, but not necessarily simpler. ICT solves some problems, but also introduces new levels of complexity. There are also the visible, physical problems of the invisible computer, even though every effort has been made to simplify the use of technology and make it as robust as possible.

Constant change

The unrelenting pressure of change, the constant need to perform, the continuous need to update skills to keep up with developments are very stressful for those who find it difficult to keep up the pace. But deciding to opt out, announce that "enough is enough" and draw a line under continuous improvement programmes in all aspects of one's life is not always a real option, since the degree of interconnection in the modern world and the peer pressures created by networks exert powerful pressures to conform and join in.

Too much information, too little learning

The importance of the PC, PDA and other connected devices has made people more dependent on such devices and the information that they can provide anywhere at anytime. People tend to spend less time on acquiring knowledge, as they have such easy access anyway, which is a trend that is also apparent in education. This development has been unwelcome to many, especially in Germany where learning – Bildung – is an important virtue. A large frame of intellectual reference, personally acquired and held in one's own memory, is argued to be the essential prerequisite for critical thinking and sound judgment. On the other hand it can equally be argued that many more people who do not possess such learning now have instant access to a vastly more comprehensive body of global information.

7.3 Challenges

Germany faces several major challenges in addressing these issues. First, it has to work hard in putting forward all the necessary changes and reforms to make Germany a global leader in the future knowledge society. However, it also require to build wider public trust in ICT and its uses; and bridging the digital divide to bring more of the benefits of ICT to more of the population.

Building trust

Trust, if it can be established, is an important enabler. People archive less in paper copy if they think the networks where their files are backed up are reliable. Once cyber crime flattens out at a level that people find acceptable, and security software is protecting individual computers effectively, electronic transactions and the wider use of e-services greatly increase. People are happy to forego some of their privacy when they see a direct benefit. For instance, by using loyalty cards people implicitly agree to tell retailers about their spending patterns. Insurers reward people for allowing them to monitor their driving behaviour by lowering the insurance premium. Security concerns can also shift perceptions about privacy, making the presence of CCTV cameras on city streets an acceptable intrusion into the private space.

Equally, lack of trust is formidable barrier to the deployment of ICT. A vital precondition to the development of online public services is free (and trusting) flow of data between government and citizens. But when citizens fear that their personal information might be used against them, they naturally try to keep as much as they can out of the factual record. If government officials do not have faith that they can keep at least some of their discussions private then they tend to hold more unminuted meetings and shred (or erase) more information they do hold. The convenience of e-voting has great potential to reinvigorate the democratic involvement of the electorate, but only if there is sufficient trust that every vote is authentic and secret. However lack of trust (particularly among the young) in the electoral authorities and the perception that e-voting is less transparent makes people wary of possible manipulation.

Building the trust to sustain a new digital reality with vastly increased transparency is a slow but steady process. It could still be seriously derailed if a data catastrophe happened or if large institutions like banks or, in particular, the government were seen to misuse private data. The leadership of the government and major institutions is vital, since it is their use of ICT that makes individuals particularly anxious. Some fear that employers use ICT not to support workers and increase their empowerment and freedom but to monitor their productivity and control them. But where new working methods have been introduced and the benign impact of the technology has been clearly demonstrated concerns have diminished.

Much obviously depends therefore on how institutions set, communicate and follow their privacy policies to demonstrate their sincerity on this issue. ICT itself can help develop more trust. Germans appreciate the increase in government transparency as an opportunity to interact with government officials and to monitor their activities. Now they are able to check how their interests are being served and to hold the authorities accountable.

Bridging the digital divide

In Germany solidarity and social cohesion are important values. Germans support ICT that provides opportunities for people who would otherwise be excluded. At the same time, they see that with increasing reliance on ICT there is a risk of a new kind of social exclusion. For instance in education, lifelong learning through e-learning tools is embraced as a way to give people a second chance and to keep the elderly actively involved in society. Nevertheless, people are concerned that a widening digital divide is leaving behind those without the right technological and communication skills. The same can be observed in healthcare, where the elderly in particular see many advantages in remote monitoring and diagnostics, but others fear that continuous health monitoring brings more stress and results in mental illnesses. They also believe that sufferers from a number of conditions (depression for example) could increasingly lose out, due to employers' or insurers' abilities to identify and reject affected applicants.

In 2015 the perspective for the digital divide – which is actually more a technology divide – is that it will endure and widen. Some level of inequality is unavoidable between regions, cities and rural areas, or between generations and social groups.

ICT itself is neither good nor bad: it is what we do with it that will shape the future of Germany. As with all change, there will be trade-offs. In order for Germany to collect the benefits of the knowledge society of 2015, challenges will have to be faced, and choices will have to be made. The choices Germany does not make explicitly for itselves will be made implicitly for it as events unfold. The potential benefits to German society if it can grasp the benefits of ICT are enormous; but unless the concerns of individuals and organizations are taken seriously, our progress towards an information society and economy will be slower and more painful than it need be.

Annex 1

Research Methodology

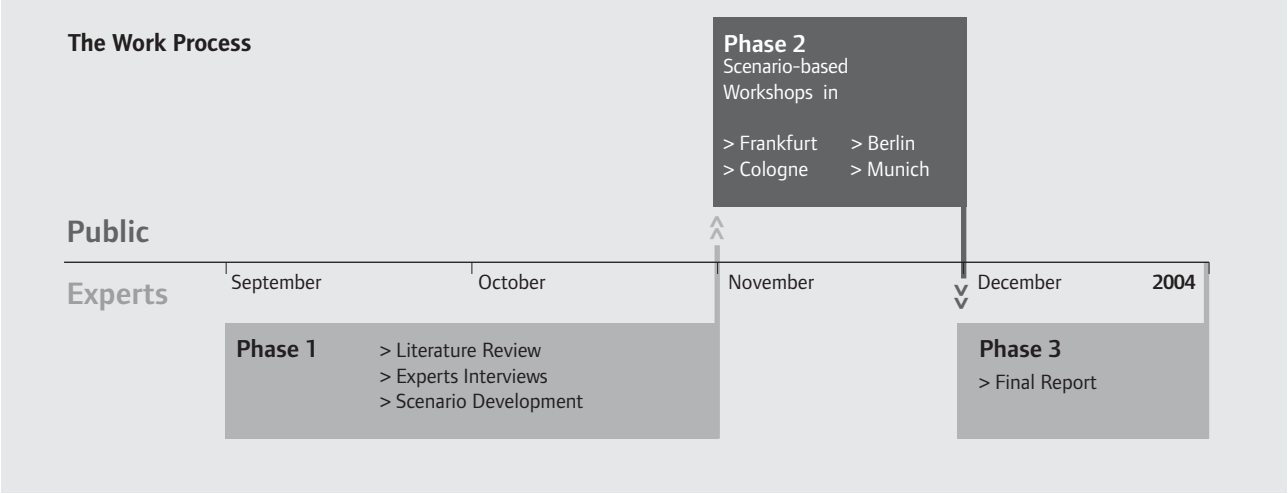
This study was conducted between September and December 2004. The objective was to identify the likely technological developments in the world of ICT over the next ten years and their impact on Germany. Within this project, there were four steps in sequence:

> A literature review of ICT development, and political, economic and cultural developments that might be affected by ICT development, especially in Germany; this section of the project was completed by Andreas Ligtvoet, Stijn Hoorens and Miriam Shergold.

> 52 semistructured interviews with experts around the world, in order to expand upon and fill in the results of the literature review; this activity was coordinated by Constantijn van Oranje, with the support of Edward Balkovitch, Tora Bikson, Somi Seung and Martin van den Mandele.

> The design and construction of two scenarios describing life in Germany in the year 2015, especially focused on possible consequences of ICT development; the scenarios were drafted by Robert Thomson, Andreas Ligtvoet and Stijn Hoorens with the support of James Paul Kahan and Miriam Shergold.

> Twelve workshops in Germany to explore public reactions to the scenarios. Of the twelve workshops, six presented one scenario and six presented the other scenario. Three workshops were held in each of four cities (Frankfurt, Cologne, Berlin, Munich); within each city a selected societal segment was recruited. Each of the three workshops within a city recruited from a different age range: 14-22, 25-45, and 52-65. The workshops were coordinated by James Paul Kahan with Silvia Anton, Lisa Klautzer and Miriam Shergold acting as workshop rapporteurs.



Source: RAND, 2004

The following paragraphs describe the methods used in each of these four steps.

Literature Review

The literature review had the following three objectives:

> to identify key trends, breakpoints and major developments in ICT technology by 2015

> to analyze the major socio-economic, cultural and organizational effects of ICT in 2015

> to determine how Germany as a country and society is expected to evolve over the next ten years.

It involved over 140 sources that included:

> fully peer-reviewed research articles selected according to 25 metasearch keywords

> technical reports from ICT-related research projects sponsored by international institutions and private organizations

> government-sponsored reports about the future implications of ICT for society

> articles and short reports from leading international weekly magazines and other periodicals.

In additional to standard guided web-based searches, the identification of the sources involved the extensive use of the following online literature databases:

> JSTOR
> FIRST Search
> Lexis-Nexis Academic Universe
> ACM/ IEEE Digital Library

JSTOR provides access to articles in over 600 journals in the fields of social science, humanities, economics and culture. These journals are selected according to number of institutional subscribers, citation analysis, recommendation from experts and length of the time that a specific journal has been published.

FIRSTSearch provides access to a large variety of full-text, full-image articles from both academic journals and technical magazines.

LexisNexis Academic Universe provides full-text access to government and non-government sources and comprehensive news, business and legal information.

ACM and IEEE Digital Libraries provide access to IC-Trelated articles, technical periodicals and conference proceedings and newsletters.

In the highly dynamic field of ICT, material can quite rapidly become out of date. In selecting the sources, the research team therefore decided to focus exclusively on fully refereed articles, technical publications, government and industry reports submitted after 2002, and in the case of articles from magazines or other periodicals, published after 2003. Still, earlier key publications were also considered.

The sources identified were then assessed by a dedicated team of RAND researchers with advanced expertise in ICT and its socio-economic and cultural implications. Particular attention was paid to identifying where there was consensus about the future direction of ICT and its socio-economic impacts, as well as disagreements and alternative points of view. The trends and developments identified were mapped onto the expected socio-economic developments of Germany over the next 10 years.

The full list of sources is available in the final bibliography.

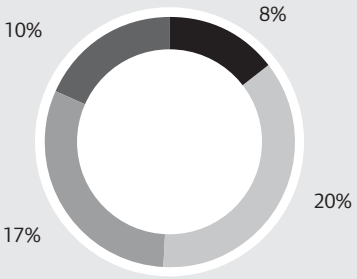
Expert Interviews

In order both to discuss the core findings of the literature review and gain deeper insights into the future of ICT, RAND carried out semi-structured interviews with 55 global experts from Germany and other European states, the United States, the People's Republic of China, Korea, Japan and India. These experts brought their experiences and ideas based on their involvement in industry, financial institutions and academia. Representatives of international government institutions such as the European Commission and the Organization for Economic Cooperation and Development (OECD) were also asked to express their opinions and ideas.

Each interview lasted about 60-90 minutes and was conducted either in person or by telephone. Since they were semi-structured, RAND had prepared a basic set of questions concerning the future ICT developments and their impact on family life, education, healthcare, education, work, public services and government. Upon completion of the interviews, the results were collated in order to identify common patterns and disagreements in the opinions of the experts.

The following list contains the list of experts, together with their professional titles and affiliation.
It is important to emphasize that each expert participated in a strictly personal capacity.

Professional Affiliations of Experts



- Independent Experts/Civil/Society
- Academia
- Industry
- Government/International Organisations

List of Experts

Aarts, Emile Head of New Media Systems & Applications, Philips Research, Netherlands

Angang, Hu Professor, Tsinghua University, China

Arnbak, Jens Chairman, OPTA, Netherlands

Berlage, Thomas Professor, Fraunhofer-Institut für Angewandte Informationstechnik FIT, Germany

Blaze, Matt Associate Professor of Computer and Information Science, University of Pennsylvania, United States

Blumenthal, Marjory Provost, Georgetown University, United States

Brownstein, Michael Director, Computer Science and Telecommunication Board, National Academy of Sciences, United States

Bruschi, Danilo Professor of Computer Science, University of Milan, Italy

Cattaneo, Gabriella Senior Consultant, Databank Consulting Milano, Italy

Cave, Martin Centre for Management Under Regulation, University of Warwick, United Kingdom

Choi, Hangsup Senior Researcher, Korea Information Society Development Institute, Korea

Choi, Joon-Young General Director Information and Communication Policy Bureau, Ministry of Information and Communicaton, Korea

Choi, Sanghong Senior Researcher, KT Convergence Research Center, Korea

Ding, Kuisong Vice Chairman, China Reform Forum, China

Dryden, John Deputy Director, Directorate Science, Technology and Industry, OECD, France

Dutta, Soumitra Dean Executive Programme, Faculty Director-lab@insead, INSEAD, France

Dyson, Esther Editor-at-Large, CNET Networks, United States

Farber, David Distinguished Career Professor in Computer Science, Carnegie Mellon University, United States

Gao, Hongbing President and Chief Executive Office, China Link Communications Group, China

Guo, Liang Professor, Chinese Academy of Social Sciences, China

Harwing, Rick Chief Executive Office, Philips Research, Netherlands

Hee-Jun, Park Project Manager-IT Society and Next Generation PC, Institute of Information Technology Assessment, Korea

Hellerstein, Joseph Professor, University of California, Berkeley, United States

Herbert, Andrew Managing Director, Microsoft Research Laboratory Cambridge, United Kingdom

Huang, Jen-Hsun CEO, NVIDIA, United States

Hustinx, Peter European Data Protection Supervisor, Belgium

Joo, Woo-sik Executive Director, Samsung Electronics, Korea

Jutland, Francis Independent consultant, Former scientific director FTR&D, France

Kang, HongRyul Director, Digital Future Research Division, Korea Information Society Development Institute, Korea

Kurihara, Jun Senior Fellow, John F. Kennedy School of Government, Harvard University, United States

Lee, Sam-yeol Researcher, Korea Information Society Development Institute, Korea

Lessig, Lawrence Professor of Law, Stanford University Law School, United States

Liang, Tao Department Head, China National Information Centre, China

Malone, Tom Professor Sloan School of Management, Massacchussets Institute of Technology (MIT), United States

Morrisett, Lloyd Former president, Markle Foundation, United States

Murase, Atsushi President and Chief Executive Office, DoCoMO Communications Laboratories Europe, Munich Germany

Nam, Minho Chief Executive Office of Dasan Networks Inc., Vice President of Korea Venture Business Association, President of INKE, DASAN Networks, Inc., Korea

Odlyzko, Andrew Digital Technology Centre, University of Minnesota, United States

Prinz, Wolfgang Professor, Fraunhofer-Institut für Angewandte Informationstechnik FIT, Germany

Sae-Young, Park Software Solution and Digital Content, Institute of Information Technology Assessment, Korea

Shim, Yongwoon Senior Manager, SK Telekom, Korea

Soete, Luc Director, Maastricht Economic Research Institute on Innovation and Technology, Netherlands

Soo-Ho, Maeng President, KT Management Research Center, Korea

Spafford, Eugene Professor, Centre for Education and Research in Information Assurance and Security, Purdue University, United States

Steels, Luc Director, Sony Computer Science Laboratory, France

Sung-shin, Kwak Chief Executive Officer, Woori Capital, Korea

Tae-Guen, Kim Project Manager-Home Network and Embedded Software, Institute of Information Technology Assessment, Korea

Timmers, Paul Head of Unit-E-Government, Directorate General Information Society, European Commission, Belgium

Tulbure, Ildiko Head of Youth Chapter Club of Rome, University of Clausthal/Club of Rome, Germany

van Binst, Paul Professor, Université Libre de Bruxelles, Belgium

Weidemann, Verena Head of ARD Office in Brussels, Vice-Chairman ICT committee of the German UNESCO Commission, Germany

Xue, Lan Professor, Tsinghia University, China

Zaba, Stephek Senior Researcher, Hewlett Packard Research Labs Bristol, United Kingdom

Zhang, Ping Professor, Beijing University of Posts and Telecommunications, China

Zhu, Youping Professor, China National Information Centre, China

Scenario Development and Workshops

Combining the findings of the literature review and the interviews, RAND prepared two scenarios describing the effect of ICT developments on Germany in 2015: "Life in a Glass World" and "Life Behind Digital Fences". These were the starting point for engaging members of the German public in workshops about the future of their country in light of the new ICT solutions.

Scenario Strategy

Scenarios should be considered as pictures of the future created to stimulate discussion. They do not claim to predict the future and often represent a discontinuity from current trends. To foster useful discussion they must be logical, internally consistent and plausible. They must be described in sufficient detail for individuals to be able to visualize them.

There are a number of conventional strategies for constructing scenarios, which RAND Corporation has considered for this project. The starting point is to decide whether to build one or two scenarios.

Trend Analysis: this strategy examines the past to ascertain how change has taken place and extrapolates the direction and degree of change into the future. This forecasting analysis produces a scenario of the future that assumes there will be no major surprises.

Trend-break Analysis: this is a variation of the previous strategy. The historical trends that might change in the future are brought explicitly into play. For each of these possible disruptions, a separate scenario is constructed. This strategy is typically employed for planning in situations where the consequences of forecasting inaccurately are large. The result is often a conservative risk mitigation plan to guard against departures from trends.

Seeking a Dream: In contrast to the previous two strategies, which begin with the past, this strategy begins with a desirable future and then uses the scenario to identify the steps that must be taken to achieve it. Often, a variation on "seeking a dream" is "averting a nightmare". Here, a "worst case scenario" is constructed, and the entire exercise concerns the steps that need to be taken in order to avoid this future.

Maximum expected value analysis: this is by nature a combination of trend-break analysis and the economic rational actor model. It designs a number of scenarios, assesses the likelihood of each, constructs measures of desirability for key characteristics of the scenarios, and plans to maximize the expected likelihood across scenarios.

Due to the specific nature of this study, RAND decided to employ Trend Analysis to identify how the ICT developments of the next ten years might affect Germany. The two scenarios relied heavily upon the technological literature and the findings from the expert interviews. Both scenarios, moreover, include essentially the same consensually-defined potential ICT environment.

RAND rejected the idea of the idea of creating one "dream scenario" and one "nightmare scenario" as indicated in the "seeking a dream" strategy. It was believed that this approach would have undermined the effectiveness of the workshops, as participant would have immediately rejected the negative scenario. It was decided, instead, to present participants with a "reasonable" scenario and an "uncomfortable" scenario, in order to assess their reaction. This approach allowed RAND to better explore societal and cultural trend breaks associated with the development of new ICT solutions.

Finally, RAND did not apply maximum expected value analysis since the objective of the study was to obtain qualitative reactions from different segments of German society, not quantitative data.

Scenario Design

In designing the two scenarios, RAND started by identifying exogenous technological, demographic and social factors that were to exogenous. These were, for example, the availability of seamless and wireless portable communication devices, open technical standards, as well as the decline in total fertility rates and continuous aging of the German population. Afterwards, RAND defined the relationships among these exogenous factors and speculated about potential policy leavers that German industry, government and civil society in order to make the scenarios more concrete and realistic for the participants. In undertaking these activities, RAND brought together also the information and data collected during the literature review and the interviews with global experts.

The core objective of the scenarios was to identify the major uncertainties in the future of ICT and its impact on German society. RAND identified these major dimensions of uncertainty in order to create the skeletons of the scenarios around the willingness of individuals to have their social circles (work, education, family, government, healthcare) open. The two skeletons were constructed and given the names "Life in a Glass World" and "Life Behind Digital Fences", describing situations where respectively information about individuals is freely available or under the control of the individual. The full text of the scenarios is available in this annex.

Scenario-based Workshops

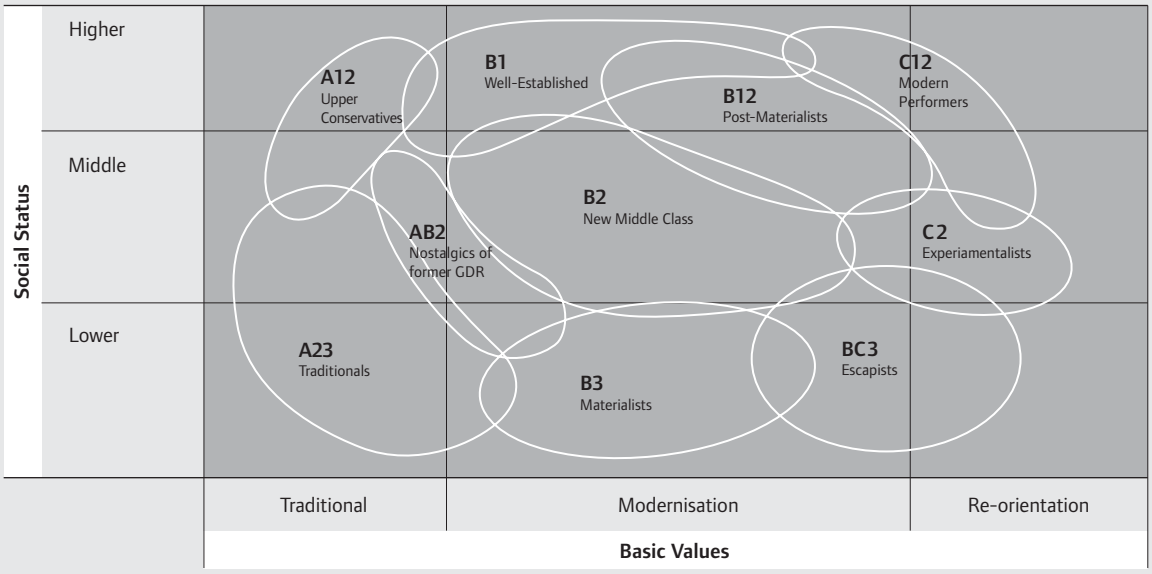
The scenarios were used as the starting point for discussions during workshops whose objective was to engage members of the German public in semi-realistic thinking and decision-making. The core philosophy behind these workshops was that, by (virtually) doing, it is possible to gain much deeper insights than those to be had just from the literature review or expert interviews.

For the present project, RAND organized 12 different groups. Each group consisted of 12 people (approximately equal numbers of men and women), who attended a three-hour discussion. Each workshop was based upon one of the two scenarios – participants were presented with only one of the two possible worlds. It was the duty of RAND to undertake an initial comparison of the reactions of members of the German public to the different worlds.

The participants were segmented along two dimensions

> "Sinus Milieu" socio-economic groupings
> Age

The Sinus-Milieus in Germany 2004



Source: Sinus Sociovision , 2004

For the socio-economic groupings, RAND engaged Socio-Vision, who originally devised the subdivision of German society into 10 different groups. A detailed description of Sociovision and the Sinus Milieu methodology is available at www.sociovision.com

For ease of recruiting, participants were recruited in each city from one or two Sinus Milieu groups. Thus, the New Middle Class ("urban middle") group was recruited from Frankfurt, the Experimentalist and Modern Performer groups in Cologne. In Berlin the participants came from the Materialistic Consumer groups while in Munich the groups involved people from the Established (Etabliert) group. Sociovision coordinated the recruitment through its network of local representatives.

Projecting participants into the future meant that age might be an important variable. Some people would reach adulthood in this future, others would be in their prime, and some would be reaching retirement. For this reason, RAND divided participants into three age groups:

> 14-22 years of age

> 25-45 years of age

> 55-62 years of age

One age group was recruited within each of the cities used. Thus, Sinus Milieu groupings were also subdivided by age. Finally, half of the groups were exposed to the scenario "Life in a Glass World" and half to the "Life Behind Digital Fences" scenario. Each city got one of the scenarios twice and the other scenario once. Each age group got two of one scenario and two of the other scenario.

The Table below summarizes the twelve groups:

City	Sinus Milieu	Age	Scenario
Frankfurt a. M.	New Middle Class	14–22	Digital Fences
Frankfurt a. M.	New Middle Class	25–45	Glass World
Frankfurt a. M.	New Middle Class	55–62	Glass World
Cologne	Experimentalists and Modern Performers	14–22	Glass World
Cologne	Experimentalists and Modern Performers	25–45	Digital Fences
Cologne	Experimentalists and Modern Performers	55–62	Digital Fences
Berlin	Materialistic	14–22	Glass World
Berlin	Materialistic	25–45	Digital Fences
Berlin	Materialistic	55–62	Glass World
Munich	Well-Established	14–22	Digital Fences
Munich	Well-Established	25–45	Glass World
Munich	Well-Established	55–62	Digital Fences

Each three-hour workshop session followed the same format. First, the moderator introduced the "rules of the game". Then the moderator introduced himself and the RAND rapporteurs and observers, plus any other individuals who might be present. Observers were just that – people who watched, but did not participate in the proceedings.

The participants then briefly introduced themselves, giving their first name, age, family status, occupation and hobbies. All of this took approximately 15 minutes. The RAND rapporteur then presented the scenario for the group, taking approximately 15 minutes. The group was offered the opportunity to ask questions, but this opportunity was rarely taken advantage of. At this point, the moderator proceeded to lead the discussion through three parts, as described in the below workshop protocol.

Between Part 1 and Part 2, there was a 15-minute break. In Parts 1 and 2, individuals were free to speak as they felt the urge, and the moderator encouraged general discussion. The topics were not covered in the same order; if the participants spontaneously brought a topic up, that was discussed on the spot. All of the topics were discussed, however. Part 3 occupied the last half hour of the workshop, and participants provided individual answers one at a time, which were recorded and coded for analysis.

For Part 1 and Part 2 of the discussion, rapporteurs noted a listing of the issues that were brought up and the extent to which there was a consensus or disagreement about each issue. If an issue was brought up by only one person and just lay there, we had little interest in it. If an issue was brought up and other people agreed, elaborated, or even just nodded their heads, then we noted that. If there was a debate, we recorded that it existed and whether it was restricted to just two people (less interesting) or others join in (more interesting). In other words, the notion of the group was dominant here.

For Part 3 (the four final questions), the moderators went around the table, and the response from everybody, even if that response was "I agree with Hans" or "I just don't know" or "I have nothing more to add" was noted.

Workshop Protocol

As anticipated in the previous section, RAND applied the following protocol during the workshops in order to collect the fears, ideas, and perceptions of the participants.

Part 1.
Reactions from the perspective of the individual:

A. What is life like?

> In the world in which you are living today (3 October 2015), what are the things you like about it?

> What are the things that you do not like about it?

> How do you believe your daily life is influenced by the communications technologies that are available to you?

> How trusting are you of people in your world?

> How much choice do you believe that you have to determine your own life?

> Do you have a permanent job, or do you switch from employer to employer? How does IT affect the way you do your job? How satisfying is your career?

> Are you depressed in this world? Is there more mental illness than there used to be, or less, or the same?

B. Family, home life and neighborhoods

> In this world of 3 October 2015, are you married? Do you live close to your relatives?

> Do you have children? If so, how are they cared for? What do you think about the ways in which technology allows parents to monitor their children?

> What type of village, town, or neighborhood do you live in?

> What sort of things do you do for leisure time and holidays?

> How do people divide home life and work life?

> What does it mean to be a German? To what extent are there differences among different parts of Germany?

Part 2. Reactions from the perspective of institutions by trying to focus on how ICT drives these institutions:

C. Education

> Primary and secondary education. Has technology been applied wisely in the education system? What do you think about the ways in which technology has affected dialogue between parents and teachers? What do you think about the ways in which technology has affected contact between teachers and students?

> University and vocational education. What does post-secondary education look like? Does everybody participate in one form or another of it? Who pays for it—students, parents, employers, government? Has the traditional "life at the university" changed?

> Education for adults. How much is "lifelong learning" a reality, and how much is it merely a slogan? How much education are you personally receiving today?

D. Social partnership

> Are the social partners still in business, or has this quietly vanished?

> What is the relationship between government and the private enterprise community?

> How much economic inequality is there?

E. Healthcare

> People are living longer, but are they healthier? What do you think about how your health status is monitored?

> Has solidarity survived, or is there now two-tier medicine, with richer people getting more care than the poor?

F. Government

> Is there transparency in government?

> Do people trust government? Is government managing the information society well?

> Is government delivering the services people want and in the ways people need them?

Part 3. Four general issues (go around the table for short answers):

1. Is life simple or complex?

2. How many people have “˝switched off“? Are you one of them?

3. Is there a digital divide? How wide is it? What are the markers of separation?

4. Is society in equilibrium? Can the current state of affairs go on the way it is, or are we heading for change soon?

Workshops Analysis

The analysis of the workshops was based on the notes of the RAND rapporteurs. The first step, therefore, was to code these twelve transcripts, one for each workshop, to identify the issues raised. An issue refers to a particular aspect of life in the future described in the scenario: for example, the availability of personal information, the need for lifelong learning or the or the quality of health, on which participants may express an opinion. There may be agreement or disagreement within each of the workshop groups on an issue. If an issue was raised by one participant and no other participants responded to it, or returned to it later in the discussion, it was not included in the analysis. A total of 39 issues were raised in at least two of the workshops. In the second step of the coding procedure, it was noted whether there was consensus or disagreement among the participants who took part in the same workshops. In the cases of agreement, these issues are referred to as consensus positions. Finally, the issues raised and consensus positions taken were compared across workshops.

Drafting of the Final Report

The final report brings together the findings of the literature review, expert interviews and scenario-based workshops. However, since this report presents a picture of German and ICT in 2015, RAND has made several assumptions concerning several technological and socio-economic developments that are at the basis of this picture.

Spectrum

The report assumes that in 2015 there will be sufficient spectrum to run the services that are described in the report. The technology already exists to do almost anything, but for the effective development and deployment of these technologies – especially video applications – more spectrum needs to be freed up. Regulation is the biggest impediment to this. The only technical impediment to the use of spectrum is that there is a lot of empty space which cannot be used. In Europe wireless technology is also kept back by spectrum issues. It has not managed to pursue the free or unlicensed spectrum policy that the US has adopted. Discussions are taking place between member states but are not currently heading towards initiatives that could lead to solutions. Some harmonization of spectrum deregulation at EU level will be needed.

In the meantime the very large open question remains whether governments will make unlicensed spectrum available. There are large amounts of (very high frequency) spectrum that are currently unlicensed and virtually unused. Some commentators believe that spectrum should be put into a pool as opposed to being sold to an organization which may then not use it. When spectrum becomes available and once technology (intelligent radio networks) is capable of doing more with the same spectrum, different models for cross-network roaming could "burst forth" quite quickly

Standards

The report assumes that by 2015 standards and protocols have emerged that allow sensors, RFID tags and other embedded software to communicate. For example, to enable a comprehensive and linked-up use of tags, it will be necessary to agree on a common RFID data format, and a common way of reading data.

For the full development of location-based services the EU-backed Galileo system needs to be up and running and most probably there will also need to be terrestrial sensory support systems to guarantee accuracy and continuity. As Galileo is expected to go live in 2008 and the drive from industry to develop such services is evident we expect the necessary infrastructure to be in place.

Storage Capacity

The report assumes that storage capacity will be more than sufficient for all the requirements of organizations and individuals. Storage is already a non-issue in 2005. It will seem infinite, given the increase in performance of compression technologies. We will be able to store our entire life in video images on one consumer electronics device in the next 10 years . Through its abundance, storage will become a commodity not only for organizations but also for individuals. The ability to extract value from accumulations of information will develop as "smarter and smarter" tools and techniques are developed for "searching, finding, data mining".

Data management will be a bigger problem. This includes issues like longevity of data and data retrieval which can be problematic as software changes and information gets lost in the sheer quantity of data. Masses of data may become irretrievable, though metadata systems and effective search engines could help address this problem. Smart computing will also play an important role, as intelligent software that recognizes user search patterns learns to retrieve data accordingly. Given these developments we assume that data management might still be an issue in 2015, but people will have the tools and skills to deal with it relatively well.

Bandwidth

The report assumes that bandwidth will not be a barrier to further broadband uptake. Of course there will always be applications that push against new limits. New compression techniques may solve some of the problems, but only stay ahead of demand by a few generations of Moore's Law. Moreover, there are fundamental limits to compression technology, and we are very close to these limits with text. There is more room with pictures and movies, but there have been no great advances. The real bottlenecks to the spread of broadband are the entrenched PTT models that are only just breaking down, and regulation). This is a political matter and therefore the pace of change is difficult to predict. Still, innovation is high on every political agenda and the availability of sufficient broadband is seen as a precondition. Therefore we expect this issue to be solved by 2015.

Home

The report assumes that a significant number of homes have an integrated IT infrastructure. This is likely to be installed in new and renovated homes. However it also requires a large number of households to switch to new technologies and adopt new ways of living with technology. The speed and volume of uptake will depend to a large extent on how and by whom the new hardware will be provided. The report assumes that that telecommunication companies telcos will play an important role as systems integrators, offering home "interfaces" as part of their telephony, broadband and digital TV offerings. For broad uptake – i.e. the demand for the hardware and the provided services – the added convenience and functionality must be evident, the cost must be low, the ease of use needs to be high, and installing, connecting and maintaining the equipment should be simple. Moreover the system should be absolutely safe. This probably also requires industry to develop standards and protocols to allow the many connected devices to communicate among themselves and with the users. Disruptive technology might also help to enable the transformation. People are glad to switch to MP3 and TVs with hard discs, in order to get rid of bulky audio and video devices, and space-consuming CDs and videotapes.

Family

Demographics are assumed to continue a more or less linear trend for the next 10 years. Even if the German government developed an aggressive fertility or birth stimulation program and a positive migration policy, this would not stop the decline in population. Firstly the effect is obviously not instantaneous; secondly the successful French policy shows that at best the increase in the rate of decline is stalled, but that the decline itself continues or at best stabilizes. Finally the numbers of migrants that would be needed to reverse the trend could not be absorbed by the German economy and society. Insufficient employment opportunities would probably lead to serious integration issues and social tensions.

Health

Patients are assumed to have an electronic patient record (EPR). This requires healthcare professionals to adjust the way they work and the way they administer patients' medical details, scans, and other diagnostic data. We assume therefore that by 2015 they have made the necessary adjustments and that the privacy and data protection concerns surrounding EPRs are dealt with. The medical profession is known to be a slow integrator of ICT and has many entrenched traditions that potentially obstruct new ways of work. The implementation of an EPR system in the UK is experiencing resistance from general practitioners and doctors, whereas many patients would be glad to have more control over their medical data (workshop results). We believe that the significant benefits to the patient – especially in an aging society – and to medical research will eventually force the introduction of EPRs in Germany and also in the rest of Europe.

The report assumes that the necessary back office diagnostics capability and administration for telemonitoring will develop through the current medical system and market forces. At first the additional preventive monitoring

function will fall on GPs and specialists, who might be overstretched. There is thus a likelihood of a shortage of qualified medical staff in the short to mid-term. As the benefits of prevention are so high, new players, and probably even automated diagnostics will enter the field. Potentially staff from underused hospitals can be re-trained to fill this gap, with the support of diagnostics software.

The report assumes that the health insurance system evolves accordingly. The business case for prevention versus cure and home care versus hospitalization is not yet clear. However, the benefits for the patients and the hospitals are, and they will demand the availability of such services. This demand will ensure that insurers continue to be interested. With increased health concerns people are expected to be willing to pay more for care.

Work

The assumption here is that companies, driven by the economic benefits of more decentralized work – especially in knowledge-based activities – will adjust their office environment to have more shared workspaces, meeting rooms and digital wall displays. The required flexibility needs to be supported by changes in existing social security and labour regulations. With a changing economic climate, where the move from manufacturing to even more value added services continues and where global competition is pressing hard on policy makers to stimulate more innovation, it is likely that they will be supportive of regulatory change.

Education

The report assumes that, within the time frame of the study the German system of higher education will change to deliver elite universities and specialized academic and higher education institutions. The writers are aware of the usual viscosity of educational systems and institutions and their resistance to change. Nevertheless the political drive in that direction is strong, even though the proposed subsidy scheme is not expected to deliver the fundamental changes required. Currently it is envisaged that Germany will have 10 elite universities. This number is probably too high and it also disregards the possibility of specialized elite universities developing. But change is in the offing and global competition as well as students' demand for quality, flexibility and practical experience will drive towards these changes.

It is also assumed that like-minded universities will set up a credit acknowledgement scheme to allow students to gain credits at other schools. This is already happening in hotel schools and in Europe through the Erasmus and Socrates programs and it should be possible to overcome organizational and bureaucratic barriers.

Government

The report assumes that within the next 10 years government will deliver on the promises made in the last 10 years – in the context of e-Europe and other schemes to drive e-government – and which are often speculated about in academic literature. However, there remains a risk when it comes to actively integrating ICT in the democratic process that the technological potential might still not be fully achieved. Old services and processes have been brought online to comply with European guidelines without seriously rethinking them in the light of new possibilities. The government wants to be responsive but inertia and entrenched legacy systems impact the development of e-government. To be efficient e-government should align with organizational, cultural and structural change, for which political leadership and continued pressure is essential.

Annex 2

The Scenarios

RAND has developed two scenarios to engage members of the German public in workshops about the future of their country in light of the new ICT solutions.

The scenarios were:

> Life in a Glass World

> Life Behind Digital Fences

The scenarios were drafted by Robert Thomson, Andreas Ligtvoet and Stijn Hoorens, with the support of James Paul Kahan, Miriam Shergold, Martin van de Mandele, Constantin van Oranje and Lorenzo Valeri.

Life in a Glass World

Germany is once again a world leader in high technology sectors. Grand German icons such as Mercedes, Opel, BMW and Siemens have moved their production activities to the Far East, but have retained their innovative design and managerial functions in Germany. Continued global competition and technological advancement, particularly the pervasiveness of integrated information and communication technology (ICT) solutions, have caused a gradual shift from manufacturing to high-end, value-added services in the German economy. In combination with its strong expertise in material design and engineering, the country has been able to build a European stronghold for innovation and growth. Germany, in particular, has been able to benefit from the European Union initiatives for rapidly enhancing its competitive basis as part of the 2000 Lisbon and 2010 Vienna Action Plans.

Therefore, it is not surprising that the German market for information technology (IT) services and related jobs is flourishing. German workers with up-to-date IT skills have little difficulty finding highly paid and interesting jobs. Meanwhile, workers with limited IT skills are experiencing difficulties in the job market. Their wages are low and some are unemployed for long periods. As the German population grows older, the economy is making more use of the experience of older workers. The German government has recently extended retirement age from 70 to 72 years. People who provide services requiring manual work, however, are usually unable to continue working beyond their sixties. A small minority have benefited from some employment initiatives from the federal government through retraining with some basic new IT skills. In addition, as is being done in other European states, the German government is selectively using immigration policy to fill the gaps in the labour market. Only those foreign workers with the right technical skills are allowed to enter the country.

Large investments in education and research and development have put Germany at the core of the global knowledge economy. These investments were led by the federal government, in close cooperation with businesses and leading German research centres, through the Deutschland Technology Programme launched in 2008. Education budgets have been increased and intense competition has been introduced at all levels of the education system. Universities, in particular, have become more independent and responsive. Therefore, they are financing a significant part of their budgets from research and specialised executive courses. These activities appear to be paying off. After a decade of scoring poorly in international comparisons, such as the 2006 Programme for International Student Assessment (PISA) study, Germany has been rising to the top of the league tables.

In universities, an Anglo-Saxon education system has been adopted by most European countries, bringing with it more flexibility and competition among academic institutions. There are now sharper differences among German universities. Several of them are now called “élite” and both compete and cooperate with similar outstanding institutions in other European countries. These schools focus on establishing their reputation in Germany and abroad by fostering their brand. Some of them, such the Advanced Technical University of Darmstadt, has attracted 10 top professors in software development and advanced wireless services. In addition, they have established direct cooperation and sharing agreements with global institutions such as the University of Michigan and Massachusetts Institute of Technology (MIT) in the United States, and Cambridge University in the United Kingdom.

These élite German academic institutions prepare some of the best technicians and engineers in the world. Their skills are in high demand and are also rapidly changing the way in which the public sector and companies work and organise themselves. Work processes are more efficient and effective, with IT allowing workers to be more productive as well as manage their increasing complex personal lives.

Family and Social Life

The structure of Germany's families has changed. Households with two parents and several children are no longer the dominant family form. A growing number of children, moreover, are born outside stable relationships. Women are having fewer children on average, and are postponing their first pregnancy to later in life. In general, Germans are spending longer periods of time single before pairing up with their life-partners. Moreover, a large proportion of the population consists of people over 65, living sometimes at some distance from their children.

New technologies facilitate easy regular communication among family members and friends even when they are distant, thanks to "always on" wireless mobile devices with advanced screens. For example, children of divorced parents are better able to maintain contact with parents who may no longer live with them. In addition to physical proximity, developing and maintaining a close and even intimate relationship can also involve virtual communication and interactions. Frequently, new friendships originate primarily through online interactions with other individuals who share similar ideas and interests. Moreover, according to Cosmopolitan and Vogue, 70% of Germans originally found their partner online. Virtual reality gadgets that allow distant communication between loved ones who live apart are very popular. For example, there are pairs of rings that glow when one of them is rubbed anywhere in Europe. Meanwhile, Lovethinking, a German spin-off of a large Chinese IT development company, has released a brain cap, a helmet that uses brainwave measurement technology. Lovethinking claims that when this is hooked up to internet connections, pairs of brain cap wearers can feel what the other is feeling.

Family life is also assisted by the new IT solutions and services. All family members have access to video-based instant messaging services on their mobile handsets so that, for example, children can stay in touch with their elderly parents. Leading German companies such as Agendasyncro and Zeitfuhrung have developed advanced IT platforms that allow families to automate the organisation of their family agenda and commitments, as well as travel arrangements and financial commitments. Communication devices for children are particularly popular. From an early age, most children wear Galileo-GPS-based arm implants provided by Kinderwireless so that parents can use their own mobile and wireless devices to know where their children are. Moreover, removing these arm implants is also becoming a ritual to celebrate the initial steps towards independence.

New IT solutions are also making it possible for busy parents to maintain interaction with and provide for their children, even when they are not together. Smart kitchens help children to get pre-selected healthy dinners from storage at the right time of day. They also make it simple to put the food in cookers that automatically prepare them at the right temperature. Using their personal digital assistant (PDA) to connect to a flat display screen at home with their children, parents can help with homework or at mealtimes if needed, and generally can maintain comfortable contact

People are working long hours, especially those IT professionals whose skills are in high demand. They can always access their office data wherever they are, thanks to significant improvements in distributed data storage solutions developed by Germany's SAP. Some people prefer to work late in the evening, in order to free up more time during the day. Employers are only concerned with employees' performance. They use cooperative software which allows groupwork and continuous monitoring of the state of play of any project or work activity and, at the same, provides information on every team member's individual inputs. It is normal for employees to share their personal timetable with their employers by integrating their professional and personal diaries. Thanks to the flexibility provided by employers, individuals are better able to organise their individual personal lives. This gives them time for recreation and to meet friends online.

Online games, in particular, are becoming an important activity through which people socialise with each other. In response to the demand for this form of entertainment, German media conglomerates have teamed up with Indian software developers and Chinese data storage companies to create the most advanced online and wireless games in the world. New and innovative role-playing games have been developed, where players are placed in different historical or futuristic settings, allowing them to escape from their daily worries. Even when families are not physically together, these games are still extremely effective. Familyfun, a spin-off company of Bertelsmann and Sony, has become the world leader in this market with its ZP game, involving webcams equipped with gesture recognition technology. Players are projected into a virtual reality, such as an old castle, where they can play virtual hide and seek.

High work pressure means that in general, people have little time for household tasks or to care for elderly family members. ICT or private services that take over these tasks are popular. A substantial number of people are also employed in companies that provide such services. Mid- to high-range home appliances have embedded processors and sensors which enable them to communicate with each other and the outside world. Meanwhile, following an alliance with the supermarket chain Extra, Bosch refrigerators automatically order all family groceries. These refrigerators automatically set the delivery time, since Extra computers have access to individual schedules saved on always-on wireless personal organisers.

These personal organisers are handsets used for mobile communication and access to a large variety of services. When people leave the home, these handsets allow service providers to identify the location of the person and offer relevant services, including travel services and directions to nearby shops. Leading handset developer Microsoft offers expensive organisers with agent-based software. Such agents represent the user in making simple decisions in communication with other appliances or people. For example, the agents automatically schedule appointments, make small transactions and sort out information and data according to personal needs and taste. It is very uncommon for people to switch off their handsets. This means that they can always be reached and can always reach others.

School and Education

Access to the right professional skills is essential for success in the global knowledge society. In order to preserve Germany's economic competitiveness, the federal government continues to make large investments in the entire education system. Particular attention is directed to a new kind of Hochschule, which develops around the core capabilities of the universities and schools that are viewed as "élite". The government's motto for its education policy is: "You can never stop learning!" Particular attention is given to the use of advanced IT developed by German companies that make learning easier and more accessible. Lifelong learning, therefore, is now accepted as the necessary and desirable goal of education.

Competition has been used to stimulate excellence. Throughout their educational careers, pupils and students receive the latest statistics about their performance and relative ranking. From an early age onward, children are able to develop their own learning profiles and curricula. These provide overviews of their capabilities, the skills they have mastered and the depth of their knowledge. Based on their profiles, people identify the specific topics in which they wish to excel, and for which they download teaching modules. Electronic aid is available for subjects in which they perform poorly.

Because education is recognised as essential for career prospects, parents regularly check up on classes to see whether their children are performing well and whether they are fulfilling their intellectual potential. In addition to visiting the classroom via webcams, parents have lively electronic debates with teachers on class activities and their children's development through their wireless digital assistants. Discussions with parents take up large amounts of teachers' time, and their primary role has become to respond to the needs and desires of students and parents. Parents demand that teachers keep daily weblogs describing the academic performance of their students. Teachers are also expected to respond regularly to instant messages from children. Fortunately, electronic teaching programmes that allow children to work relatively independently compensate for this. EduTech, a Korean company, dominates the German market for electronic teaching programmes. Through its servers in Seoul, it has developed agents and universal translation software that help children to collect information automatically. Teachers are seen as coaches who try to push their pupils to excel. Their main function is not to teach facts (as the pupils are taught to be proactive in electronic fact-finding) but to help children develop proactive skills in finding and evaluating information and learning independently.

When students reach secondary education, they are aware that their performance is being closely monitored, and not only by their teachers and parents. Employers are actively involved in monitoring students since they want to identify and recruit those with the most promising skills. Students who cope easily with the standard material are invited to take part in short internships or receive real-life questions from companies. Generally speaking, these opportunities are welcomed and competition for them is fierce. Competition between high schools is also strong, as business involvement in secondary education means more financial resources that allow better facilities for students.

As people progress through the education system, they are expected to take total control of their curricula and "learning career". More importantly, they constantly compare themselves with other students as they look to develop skills to enhance their competitive advantage. Flexibility, therefore, is a central element of modern tertiary education: to a large degree, students have the freedom to mould their education to their interests and professional achievements, although the demands of future employers play a significant role. Distance lectures are available at reasonable fees and there is a close interaction between students and teacher-coaches based on continuous testing and evaluation. Lifelike simulations in virtual worlds are a practical part of the curriculum.

Work

A large proportion of the German workforce is employed in the service sector, or directly involved through individual consultancy contracts. Important service sectors include entertainment, travel, banking and finance, translation, organisation and "information finding". The increased use of communication technologies, mainly video conferencing, has enabled many knowledge workers to work from home while being in constant contact with colleagues and available for work ethics scrutiny. Text-writers, bookkeepers, telephonists and non-laboratory researchers are asked to work from home, allowing companies to save on office space. Their company's IT infrastructure is directly integrated into their home, eliminating any difference between home and work.

Technology has not replaced human work, but it has shifted human work so that it now focuses much more on person-to-person contact, also called the "front desk". Repetitive jobs in "the archives" are totally automated, thanks to advanced data storage solutions developed by SAP. More so than at the end of the previous century, organisations have split up into functional units that perform fee-based work.

Employees' performance is constantly measured and appraised. Employees receive measurable targets and are evaluated, rewarded or fired according to their ability to reach those targets. In this competitive environment, employees generally work hard and the successful ones receive proper compensation for their hard work. Most employers have detailed information on the people they hire. Job applicants' profiles are carefully selected by specialised professional headhunting agencies. These agencies specialise in different sectors of the labour market: for example, school leavers, young professionals or experienced professionals. All applicants share their CVs with the job agencies that specialise in their area so that employers have access to large databases from which they can select promising candidates.

Training in "information finding and trustworthiness analysis" techniques is valued highly in the job market. With the increasing amount of untrustworthy information on the internet, such techniques have become a compulsory part of the curriculum in secondary schools. For those already in the labour market, there is a "certified information analyst" diploma that boosts people's value highly on the job market. Language skills have lost some of their value as highly sophisticated translation software is available.

Jobseekers who have the means to constantly share information with prospective employers tend to receive more attractive conditions. More importantly, it is evident that jobseekers who submit psychological and medical profiles to their employers receive substantially higher benefits than those who refuse to do so.

Health and Healthcare

Huge steps forward have been made in healthcare in recent years. There is now much more emphasis on the prevention of diseases than was previously the case. Part of the government's efficiency programme was the Regional Health Database (Länder Gesundheits Datenbank) Act. A central agency now collects data on citizens' heart rates, blood sugar levels, cholesterol, body fat ratios and other health indicators every quarter. This regular measurement is a general requirement for health insurance and 99% of Germans have complied with the measure. People with high health risks, such as those with a history of heart failure, wear unobtrusive sensors implanted under their skin that constantly monitor health and send this information to a health control organisation. More importantly, this massive data collection has provided health researchers with valuable information. They have already used this information to find statistical evidence on the health effects of high-risk lifestyles.

To facilitate cooperation and coordination between healthcare institutions, an electronic medical dossier has been implemented throughout the whole country, bringing together data collected at regional level. This has significantly decreased the number of medical errors and has led to a more transparent health care system – doctors can access the files wirelessly on their PDA. The effects of different medical treatments are monitored constantly and measured better than ever before, and the performance of individual clinics can be compared with each other. Private healthcare providers from the United States and Japan have seen the potential financial returns of these developments. They have invested heavily in Germany and other European countries, although their IT infrastructures have all been outsourced to Healthdata and ClinicIT, the two India-based global leaders in healthcare solutions, including the management of personal health data.

Preventive medicine is at the core of Germany's approach to health care. People are now receiving daily health tips, exercise programmes and diet suggestions via their mobile handsets, based on information in their medical dossiers. This service was set up jointly by the Federal Ministry of Health and private healthcare providers to mitigate the effects of "welfare diseases". As an added incentive, health insurers regularly remind people that unhealthy lifestyles lead automatically to high percentage increases in their premium.

Genetic research continues to provide new possibilities, thanks to the technical successes of companies based in the Biotechnology Campuses of Berlin. It is now common for people to undergo three-minute tests that evaluate the likelihood of a person developing any one of a range of diseases. Moreover, everybody is invited to have a DNA test so that personalised medication can become available. Rather than giving patients a standard drug for their ailments, doctors prescribe mass-personalised drugs, so that only highly effective specific medication is given. By combining the results of the quarterly health check and the medication given, the effectiveness of a specific treatment can be measured, which leads to improvements. Non-personalised drugs are also being improved. A very popular and effective medicine is the preventive geron-pill that limits the chances of heart failure, blood clotting and Alzheimer's disease for people aged 55+.

Government and Democracy

Government has finally become citizen-orientated. For services delivered by governments at all levels, whether local, regional or national, citizens can go to one central electronic service desk. All citizens have a pan-European identity card with iris-based biometrical identifiers. Government services have been standardised centrally, resulting in a coordinated approach to the management of public services provided by the different Länder. Moreover, the federal government is now better able to spot fraudulent activities by individual citizens.

Under the motto "We know that you need to do it! We help you do it quickly and efficiently!", tax authorities now proactively fill out tax forms that are sent electronically to citizens for their approval. Automated requests for social benefits, such as housing subsidies, are linked directly to this tax information. This ensures that citizens are helped efficiently and effectively. To facilitate interaction with government, all citizens receive a governmental email address that can be read from any internet connection. In order to speed up the integration process for foreigners, government information is only in German and English. If people need language support, they are expected to hire this in the market.

Due to the increasing pressure on the working population, fewer people between their twenties and fifties are willing to participate in politics and elections, even if they have access to a lot of information and data to make informed decisions. Moreover, senior citizens are highly represented in the Bundestag and their approaches and perspectives have a direct impact on the discussed issued. The role of the Bundestag and the regional assemblies has declined gradually as direct consultation takes place more often. Politicians are expected to be constantly open about all their initiatives. All political representatives are requested to have weblogs on which they inform citizens about their daily activities. Many also have frequent instant messaging sessions to interact directly with citizens. Politicians have to be careful in this environment, since inconsistencies or irregularities in their actions or arguments are soon spotted. Electronic voting is an acceptable way of casting votes, be it to select representational bodies or for local, regional and national referenda.

Life Behind Digital Fences

Germany has managed to maintain its distinct socio-economic and cultural characteristics in a rapidly changing world that is strongly influenced by new information technologies, globalisation and demographic trends. Some reforms to the welfare system have been necessary, but Germans can still be proud that they live in a country where young people have equal access to educational opportunities and where the weakest members of society are looked after.

Competition for jobs in specific industries is intense in all sectors. The German economy is becoming ever more dominated by the service sector. Grand industrial icons such as Mercedes, BMW and Siemens have shifted much of their remaining production facilities to other countries where labour costs are cheaper. However, high value-added engineering and design functions have been kept in Germany.

Germany's strong performance in information technology (IT) has provided just enough wealth to finance the country's relatively generous welfare state. Elements of the welfare state have been continuously adjusted, but by and large the system remains unchanged. Pressure on Germany's welfare state, however, is growing. With the continued ageing of the population, there are calls for the retirement age to be extended even further from the current 70 to 72 years of age.

It was thought that IT would bring more openness and transparency in society. However, Germans have not welcomed this development completely. They still like to have their own network or family and friends, protected from outside interference. Essentially, they want to create a digital village. New IT technological solutions have allowed them to achieve this by facilitating the creation of "virtual fences". These fences limit who has access to personal information and the extent to which other individuals or government and private organisations can intrude into their lives. It is generally considered a basic civil right that people should be able to choose who should have what information about them, even if there is an economic cost to having this choice.

A host of small firms – SecuriBox, DigiNotar, DatenPrivat – have sprung up, which offer technologies to control and track what information is divulged to whom. Personal data is given a "security level" and, depending on the profile of the receiving party, an autonomous agent can make decisions on sharing personal information. In case of doubt, no information is shared and the process has to be finalised manually.

Family and Social Life

Households with two parents and multiple children are not as dominant a structure as once was the case. Women are having fewer children on average, and are postponing first pregnancy to later in life. People are also spending longer periods of time as singles before pairing up with their first life partners. A large proportion of the population consists of people over 65 years of age. All of this combines to create considerable variation in how households are composed; in particular, there is an increase in households with one or two adults and no or one child. Good quality public services help people – in particular single parents, people on low incomes and jobseekers – to have a reasonable quality of life. In addition to health care, education and childcare, public services also include access to super-fast broadband. This allows people to participate in the information society, no matter what their economic circumstances. Better-off households are required to pay more of the costs of health care, education, childcare and information access themselves.

The house is a central base in people's lives and technologies have been developed to bring optimal comfort and entertainment to the home. When people come home from work in the evening, they want to spend their leisure time in a secure and relaxed environment. Those people working at home (a larger number than 20 years ago) stop working every day in time to enjoy life. In fact, many professionals adjust their personal digital assistant (PDA) handsets to block work-related communications in the evenings. For most people, this is not necessary, since they are only contacted for work-related matters between 8am and 6pm.

New technologies make staying at home for both fun and work very attractive. It also allows people to protect their circle of friends from unnecessary digital intrusions. A large flatscreen display that can extend to the size of a full wall, accompanied by full surround sound, has a central position in many middle-income households. This makes watching a movie or concert an intense experience. A huge range of movies is available on demand thanks to new integrated online entertainment systems produced by Digisperience, a start-up based in Mainz. These allow for automatic access to music, videos, games and photos stored over the internet directly from the sofa through voice-recognition systems. ETIntegrated, a spin-off of Munich-based chipmaker Infineon, has created wireless jukebox systems that automatically synchronise personal music and video taste with online sites. This allows people to access only the information and entertainment that match their taste while excluding unwanted material.

Families still like to gather with friends and family to enjoy entertainment together in a controlled IT environment. Participatory game shows are popular forms of entertainment. A popular show is the Familie Zusammer, where people play against family members and friends and are insulted by the absurd and hilarious virtual hostess. Games are becoming ever more advanced and fun. Children organise their party music together by connecting turntables and mixers to each other's wireless devices, making sure that only specific tunes are played. Moreover, gesture recognition technologies and virtual reality allow people to play tennis or football in their living rooms – the "Mark Cicic Virtual Match", a game developed following the success of the first German tennis player of Turkish origin at Wimbledon, sold 12 million licences last year. In some cases, families may want to virtually include some external players, provided that they can check their identity and credentials in advance.

Although video communication is an important part of interaction in the workplace, people often see it as too cold and antisocial for having fun. People enjoy proximity. Other real world activities, such as dinners, days out and sports are common. Intelligent agents help people with busy lives to arrange times with friends and family members. Leading German companies such as Agendasyncro and Zeit-MNGR have developed advanced IT platforms through which the family's agenda and commitments can be organised automatically, as well as travel arrangements and financial commitments.

A reluctance to share too much information is thought to be behind the slow penetration and use of some technologies in the home. Video conferencing and mobile devices with screens have existed for quite some time now, and are used widely in the business sector. Most people limit their private use of these services to very close friends and family members. Location-based services are

another example. Many teenagers use location-based services that reveal their location to a limited number of friends. Agent-based software then identifies friends who are nearby and feel like meeting at the nearest EduschOnline coffee shop. Some parents feel uncomfortable that their children's location can be identified by others. Kinderwireless, a Darmstadt-based company specialising in advanced IT solutions, has had great success in selling anonymisers which are specifically targeted to this group.

Because people are so concerned with privacy, there is only limited information on the behaviour and spending patterns of German households. Spammers and marketing companies have been sued for the abuse and illegal acquisition of such information. As a result of the difficulty of obtaining reliable information for marketing purposes, some companies have began to offer generous benefits to people who are willing to sign contracts and share information on various aspects of their life, for example, shopping or internet surfing behaviour. Households on low incomes are particularly responsive to such offers, but it is the middle- and high-income households that marketers would ideally like to target.

School and Education

Information technologies are used extensively in education at all levels, from primary schools to advanced university courses. Throughout their lives, people build up a knowledge log containing all the information they have received. This massive repository of information is usually stored at home or at a secure internet location. People access this resource through their PDA handsets. When they look up the information in their knowledge log, e.g. what they learned about the solar system in third grade, the system provides them with links to other information in later stages of education as well as additional new reading. This highly successful software application was developed by the Federal Ministry of Education and Research as an open source program.

Technology has not made teachers any less essential. The development of positive attitudes towards learning and the ability to search for and organise information are considered to be more important than memorising facts. Skills that are relevant today may become obsolete in a few years' time. It is therefore essential that education provides people with the attitudes and skills they need to acquire new skills in the course of their working lives. Teachers are particularly important when it comes to developing skills that will equip people for lifelong learning.

The classroom, managed and controlled by a teacher, continues to be the centre of learning in primary and secondary schools. Teachers' authority is ensured by their control of all communication to and from the classroom. Schulblock.de provides a specialised firewall that curbs unauthorised communication to, from and within the classroom. Internet access is restricted in the classroom so that pupils focus on what they should be learning.

Public schools are prohibited from applying technologies that allow parents to monitor what goes on in the classroom. As a result, parents' role in their children's education has not increased. A few private primary schools do allow parents to observe their children's classrooms through secure internet video connections. These experiments have been criticised for introducing a culture of surveillance.

Strong privacy controls restrict the distribution of information, including information on the performance of pupils, at all levels of education. Parents have access to their children's results, but often find it difficult to identify how well their children are doing compared to their peers. Trusted third parties, such as Korea-based EduScore, have emerged that allow children and their parents to compare school results anonymously with similar pupils from the region, the country or even the world. Similarly, in university, students often find it impossible to measure their performance compared to others. Moreover, many employers would like to have access to information on students' educational performance in a standard format. This is particularly important due to the large variety of university courses that employers find difficult to assess and categorise.

Whatever industry they work in, employees realise that they must update their skills throughout their working lives. People need to stay informed of educational opportunities relating to their jobs. Depending on the skills that need to be acquired, courses range from online courses that can be followed in the evenings, to residential courses. Labour market experts project that the average worker will need to refresh his or her skills once every three to five years. A question that is currently the focus of debate is who should pay for this. Some companies pay for their workers to receive work-related education. Other companies offer such opportunities to a selection of their employees. The Federal Ministry of Education and Technology is currently drawing up plans for a lifelong learning scheme. This will allow people to borrow money to cover the costs of their continued professional training.

Work

New technologies are allowing knowledge workers to do more in less time. Labour market researchers say that employers' expectations have increased as a result. Communication amongst co-workers has become much more efficient in recent years, using convenient and secure technologies. Sophisticated access controls are in place to make sure that only authorised personnel are on the system, also limiting their access on a strict need-to-know basis. Workers usually have to authenticate their identity using a retina scan when logging on. In the typical company, strict security access controls mean that only a limited number of senior managers can monitor employees' activities under strict protocols and rules for the use of data. German organisations remain fairly hierarchical. Developments in IT technologies do not seem to have broken down hierarchies and have introduced more employee empowerment.

Most of the communication among teams of co-workers takes place electronically by email or video conferencing on company intranets. Even when workers are located in the same building, it is usually considered most efficient to send a message or to have a quick chat over the intranet video conference system. Nevertheless, face-to-face meetings have not disappeared as they are seen as pivotal for building trust among individuals. Some people say that less face-to-face communication is taking away the social experience of work and the uniqueness of different organisations.

New technologies have made office life more efficient. Electronic paper is commonly used, which has eliminated the need for paper files. Voice recognition and translation technologies have eliminated the need for some secretarial tasks. For example, a businessperson can now dictate a letter in German which, if it is reasonably straightforward, can automatically be translated into Polish. The technology for enabling this comes from India.

Working practices, organisations and the economy as a whole have not been transformed as much as some people supposed they would be 10 or 15 years ago. For most people, work still takes place at a physical location during a set time period. A relatively small group of knowledge workers can work from any location at any time. Employers say that if more workers want this type of flexibility, they will need to accept that their work-related activities at home or elsewhere are monitored. However, many people value the separation between work and home life. At home, they can enjoy entertainment and easily communicate with family and friends. For them, work in the home would be an unwelcome intrusion.

Healthcare

Technological advances in healthcare are providing new and improved treatments for diseases, although fears about potentially unwelcome intrusions into personal life are constantly on individuals' minds. German researchers are among the frontrunners in these developments. In 2014 a research group headed by Professor Dr. Kohler at the Cancer Research Centre, University of Heidelberg, announced an important step forward in micro-delivery systems that attack cancer cells. Advances are being made also in disease prevention. Genetic research is improving doctors' ability to identify those families and individuals who are at risk of heart disease and Alzheimer's disease.

Such advances in medical science are welcomed by all, but they are putting strains on the healthcare system. Basic health insurance, to which all Germans are entitled, covers all essential healthcare services and is paid for by a flat insurance premium. Due to increasing costs, individual charges have been introduced for the use of some medical services, but the government argues that it has done what it can to offer a high standard of healthcare provision to all. Some of the more advanced new technologies are not included in the basic health insurance programme. Micro-delivery chips that administer new medicines in controlled doses – happily picked up by pharmaceutical giants such as Bayer and NovaGlaxis – are only covered in the expensive supplementary insurance policies offered by private insurers. It is hoped that these will become cheaper in a few years' time and available to all.

Healthcare spending in Germany is among the highest in the world. Most Germans believe this is the price that has to be paid for living in a civilised society where everyone has access to necessary healthcare. However, some worry that costs are spiralling out of control. The fact that all people pay the same level of health insurance for the basic programme has upset some people. They argue that people who make an effort to lead healthy lives should not be forced to pay for those who do not.

Advances in medical science have also raised concerns about the disclosure of personal medical information. In general, people who know that they are in a high-risk group are glad to have their medical condition monitored constantly. The public healthcare system covers the costs of sensors for people in risk groups, such as the elderly infirm. This allows critical indicators such as heart rate, blood pressure, blood sugar level and cholesterol to be monitored regularly. This information is sent to a medical centre that alerts a local team of medical professionals if necessary. The sensors themselves (developed by German researchers in combination with large chip-manufacturing firms) can be either embedded into patients or worn in a vest. If patients will not accept either implants or wearing sensors in their clothes, they can still send data through their mobile phones or PDAs since they are all equipped with active biometric devices.

Most people who are not in a high risk group, or who are unaware that they are in a high risk group, do not share their medical information as widely. One reason is for this is the extra costs, not covered in the basic healthcare system, of implanting sensors and having the information monitored. Another reason is that many people find this an unnecessary intrusion into their privacy. These concerns have an impact in an emergency since medical information is stored in central databases and can be accessed only after the identity of the authorised medical professional and the individual patient has been authenticated. Moreover, medical researchers warn that restrictions on their access to health-related information endanger progress in the development of preventative and curative treatments. From a scientific point of view, it would be ideal to have a large central database containing comprehensive health-related data on all Germans. This would allow medical researchers to identify high-risk lifestyles and groups of people at risk of particular diseases.

Government and Democracy

Federal and state government organisations are also changing, albeit slowly, as a result of new technological developments. New technologies have been used to replace lengthy bureaucratic procedures with streamlined services. Citizens can now perform most of their dealings with government agencies online, for example when filing tax returns, applying for planning permission and registering for welfare payments. This has led to considerable cost savings for government that have been used to maintain the welfare state protection for the unemployed.

Peoples' desire to control access to their personal information puts limits on the extent to which new technologies can transform government. Since a government agency has limited information on the individual who is accessing its services, it cannot automatically tailor its online services to that individual's requirements, but instead must make selective queries of the individual. This means that for some people, especially those reluctant to provide information, government can be seen as complex and difficult to access. Because some prefer not to provide online data readily, many government services must still be provided the old-fashioned way, as well as online, so that people can choose how they access them.

Politics too has been affected by new technologies. Electronic voting over the internet is now possible in local, national and European elections. Polling stations are still used by a sizable number of voters on election days. To be able to vote online and avoid some of the electronic election frauds of 2010, citizens must register their retina print and fingerprints in order to vote. These two identifiers are then used to authenticate the voter's identity using terminals such as PDAs and mobile phones before the vote is cast online. Despite the use of sophisticated encryption techniques to separate the individual's identity from the vote that he or she casts, many citizens still feel uncomfortable about transferring this information. It is believed that citizens will come to accept voting over the internet with time.

Many Germans are politically engaged and active. New technologies are used to organise political actions in both the online and offline worlds. Last year, the government proposed a series of cuts in welfare payments, but had to back down after protests. In addition to traditional demonstrations outside the Reichstag, protesters swamped government departments' online services with bogus applications and requests. Government officials insisted that the changes to the proposals were due to the parliamentary process, rather than activities they described as verging on the criminal.

The anonymity of the online world has long allowed radical political groups to survive on the fringes of society. Some people argue that privacy protection should be relaxed so that such groups are brought under effective control of the law. Also, there have been several incidents where evidence has been deemed inadmissible in courts because the collection of that information violated data protection laws. In one case, the police discovered the identity of a shoplifter by intercepting information, including his name and home address, from his PDA. Data protection laws mandate that such information cannot be passed on to third parties without the consent of the individual concerned. Therefore, the charges based on this information had no legal basis. While such cases have caused public concern, it is generally agreed that such protections are essential to the civil liberties valued by German society.

Annex 3

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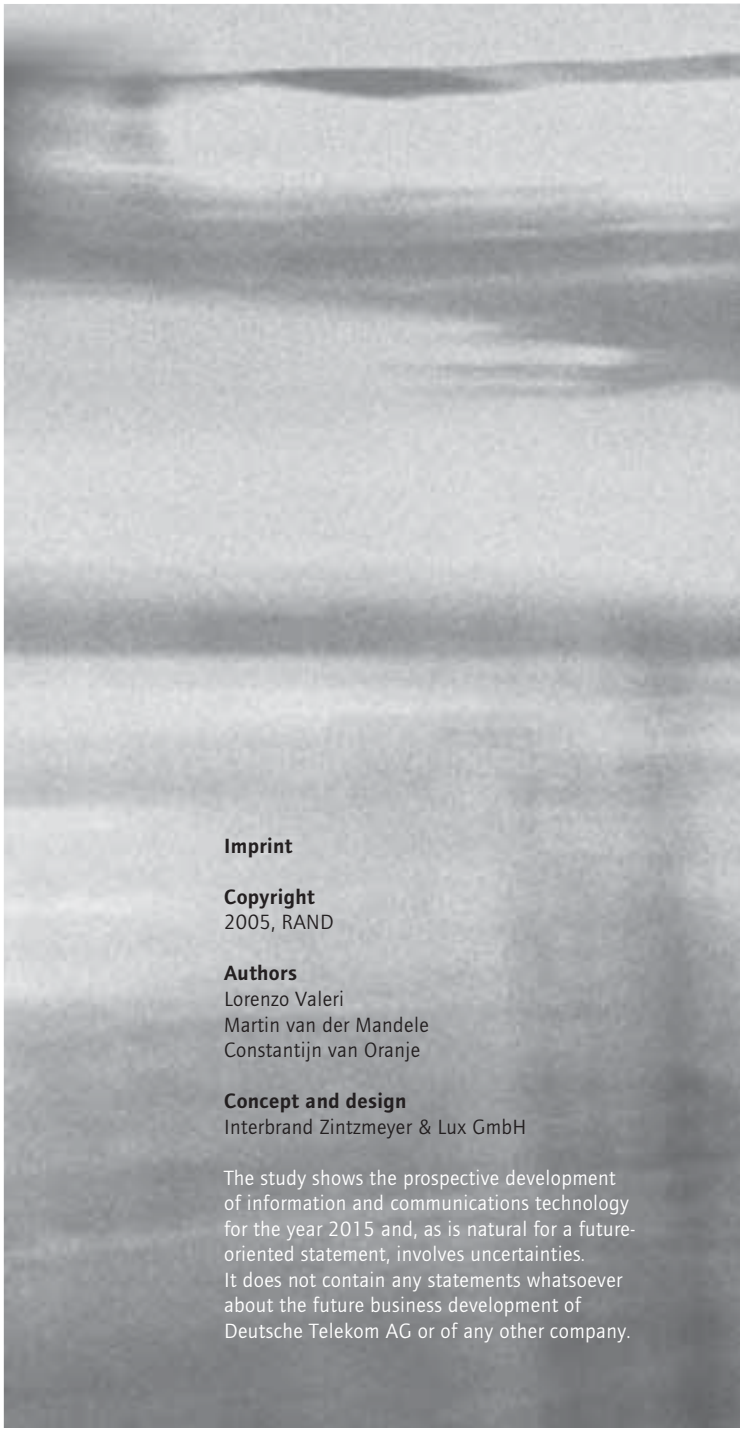

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Authors
Lorenzo Valeri
Martin van der Mandele
Constantijn van Oranje

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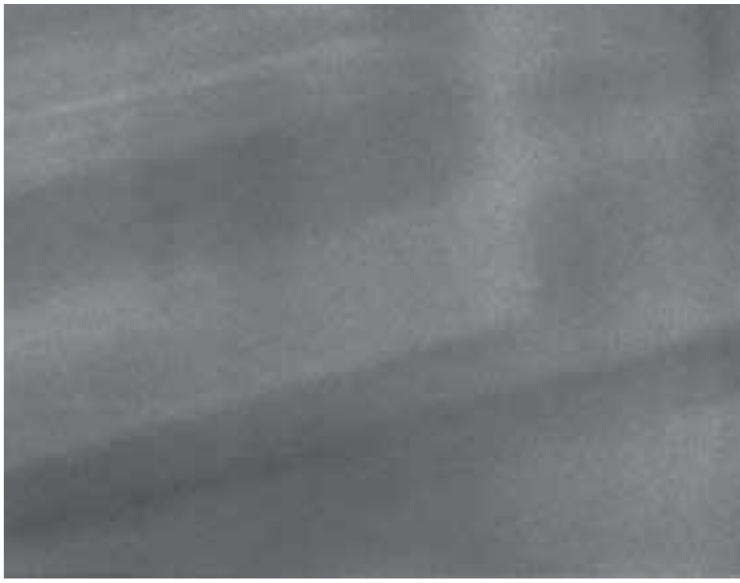

RAND
Newtonweg 1
2333 CP Leiden
The Netherlands
Tel +31 71 524 5151
Fax +31 71 524 5191