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Shaping Ideas to Shape the Future

Competence, security and new business areas

Results of the third phase of the international study "Prospects and Opportunities of Information and Communication Technologies (ICT) and Media"

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Shaping Ideas to Shape the Future

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Foreword by the Federal Ministry of Economics and Technology

After the development of language, the written word and the printed word, digitization is the next step in decisively changing how people interact with each other. Information and communication technologies (ICT) are an integral component of our everyday lives. They constitute one of the most important economic sectors in Germany, as well as accelerate growth and drive innovation in core industries, such as automotive and mechanical engineering, energy, media and healthcare.

The German IT Summit, which pursues the goal of further strengthening Germany as a location for ICT, has adopted the long-term study "Prospects and Opportunities of Information and Communication Technologies (ICT) and Media" as a project for the third time now. This year's study "Shaping Ideas to Shape the Future" provides concrete recommendations for a successful, sustainable path to the future of ICT and media and delivers valuable information for the fifth IT summit in Dresden on December 7, 2010.

I am delighted that the third project phase of the study is focusing on future developments in ICT and media and their areas of application, thus probing more deeply into the findings made so far and providing impetus for the future. The preceding Delphi Study already explored the extreme importance of future developments in information and communication technologies for society, the economy, academia and politics. This year's publication illustrates this importance using the issues of competence, security and new business areas.

The trend of the last few years makes it clear that it is no longer possible to conceive of life without ICT and the Internet. Hence it is all the more crucial not only that all citizens have fast access to the Internet in the future, but also that they are able to use it competently and safely.

Children must be introduced to new media early on and in a responsible way, and adults must also continuously further their training.

But it is not just for users that the appropriate conditions for using information and communication technologies and new media have to be created. Providers also have obligations. Security and availability of ICT are not just core components of a modern information society, they are also of immense economic importance for Germany as a center of business. Secure communication and secure transactions are the foundation for fully realizing the opportunities of the new technologies.

ICT is already the most important driver of innovation. And, as the study shows, this development will continue to gain momentum. ICT does not just reshape innovation processes, it also accelerates them. Furthermore, new trends in technology transform entire industries and open up whole new areas of business. At the IT summit in Dresden, we will discuss these developments and work out the opportunities for the German economy.

The joint project "Prospects and Opportunities of Information and Communication Technologies (ICT) and Media" of Münchner Kreis, EICT, Deutsche Telekom, TNS Infratest, Siemens, Vodafone, SAP, Telefónica O_2, ZDF as well as Focus, VDE, Sony, Deutsche Bank, Opera, Daimler and the German Federal Ministry of Economics and Technology is a good example of how a number of organizations and companies from all kinds of different fields can come together for a project and work on an important issue from a range of angles. The study managed once again this year to bring together academics, economists and politicians in a common discourse.

I hope the study enjoys a wide readership and I thank the project partners for their dedication.

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Foreword by MÜNCHNER KREIS

The response to the studies carried out in the last two years on the "Prospects and Opportunities of Information and Communication Technologies (ICT) and Media" has exceeded all expectations. The assessments of the more than 500 international experts on potential trends in the next 20 years and the challenges and opportunities identified have triggered countless discussions and provoked a great deal of thought. The very extensive study on the future of ICT has been downloaded from the Internet more than 60,000 times. The findings were included in the federal government's 2009 IT summit process.

It is clear that "looking into the crystal ball" has only been a first step. Issues like technology, applications, social implications, innovation policy and infrastructure development, to name but a few, are not only diverse and highly complex but above all are very closely interrelated. This is where the third phase of the study, presented here, comes in. Three selected overarching groups of issues, namely "ICT and competence," "ICT and security" and "ICT for new business areas," were discussed in depth in a multi-layered process, again with a large number of experts, with the aim of developing specific action areas and, if necessary, measures.

In the course of the project, an interactive online discourse was held in spring and summer 2010 for the three issues selected in the preparatory phase. In this discourse, 97 experts made more than 690 contributions overall to the discussion. A standardized questionnaire derived from this discourse was then answered by 880 international experts from the ICT and media industry. The central findings and assessments of the people surveyed are summarized and explained in this report.

The contributions presented discuss key issues of future ICT and media, and present proposals and concepts for measures or specify the problems in detail as a basis for further inquiry and possible solutions. This is where the interdisciplinary approach of the study comes into its own: it is possible to improve the ICT competence of people with the support of advanced technologies, but it also requires business know-how and a suitable political framework. The same applies for the explosive issue of information security and the field of ICT-based business opportunities.

As in the preceding phases of the study, the findings were extremely diverse as well as highly controversial. No wonder – complex tasks rarely have simple solutions. The study therefore shows all the more that it is incumbent on us to work intensively on developing comprehensive solutions and measures. In Germany, we face the challenge of resolutely seizing the abundant opportunities offered by the wide-ranging potential uses of ICT in almost all areas of the economy and society, and ensuring the necessary institutional framework. Only then will we be able to shape the transformation of the economy and society that is being rapidly brought about by digitization in a sustainable way, and at the same time acquire and secure the technical and social skills that will be indispensable in the world of tomorrow and without which Germany cannot maintain its position as a leading economy. To this extent it can be hoped that the contributions and food for thought provided by the study give rise to debate and action plans.

The study was conducted by TNS Infratest on behalf of a consortium led by MÜNCHNER KREIS and is supported by the German Federal Ministry of Economics and Technology (BMWi) as part of the 2010 IT summit process. Partner companies and organizations as well as representatives from academia engaged intensively in the discussion process and in preparing the findings in textual form over a number of months. Our thanks goes to them all, as well as to the excellent operational project coordination team! We hope that this third phase of the future study will be as widely received as the preceding phases and thus help to improve the future sustainability of our country. We are pleased that Münchner Kreis was able to act as a neutral, functional platform for this important study.

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Methodology

The findings of the Delphi Study from 2009 already afforded all kinds of insights into the future of information and communication technologies – quite a few were expected, many were surprising, some were even controversial. This variety provided by the study shows the potential of the "Prospects and Opportunities of Information and Communication Technologies (ICT) and Media" project: It gives us the opportunity to reflect. Is the result desirable? Do we want such a scenario to occur? And the answers to these questions lead to further questions: What do we have to do to facilitate a desirable state of affairs in the future? What can we do to better exploit future opportunities? In terms of methodology, this third phase of the project links directly with the preceding study: its core and key methods comprise a moderated online expert discussion and an Internet-based expert survey.

Composition of expert team

The team of experts involved in the project who developed the questionnaire, identified the experts for the expert discussion and expert survey, as well as interpreted and evaluated the results, consists of representatives from the project partners Münchner Kreis, EICT, Deutsche Telekom, TNS Infratest, Siemens, Vodafone, SAP, Telefónica O_2, ZDF as well as Focus, VDE, Sony, Deutsche Bank, Opera and Daimler.

The findings of the discussion and survey are based on the assessments of various expert groups. The experts from both the moderated expert discussion and the Internet-based expert survey comprise representatives from business, academia and politics who were personally invited from the networks of the project partners and the German Federal Ministry of Economics and Technology (BMWi) to take part in the study on the basis of their knowledge and experience in certain subject areas.

Preparation of the questionnaire

Building on the findings of the second phase of the "Prospects and Opportunities of ICT and Media" study, the team of experts involved in the project identified three core issues that will decisively influence the development of the ICT and media sector over the next few years. Central questions were formulated in workshops with the expert team for the three core issues of "ICT and competence," "ICT and security" and "ICT for new business" areas. They were then compiled in a comprehensive questionnaire for both the moderated online expert discussion and the Internet-based expert survey.

In the online questionnaire, four standardized questions were asked on each issue, in addition to individual questions: on the economic and social significance of the issue, on Germany's position with regard to this issue compared with other countries, and on the players called upon for the issue (specifically: politics, business, academia and/or every single citizen).

Moderated online expert discussion (Delphi discourse)

For this study, a moderated expert discussion was held. It was conducted over the Internet in two waves in May/June (wave 1) and July 2010 (wave 2). The experts approached by the project partners for this discussion were asked in pre-registration to answer questions on their personal geographical focus and professional experience, and to state which three areas they would like to comment on in accordance with their expertise. Using this information, profiles were created on the online platform for the registered experts.

A moderated online expert discussion was chosen as a basis for the study because of the focus on three core issues. It enabled deep insights into these three issues and provided additional broad background knowledge on the current debates in these areas. In addition, it allowed a differentiated interpretation of the quantitative, empirical part of the project phase. The online expert discussion made it possible to bring numerous and above all international experts together. Each participant was able to give their opinion at any time of day and, if they wanted, to take time to formulate complex answers. Several discussion threads could run simultaneously and independently. They could, for example, also return directly to contributions days later and add comments or expand on their own thoughts.

Three moderators supervised the discussion. In all, 97 experts actively took part in the two panel discussions, answering a total of 79 questions and making 691 contributions.

The findings of the discussions and the answers to and opinions on the 79 questions will be addressed in the following articles. In addition, in many places in the articles, the findings of a discussion or also individual expert opinions are illustrated by highlighted quotes.

Internet-based expert survey

In addition to the expert discussion, in July/August 2010, a quantitative Internet-based expert survey was conducted, which reflected quantitatively the findings of the moderated expert discussion, i.e., using closed questions. The experts from the moderated online discussion were also given the opportunity to participate in the expert survey. The questionnaire comprised three sections – a section on each of the subject areas "ICT and competence," "ICT and security," and "ICT for new business areas." The questionnaire comprised 120 questions in all; 880 experts took part, 385 answered the section on "ICT and competence," 197 the questions on "ICT and security" and 581 the block on "ICT for new business areas." At the beginning of the survey, the experts were asked to give their personal geographical focus. Based on this, for questions for which the country-specific background was significant for the study, the experts were asked about the country they had specified. For the evaluation, the experts were divided into two groups: the experts for Germany are shown as "GER experts," experts for other European countries (excl. Germany) as "EU experts."

Presentation of findings

The findings of this year's study are thematically summarized below in 18 articles. Each article presents the results of the expert survey in detail. For each question, only those groups in which at least ten experts gave an answer are shown. Unless stated otherwise, the percentages are based on all possible answers, including "don't know/N/A."

In addition to a large number of specific questions, the individual text contributions include in particular questions on economic and social significance (represented in two semicircles), on Germany's position ranked against other countries (depicted using a stacked bar) and on the experts' assessments with regard to the players called upon (illustrated using stacked columns).

Summary

The executive summary outlines the essence of the three sections. The two methods used – the online expert discussion and expert survey – complemented each other extremely well. Together they provide meaningful figures and insights into deeper correlations. The experts highlight the issues that are significant for Germany's economic and social development and how Germany as a center of business is positioned at present compared with other countries. Implementation of the recommendations is now in the hands of the players from politics, business and academia, but also of every single citizen. In many cases, a joint effort will be required.

We are delighted to be able to present you with the findings of the third project phase, which examines the future of ICT and media from the perspective of three very different but interrelated core issues.

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Methodology profile

Online expert discussion

Method

Moderated online expert discussion

Survey period

Wave 1: May 31 to June 8, 2010

Wave 2: July 19 to July 27, 2010

Number of contributions from participants

691 overall

Selection of experts

Representatives from business, academia and politics who were personally invited to take part in the study on the basis of their knowledge and experience in certain subject areas, from the networks of the project partners.

Composition of expert team

GER Experten	n = 87
Other European and international experts	n = 10

Content of the questionnaires

79 questions in total on the three subject areas:

- "ICT and competence"
- "ICT and security"
- "ICT for new business areas"

Pre-registration

Questions on:

- Geographical focus
- Professional experience, etc.

Internet-based expert survey

Method

Internet-based survey of experts

Survey period

July 20 to August 16, 2010

Interviews conducted

880

Selection of experts

Representatives from business, academia and politics who were invited to take part in the study on the basis of their knowledge and experience in certain subject areas, from the networks of the project partners.

Composition of expert team

Where the country-specific background was significant for the study the questions put to the experts were based on the country specified as their geographical focus.

GER experts	n = 777
EU experts	n = 77
Other int. experts	n = 26

Content of the questionnaires

Total of 120 questions:

- 40 questions on "ICT and competence"
- 34 questions on "ICT and security"
- 38 questions on "ICT for new business areas"
- 4 questions on the economic crisis
- 4 statistical questions

Executive Summary "Shaping Ideas to Shape the Future"

Only through a coordinated effort, in which all players from society, politics, industry and academia are aware of the opportunities and impacts of digitization, will it be possible to shape the future and to do so successfully.

The study at a glance

In the future, trust in digital media, services and applications and their use in society and the economy will be determined by competence, knowledge and security.

For the third time already, the long-term project "Prospects and Opportunities of Information and Communication Technologies (ICT) and Media," which is being carried out by MÜNCHNER KREIS together with partners and sponsors, provides a platform for notable experts from industry, academia and politics to discuss their understanding of the future significance of digitization for the economy and society. This study is based on the results of the two preceding project phases from 2008 and 2009. The findings on future developments, challenges and opportunities of ICT and media suggest a future that is increasingly infused with digital technologies, both in private and professional spheres. More than 1,000 international experts actively took part in this extensive study. The ICT and media experts commented on 79 questions in two moderated online panel discussions. The resulting findings were incorporated into a further international expert survey comprising 120 questions, after which they were evaluated and analyzed.

In continuation of the findings from the previous years, under the central themes "Shaping Ideas to Shape the Future," three issues came under close scrutiny:

1. **"ICT and competence"**
2. **"ICT and security"**
3. **"ICT for new business areas"**

Based on the results of the online discussion and the international expert survey, the third project phase identifies the potential of central developments, determines Germany's current position compared internationally and calls on the main players to provide impetus. The stated aim of this phase is to support and shape our digital future. The findings of the study were presented at a special conference on November 5, 2010 in Berlin. The 150 participants then discussed Germany's future economic and social development on the basis of these findings. The aim of the three workshop groups on the issues of "ICT and competence," "ICT and security" and "ICT for new business areas" was to develop specific stimuli to make Germany fit for the future. Action areas were identified in each of the three subject areas and, where possible, recommendations were derived to provide valuable impetus for the IT summit in Dresden at the beginning of December 2010.

The new findings also confirm that, while the pace at which information and communication technologies are changing the world of today remains undiminished, the majority of developments that lie ahead of us depend on courses set today and are not predetermined per se.

In the following three sections, the authors of the "Shaping Ideas to Shape the Future" study set out specific potential ways in which our digital future can be shaped.

"ICT and competence"

(Media) competence, (media) use and education are the keys to unlock the digital door of the 21st century. 19 years after the World Wide Web opened up, broad cross-sections of society still do not possess these keys. Only around a quarter of the German population has the necessary (media) competence to use the Internet expediently and securely. That is the latest finding on the status quo of the digital divide in this study. The section "ICT and competence" includes solutions for building up digital competence and securing these skills for even more people in the long term.

The findings of the study clearly show that traditional basic skills like reading, writing and arithmetic remain a core component of a modern education system, as does an awareness of cultural and ethical values. However, they are no longer sufficient in themselves. Many Germans, for example, do not have the necessary applied knowledge on the issue of network and data security on the Internet. Corresponding action must be taken to remedy these deficits. This is also the call of the experts involved in this study. They emphasize that specific skills and key qualifications, such as competent handling of personal data on the Internet, data privacy and information processing, are a top priority. It is equally important that people have the ability to assess the relevance, credibility and up-to-dateness of information and sources on the Internet.

The Federal Ministry of Economics and Technology (BMWi) has already made successful inroads into building up these skills with initiatives like "Experience the Internet." The experts believe the most important thing is to ensure that users have sufficient experience. Only by actually doing can users overcome their reservations, or even fears, and achieve the necessary confidence and trust. To this end, there should be certificates about whose reliability and independence users can be absolutely certain. This also includes an (evaluation) system which can be used as a guide. Politics and the economy, as providers of impetus, must set up and introduce an independent, reliable system of this kind.

Now is the time for reform: The Internet requires a modern, multilayered education system and a corresponding education infrastructure. Only then can children and young people be introduced to new media from school-age as part of their education and be taught how to use it. The experts recommend a Germany-wide campaign to introduce media studies on a broad basis as a school subject.

They are also calling for continuous training of teachers and educators in order to ensure that teaching remains innovative and appropriate to media. The state, as the most important provider of impetus, must first prescribe a national, binding framework for this.

But parents should also be more closely involved in their children's learning process. The idea of Germany-wide guidelines "Living in digital worlds" as a "standard" could be particularly powerful. As basic reading, with clear and simple rules for using the Internet, they could help to dispel uncertainties, counteract reservations, build trust, and work against naïve use of the Internet. A Germany-wide initiative like this could lay the foundations for the urgently required blanket (media) competence. Responsibility for developing the guidelines lies with politics and academia, as well as with the economy. But individuals will also increasingly be required to take the initiative in constantly developing their own skills in this area. The principle of "life-long learning" will be crucial for everyone in the future.

The results also make clear that the ability of companies to adapt to digital globalization will be crucial to the economic development of a country. The phenomena arising under Web 2.0, such as user-generated content, mass collaboration, and social communities, result in new kinds of cooperation within and between companies and increase the transparency of corporate communication. In research and development, approaches such as open innovation or open source are playing an ever more important role. Specifically, digitization requires new competencies in the professional context. As such, companies must develop appropriate digital competence and adapt their own organizational structures.

The competence of employees should be expanded through institutionalized training measures. The experts deem the first steps in this direction to be guidelines that provide a framework for behavior in using Internet/Web 2.0. Teleworkstations and virtual teams as well as open approaches to collaboration require a strong corporate culture and employees to be treated with respect. Flexible worktime models are an initial, concrete step here.

The increasingly web-based nature of networking with employees allows scope for criminal or unethical conduct. In this regard, the onus is on politics above all to provide impetus and legislate accordingly to promote networking while at the same time preventing loss or damage.

Raising awareness about changes in a digitized world and sharing knowledge about the possibilities of active, open participation in Germany are the two most important steps forward into the future at present. They allow future changes to be shaped today.

It should be noted that all stakeholders are actively called upon to support and promote this process. After all, it is only with competent users, students, employees and companies that Germany will be able to meet the challenges of the future.

"ICT and security"

Secure, trustworthy and reliable conduct in an increasingly digitized world is the future key factor for successful societies and economies. Use of the Internet is based on the unprotected exchange of data in a globally distributed network of computers. Open, unrestricted access to information and markets is intrinsically insecure. How can it be better protected?

In the "ICT and security" section, experts identified and evaluated current issues and developments on this subject. They answered questions about comprehensive and appropriate security in the digital world, discussed the roles and obligations of state, industry, academia, and users, and assessed the opportunities for national societies and economies.

Their common denominator is: "Privacy is probably the most endangered objective in a digitized world." This section therefore focuses on secure digital identities and the new electronic ID card in Germany. The new ID card is a means of enabling a digital identity to be documented at any time.

The experts recognize what has been achieved so far: research and development are at a high level; advances are being made in standardization, including for new scenarios like cloud computing or e-energy; data privacy and data security have been enshrined in the German constitution (Article 91c); electronic ID cards and De-Mail make important, exemplary contributions to secure ICT infrastructures; the German and European security industries are internationally competitive, their technology is seen as reliable and neutral.

Nevertheless, the experts believe there are still conflicting interests that require a balance to be struck between legal regulation and voluntary commitment by the private sector – as is currently the case with geodata services. Network operators and providers are liable in case of insecure systems and users have duties of care. They should keep user IDs and PINs in a safe place and report their loss immediately; they should use firewall and antivirus software and keep it up-to-date at all times. However, many users are still unaware of, and need to be taught, the value of protecting personal and sensitive data on the Internet, e. g., in social networks.

The first impetus for creating such awareness should be provided by the government. The experts believe it should do more to inform people about the risks, rights and obligations in regard to the handling of their personal data. This should include, they say, additional measures in education – both in schools and in further education and training. They recommend the introduction of a Germany-wide, standard "Internet license," that would have to be regularly renewed.

The simple usability of security functions is also crucial. In this regard, the experts say that it must be possible to use high-quality security functions without expert knowledge. Data privacy and security measures designed to be user-friendly are to reduce the risk of unintended release of personal data. Furthermore, this impetus must come from academia and, together with the economy, must result in new products.

Provision of a legal framework and the monitoring of legitimate use of personal data is the responsibility of a democratically elected and accountable legislature. It determines the rights and ownership of certain data, who is responsible for protecting data in which cases, and how violations of this legal framework are to be punished. Impetus should come from politics, which is particularly responsible for the security of the Internet and the data entailed.

According to the experts, impetus could come from binding, international data privacy regulations (see Data Protection Center 2010), agreed jointly by politics and the economy.

Politics and the economy should also protect the ICT infrastructure with secure communication and identification functions. The electronic ID card can be seen as a particularly positive impetus here, with an immense scattering effect. The electronic ID card provides users with a tool for documenting their identity at any time – offline or online – in a self-determined way, transparently and securely.

"ICT for new business areas"

Information and communication technologies have effected serious changes in competition and the global markets and will do this to a much greater extent in the future. Almost all industries and market players are affected by the changes. Who sets ICT trends is a crucial factor for the future competitiveness of a country or region. According to the experts, Germany only has a middle ranking in this respect at present – too far down the field to be successful in the core areas of ICT on a sustained basis.

They see huge opportunities for Germany in linking ICT with traditional application industries, in the area of e-energy, e-health and e-mobility, but also in e-commerce. It is in these promising growth markets that Germany has the potential to achieve a pioneering and top position. The German economy meets the requirements of system integration and standardization in the area of embedded systems in particular. The same applies to the "Internet of Things." Here too, Germany can meet the main requirements for excellent technical development of complex systems.

However, the strong competence in technology is currently not supported by agile business models and attractive, emotional marketing activities. There is a lack of "hybrid innovations" that combine and advance new ideas for products and services with market and business strategies. In Europe as a center for business, it is difficult to see any comprehensive branding as achieved by Apple, for example, under whose umbrella new products are developed, core business is systematically expanded, and new business models (App Store) are successful.

On the dynamic ICT markets, the experts believe it has become very difficult to survive over the longer-term. Leading players are more easily challenged today: flexible value-creation networks are open to new players. ICT creates a basis for achieving broad reach with relatively low investment. This provides a new opportunity for small and medium-sized enterprises (SMEs). It also creates new scope for customers to compare existing agreements and offers with the available market information and to act accordingly.

In view of these developments, the European deficit in marketing competence and entrepreneurial initiative urgently needs to be remedied. Despite a large number of players with high levels of competence, two-way transfer and commercialization are very limited at present. Inadequate interaction between developers and marketing experts hinders in particular the rapid market maturity of disruptive innovations. In order to engender the necessary cultural shift in companies, the experts recommend greater efforts by business.

In the area of business processes, impetus can be found in the "open innovation model," in which companies can open themselves up to ideas from outside, from customers, suppliers or universities through ICT. The model can inject dynamism into established patterns of thought and action, but it can also specifically save on costs and time in the development process.

Tapping into the expected benefits of ICT in companies requires flexible, scalable IT systems and tools that adequately take into account the size of the company, the ability of a system to adapt, and the distribution within the company.

For established, individual companies, ICT offers huge potential for improvement. The experts see resource savings through planning, flexible availability and virtual cooperation in real time with digital media. They call for corporate guidelines for competent use of ICT as well as communications etiquette that must be supported and practiced by a company's main decision-makers.

For the required cultural shift which promotes more entrepreneurial initiative, company incentive systems are recommended. In particular, target agreement should be used as a tool to promote innovation and business ideas. Specific measures proposed include the initiation of spin-offs or the development of marketing plans.

The most persistent barrier to the successful implementation of development projects and new business ideas is financing, especially in small companies. It falls to both the economy and politics to act faster with sufficient risk capital.

For the ICT industry and the traditional industries transformed by ICT, national and European support programs are hugely important. They should contain elements that support cross-industry collaborations by systematically promoting ideas for commercialization in the form of joint ventures, projects or the establishment of new companies.

I. ICT and competence

At present, information and communication technologies (ICT) and competence are conflicting areas: while access to ICT helps people to gain competence, they need to have competence in the first place to take advantage of the opportunities that are opening up.

Against this background, the challenge in the next few years will be to open up access to ICT. This includes nationwide, cost-effective provision of ICT. But the availability of technology in itself does not automatically mean that it can also be used competently. This is also highlighted by the fact that there is already a digital divide in society: Senior citizens and the less-well educated make significantly less use of the possibilities provided by the Internet than other sections of the population. It is therefore also necessary to design a learning process for the acquisition of competence – and this thesis is a common thread throughout this entire section. In the future, access to ICT will be defined less in terms of the degree of technical provision, and more in terms of the distribution of digital competence in the overall population.

This competence includes responsible, farsighted handling of personal data, the ability to create and design digital identities from Facebook to XING. Of equally great importance is the competent navigation of the vast amount of information on the Internet, in terms of selecting and evaluating it. One article addresses the problem of distinguishing between, and making clear the distinction between Internet content that is verified, responsible journalism and non-editorial content. Because in contrast to the traditional proliferation of media, media providers on the Internet are facing increasing direct competition within and between media, as well as with non-editorial content, since the Internet is a carrier platform for all media, as well as for non-media content. In terms of providing independent information on relevant issues, editorial content therefore has particular social importance. Ultimately, however, it also comes down to the ability of the individual to cross-link information with knowledge.

One article in this section deals with the question of how competence profiles can be designed and flexibly adapted

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to future developments. Another article discusses new requirements regarding the digital skills of employees and their continuous further development in a company context. For individuals, the greatest challenge both professionally and privately will be to get to grips with the speed of change in the digitized world and thus to cope with the accelerated rate of learning.

The development of these competencies places new demands on the education infrastructure. The experts believe that above all the state is obligated to invest adequately in order to ensure access to and competence in the use of ICT. They continue to emphasize the need to rethink the importance of the building blocks of education in a digitized world: Traditional elements such as reading, writing and arithmetic will continue to be relevant in the future, while other components, such as the standardized concept of "general education," will change dramatically.

As long as the basis for competent use of information and communication technologies is not comprehensively ensured throughout the population, the focus will be on the following question: How do people use the available information and communication technologies to satisfy their information needs, enhance their everyday lives and consumption decisions, maintain their social contacts, and communicate in Web 2.0?

In this context, the resource network determines the added value for society. In the medium term, competent citizens themselves will be a crucial resource, inasmuch as they will create added value by using technology in innovative ways. Wikipedia may act as an example here: The now most-used online encyclopedia in the world, which was originally planned as a "fun project," shows that competent citizens use technology as a vehicle for sharing their knowledge and creativity with others. Thus ICT will not only change the competence of every individual, it will also frequently be changed itself in the future by new competencies.

Dr. Bernhard Engel
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ZDF

I.1 Participation on and in the Net – status quo of the digital divide

It is probable that the digital divide in Germany will never be overcome – that was the forecast of the majority of Germany experts surveyed in 2009 in the International Delphi Study 2030. In 2010, the percentage of the German population using the Internet from the age of 14 increased to over 70 percent for the first time. This is two million more people that in the prior year 2009, pushing up the number of online people to 48.3 million (see (N)ONLINER Atlas 2010). At first glance, these figures reflect a positive trend. Does this mean that talk of a digital divide in the German population is long out-of-date? Not at all. As already highlighted in the second phase of the study "Prospects and Opportunities of Information and Communication Technologies (ICT) and Media. International Delphi Study 2030," the reverse perspective must always be considered as well: If 72 percent of all those over 14 are online, that also means that 28 percent of this group has still not been integrated. These findings are also explosive when analyzed in socio-demographic terms. For example, there are still substantial discrepancies in Internet usage according to gender, age and formal education: In terms of capitalizing on opportunities provided by the Internet, certain social groups are still underrepresented. In 2010, for example, 65 percent of women in Germany use the Internet, compared with 80 percent of men. Even greater discrepancies appear when looking at various age groups: In 2010, 96 percent of 14 to 29-year-olds already use the Internet, compared with just 50 percent of the over 50s. Even though the number of users among persons with a school leaving certificate has risen relatively quickly in the last three years, an analysis of Internet use after formal education shows that, at 57 percent, this group is still well behind persons with higher qualifications.

In light of the ever greater volumes of data that have to be processed on the Internet, the question now is not just whether a person has Internet access at all, but also what kind of access they have. These days, modem users can't get very far on the Internet, and yet there are only 26.5 million households in Germany with broadband access (see BITKOM 2010c). That is only about 69 percent of the people actually online. They are the only ones able to access the full range of the Internet without long waiting times.

The "second digital divide"

In 2009, the International Delphi Study 2030 forecast that more than 95 percent of the adult population in Germany will actively and regularly use the Internet and its services by 2024 at the latest. In light of this increasing number of users, however, a further level of the digital divide seems to come to the fore – the "second digital divide."

As the prevalence of the Internet spreads, it is becoming ever more important to analyze how content is used with new media: Differences between Internet users are increasingly manifested in terms of the intensity and type of their usage. After the issue of whether a person has access to the Internet at all, the question now at the forefront is how intensively and competently they use the Internet. Not all users are able to take advantage of the wide range of Internet content to the same extent. This means not only that people benefit to differing degrees from the wealth of information available, but a lack of knowledge or gaps in security may also mean they leave themselves open to harm, e.g., misuse of personal data divulged on the Internet, catching computer viruses due to inadequate security updates.

The study "Digital society in Germany – a comparison of six user types" looks into this second digital divide, examining who is actually capable of navigating the Internet with confidence. The study found clear discrepancies: Having divided the German population into these segments, it can be said of just 26 percent at the start of 2010 that they have arrived in the world of digital content. This 26 percent are the only ones who can be described as "digitally confident." For this section of the population, digital media are a fixed part of everyday life. By contrast, 74 percent are "hardly reached by digital media," i.e., only use the

Internet and its services sporadically, often do not have broadband access to the Internet, are not very competent in using the Internet, make only limited use of the opportunities offered by digital technologies, and do so with little intensity. This group of citizens is characterized by reservations about new media (see Digital Society 2010).

The figures show how deep the digital divide still is, 17 years after the World Wide Web opened up to the general public. It poses the question of how serious the effects of this gap will be on the future development of the economy and society and what competencies people will need to have in the future to survive in our information society. In the online discussion initiated especially for this study, experts dealt with question in detail.

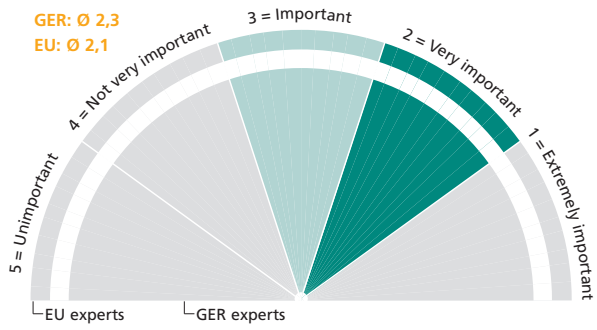
"The digital divide poses a major risk for our contemporary and especially for future societies. Since almost all relevant data and information is accessible via electronic channels only a digital divide would mean that the gap between those who have access and know how to make use of it and those who do not have access or who do not know to use that access [...] will widen."

The original concept of the digital divide referred to different opportunities to access the Internet and new media depending on social factors (see Gleich 2004, Marr 2005, among others). There are fears that these different opportunities for access impact negatively on the social development and economic opportunities of individuals, or even of entire countries – depending on the overall perspective from which the digital divide is viewed. The concept refers to variation in access to the Internet and new media both of countries around the world, and of various groups within countries.

Fig. I.1: Overcoming the digital divide – Importance

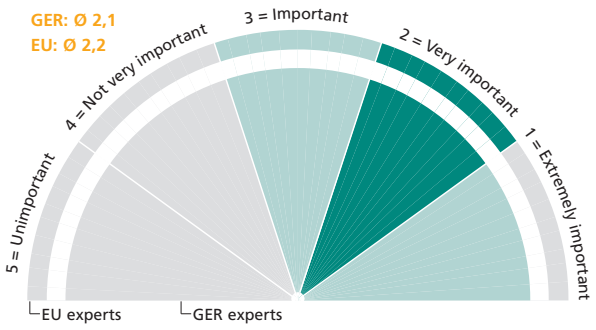
How important is overcoming the digital divide in terms of people's media skills for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	1 %	10 %	26 %	42 %	18 %
EU experts[2]	0 %	0 %	29 %	52 %	19 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	1 %	5 %	24 %	41 %	26 %
EU experts[2]	0 %	6 %	23 %	55 %	16 %

■ ≥ 40 % of experts ■ 30–39 % of experts ■ 20–29 % of experts ■ < 20 % of experts ■ Averages

[1] Experts for Germany, n=346; [2] Experts for European countries, excl. Germany, n=31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Overall social significance of the Internet rising steadily

The Internet is changing our world and our everyday lives forever. And the experts surveyed believe it will continue to have a huge influence on our culture. It is driving globalization forward and will also do so in the future – we already have access to an infinitely large volume of information around the clock. Anyone with Internet access and the appropriate competence has the option of presenting themself to a global public – even small interest groups can potentially reach an audience of millions in this way and thereby increase their chances of greater participation. This just goes to show how vital it is to bridge the digital divide and give everyone the opportunity to participate in this way.

The experts in the discussion agreed:

"Reducing the digital divide in all its variants […] is of paramount importance in a digital future […]."

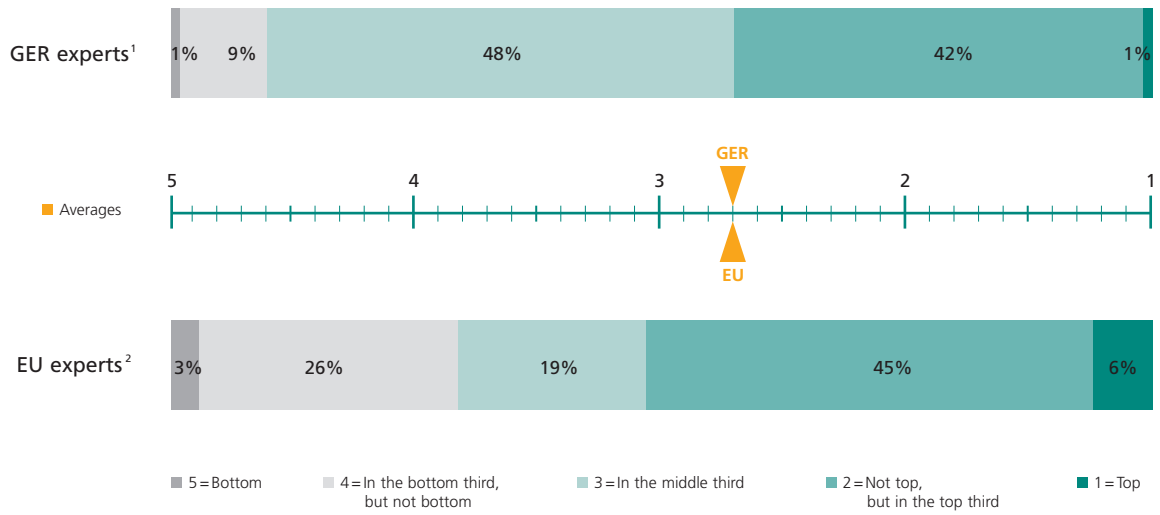
After all, more and more services will only be available in digital form in the future. Just like learning to read and write, therefore, fast, efficient, competent use and navigation of the Internet will be yet another cultural technique that people will need in order to access global resources and services.

Overcoming the digital divide – also important for society as a whole

The experts surveyed online assessed the importance of overcoming the digital divide for the economic and social development of a country. 61 percent of the Germany experts consider the economic significance of overcoming the digital divide in Germany to be very or extremely important – just 12 percent consider it to be not very

Fig. I.2: Overcoming the digital divide – Position

And how do you think Germany (<country>) is positioned on overcoming the digital divide in terms of people's media skills in an international comparison?



[1] Experts for Germany, n = 338; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

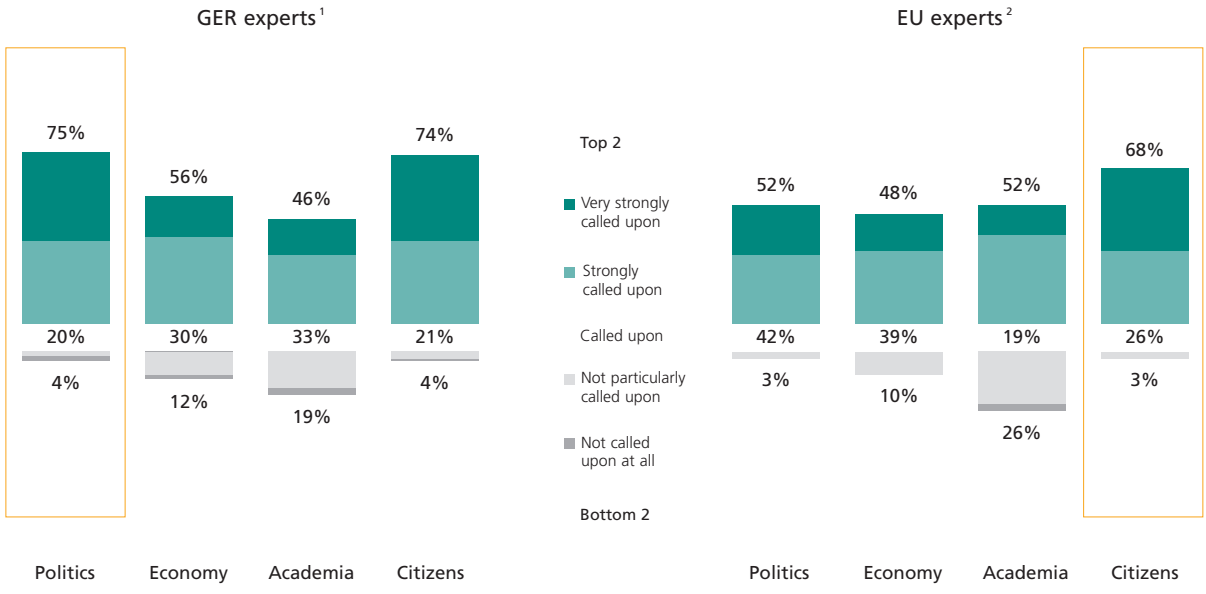
important or unimportant (see Fig I.1). The Europe experts place even greater importance on overcoming the digital divide for the economic development of their countries: 71 percent stated it to be very or extremely important. They give a similar assessment of its social importance: 68 percent of the Germany experts and 71 percent of the Europe experts consider overcoming the digital divide to be very or extremely important. At the same time, however, the experts are of the opinion that, compared with other countries, Germany is not playing any kind of leading role in overcoming the digital divide – 48 percent believe that Germany only falls in the center third of countries in overcoming the digital divide, whereas the majority of the Europe experts consider their country to be in the top third (45 percent; see Fig. I.2). As such, there is a great deal still to be done in this regard: The Germany experts believe that above all politics (75 percent) and citizens themselves (74 percent) are called upon to take action. By comparison, "just" 56 percent of the experts believe that the economy as a whole is called upon, and just 46 percent that academia has an obligation – the experts for Europe believe citizens are most called upon (68 percent; see Fig. I.3).

Participation in the Internet changes everyday life

In addition to the issue of the digital divide, participants in the discussion also talked about the impact of the increasing penetration of the Internet in our everyday lives: The rapid pace of change and structures of certain offers on the Internet can have a negative impact on people's ability to concentrate. Frequent telephone calls already interrupt concentrated work, the constant inflow of e-mails distracts attention. The ability to filter or set up a digital assistant to custom filter information will become increasingly important in the future, according to the experts. The same applies to information on the Internet. The Internet enables users to become active and generate

Fig. I.3: Overcoming the digital divide – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to overcome the digital divide in terms of people's media skills?



[1] Experts for Germany, n=346; [2] Experts for European countries, excl. Germany, n=31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

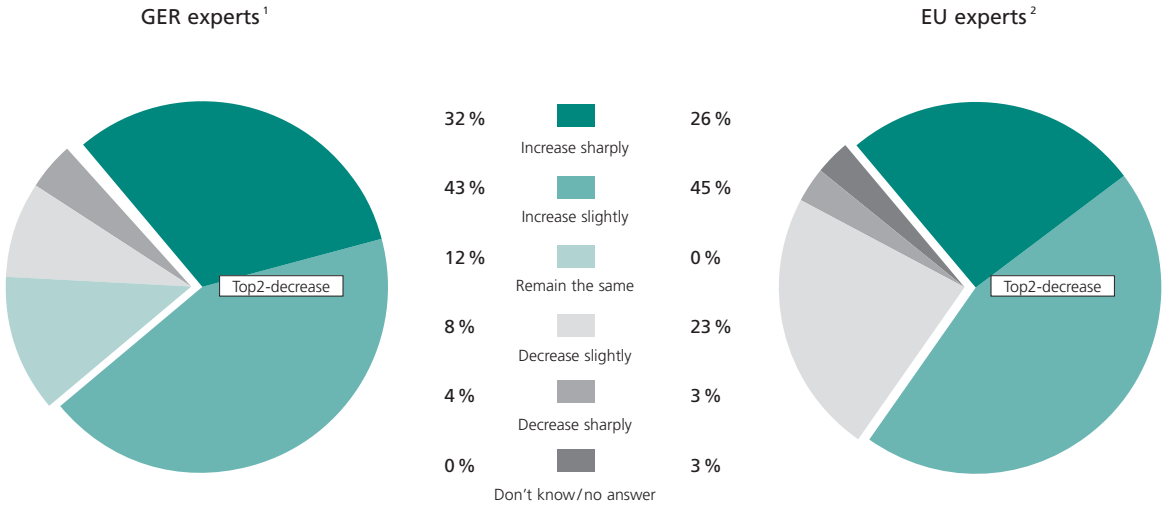
content themselves. On the one hand, it is positive that everyone can participate in shaping the Net; on the other, it will become increasingly difficult for receiving users to assess the quality of information. In this regard, a kind of seal of quality for information could help to create greater transparency.

In the future, it will be almost impossible to escape the influence of the Internet

In this connection, the question also arises of what impact the existence and use of the Internet will have on the way every individual lives their life. One of the findings of the experts was that, primarily due to mobile Internet, even short periods that previously had to be "unproductively wasted," can now be turned to good use. Being contactable at all times and the ability to deal quickly with work matters even when out of the office will make it even more difficult in the future to separate work and free time. In some sense, therefore, mobile services can facilitate a certain freedom, but they can also take it away again. In light of this, the experts were asked how the proportion of "conscious non-users" of the Internet will develop: 75 percent of the Germany experts are of the opinion that the proportion of conscious non-users will decrease by 2015 (see Fig. I.4). This opinion was also propounded by the experts in the online discussion: With increasing convergence of media it will be difficult to "escape" the Internet in the future, and people who already use the Internet are likely to have little reason to actively avoid it. However, the experts can imagine "offline zones," where the Internet is deliberately inaccessible.

Fig. I.4: Change of "conscious non-users"

How do you think the percentage of "conscious non-users" of the Internet in Germany (<country>) will change by 2015?



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Basis: All people surveyed with special expertise in the topic area

Summary and recommendations

A digital divide continues to persist in Germany, Europe and the world in 2010. Precisely because 72 percent of Germans now have access to the Internet, the question of quality of Internet usage is now coming to the fore.

Not only do the experts point out the huge social importance of overcoming the digital divide, they also consider it to be of great economic significance. So far, Germany has only been in the middle of the field in overcoming the digital divide in terms of media competence – the experts attest to the urgent need to catch up. In their view, the responsibility in this regard lies with politics and citizens themselves. Every individual must be equipped to search for specific information on the Internet and to assess it. It falls to politics to ensure that children are introduced to using the Internet and new media at school and throughout their education. Once they have left education, people should constantly refresh their knowledge of how to use the Internet through courses and training in companies, organizations and adult education centers – the rapid rate of developments on the Net and their impact on our daily lives make this a necessity. In the future, webinars could potentially be offered on the German federal government's homepages for the continuous improvement of personal Internet use, e. g., how do I optimize my searches in Google, how do I use an online shop, what do I have to be aware of in online banking.

I.2 Competence profiles of the future

Information and communication technologies shape our living environments in all kinds of ways – in both our private and our professional lives.

The latest figures show that 61 percent of people in employment in Germany now regularly use a computer at work; furthermore, more than 72 percent of the population now use the Internet (see BITKOM 2010b, (N)ONLINER Atlas 2010).

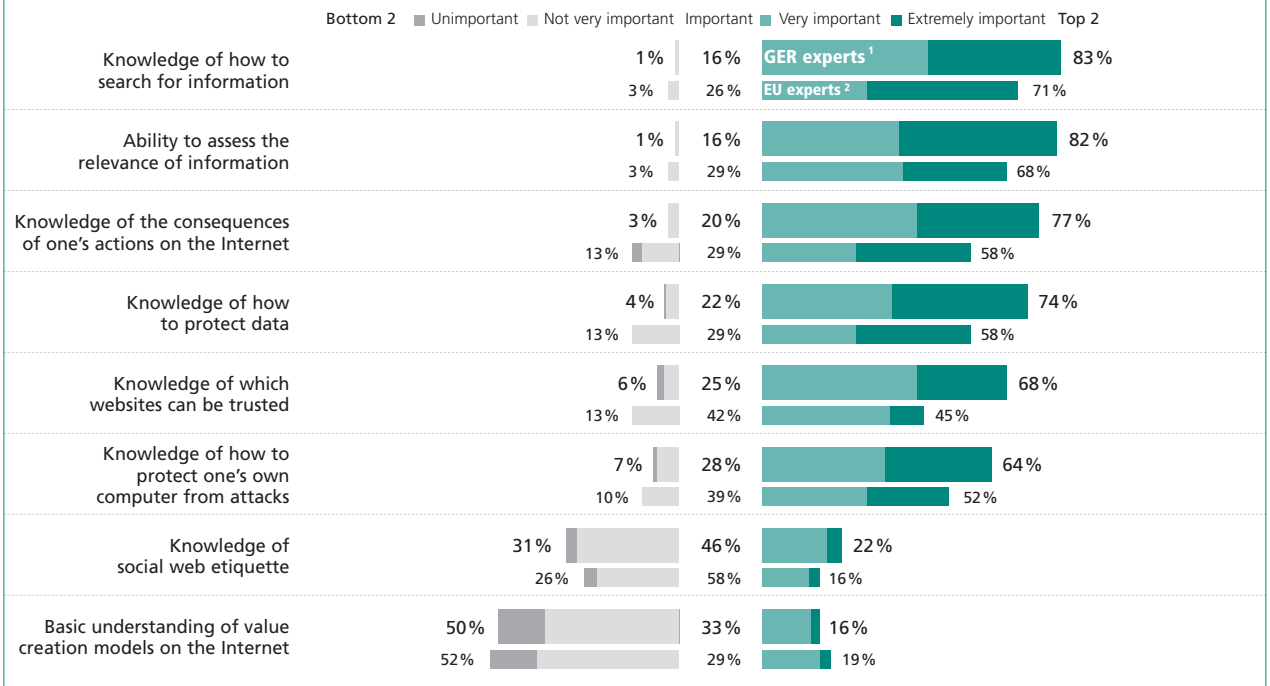
Looking at the trend of the last few years, it is clear that it is no longer possible to conceive of life without the Internet. Many people can no longer imagine a world without online shopping, online banking or increasingly also e government services. The importance of the Internet, in particular as a medium for communication, is growing.

User figures for social networks and their trends look as follows: In July this year, Facebook welcomed its 500 millionth user; the number of Facebook users in Germany alone doubled from January 2010 (September 2010: 11.07 million users; see Facebook 2010). The popularity of Twitter is also on the up and up: in June 2010, Twitter.com had more than 2.93 million visitors in Germany – in February 2009 it was just 0.28 million (see Twitter 2010).

This finding could suggest that Germany has already arrived in the digital society, or is well on the way. But it is not enough just to look at the dynamic development of (user) figures to verify Germany's arrival in the digital world of tomorrow – the crucial test is whether large sections of the population have an appropriately high degree of competence.

Fig. I.5: Key skills for Internet use

How important do you think the following key skills will be in the future for daily use of the Internet by all individuals?



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Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Wide-ranging points of contact with ICT in people's everyday lives

Nevertheless, ICT is also playing an ever greater role in the world of work. In addition to the fact that more and more people are confronted with ICT every day at work – 61 percent of people in employment in Germany now use a computer – the demands on users are also in constant flux. Long gone are the days when all you had to be able to do was switch a computer on and use a simple word processing program. The proliferation of Web 2.0 means that many employees now also need to have basic skills in using new forms of communication (see section III.4).

Since, as noted, the Internet has developed into a complex and significant economic, social and cultural space, occupied by ever growing numbers of people, it must be ensured that in a digitized society all participants have the core competencies required to take an active part.

Users now need a variety of competencies to be able to navigate the Internet without fear of negative consequences. Because these competencies are often situation-specific, we examine more closely below the basic competencies that allow every citizen to survive in our increasingly digitized world. We also look into the question of how it can be ensured that this basic know-how is made available to the entire population for the long term.

The most important "digital" competence: Searching for and evaluating sources and information

Digital competencies describe skills in using computers and the Internet, from mastering word processing programs and installing software, through to evaluating information on the Internet and actively participating online.

As part of this study, the selected experts discussed on an online discussion platform the question of which factors describe "digital competence" today and in the future. In addition to stipulating the ability to use technical equipment – i. e., hardware and software – the evaluation of sources and information were deemed particularly important. Information on the Internet and its quality must be evaluated just as "analog" media are, as must the trustworthiness of suppliers and sources.

"In this sense, competence asks for well-grounded general education […]."

And not only, but especially when using digital media: there is an even greater flood of information to negotiate on the Internet. The discussion threw up another aspect, which had previously received little attention: Part of digital competence already entails, and will continue in the future to entail, mastering communication on the Internet, i. e., transferring the etiquette of the "analog world" to the "digital world" and acting on that basis. Thus etiquette is also required on the Internet or when using electronic communications and should be adapted to the communication partner accordingly. A different picture should be used in a profile on a professional network than is used on a private network, such as Facebook or studiVZ.

In an additional online survey, the international experts were asked to evaluate the future importance of various key qualifications for everyone's day-to-day use of the Internet. They too considered the knowledge of how to search for information (83 percent) and the ability to evaluate the relevance of information (82 percent) to be most important. But 77 percent of the Germany experts also considered knowing the consequences of acting on the Internet to be very or extremely important. Surprisingly, "only" 74 percent or 64 percent respectively of the experts deemed it important for people to know how to protect data or their own computer from attack. In contrast to the specified key qualifications, a large number of the experts surveyed – 31 percent (see Fig. I.5) – deem knowing the etiquette to be not very important or unimportant, contrary to the participants in the discussion on the online platform. Possibly, this aspect of digital competence tends to pale in comparison with the knowledge of how to protect one's own data and computer.

Competent handling of personal data

"Too many people are too careless with their information, neglecting the fact that the Internet means a worldwide auditorium of people."

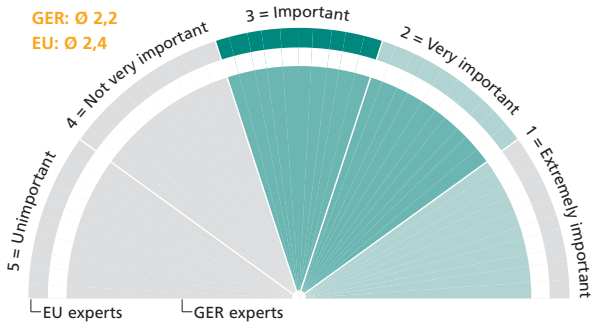
Many users are unaware that the Internet never forgets anything: Once uploaded to the Internet, data and files can be called up from anywhere in the world and can never be completely removed from the Internet. As the technology currently stands, "youthful folly" also remains permanently accessible and visible, since despite the efforts of academics (the Fraunhofer Institute for Secure Information Technology, among others) the called-for expiry date for Internet content is still unfeasible (on a large scale); the "digital eraser" also called for is not available yet either (see section II). According to the experts who submitted their assessment for Germany in 2009, digital self-determination, i.e., an individual's control over the use of his/her personal data on the Internet, will never be guaranteed (see "International Delphi Study 2030," 2009). It is therefore essential that Internet users are aware of the consequences of their frequently injudicious handling of personal data. In the future, the misuse of data published by the user himself/herself will be one of the greatest risks of Internet use. The growing relevance of digital identities means that entries on the Internet can increasingly influence personal success, whether privately or professionally. One study found that some 59 percent of human resources managers in Germany use the Internet to scrutinize applicants – and on finding certain search results, do not consider them further in the selection process (see Microsoft 2010).

In order to get Internet users to take a risk free and, above all, careful and considered approach to using the Internet, the primary goal should be to make people aware of the necessary security aspects and to strengthen everyone's sense of personal responsibility.

Fig. I.6: Ensuring responsible use of personal data – Importance

How important is ensuring responsible use of personal data for economic/social development in Germany (<country>)?

Economic importance



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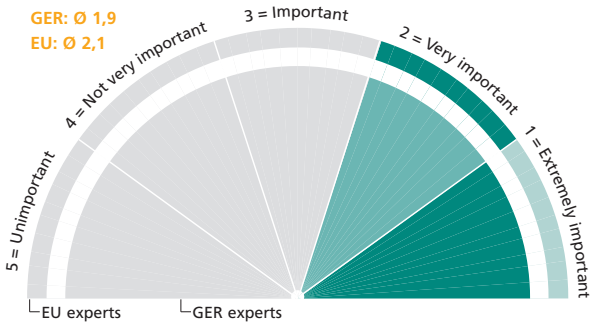
GER experts[1]	1 %	10 %	30 %	32 %	28 %
EU experts[2]	0 %	10 %	42 %	29 %	19 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
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EU experts[2]	0 %	10 %	19 %	45 %	26 %

■ ≥ 40 % of experts ■ 30–39 % of experts ■ 20–29 % of experts ■ < 20 % of experts ■ Averages

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Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Basic competence includes:

- Secure handling of private data on the Internet, e. g., privacy settings in online communities
- Competent handling of digital identities
- Recognizing potential risks of publishing (personal) information

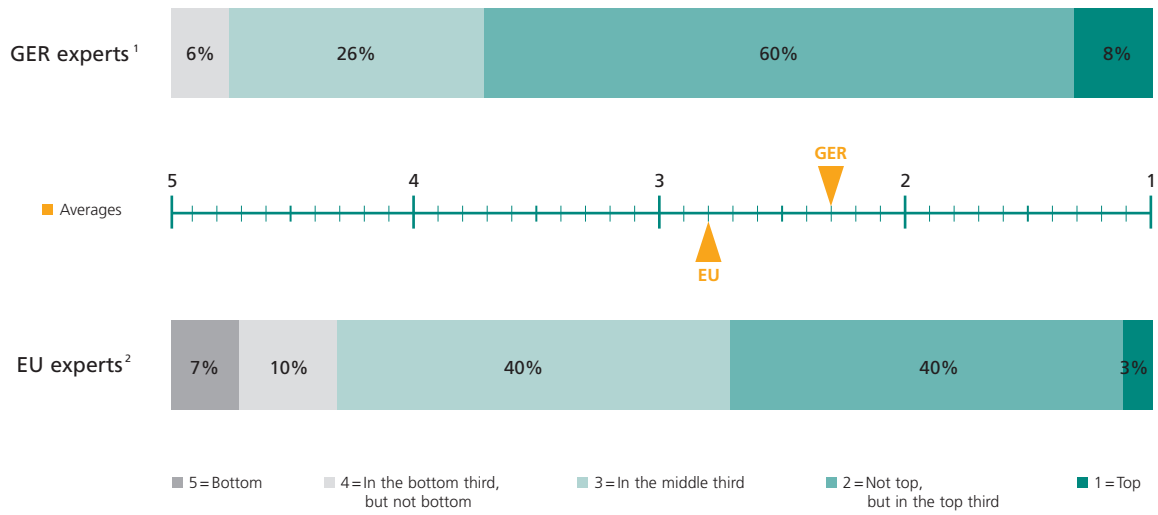
Responsible handling of personal data of the highest social importance

The expert survey in this study confirms the importance of digital competence. Ensuring responsible handling of personal data will be crucial in the future, above all for social development. 78 percent of the Germany experts and 71 percent of the experts for the rest of Europe consider this to be very or extremely important. When assessing the impact on Germany's economic development, the experts surveyed were somewhat more cautious. Only 59 percent believe that ensuring responsible handling of personal data will have a very or extremely important influence on Germany's economic development. The Europe experts are of a similar opinion: 48 percent of them consider this issue to be extremely or very important for the economic development of European countries (see Fig. I.6).

Looking at the level Germany has reached so far in ensuring responsible handling of personal data, the experts put Germany in a strong position when compared internationally: 60 percent of the Germany experts place Germany in the top third, and eight percent even put it in first place in handling personal data (see Fig. I.7). This highly positive finding could be attributable to the fact that the issue of data privacy has been thrown into sharp public focus in Germany as a result of a number of data problems in the recent past. A current example in this connection, which was made public above all by politics, is the privacy settings on Facebook. For Germany to be able to retain its good

Fig. I.7: Ensuring responsible use of personal data – Position

And how do you think Germany (<country>) is positioned on ensuring responsible use of personal data in an international comparison?



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position, experts believe politics (88 percent) and citizens themselves (81 percent) are primarily called upon (see Fig. I.8). This finding clearly highlights the socio-political importance of this task. State and citizens must work together to build up competencies.

Competent handling of the rising flood of information

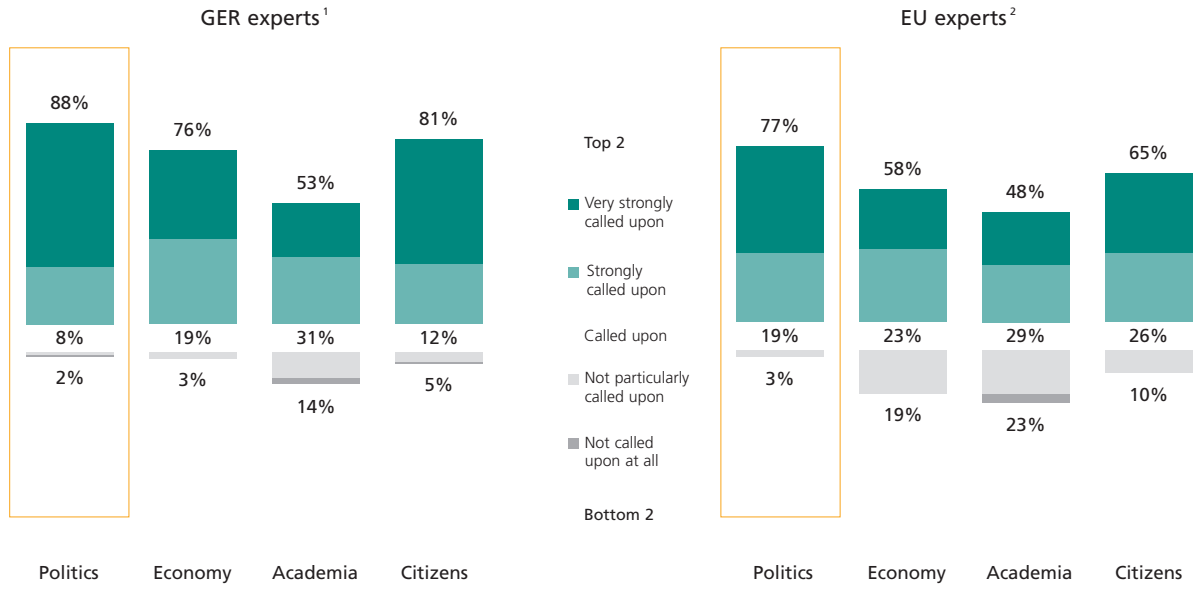
The advantages and benefits provided by the Internet in our everyday working and private lives must also be considered particularly in terms of the almost limitless supply of information. It is becoming increasingly clear that the vast amount of information available is both a blessing and a curse. Content is updated ever more frequently, while more and more new content is also put online. The resulting proliferation of available information can end in individuals receiving an information overload. This trend can be seen around the world and yet more websites and new information are added daily. In light of the global reach of the Internet and the associated variety of information, (independent) information processing and knowledge work using digital media are a key prerequisite for anyone who wants to be equipped for the requirements and duties of work in the long term. There are all kinds of tools for coping with the information overload online (e.g., filters, search optimization), which however, mainly help proficient Internet users to make the most of the opportunities offered by the Internet efficiently and securely.

"The ability of handling the increasing amount of available knowledge already splits our societies into groups today: those who use the Internet advantageously […] [and] those who cannot use it."

In order to close this gap in the long run, it is important that all users have certain basic skills for coping with the information flood on a daily basis. Assessing the quality of information is a particularly key competence that individuals must develop. Other competencies are:

Fig. I.8: Ensuring responsible use of personal data – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to ensure responsible use of personal data?



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- Selecting the right sources of information for the context

- Assessing the relevance of information/filtering relevant information

- Assessing sources of information in terms of credibility, authorship, accuracy, quality, etc.

- Assessing how up-to-date information is

"We need skills to separate trusted information from trash […]. I think one key to achieving this target is that experience becomes more important than knowledge."

In the expert discussion, it became very clear that it is not only users themselves who are called upon to deal with the glut of information on the Internet. Rather public authorities and specific bodies should provide guidance to users to make it easier for them to cope competently. Specifically, the experts discussed having the reliability of sources assessed and published, e.g., by official agencies or authorities.

The next step could now be an appropriate implementation initiative, which must first determine who could be responsible for such a project and define the next steps.

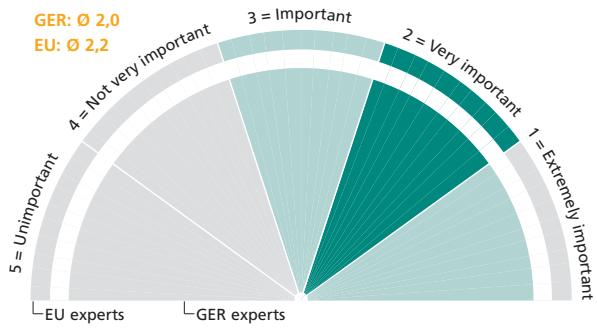
Communication competencies on the Internet

The acceleration in Internet use is primarily driven by the new opportunities available online. More and more users are active in social communities: 35 percent of German Internet users now log onto social networks at least once a day (see Digital Life 2010). Thus navigating this private world is already part of everyday life for many onliners. Experts are convinced that by 2024 at the latest, more than half of the population in Germany will regularly maintain their social contacts using the "social web" (Web 2.0) applications and services (see "International Delphi Study

Fig. I.9: Adaption to the user – Importance

How important is developing ICT technologies and products that adapt to the user for economic/social development in Germany (<country>)?

Economic importance



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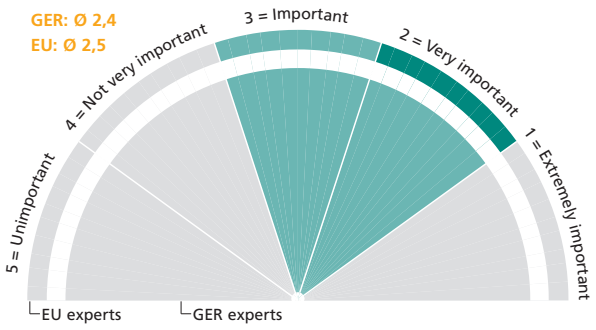

	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	2 %	12 %	30 %	39 %	16 %
EU experts[2]	0 %	16 %	32 %	42 %	10 %

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2030," 2009). A growing number of companies are also increasingly discovering this form of communication for internal and external corporate communications (see Article I.6).

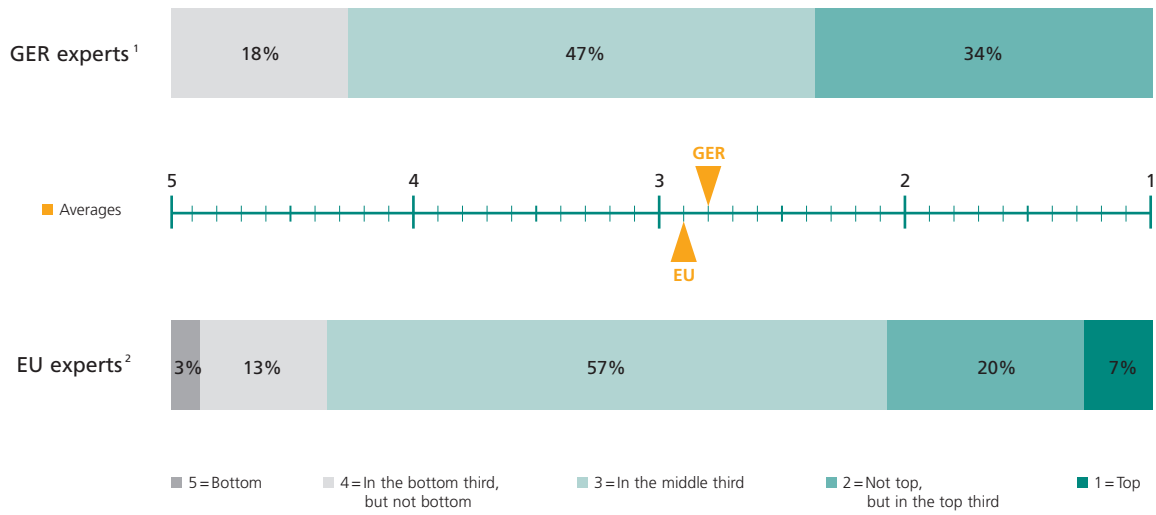
In addition to countless benefits, such as the fast exchange of information or simplified communications, especially in light of the increasingly international operations of companies, there are also complex problem areas, above all when considering the impact of Web 2.0 on external communications. In this connection, the disclosure of sensitive internal information is a core issue that companies must consider.

When you look at the way many employees use Web 2.0, it can be seen that many users are not really aware of the consequences of posting comments and information in social networks. Studies show that employees who identify themselves as belonging to a certain company in a social network are seen as ambassadors for that company (see BITKOM 2010a). Consequently, remarks made by such employees in networks or blogs that are damaging to a company's business or reputation can have very negative consequences for the company's public image. The trend toward more open companies, which is positive in itself, nevertheless results in the fact that corporate communications can no longer be entirely controlled and are shifted to channels outside of the company. This requires employees to understand the interactions and implications of Web 2.0 – it appears that many companies have only had a rudimentary grasp of this fact, at least so far.

Companies need to provide their employees with guidelines that define what can be communicated, what should be omitted, and also what is prohibited by law. Specifically, companies must make it clear to every single employee how far-reaching professional remarks can be, i. e., which rules must be observed at all costs in professional contexts.

Fig. I.10: Adaption to the user – Position

And how do you think Germany (<country>) is positioned on developing ICT technologies and products that adapt to the user in an international comparison?



[1] Experts for Germany, n = 326; [2] Experts for European countries, excl. Germany, n = 30
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

Internal communications must also take into account the fact that the opportunity to chat with colleagues may distract employees excessively from their daily work, or they may feel disturbed by unnecessary information. The expert discussion developed a specific, overarching solution, primarily in light of the use of Web 2.0 by companies. A demand for communications etiquette was formulated, primarily to remove existing uncertainties and disruptive factors in professional contexts (see Article III.4).

Basic competencies as a foundation

"[…] I do not necessarily need special technical skills. […], but competence based on human education and fundamental general knowledge."

Aside from the specific competencies for navigating the Internet expressly discussed here, it was also made very clear in the expert discussion that, in addition to this digital know-how, "fundamental" basic competencies are necessary for mastering everyday life. Experts believe it is advisable to use a degree of "common sense" when assessing the accuracy, value and consequences of certain information:

"[…] a good general education will also help to judge if information is correct, wrong, etc."

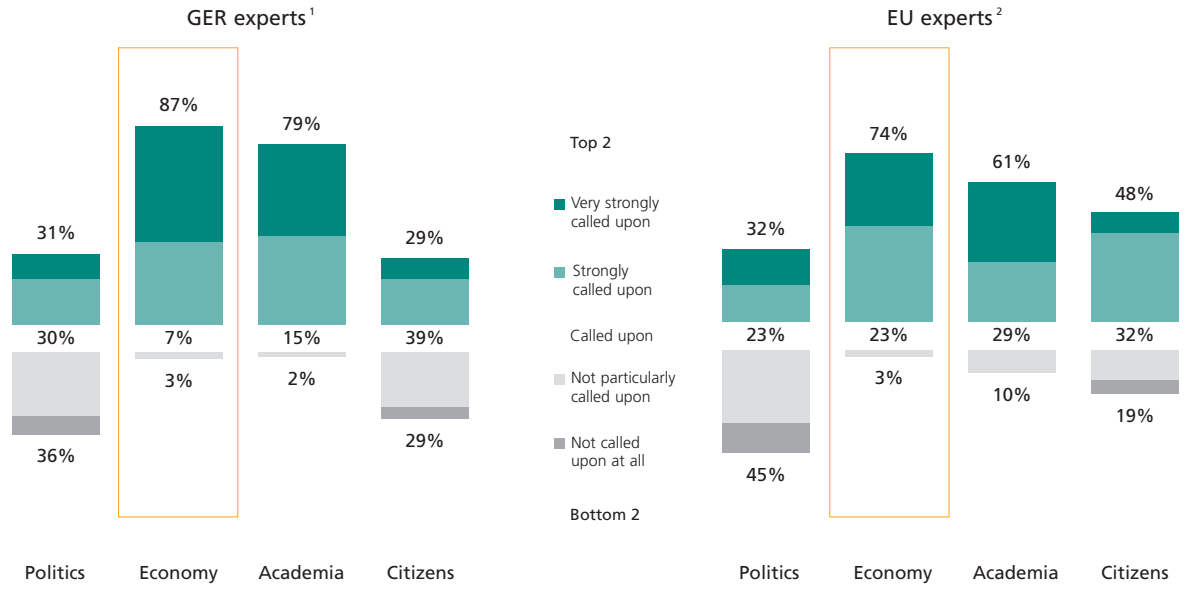
But there must also be a certain basic understanding of specific applications, e.g., for online banking. After all, certain activities can only be managed online without any great difficulties if they have already been carried out in the real world.

User-friendly interfaces the solution?

"I am always astonished that engineers automatically accept that humans have to adapt to machines and not vice versa."

Fig. I.11: Adaption to the user – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to develop ICT technologies and products that adapt to the user?



[1] Experts for Germany, n = 346; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

The success of the Apple iPad is a prime example of how current this issue is: Its focus is on the user-friendly interface, i.e., the technology was adapted to the users. The study found very clearly that it is not only users who are called upon to acquire competencies – there is also a growing obligation on manufacturers of ICT.

In fact, 72 percent of the Germany experts and 71 percent of the Europe experts expect the development of ICT technologies and products that adapt to users to be an important driver of economic development (see Fig. I.9). Nevertheless, this importance does not yet appear to have really taken hold in Germany. Around half of the experts only placed Germany in the middle third compared internationally, and Europe's role is deemed to be similar (see Fig. I.10). Experts believe it is primarily business (87 percent) and academia (79 percent) who are called upon to adapt ICT technologies and products to users (see Fig. I.11). If usability is made intuitive, then many inexperienced users need no longer be afraid of having a go with new technologies. It was clear from the expert discussion that this need has long been acknowledged by many companies. So far, however, many approaches have failed due to a lack of feasibility, because:

"[…] the human interface will be the key but also a great challenge."

Summary and recommendations

The study makes it clear that many Germans use the Internet without having any extensive knowledge of the issue of network and data security. This deficit can be easily overcome. Basically, the main factor required for competent use is sufficient experience. One step in the right direction is already being made by the Federal Ministry of Economics and Technology with initiatives like "Experience the Internet." This is aimed at people who have not previously used the Internet, or not competently, and are therefore excluded from the professional and social opportunities offered by digital media.

"Competence is the prerequisite to understanding."

Germany-wide guidelines on "Living in digital worlds" could set a powerful "standard" in this regard. Promising projects, like the Bavarian "media license," should also be put into practice Germany-wide and linked with similar initiatives. Publishing this standard in digital and paper form, distributing it and making it available at public authorities, in day care centers and schools, positioning it on the Internet and in relevant initiatives, as well as making it "basic reading" for teaching staff, would help to break down reservations and counteract naive use of the Internet, and thus to create underlying competence for many citizens. This would help to bring Germany a significant step closer to digital sustainability.

In addition to the listed competence profiles of users, it was very clear from the expert discussion that they do not just see individual citizens as being responsible for this. Rather, it was pointed out that the technological foundations also need to be further developed, so as to enable users to quickly get to grips with using (new) technologies. Technology needs to be increasingly perspicuous and comprehensible – black-box systems, which lead to uncertainty, are to be avoided. In addition to the user-friendly interfaces already mentioned, seals of quality could also be beneficial to consumers and users as signposts in the Internet.

I.3 Education and education infrastructure in the digital society

Good education leads to economic success – our future is linked to the level of education

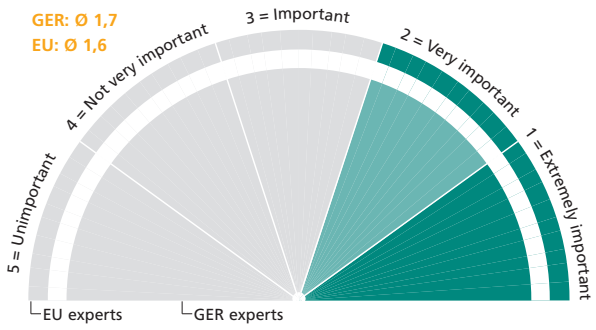
Investment in education brings significant returns, not just for citizens, but also for the state. This is backed up by the latest OECD Study from 2010. In fact, OECD countries invest massively in education (see OECD 2010a). Across all countries, expenditure per pupil of educational institutions below university level rose by an average of 43 percent between 1995 and 2007, despite relatively stable pupil numbers. However, the level of expenditure varied significantly between countries, in both absolute and relative terms. Because the OECD countries and specifically Germany have to prepare for a high degree of population aging, it is widely accepted that education is becoming an increasingly important factor and is crucial to employability. The Germany experts surveyed for this study believe that an integrated education infrastructure that meets the requirements of the digital world is central for both the economic (84 percent) and the social (76 percent; see Fig. I.12) development of a country. The Europe experts concur: They also see the significance primarily for economic development (90 percent), but also for social development (77 percent).

But what will the education infrastructure of the future look like? What skills will be required in future? How important will factual knowledge be? How important is practical experience? How will we actually learn tomorrow? What role will the Internet play in the "learning" society? And finally, who will be responsible for the education infrastructure of the future? How will the tasks be distributed between state, economy and academia in terms of providing a modern education? The issues discussed with the experts in an online debate and the answers from the expert survey give an insight into the future of education.

Fig. I.12: Education infrastructure in a digitized world – Importance

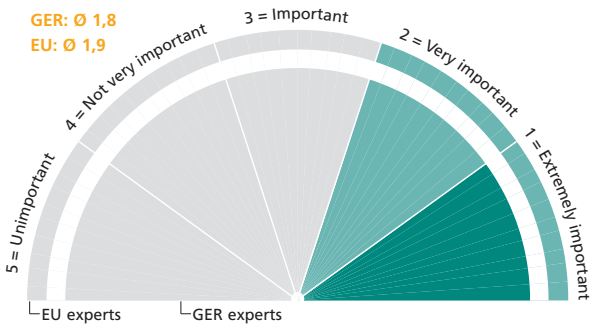
How important is implementing an integrated education infrastructure that meets the needs of a digitized world for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	1 %	2 %	11 %	37 %	47 %
EU experts[2]	0 %	3 %	6 %	42 %	48 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	1 %	2 %	18 %	35 %	41 %
EU experts[2]	0 %	3 %	19 %	39 %	39 %

■ ≥ 40 % of experts ■ 30–39 % of experts ■ 20–29 % of experts ■ < 20 % of experts ■ Averages

[1] Experts for Germany, n = 346; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Goethe and Google?

Traditional elements, such as reading, writing and arithmetic will continue to be core components of a modern education in the future, as well as an awareness of cultural and ethical values. A broad spectrum of strategies for acquiring knowledge and an education was needed even before the Internet arrived. These strategies remain relevant and have expanded to include the Internet – from Internet research, e. g., using search engines, and reading textbooks or articles, through to the skills needed in the knowledge society. The experts therefore agree that, in addition to mastering traditional disciplines, a thorough understanding of the new media is now an essential component of a modern education.

"There is no question that basic knowledge like reading, writing and mathematics is essential for further education."

According to the experts, the primary skill needed in the future will be to develop strategies for classifying, evaluating, interpreting and organizing the ever growing flood of facts quickly, critically and constructively (see article I.2). Facts must be made useful.

"What counts are relations between facts and even more: processes, i.e. application of facts to a given situation."

How will we learn tomorrow?

Traditional learning is still the prevailing form of acquiring knowledge and education. Digital media are new, additional tools which can be used to make learning more interactive and thus more tangible. The experts in the discussion were in agreement on this point. Digital media supplement and complement conventional teaching methods, but will not replace them. Riepl's Law applies, which states that established methods and media are never replaced by newer, further developed methods, but rather remain in parallel with them and take on different roles (see Riepl 1913).

"When the radio arrived for the public, it did not replace the newspaper. And when television arrived, it did not replace the radio. I think that in the same fashion the computer, the Internet and e-learning do not replace classical methods of learning, but complement them."

The experts agree that the new technologies need to be integrated right from a very early age, e. g., in kindergarten. This gives educators and teachers in particular a new and central role in teaching media competence. Accordingly, training for educators and teachers must be decisively developed further in the future and the awareness of teachers and educators for life-long learning and training must be raised.

"Learning programs and the use of computers (for whatever purpose) are and will be supplements and they can play a very important role. But they cannot replace a human teacher."

The learning process takes effect through our senses. The presence of the teacher is important for teaching modern learning strategies. This applies both to online learning and virtual communities as well as to offline learning, using books, trade journals and in libraries.

The digital society enables everyone to learn in their own way at their own pace. All kinds of learning methods and international teachers are available on the Internet, such that everyone can and should find their own personal approach to education. While the experts agree that the virtual learning programs and methods won't replace the teacher as a human and role model, they differ on which is the best method for self-study.

Digital media enrich the learning experience, but also change the ways and means in which people learn, and thus add new charm and zest to the learning process. Young people in particular increasingly use digital media to learn. The latest Shell Youth Study 2010 shows that among all the many differences, one factor is the same for young people in 2010 (aged between 12 and 25):

"Almost all young people (96 percent) now have access to the Internet (in 2002 it was just 66 percent). Not only has the number of Internet users increased, but also the number of hours young people spend online: 13 hours a week on average." This equates to almost two hours a day. It can therefore be said that it is possible to reach all levels of society in this age group through digital media to impart knowledge and an education: yet another reason for starting with "digital" education early on.

"Notebook classes have already been tested and proven to work fine. Integrating new technologies must start in kindergarten. Life-long learning is already the key to success today. Adopting new technologies and knowing how to evaluate information is not only something that should be learned at school. A faster changing society and faster developing technologies will demand an ongoing process of learning."

Digital infrastructure is a key success factor for modern education

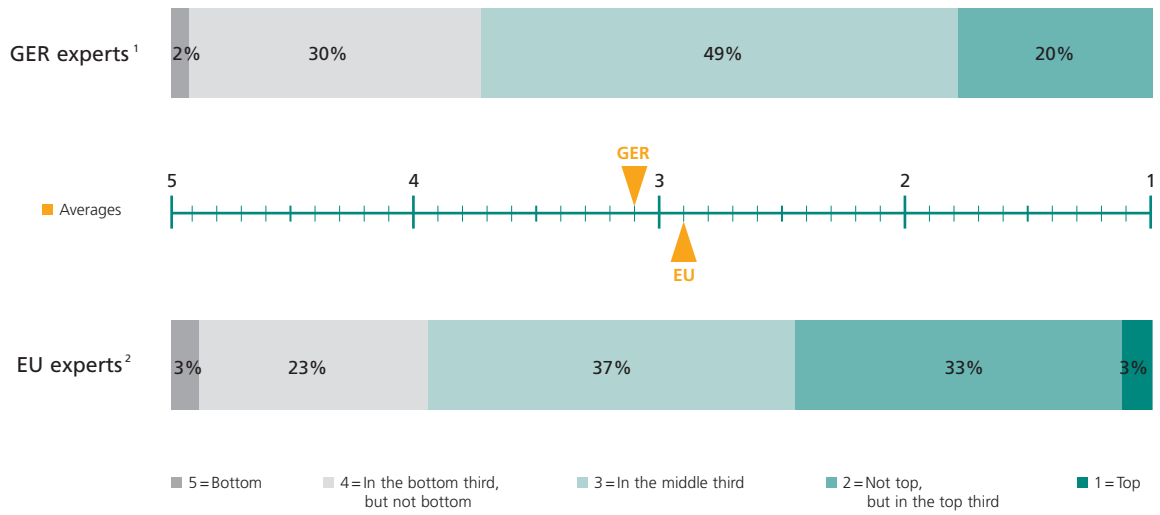
Teachers continue to be important as role models, above all in schools and universities. The best known example can be taken from antiquity, where Aristotle acted as a teacher of ethics and politics for Alexander the Great. The acceptance of the teacher as an imparter of knowledge and moral role model remains central. He/she teaches relevant background knowledge and the associated cultural and ethical values.

"[…] at least at school and at university we will have a classical style of teaching for a long time still. This may be different in life-long learning where, experienced people try to improve their knowledge […]."

In addition to the human network, the digital infrastructure is a key success factor for modern education. Access

Fig. I.13: Education infrastructure in a digitized world – Position

And how do you think Germany (<country>) is positioned on implementing an integrated education infrastructure that meets the needs of a digitized world in an international comparison?



[1] Experts for Germany, n = 324; [2] Experts for European countries, excl. Germany, n = 30
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

to computers with broadband connections and modern simulation software are just as central as a cultural, academic-artistic educational setting and access to educational institutions, such as libraries.

It is central, as it were, especially in the digital society and when learning using digital media, to have a helpdesk where users can talk to qualified experts about specific issues virtually and in person. The experts found it important to emphasize that the students should ideally be able to work from "a platform" – a major advantage of this is that everyone can learn at their own pace.

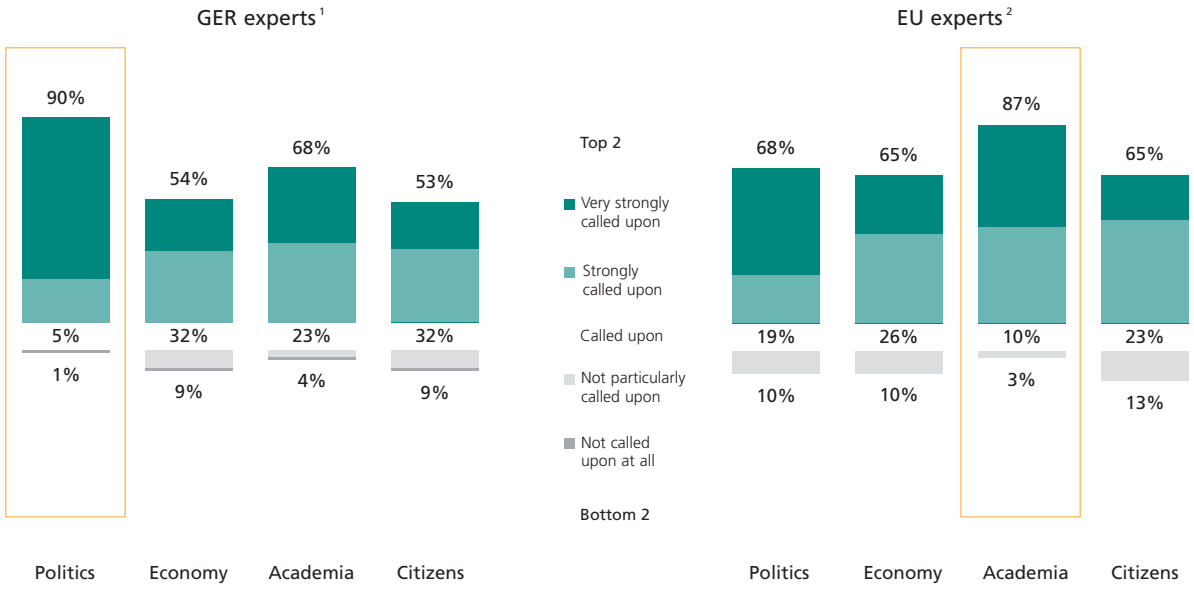
Overall, the majority of the Germany experts (49 percent) place Germany in the middle third compared internationally in terms of implementing an integrated education infrastructure that meets the requirements of a digitized world. The Europe experts are more optimistic as regards their countries: In fact, 33 percent place their country in the top third (see Fig. I.13).

The experts were agreed that the so-called 70-20-10 concept increasingly applies: These days, we learn 70 percent of our job through practical experience, 20 percent through our colleagues and other experts, and just 10 percent through formal training. Life-long learning arises from working with other people, at conferences, in projects and above all, in networks.

"Training on the job focuses on work in real projects, study groups, best practice sharing, and self-study. Learning from others requires coaching, mentoring, and assessment. Formal training is the best option, gathering knowledge by instructor-led-training, e-learning, mobile learning, or blended methods."

Fig. I.14: Education infrastructure in a digitized world – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to initiate implementation of an integrated education infrastructure that meets the needs of a digitized world?



[1] Experts for Germany, n = 346; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Success in future education requires a new education infrastructure

Experts believe that a successful education infrastructure comprises the elements of school, a university education, a career, and life-long learning. **Schools** teach basic skills like reading, writing and arithmetic. **Careers** provide practical experience-based training. The success of a **university education** comes from an in-depth knowledge infrastructure combined with a network of specialists who enable work on new problems. **Life-long learning** depends in particular on the level of the education environment in all social and academic areas, like conferences, talks, and libraries, and thus on a high-caliber education network.

Nowadays, the "Internet" is an all-encompassing culture technology. In the battle against the shortage of experts and educational poverty, many people are calling for better encouragement of children right from preschool. It is hoped that kindergartens will be equipped with notebooks and learning software so as to teach children from a very young age of around three years the right way to use the Internet. In order to achieve wide-ranging media competence, the experts draw parallels with the early motor traffic of some 100 years ago and recommend the universal introduction of the equivalent of a driver's license for the Internet.

"[…] the Internet is very similar to traffic, although with many people participating without a driver's license."

The experts believe that, above all, politics is called upon to implement an integrated education infrastructure. 90 percent of them believe politics to be called upon or strongly called upon in this regard. Ahead of the economy as a whole, the experts believe academia is under obligation to initiate the implementation of an integrated education infrastructure. Only 53 percent claim that every citizen is called upon or is strongly called upon in this regard (see Fig. I.14). Interestingly, the Europe experts consider academia to be called upon above all for their countries (87 percent).

Summary and recommendations

Goethe and Google! Traditional skills, such as reading, writing and arithmetic will continue to be core components of a modern education in the future, as well as an awareness of cultural and ethical values. In addition to mastering traditional disciplines, a profound understanding of the new media must be an essential component of a modern education in the future. Digital media supplement and complement conventional teaching methods, but will not replace them.

In the future, the learning process will be driven by teachers as well as by an innovative digital education infrastructure, which should be accessible to all citizens. A new and important role will be given to promoting media competence in preschool children. The main aim will be to be able to manage the growing flood of information and to learn strategies for classifying, evaluating and making use of facts quickly, critically and constructively. An Internet license for education in the digital society is considered promising in this regard. For the provision of education infrastructure in schools, universities, the economy and private households, and the continuous training of teachers and educators in order to make teaching innovative and appropriate to media, the main onus is on politics and academia.

The International Delphi Study 2030 defined the awareness for the political and social significance of all media as an educational responsibility and expressly called for media studies to be established as a subject in schools on a broad basis. We refer to the suggestion in the study to launch a corresponding campaign. A key to life-long learning is to teach students from a very young age to assess information sources in terms of their credibility. At the same time, skills in communicating with other people should be trained so that knowledge can be constantly further developed. "Nonetheless, such measures remain ineffective unless knowledge is conveyed on a broad basis. The traditional learning of facts is the basis for assessing the relevance and credibility of information and its sources." (International Delphi Study 2030 from 2009).

In order to ensure the population has the necessary competency for the future, in addition to building up the basic competence of students, adult education should also address the issue of "digital competence." Adult education should focus above all on managing the information overload and efficient self-organization of Internet use. Furthermore, individuals should develop skills that enable them to assess the value and quality of information for themselves. Previous measures from (school) education should be built on through interdisciplinary use of the medium of the Internet.

I.4 Responsibility for "digital" education

Education advances the economy

Almost all industrial nations have to contend with declining birth rates. The most recent OECD country study from late summer in 2010 concluded that only by increasing the level of qualifications will it be possible to meet demand for skilled employees in the future. For the state, these investments in education pay off in the form of economic growth and greater tax revenues, according to the OECD's analysis (see OECD 2010a).

Education is the central lever for social development

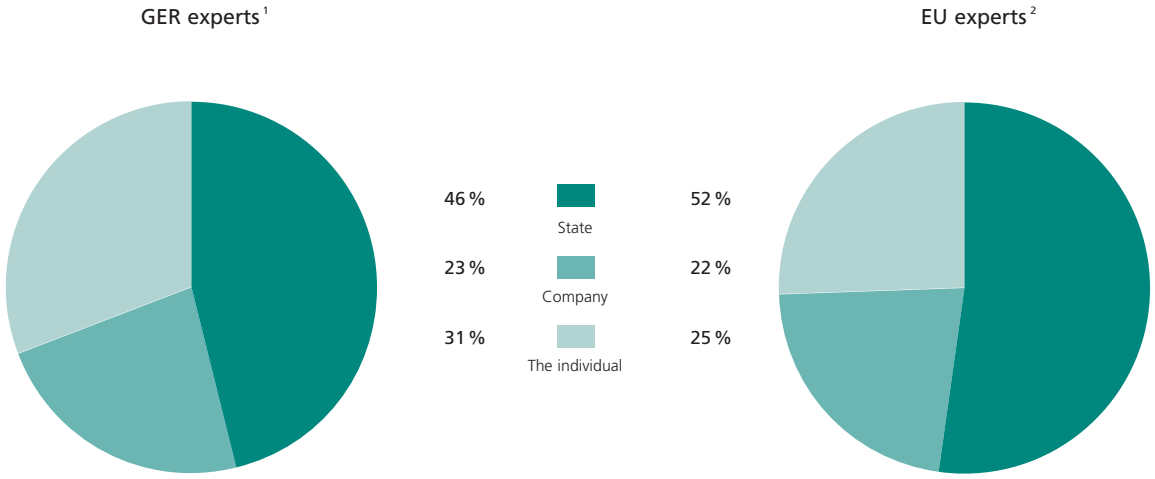
The experts surveyed are also in no doubt that education is of central importance to the future of our society. The Germany experts consider the onus to be equally on the state, the economy as a whole, and individual citizens when it comes to continually promoting life-long learning.

The experts expect the state to bear 46 percent – and thus the largest proportion – of the general cost of educating individuals. Each individual is expected to contribute around a third, and companies will bear almost a quarter of the cost (see Fig. I.15). The Europe experts indicate a similar distribution, although they expect the state's obligation to be somewhat higher (52 percent). Different social groups are assigned different roles, however: The state is deemed to be obligated to provide suitable basic conditions for education in the digital society. The experts specified this obligation in the online discussion to mean free access to educational institutions and communication technologies. The state does not have to own the communication networks for this, but it must ensure that everyone has access to them:

"That doesn't necessarily mean that the state must own and operate these infrastructures. But the state has to make sure that they are accessible to anybody."

Fig. I.15: Investments in expenditures for education

What percentage must the following players contribute toward the general expenses of an individual's education in the future? Please distribute 100 percent between the following parties:



1 Experts for Germany, n = 314; 2 Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; averages

The experts are not entirely sure, however, whether the state is currently meeting its obligation adequately. Many experts are skeptical as regards specific appropriate campaigns by politics, especially given the fact that education budgets in Germany have been falling again in the last few years and are increasingly curtailed (see Education for Germany 2009). The OECD country report from 2010 also found, for example, that the proportion of GDP spent on education has been declining for years (GDP; see Education Report 2010). At 4.7 percent of GDP, Germany's investment in education is below the OECD average. Due to the lower number of students, however, spending per capita is average compared with other OECD countries. In tertiary education, i. e., at universities, German expenditure is slightly above average, in primary and secondary education it is below the average of the OECD countries (see OECD 2010b).

Education awareness instead of an education solidarity surcharge

Nevertheless, the experts agree that sustainable education is not to be financed by yet another new tax. They are of the opinion that existing budgets should be reallocated and strategically injected into the education sector:

"Of course, such a tax will not help, it is more or less to change the distribution of the public budget."

It is not so much the financial aspect to which the experts assign a central role in shaping sustainable education and life-long learning. For them, public awareness of the great importance of education plays a much bigger role:

"The key point is a broad awareness of how important education is for our future (and it is no exaggeration to say: for our survival!)."

For some experts, the debate about education among those with political responsibility is in itself cause for hope that serious investment will be made in education. But other experts fear that although politicians are increasingly paying lip service to the issue of sustainable education in general, and digital competence in particular, this will not be followed up by appropriate action.

"But I do not see any action by politicians (and therefore see no hope). They just talk about its importance while they […] remove money from education budgets […]."

State investment in the digital training of teachers

Teachers play a central role in the education process. In order to be able to teach up-to-date knowledge, they need to receive regular training. It is precisely on this point that the experts see scope for state investment in education, namely in the training of teachers. For the experts, this not only means providing appropriate programs, it also means creating financial incentives to encourage teachers to do the training.

"[…] the continuous education of teachers would be necessary and would contribute much to improve the current situation in schools. Financial motivation of teachers for updating their knowledge would be helpful."

Teachers impart technical knowledge and social skills and they also teach how to network and apply knowledge. They encourage students to be curious and to question things, and teach them to evaluate things for themselves. School teachers generally teach basic knowledge and university lecturers specialist knowledge and conceptual thinking. Teachers increasingly have to emphasize the skills of the individual and, in the future, they will not only have to be imparters of knowledge, but also above all educationalists.

"The functions teachers have to fulfill are twofold: 1. To teach TECHNICAL skills about living in a digital environment. 2. To teach SOCIAL skills about handling the digital environment: finding, sorting, evaluating, and exchanging information, and being aware of the risks of mutual manipulation."

Today, the experts see a focus on the ongoing digital training of teachers: regular participation in training courses and programs is necessary to keep them up to date with the latest developments in information and communication technologies and how to use them.

Several questions arise in this regard. Can teachers really keep up technically with students who spend around two hours a day outside of school surfing the Internet, as the latest Shell Youth Study 2010 found? How are teachers seriously supposed to teach these students how to use the Internet and other communication technologies? That's like a German driving school trying to teach Michael Schumacher how to drive. And might this problem not simply resolve itself in a few years, i.e., when the next generations of teachers arrive at schools, for whom the use of Twitter, Facebook, Apps and iPads is as natural as the use of chalk and sponge was for earlier generations?

Does this intensely technology-centric view really get to the heart of the education problem? If, for all kinds of reasons, access to high-quality education in Germany still largely depends on social level, then providing schools with digital equipment and highly digitally competent teachers will not resolve the actual plight of education.

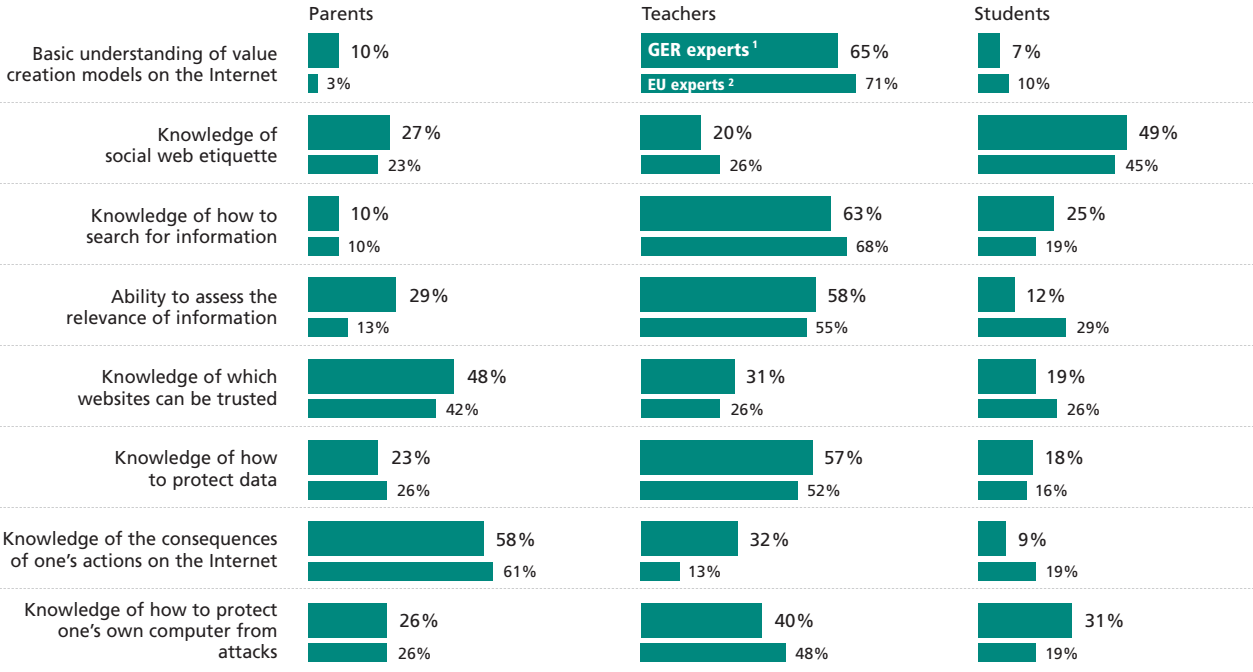
"I think we will come to the conclusion that the traditional school system has to change into a more local, more individual system, concentrating more on the special needs of people. There is enough money in the school systems, we should think about how we can meet the unique individual needs of each child."

Assignment of roles in the teaching of digital competence – the key importance of teachers

Competent use of digital information sources will be taught in schools. Teachers are to instruct students how to find what information on the Internet, work out how relevant it is, how to assess its quality, who is providing the information and whether this provider would like to earn money if possible from offering it (see article I.2). Around two thirds of the Germany and Europe experts say that teachers are responsible for giving students a basic understanding of the value creation model on the Internet (see

Fig. I.16: Competence in skills development of students

Below is a list of skills for using the Internet with three players (parents, teachers, students) responsible for developing these skills. Please indicate which of the players (parents, teachers, students) is most important for the development of each skill among school students.



[1] Experts for Germany, n=346; [2] Experts for European countries, excl. Germany, n=31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Fig. I.16). 63 percent of the Germany experts and 68 percent of the Europe experts also see teachers as responsible for teaching students how to search for information. At the same time, the experts believe that teachers must teach their students how to assess the relevance of information (58 percent of the Germany experts).

Parents only play a subordinate role

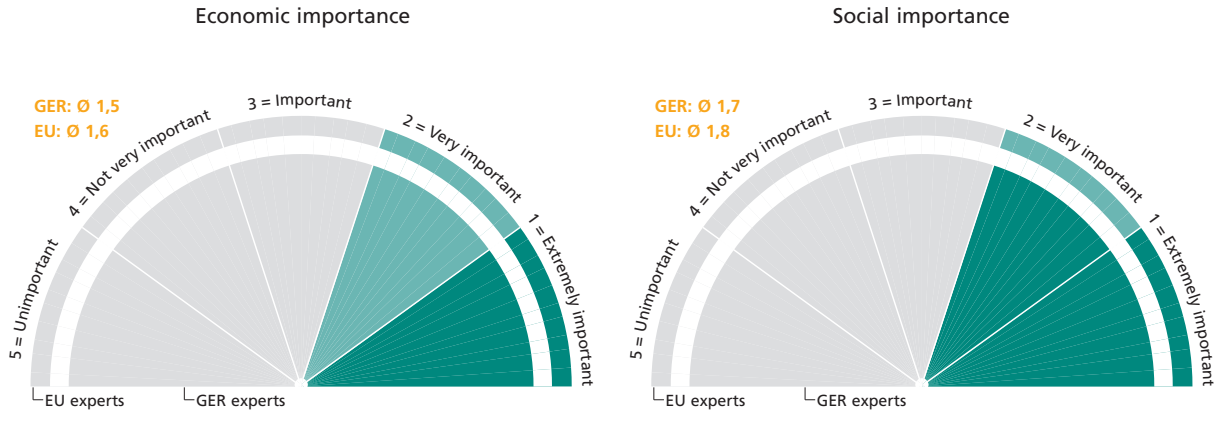
Experts rate the importance of parents in building up the above-mentioned competencies in using the Internet as much lower than that of the students themselves. An exception to this for the Germany experts is the skill of how to assess the relevance of information from the Internet. In this regard, the Germany experts place greater trust in parents (29 percent) than in students (12 percent). The Europe experts, however, also see this skill as being more down to students (29 percent).

The area where experts consider neither parents nor teachers to have any significant influence is in how users interact with each other. What is ok and what is not – rules of digital etiquette have grown up, which work largely without the interference of adults. It is not just that today's parents often don't really know where to find what on the Internet and who earns from it or not, the experts believe they also have little idea of the rules of play in this virtual society. 49 percent of the Germany experts said that students themselves are responsible for building up their own and each other's competence in digital etiquette.

There are two skills, however, for which the Germany experts deem parents to be responsible: understanding which websites can be trusted (48 percent) and understanding the consequences of one's own actions on the Internet (58 percent).

Fig. I.17: Promoting life-long learning – Importance

How important is promoting life-long learning for economic/social development in Germany (<country>)?



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	0 %	0 %	8 %	32 %	59 %
EU experts[2]	0 %	3 %	6 %	39 %	52 %

	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	0 %	2 %	13 %	40 %	45 %
EU experts[2]	0 %	6 %	10 %	39 %	45 %

■ ≥ 40 % of experts ■ 30 – 39 % of experts ■ 20 – 29 % of experts ■ < 20 % of experts ■ Averages

[1] Experts for Germany, n = 346; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

The experts believe parents will have a lot of catching up to do in the future. They will have to equip their children with basic skills, which not only include learning their own language, but also teaching social skills and ethical guidelines. Parents have the greatest responsibility because they must supervise and promote the development and skills of their child right from their earliest childhood. They teach their child how to speak, foster their talents, help them to overcome weaknesses and set their first boundaries for what is right and wrong, good and bad.

"The key responsibility for education belongs to PARENTS! If 'early' education does not happen, even the best teacher will not be successful. Social and mental development starts in early childhood."

To begin with this is only indirectly related to the teaching of digital skills. But teaching technical competencies, like sending and receiving messages, operating mobile devices, setting up accounts with providers, etc., will soon cease to be a focus of interest for knowledge transfer – say the experts. At some point in the not too distant future, the use of modern means of communication will be as much second nature as turning on a television or opening a book. It will then be all the more important to use these new possibilities appropriately.

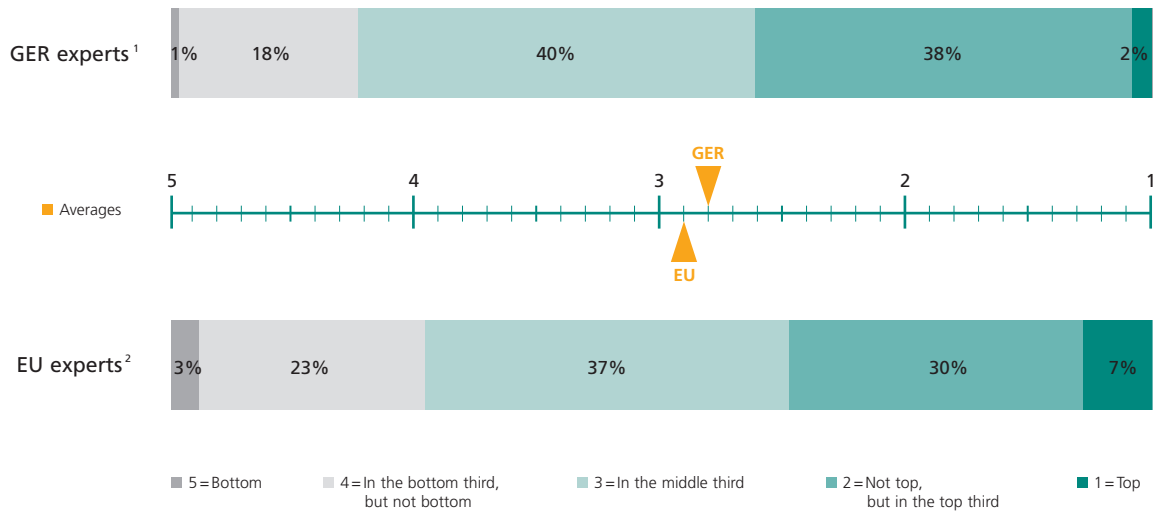
Personal responsibility for life-long learning

The importance of life-long learning is undisputed among the Germany experts. 91 percent emphasize above all the economic importance of a process of life-long training. But 85 percent of the Germany experts also classified the importance for social development as very or extremely important (see Fig. I.17).

When assessing Germany's position in terms of measures to promote life-long learning, the experts ranked Germany between the middle and the top of the field. In fact, 38 percent of the experts place Germany with great confi-

Fig. I.18: Promoting life-long learning – Position

And how do you think Germany (<country>) is positioned on promoting life-long learning in an international comparison?



[1] Experts for Germany, n = 341; [2] Experts for European countries, excl. Germany, n = 30
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

dence in the top third compared internationally. A similarly high proportion place Germany in center-field (see Fig. I.18).

The experts consider individuals to be equally as responsible for education and ongoing training as companies. In the teaching of digital competence in particular, the experts place the onus on companies to teach their employees knowledge that is important for them to gain further qualifications and thus for the sustainable success of the company.

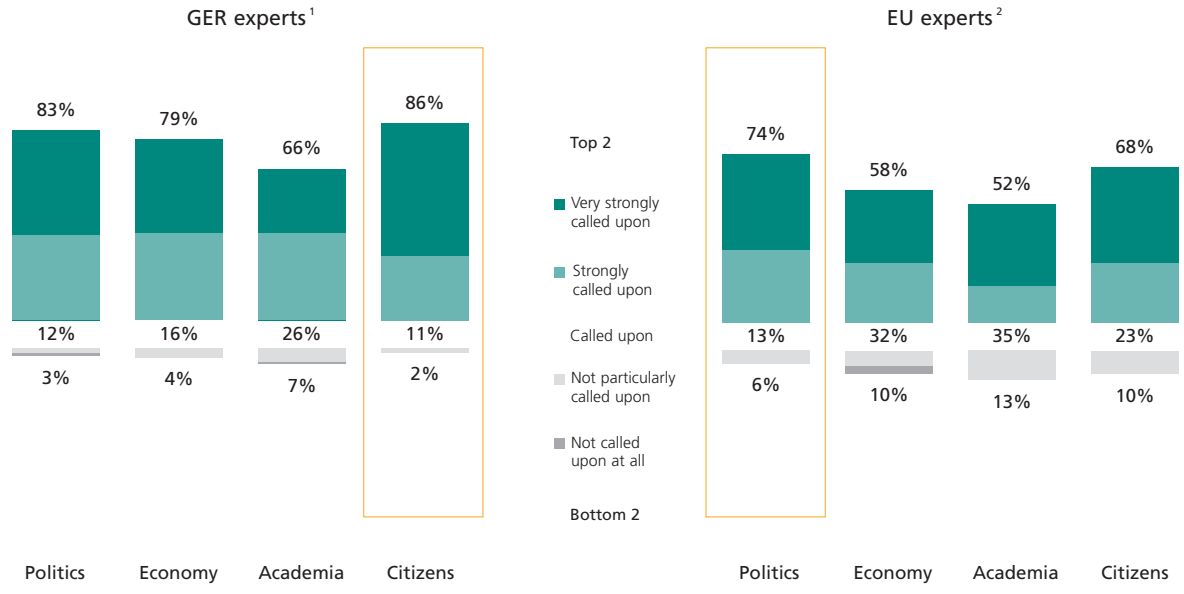
"Different people need different kinds/amounts of competence. Individuals who need that competence should/can efficiently make investments in their continuing education. At the same time, employers should, as it is also in their own interests, take responsibility for supporting their employees in acquiring the necessary digital competence."

The experts expect individuals to contribute a high proportion of investment in education and above all further training. Just as each employee must take personal responsibility for part of their pension, they must also ensure their own ongoing training. This opinion expressed in the online expert discussion is also backed up by the expert survey: 86 percent of the Germany experts consider citizens themselves to be called upon or strongly called upon. But politics is also under obligation in this regard (83 percent), according to the experts, as well as the overall economy (79 percent; see Fig. I.19).

Thus the experts call for a binding framework for education and further training. Within this framework, the responsibility for appropriately ensuring one's own education remains with the individual. Even though the rapid succession of innovations in technical means of communication grows ever faster, the core competencies identified by the experts for communication in the digital age are still the traditional ones:

Fig. I.19: Promoting life-long learning – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to continually promote life-long learning?



[1] Experts for Germany, n = 346; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

"However, we must try to create at least some key competences for every individual networking in a digital environment: awareness, cognition, responsibility, and diligence."

Just as with responsibility for personal education, these characteristics grow more important, the greater the multiplier effect arising from the possibilities of digital communication. All of the experts were quite clear that, although the technical framework for communication may change, the sense of responsibility of the individual in dealing with other people or for their own education depends on it. This results from the ethical basis and legal framework that a society provides. However, there are also voices that caution against turning education into a kind of commodity. That would happen if society and politics ceased to see sustainable education as being of central importance for the future, as they do at the moment. As importance waned, so spending on education would decline. Responsibilities would not be clearly defined, only those who could afford it and understood its value would invest in their own and their children's education.

Summary and recommendations

What do the above comments mean for future education, especially in terms of complex digital competencies? What roles will be assigned to parents, schools, the state and learners? The experts expect the roles to be as follows:

The **state** defines the binding framework and the infrastructure for this education.

Teachers and schools must teach knowledge and the understanding of how everyone can acquire knowledge for themselves and how to use it responsibly.

Parents must be much more closely involved in this process and in taking responsibility for their children.

Companies are called upon to train their employees further.

Individuals, whether children at primary school, students, apprentices or employees of a company must continuously develop their skills further. They must continue to increase their knowledge throughout their entire lives, further expand specific skills and, above all, be able at all times to distinguish between the important and the unimportant.

Is learning in the digital age now very different from earlier times? Not at heart. No one leaving university more than 50 years ago could have seriously supposed they knew everything there was to know about their subject area. But since then, the pace of new information has quickened substantially. For this very reason, however, it will not be possible in the future to escape the simple learning of basic knowledge. All the more reason that the key skill for the future will be to cross-link information with knowledge in order to be better able to assess individual pieces of information. New means of communication can make this learning easier or more exciting. But without a sustainable teaching concept, they will not produce more successful generations of students.

Teaching social skills and ethical guidelines at home and at school is not a new element of education. But it seems to be growing increasingly urgent. It will be less important to teach students the technical skills for dealing with new means of communication – teachers, like parents, will doubtless always be playing catch up in that regard – rather they will have to be taught what is morally unacceptable, even if it is technically feasible. It is the responsibility of society, politics and the economy not only to ensure that these points find their way onto a syllabus, but also to practice them themselves.

I.5 Competent use of media in the knowledge and entertainment society of the future

In 2010, adults used daily electronic media for 490 minutes a day (see Massenkommunikation 2010). As such, the future estimates of the experts surveyed with regard to intermedial and intramedial relations are of particular interest. According to the experts, no serious changes are to be expected in the overall volume of media usage by 2015 – both the Germany and the Europe experts agree on this point. They each expect media usage to lie at around 6.4 hours in 2015, assuming approximately equal distribution between use of information and entertainment offerings (see Fig. I.20). In order to differentiate usage, the experts were asked to distinguish between reading media, audio media and moving images, i.e., the Internet was treated as a carrier platform for digital media and not as a separate media type. If the fact of a more or less constant usage volume is considered in light of growing offers and new possible uses thanks to the digitization of media, the usage scenario for 2015 means a restructuring of usage. This will be both intermedial, i.e., between media, and intramedial, between traditional and new, "typically digital" offer forms. What will not change is that different media will continue to be used not sequentially, but rather in parallel, as they are today – for example, reading the newspaper while listening to the radio, or watching television while flipping through a magazine, regardless of whether the respective media are used in their traditional or digital forms.

Digitization drives the change from print

The experts believe the media portfolio in the print segment will also be used in the same way electronically as traditionally, i.e., printed on paper. This applies as much to newspapers as to magazines, and for both genres – information and entertainment (see Fig. I.21). Looking at the current situation, this assessment of the future will mean a very significant change in usage. The Europe experts expect a migration of print products to the digital world just as much as the Germany experts. The question remains unanswered of whether all print genres will be equally affected by this digital migration and whether or not paper will continue to be the medium of choice for intensive and pleasurable reading in a quiet hour.

With regard to television, there is a differentiated picture between usage for information and for entertainment purposes. In the entertainment segment, the experts expect time-controlled usage – i.e., usage on own recording equipment or via video on-demand services – will play a major role, accounting for at least 17 percent of media usage on a normal weekday, although traditional television usage – live and in the home – will remain the main form of usage, accounting for 26 percent. But they also expect services which are only just emerging now, such as interactive or mobile services, to be a relevant form of usage for

Fig. I.20: Media usage: Information vs. entertainment

If you think of media usage on a normal working day in 2015, how many hours do you think an average person using media will spend on information and how many hours on entertainment

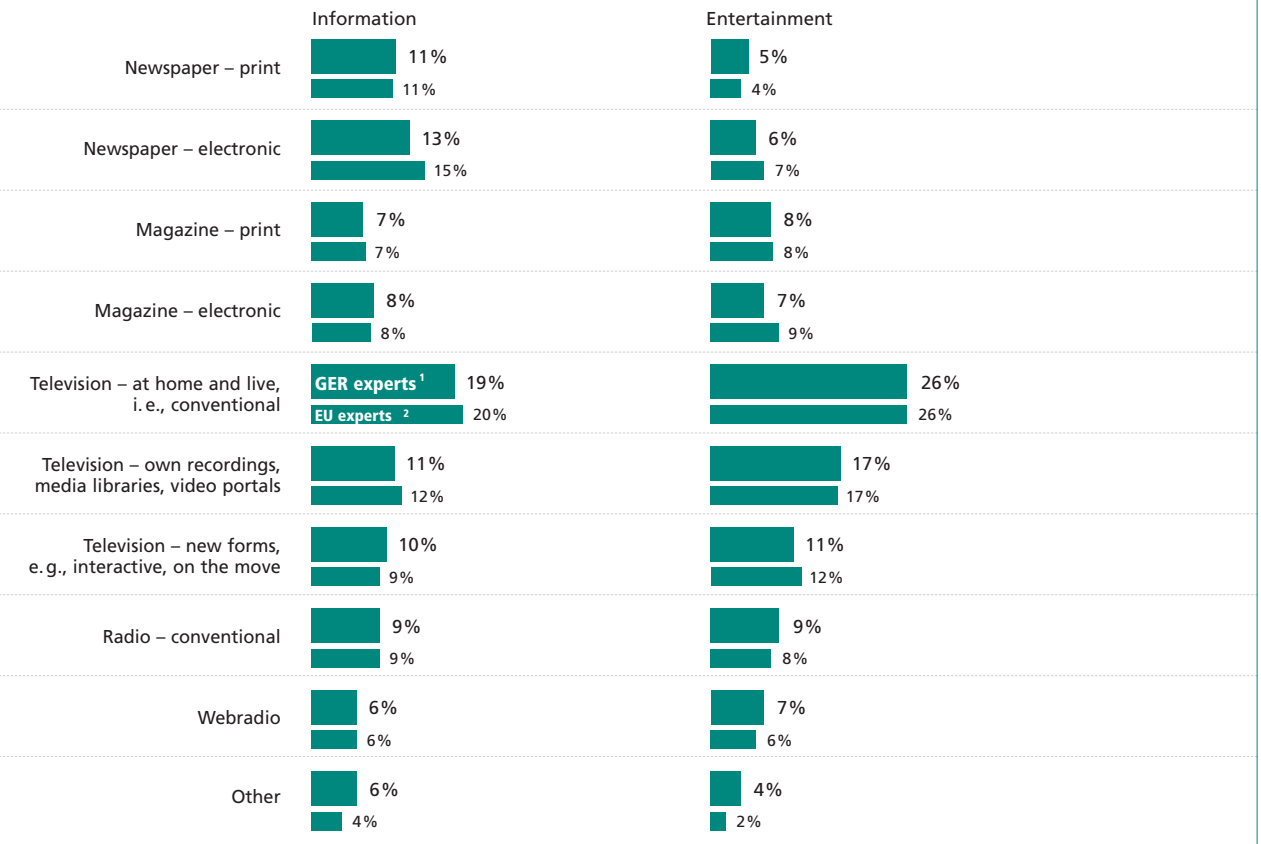
[1] Experts for Germany, n = 313; [2] Experts for European countries, excl. Germany, n = 30
Basis: All people surveyed with special expertise in the topic area; averages

the entertainment segment, which will therefore contain substantial potential for growth in the next few years. When it comes to information usage, time-autonomous usage plays a somewhat lesser role than in entertainment, whereby the experts believe that the entertainment function of television will remain more important than the information function regardless of technical platform. For other media, this relationship is counterbalanced by one exception: for newspapers, whether in print or electronic format, the information function prevails (see Fig. I.21).

When considering changes in radio, advances in other possibilities for using audio recordings must always be considered as well. Huge changes have already arisen in the last few years due to digital terminal equipment (MP3 players). By contrast, hardly any progress has been made in the digitization of broadcast radio. Web-based radio offers the medium yet more opportunities for digitization. But the experts believe that the traditional use of radio, which means largely analog, will still prevail in 2015 as the main form of usage, even though web radio will experience strong growth. With regard to the very wide-ranging possibilities of using radio as a mobile medium while on the move, on the way to and from work, or in the car, web-based radio use will also depend on the availability and usage of mobile broadband. It should also be noted that web radio is relatively limited in the additional functionality it can offer compared to other media. The range of sta-

Fig. I.21: Media use for information / entertainment purposes

And, in percentage terms, how will the use of media for information purposes / entertainment purposes break down over the following forms of media on a normal weekday in 2015? Please distribute 100 percent between the following media:



[1] Experts for Germany, n = 318 / 305; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; averages

tions is already extensive; format-dependent usage and usage at the same time as doing other activities make the basic advantages of IP-based services seem less relevant. As such, the experts consider it to be entirely conceivable that there will not be any genre-specific differences between information and entertainment in the technological shift in the medium of radio.

Television accounts for the largest proportion of the daily budget of time allotted to media

When comparing different media, it will continue to be the case that more time is allotted to television than to other media: moving pictures are well ahead of the media field, expected to account for 40 percent of information usage and more than 50 percent of entertainment. Compared with the status quo, the future estimates of the experts for print media are relatively high. Even though their estimates cannot be taken as quantitative forecasts of reach, they show that print media will continue to be very important in the future.

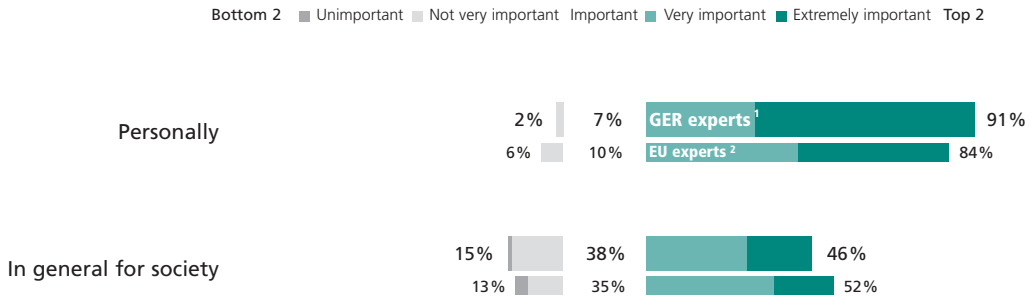
One of the most important changes to media resulting from the Internet is that anyone can become an originator of media content, if the concept of medium includes addressing content publicly. While this is deemed to be positive in connection with social media, it also means that a critical view must be taken of the more difficult identification of content as "editorial content," i.e., as content that is journalistically and editorially accountable and reviewed, when it comes to being impartially informed on social issues.

Independent editorial media content will play a hugely significant role for the future personal media usage of the experts. 91 percent of the experts for Germany consider it to be very or extremely important, just two percent deem it to be not very important. The consensus in this regard is greater among the Germany experts than among the Europe experts (84 percent very or extremely important; see Fig. I.22). For the overall population, however, the experts expect editorial media content to be less relevant: Just 46 percent of the Germany experts expect editorial content to be very or extremely important for the population in 2015 (see Fig. I.22).

Of course, even today, editorial content does not play an important role for everyone. What's more, a formal classification as editorial content is not sufficient to identify "quality media products." If the experts almost unanimously attach great importance to editorial content, the question arises of how users can verify this. At another

Fig. I.22: Importance of journalistic media content

If you think of your own personal use of media in 2015, how important will journalistically independent media content be for you personally? / And if you think of society as a whole in Germany (<country>) in 2015, how important will journalistically independent media content be for people in general in 2015?



[1] Experts for Germany, n = 346; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

point in this study, the role of media competence was addressed in great detail (see articles I.1 and I.2). There needs to be a discussion about the extent to which, apart from the measures instigated by users of media, providers of media can make editorial content identifiable or extend existing rules to cover the changed technological framework and new media products.

Labeling of reliable sources of information on the Internet of great social importance

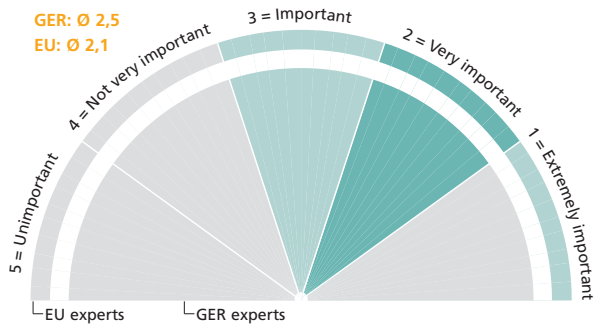
A good half of the Germany experts surveyed consider labeling reliable sources of information on the Internet to be extremely or very important for Germany's economic development, even more of them (60 percent) for its social development. The Europe experts place even greater importance on labeling sources of information for the economic development of their country: 68 percent gave the top two values. Just 55 percent consider it to be important for social development (see Fig. I.23). Half of the Germany experts place Germany in the middle third of countries with regard to labeling reliable sources of information, another 33 percent in the top third (see Fig. I.24) – overall a disappointing result with a great deal of room for improvement in the future. The experts place the onus on a number of players: politics and the overall economy are most commonly seen to be responsible (deemed to be very strongly or strongly called upon by 70 and 71 percent respectively). More than half of the experts also consider academia to under obligation (see Fig. I.25).

First and foremost, the media, especially the established media, will have to earn the seal of quality themselves. Seals of quality, no matter who grants them, will be of no use to any radio or television station, or print or online medium, if users doubt their professionalism and impartiality.

Fig. I.23: Identifying reliable information sources on the Internet – Importance

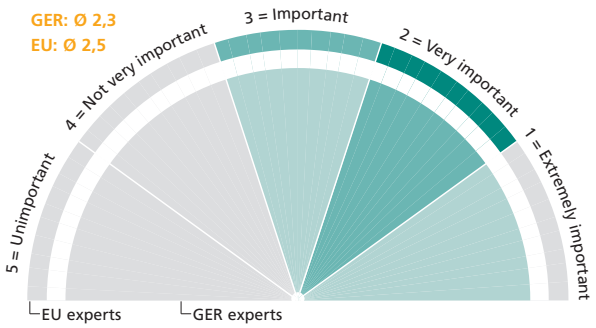
How important is identifying reliable information sources on the Internet for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	3 %	16 %	27 %	35 %	18 %
EU experts[2]	0 %	3 %	29 %	39 %	29 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	2 %	11 %	25 %	36 %	25 %
EU experts[2]	0 %	10 %	35 %	45 %	10 %

■ ≥ 40 % of experts ■ 30 – 39 % of experts ■ 20 – 29 % of experts ■ < 20 % of experts ■ Averages

[1] Experts for Germany, n = 346; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Changes in the media production process enable new kinds of products

The question of connections between new media products and new usage patterns is one of the core questions of media development looked into by the expert debate. The role of information and communication technologies goes far beyond a media transport function. Changes in the production process enable new kinds of products, which in turn result in changes in content. Those who follow the media production process can already see changes, which will become even more pronounced and widespread in the future:

- The production of **content** will become more media-specific. A number of experts expect content management systems (CMS) to result in content being delivered and then customized according to target group or media type:

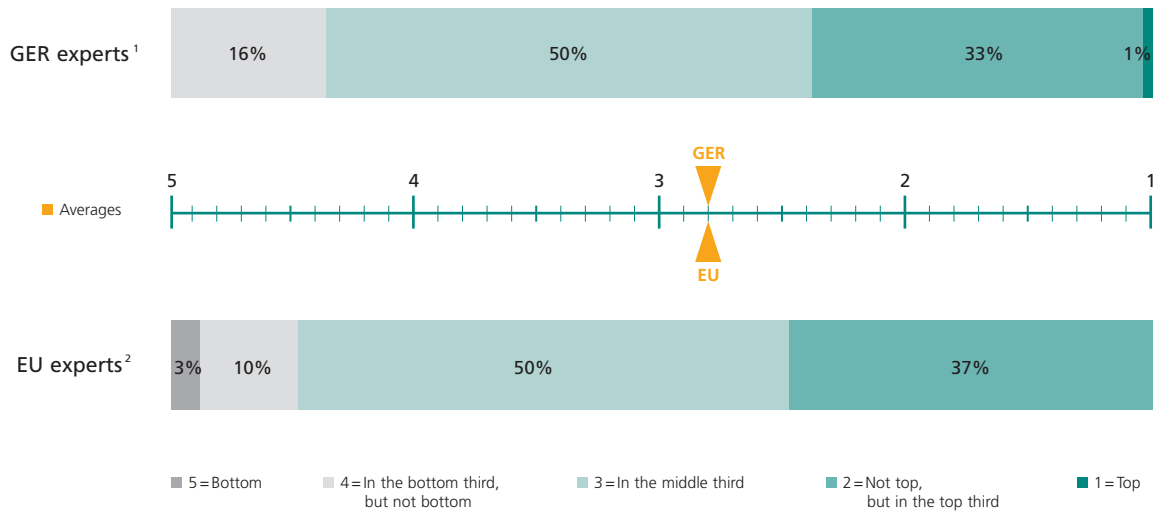
"After making a piece of news, he has to produce/mix/cut material for the primary format, e. g., for TV news. Then he [the reporter] does the same thing for other formats, like radio news, text tv, Internet, Twitter, media clips, Facebook, etc."

- Experience has shown that using content management systems as containers for various types of media only works if specific editorial expertise is on hand. It is unlikely that a CMS will function as a "content vending machine" for different media in the foreseeable future. In this regard, it should also be noted that increasing media convergence and the option of broadcasting "rich content" are facilitating the process of media-specific content production.

- **Interactivity** has two meanings: First, interactivity serves to navigate and manage content. The experts agree unanimously that rapid advances will be made in this area.

Fig. I.24: Identifying reliable information sources on the Internet – Position

And how do you think Germany (<country>) is positioned on identifying reliable information sources on the Internet in an international comparison?



[1] Experts for Germany, n = 302; [2] Experts for European countries, excl. Germany, n = 30
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

"When talking about media in a digitized world I think it's also very important to talk about the changing ways of interaction – as opposed to the mere consumption of media in the past (with a few letters to the editor), people will be able to rate articles and post their opinion very easily. In short: from consumers to contributors, from monolog to dialog. This will surely influence future formats and possibly content."

Second, interactivity is also media usage in itself, for instance, question and answer dialogs or game components in traditional media in IP-based distribution. The experts did not address the extent to which the needs of users are met in this regard or economically feasible business models can be developed.

- New players can get involved in generating media products. According to a number of experts, this can be individuals or entire committees. Opinions are divided on the role that traditional media companies will play, ranging from thoroughly independent social media through to the "exploitation" of social media by traditional media companies.

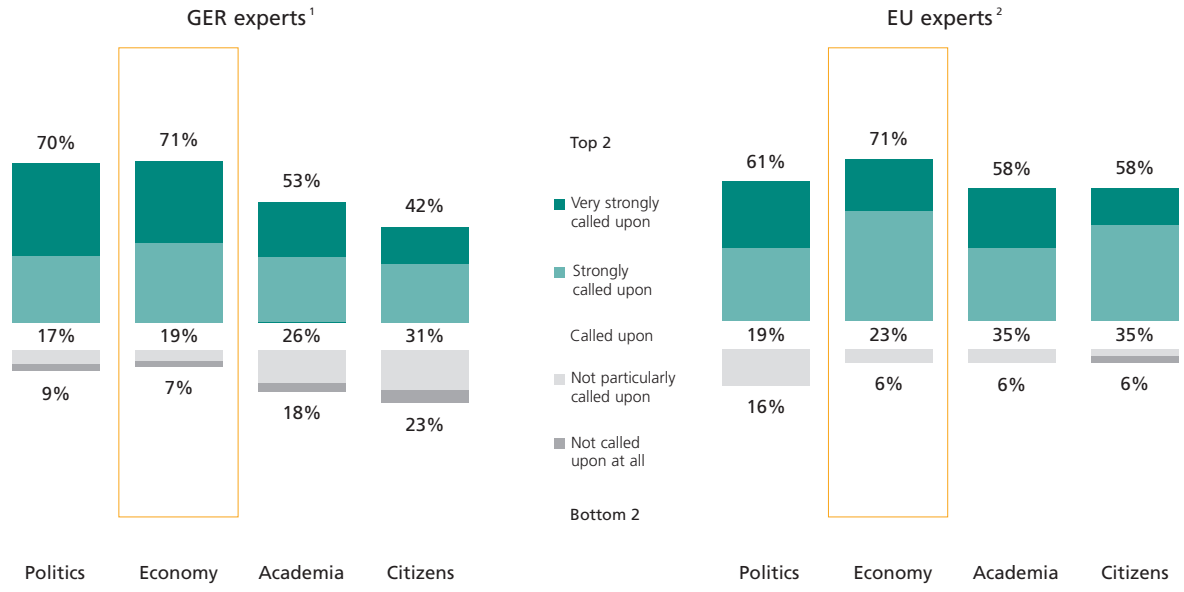
- The trend of individualization of usage habits has been known for some time. Further changes are expected in this regard on the part of media production. For informative content in particular, the tailored compilation of interesting topics will make further progress as an innovation in the media sector:

"I think that the consumption of media will be much more individualized than it is today. Users will ask for or subscribe to specific information they are interested in."

The experts did not actually address entertainment content, which presumably has to do with the selection of experts. At this point, it should be noted that the entertain-

Fig. I.25: Identifying reliable information sources on the Internet – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to make it possible to identify the reliability of information sources on the Internet?



[1] Experts for Germany, n = 346; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

ment industry plays an entirely positive role in media development. The convergence of media products (e. g., watching NBA – National Basketball Association – and playing NBA personally on a console) and interactivity are precisely what drive media developments in this area. A concept that is innovative in many areas can be seen in the U.S. ESPN network.

Customized media selection meets the needs of users

Media science typologies, such as individual and mass communication, push and pull services or media types will hardly still be able to comprehensively describe supply and demand structures. Content tailored specifically to meet individual needs could compete with search engines on the web: The provision of a manageable, personalized compilation of media meets the needs of people and will therefore have a future as media content. It remains to be seen to what extent possibilities for technical personalization will move broad sections of the population to become their own program director or editor in chief. Aside from their information and entertainment function, mass media also create social identity, giving individuals a feeling of belonging and of keeping up with the times, as well as of sharing this with others. Closed media content, such as a news program that lasts for 20 minutes, or a printed news magazine with 200 pages, gives the feeling of providing an overview, in the truest sense of the word, of an increasingly complex reality, even if they include issues which the individual user is not really interested in. Nor should the inactivity of the media user be underestimated. It is much easier to consume a ready-made program than to create one yourself. All this becomes more difficult with increasing individualization.

The effects of the changed media content and media usage patterns are discussed very differently by the experts. On the one hand, the Internet is seen as a platform for discussion, available to all, with the option of freely expressing your opinion; on the other, however, there are warnings of false euphoria:

"However interactivity does not necessarily mean that we are facing a more social or democratic world in the future. In the end it always depends on who is controlling the systems that handle the interactive environments."

This can be illustrated using the example of the development of Apple, whose products enable a huge amount of interaction and community, but at the same time, the providers exercise very extensive access and activity control.

Summary and recommendations

To summarize the findings, it can be assumed that media products will tend to develop on an evolutionary basis for the knowledge and entertainment society, and thus also for the media usage of the future. Media products that will be relevant for the future have already been developed, and some of them are already in use. The relevance of these products will increase substantially. Nevertheless, there are basic needs in the media sector which can be met without the need for new technologies. And – to return to the beginning of this article – the time available to people is a limited and finite resource.

I.6 Evolution of competence requirements of and within companies

It has long been known and accepted that we find ourselves in the knowledge age, which is still frequently referred to as the information age. The workplace, the work environment and the work to be done have changed and – as early economic political scientists from Adam Smith to Karl Marx found – productivity influences minds and people's mindsets are increasingly shaped by the way in which they do their work. In other words, by changing our work environment and our work, we change ourselves as people.

In the last ten years, companies and human resources have faced complex changes, the effects of which on employers and employees are considered below and roughly extrapolated for the future. Some of these changes are simply following a trend, while others are more disruptive, thus making their arrival and continued presence in society and companies surprising.

The first category includes the **globalization** of organizations and companies and hence increasingly heterogeneous team structures, as well as **demographic trends**, which result in new working life models and require companies and people to cope with the mixing of generations more than ever before. This category also includes the **acceleration** of daily routines as well as innovation cycles, the new way of managing change processes, through to living adaptive organizations and processes with a culture of change readiness. The second category covers the phenomena arising under the concept of **Web 2.0**, like user-generated content, mass collaboration, and social communities, the effects of which on companies are frequently subsumed under the concept of **Enterprise 2.0**. No company can now escape the influence of digital social network structures and new, transparency-increasing forms of communication of the like of Twitter, or the power of open innovation or open source.

In this environment, it therefore makes sense to look more closely at developing the necessary competencies of employees and companies or organizations in order to identify shifts in good time and introduce changes at an early stage.

Basic skills of career starters and employees – today and tomorrow

During the expert discussion, abstract logical thought, a broad technical background and a profound understanding of underlying business models were named as basic knowledge. In terms of skills, the entire spectrum of soft skills is deemed to be important, e. g., communicative strength, the ability to work in a team, efficient results-based work, creativity, flexibility, the ability to adapt, self-motivation, and also intuitive use of new tools in the world of information and communication. No significant changes are expected in this regard in the next few years, although shifts in the importance of different skills are very likely.

"I think willingness to learn continuously is more important than ever before. Things change more quickly than in the past, and life-long learning is the key to a good performance as a professional."

This comment was met with wide approval in the expert discussion. The diminishing of traditional hierarchical structures in companies and a significant increase in the multicultural mix are making future employee structures more complex and require **continuous development of competence** (see article I.4) as well as familiarity with a range of different philosophies and cultures.

Creativity and the creative and constructive use of knowledge will become a success factor. In the future, "creative workers" will include engineers just as much as artists, designers or university professors and researchers, as automated, largely autonomous processes will increasingly free them up from routine activities and, as a result, more demands will be made on their creative powers.

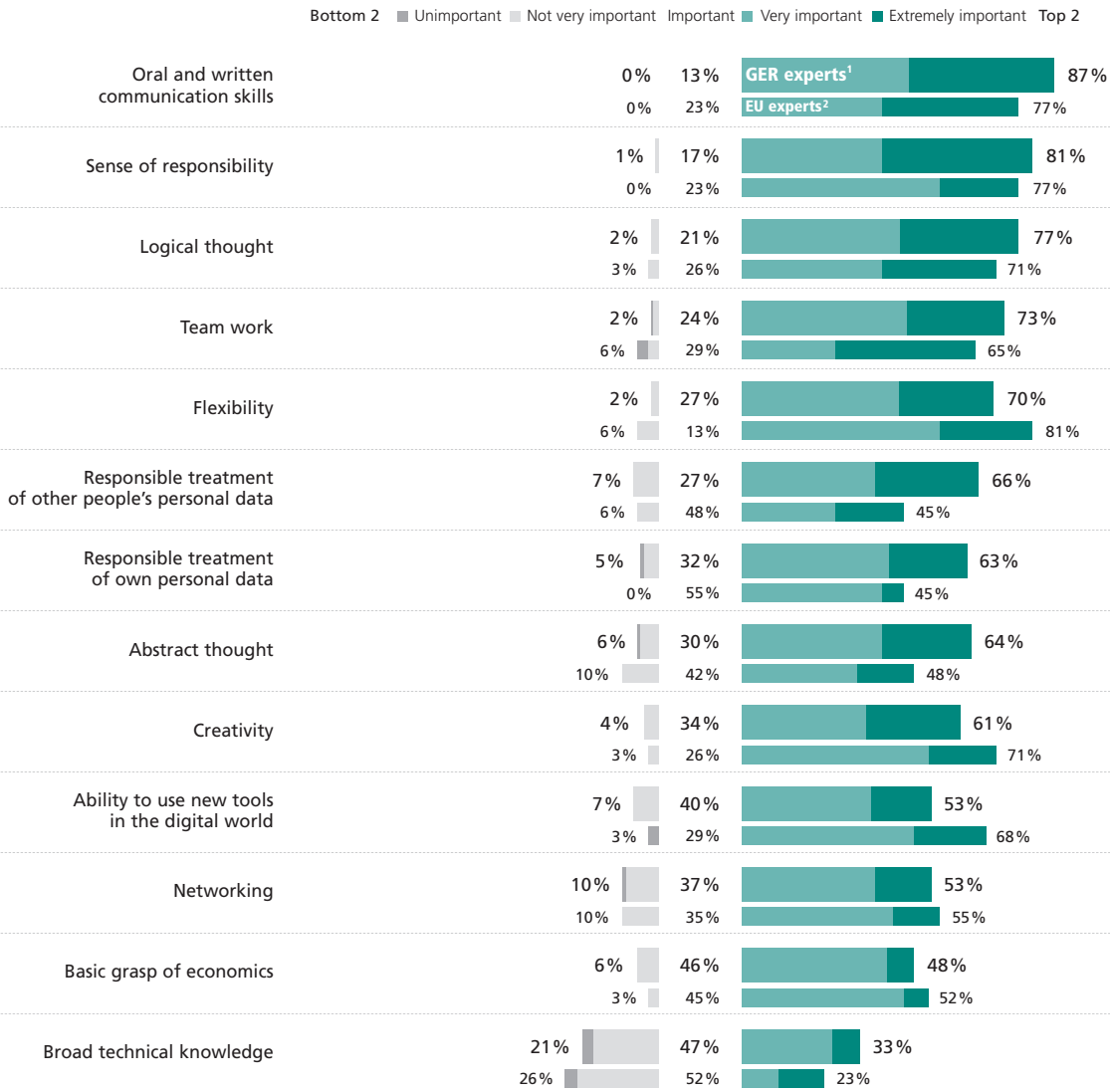
Another feature that is deemed to be gaining in importance is spatial, temporal, professional and social **mobility and flexibility**, which covers both the use of information and media content in any place at any time, and the increasing blurring between work and private life in the real and virtual world.

At this point, a number of additional core competencies of the future should be pointed out that underpin the shift in the importance of competencies. They were identified by experts from the "future_bizz" network in numerous workshops on future worlds of work. They include the following:

- Operating in a digital, connected world and networked communities.
- Personal responsibility, e. g., developing competence throughout a lifetime and taking on responsibility.
- Thinking in terms of systematic connections and thereby mastering how to deal with complexity.
- Developing constructive and forward-looking strategies for coping with accelerated change processes (see Arbeitswelten 2030 2010).

Fig. I.26: Skills of graduates for professional life

In your opinion, how important will the following basic skills be for university graduates beginning their careers?



[1] Experts for Germany, n = 346; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Static knowledge is becoming less important, especially in the field of learning. The problem-driven acquisition of context-based knowledge and the ability to derive possible options for action from this knowledge are becoming a performance parameter.

The trends described above are corroborated by the results of the expert survey carried out as part of the study: For example, communication skills, a sense of responsibility, the ability to work in a team, flexibility, abstract thought and creativity are all considered to be very or extremely important by more than 60 percent of the Germany experts (see Fig. I.26). In addition to the expert discussion, the results of the expert survey make two further points clear. Firstly, the responsible handling of personal data is deemed to be highly relevant (see article I.2), as reflected by current public debate. Secondly, the issue of networking is considered to be more important than a basic grasp of economics and broad technical knowledge, but much less important than responsibility, flexibility and communication skills. This is interesting, since the majority of communication and forming of opinion these days takes place in and via networks. From the results, the following thesis can be drawn, which it would surely be worth investigating in detail: "In the future, the social value of a person will be determined by their degree of connectedness, their networks, and their role in these networks (e. g., opinion leader, network node, active/passive)." In organization development research, the importance of social networks, especially in times of rapid reorganization, frequent mergers and acquisitions, and local, virtual structures, is analyzed as a relevant parameter in company procedures. This is followed by the following questions in the expert discussion on corporate structures: Which structures do companies have to create in an entirely digitized future world in order to attract and retain competent employees? What demands will employees place on their place of work and employer in the future?

The virtual organization: opportunity and challenge for employee and management

During the expert discussion, it clearly emerged that a new understanding of organizational structures is to be assumed. The traditional, fixed workplace and work location will be the exception. Instead, free choice of work location and working hours will dominate, as cloud computing and mobile/nomadic broadband coverage will make it possible to securely access company networks from anywhere at any time from a wide range of terminal equipment, and an interactive, virtual work environment will enable collaboration between colleagues, partners, etc. From the employee's perspective, this will also offer greater freedom in the organization of their private and working lives in terms of both time and place, although it will also inevitably lead to a blurring of both spheres and of social networks and information and knowledge flows.

In companies, the focus will no longer be on organizational hierarchies, but rather on efficient, established procedures with a high degree of networked, automated processes. Process managers who are assessed on the basis of output and defined targets shape and manage the company's interests. Employees will be given greater personal responsibility and one expert in the discussion also proposed the following hypothesis:

"Employees will want to be evaluated based on their performance for the business goals of the company, not on the number of hours they spend in the office."

This is a very important point, because merely putting this into practice would result in a purely performance-based form of collaboration, without taking into account human and ethical needs. The company of the future will therefore particularly need to create a culture and team focus within the company and projects, in order to be able to retain good employees as well as manage collaboration in virtual, culturally complex teams.

So far, there has been very little use of modern, web-based tools to spread and experience corporate culture. Since employees spend the majority of their time on the intranet and Internet, the presentation of these user interfaces and then, of course, the available content, are of huge importance. In the future, this will be a living interface between company, employees, partners, customers and all other stakeholders. The authenticity of the company, how up-to-date the content is, but also in particular, the user interface are of great importance and, due to digital social networks, are subject to a new kind of transparency.

From the employee's perspective, these developments entail advantages and disadvantages: in Europe, skilled staff with expertise and creative workers are rare and are already being headhunted. They are enticed with offers of flexible worktime and workplace models as well as professional support of individual skills and cross-generation

models of collaboration and continuous learning. Companies which develop new forms of human resources management for managing employees, adapt their corporate culture to the digitized world in an authentic, value-based way, and pursue transparent company targets will further enhance their attractiveness for employees and partners. On the other hand, the new generation of "creative workers" will come under immense pressure from the greater level of personal responsibility for producing results independently and according to their own assessment of the time and effort required, largely virtual teamwork (without the unofficial exchange of information in the staff room that is so highly valued today), and growing sources of information and complexity from which they must independently develop knowledge that they must put into practice using the right measures.

The expert survey looked closely into and assessed the balance between work and private life in the increasingly digitized world: Both the Germany experts (79 percent) and the Europe experts (74 percent) consider work-life balance to be very important, especially for the social development of Germany (see Fig. I.27). In an international comparison, the majority of the experts surveyed for Germany place Germany in the middle third in terms of work-life balance (48 percent; see Fig. I.28). Although this does not allow any conclusion to be drawn about absolute satisfaction, it does show Germany to still be an attractive place to work.

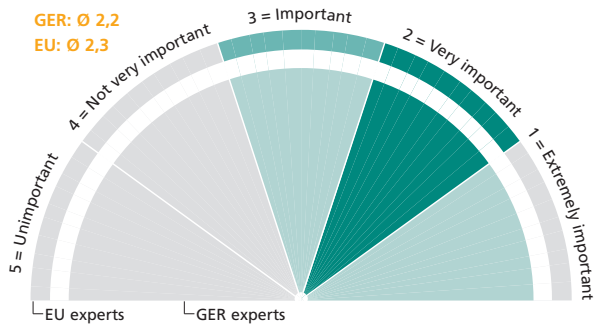
It is interesting that the Germany experts see the overall economy (84 percent) and individual citizens (70 percent) to be particularly called upon with regard to the balance between work and private life. By contrast, politics is seen as being much less under obligation (59 percent; see Fig. I.29).

These findings have so far had a very high degree of abstraction, but nevertheless show that it would be very interesting to identify the relevant factors for each group of players and to investigate their interaction in terms of driv-

Fig. I.27: Good work-life balance despite the increasing digitization of the world of work – Importance

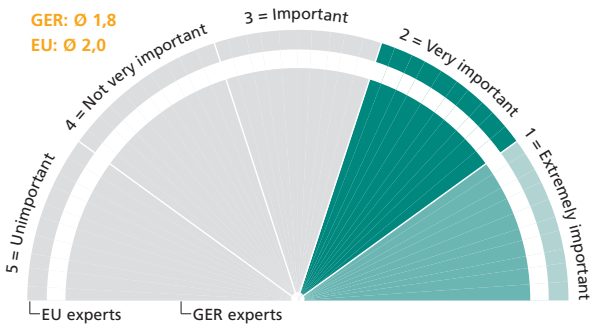
How important is finding a good work-life balance despite the increasing digitization of the world of work for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts [1]	0 %	7 %	27 %	42 %	21 %
EU experts [2]	0 %	6 %	32 %	45 %	16 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts [1]	0 %	2 %	16 %	41 %	39 %
EU experts [2]	0 %	6 %	19 %	45 %	29 %

≥ 40 % of experts | 30–39 % of experts | 20–29 % of experts | < 20 % of experts | Averages

[1] Experts for Germany, n = 346; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

ing versus driven factors. This would make it possible to identify the relevant parameters for the balance between private life and work life, while optimizing social and economic development.

A new era for value creation

Having considered the skills of people and the company's structures for attracting and retaining employees, the question arises of the extent to which people who are not "creative workers" are affected by the increasing penetration of digitization in their workplace.

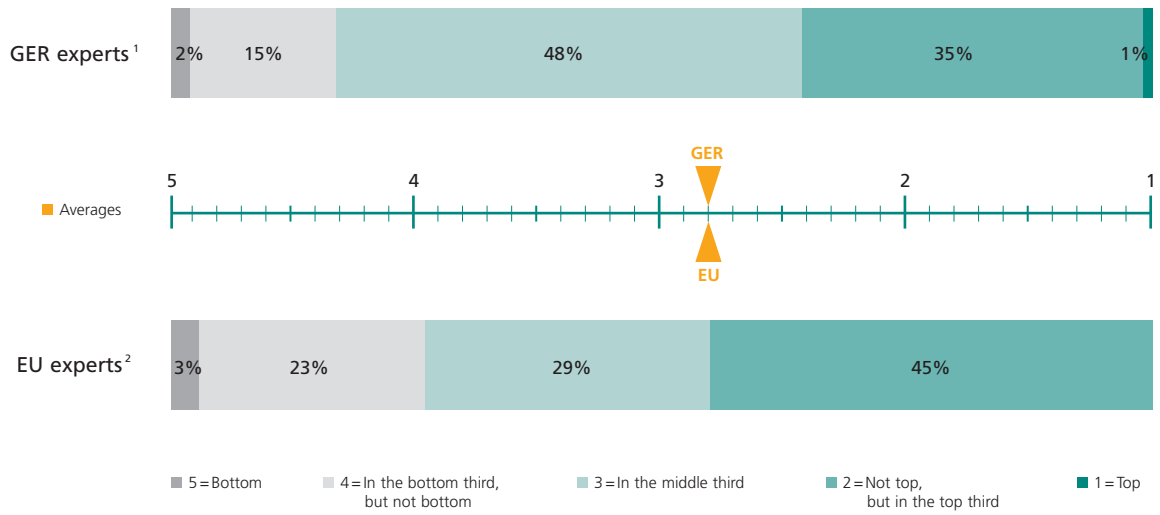
The experts discussed this in detail. It is widely held that a new era of value creation has begun thanks to collaborative, open innovation approaches and so-called "living labs." This will be reflected in the adaptation of innovation processes. It also requires relevant digital infrastructure and processes at the external interface with potential customers, partners, and the general public. Collaboration in virtual, open teams to use collective intelligence and the systematic application of user-centric approaches during exploration, development and evaluation phases continue to grow in importance.

But there is also another side to development: Questions remain unanswered about opportunities for companies to differentiate themselves and dealing with ownership of ideas and developments, or the importance of patents. Openness also offers points of attack, of both a technical nature, such as denial-of-service attacks, and in the form of manipulation and data misuse. New governance processes or a corresponding framework for Internet-based projects, processes and interactions must be developed that enable a form of oversight/control.

These new forms of "business eco-systems" require both competence in using internal network structures and processes, and the adaptation of management competence. The important factors are authenticity and trans-

Fig. I.28: Good work-life balance despite the increasing digitization of the world of work – Position

And how do you think Germany (<country>) is positioned on finding a good work-life balance despite the increasing digitization of the world of work in an international comparison?



[1] Experts for Germany, n = 327; [2] Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

parency, internal use and interaction to convey visions and strategies, interaction beyond levels of the hierarchy to all levels, awareness of and imbuing a sense of personal responsibility and risk in open collaboration. In this context, executives tend to be shown more by process responsibility than by hierarchical level, as already described in greater detail.

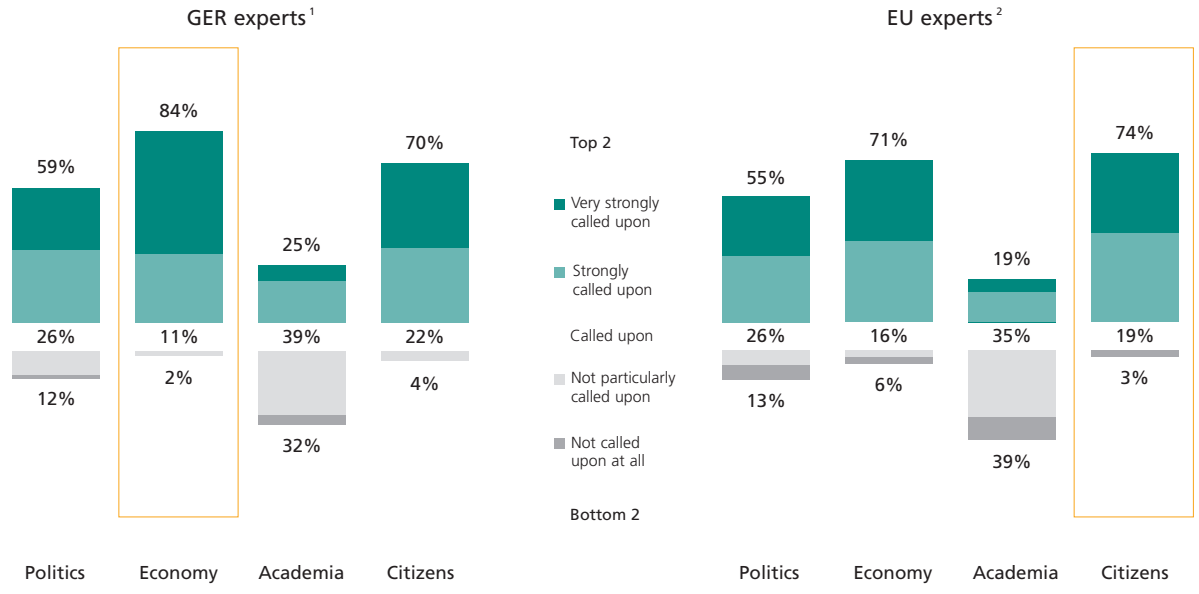
It will be much easier to appreciate a company's ability to move in this connected, digitized world from the outside. This means that companies will have to make all their intranet and Internet pages and processes customer-friendly and intuitively usable, as well as informative. Expectations are especially high in the B2B (business-to-business) environment with regard to self-care options, that is, possibilities to independently – i. e., without a contact partner – and at any time view and adjust contractual components, (de)activate services, and get up-to-date information about progress in processes. This results in the right to be able to view and edit digital customer data in a timely and secure manner via a user-friendly, interactive interface. Generally, the issue of providing specific, useful information for questions from inside and outside the company is of fundamental importance. Information and knowledge management is moving in two research directions:

- smart, context-based search systems that are already managing to reduce complexity and
- connecting people with knowledge instead of building up knowledge databases. The latter is an exciting field. It is based on the analysis of roles/profiles of people in communication networks and thus throws up many issues of privacy, security, etc.

Another facet of complete digitization leads us to the automation of all kinds of processes and procedures, as well as to the possibility of mastering the degrees of complexity of self-learning, intelligently connected systems,

Fig. I.29: Good work-life balance despite the increasing digitization of the world of work – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to enable a good work-life balance despite the increasing digitization of the world of work?



1 Experts for Germany, n = 346; 2 Experts for European countries, excl. Germany, n = 31
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

which an individual person would not be able to achieve on their own. In this way, work processes move toward the monitoring of automated processes; conversely, this makes it possible to precisely monitor the employee's activities. The experts already see a division of the world of work, which is already saturated with ICT, into an area in which employees are continuously monitored and supervised through digitization, and another which primarily deals with creative workers, who are given greater freedom and flexibility.

It is the role of companies to set the performance parameters for automated or digitized processes such that the motivation and inventiveness of all employees is not inhibited by dogmatic, prescribed approaches, but rather active involvement is encouraged and management takes place through the clear definition of the goal (quality, time and budget).

Summary and recommendations

The comments above focus on three facets of developing competence in a professional context, that are becoming necessary due to increasing digitization and, in particular, networked structures and services. The **first facet** covers the competence of people, whether in the role of employee or partner. The **second point** discusses the necessary corporate competencies for turning "desired" persons into active participants, and the **third facet** is the effect of network structures and services on structures and processes and on the development of competencies within the company. There are certainly several options for individuals as employees or companies to react to observable and anticipated future developments, but for some changes, the same solutions are needed for all players.

Based on the findings of the expert discussion and the expert survey, it is clear that the following aspects need to be dealt with urgently:

1. The need for life-long learning and the ability to adapt to changes both on the part of companies and of every individual is hugely important to enable them to keep up with the dynamic economic development and to actively participate in shaping it.

To this end, value adjustments must be made in our society accordingly, some of which are as follows: An attempt at professional independence is not a failure, but rather the knowledge of how it does not work. There is no stigma in taking time out from work to change focus and retrain, rather this is a normal part of working life. But there is also a need to refocus on transcultural and less hierarchical collaboration in virtual teams. This is done not least through a corresponding education policy and professionally introducing children and young people at an early stage to the new, constantly developing principles with their opportunities and risks (see article I.3).

2. The increasing networking and handling of complex networks and structures requires new approaches to coping with complexity to understand the correlations and effects especially in handling data and company assets. Modern, cybernetic control theory and its functional laws for high complexity conditions are an initial starting point for dealing with the problem.

3. The ongoing change of corporate structures toward a focus on processes with the need for new forms of human resources management and leadership is a challenge for all companies operating in the global arena.

Companies that are sustainably focused on the market need to further develop and adapt their corporate culture and enable employees to experience it by using professional user-friendly online interfaces. A leadership style based on open, shared objectives and management based on results instead of on time worked and predefined paths are to be implemented with caution. The human resources area is not just required to recruit new employees, but also in particular to encourage further development and identification with the company. Teleworkstations and virtual teams as well as open approaches to collaboration require a strong corporate culture and employees to be treated with respect. Added to this is the challenge of changing age structures, which require new forms of teamwork in order to use everyone's potential constructively.

4. Companies will need to integrate open innovation networks and "living labs" in their value creation to an even greater extent in the future. There are many ways of doing this.

A precise understanding of the different open collaboration approaches (inside-out versus outside-in methods, foresight-based versus prototyping, etc.) is needed for integration in a company's internal innovation process. The people involved also need concrete rules on how to treat information and knowledge. The number of open networks is already rapidly increasing, such that it is necessary to make a careful selection that will provide the respective company with pre-determined added value.

5. The increasing web-based connectedness of people within projects, between companies, partners, etc. is not as yet subject to any legal regulation and thus offers scope for criminal or unethical conduct.

The question arises to what extent a regulatory or legal framework is necessary for web-based data exchange, Internet-based monitoring, idea development, web-based acts or projects, as these forms of interaction generate substantial value, but can also be destroyed or abused. This is an issue that the social vanguard must examine, as well as politics, companies and academia.

The issue of developing competence in an entirely digitized world with strongly networked structures and services is still in its infancy, as we are not yet able to see to what extent changes will arise for society and people due to new categories of workers and the virtualization and autonomy of the work location. However, the awareness of these changes that are already taking place and the possibility of actively helping to shape education of people and develop sustainable corporate structures and processes in Germany is a first step.

II. ICT and security

Security is a highly subjective, personal need that varies with our individual situation. We experience security within our own four walls, in a familiar environment and when protected by established and recognized rules. We feel secure doing things we have learned to do or where measures have been taken to protect us – our lives, our prosperity and our freedom.

Small wonder that major confusion reigns when it comes to security in data networks. These provide a means of access to our homes and private lives which complete strangers can use to intrude without us noticing. By traditional standards this is not a real problem, since it does not pose a physical threat, danger to life and limb or to our health. What we stand to lose is of a different nature, in the very area in which data, computers and networks actually represent and create value. This means abuse of data, loss or manipulation of digital media, dissemination of digital documents, photos and videos that are not intended for public use, or bank account data, which can be used to route digital cash streams in the wrong direction. Today, data represents our values and – in addition – portrays us so to speak in digital terms, giving us a digital identity.

Dr. Heinrich M. Arnold
Head of Innovation Development,
Deutsche Telekom AG, Laboratories

By intelligently linking the traces we leave on the Net and correlating our online media usage and activities, others can draw conclusions about our preferences, behavior patterns and social networks. Technology is able to use this information to simplify and support our digital lives – providing improved bases for decision-making, recommendations, personalization and, above all, a reduction to the essentials. However, abuse of this knowledge, both legal and illegal, and the potential manipulation of people and groups involves risks that are yet unknown.

The present objective is to minimize these new dangers and risks. With increasing use of digital services and transformation to a data society that accepts and uses these services, hazards are no longer confined to the people who participate voluntarily. Identity theft poses a threat to every citizen: customers of banks and mail-order firms, even Internet-abstinent credit-card users should fear any misuse of a number that is not treated as an asset or secret. Since the credit industry has a vested interest in its services being used on the Net, it does its best to protect customers from data abuse, assumes responsibility for risk and takes out insurance coverage. Generating trust in the security of the services they provide is the basis for business in the credit card industry.

Security is a basic requirement but not an absolute. It is the result of an individual analysis by individuals and institutions of the balance between cost and benefit, cost and image, circumstance and necessity, convenience and acceptance and, of course, the risk involved. The result for institutions will seem unfair to those that have been the object of specific attacks or are taken completely by surprise as victims of security vulnerabilities. It is essential for society to achieve a balance in these private, institutional

and public appraisal processes; this is the vital foundation for creating trust – trust in the security of digital processes, personal data and, consequently, digital identities as the basis for social networks, communication and the economy.

Trust emerges and grows between people through personal contact and the impression that each person conveys – without either side submitting documentary proof of their identity. On the Internet, this personal impression can only be conveyed indirectly and is far easier to fake than in the real world. This makes it all the more important for companies and personalities to maintain a flawless image on the Net, with the result that it is in the interest of all business enterprises – as well as entire industry segments – to create trust.

With the electronic ID card, the state provides a means of safeguarding official functions for use in business. Ultimately, it is up to the user to apply this correctly, and it is in the interest of politics, the economy and every individual citizen to safeguard this balance at the level of high Internet usage. It is not actually possible to achieve one hundred percent security. Even the best security technology cannot guarantee absolute security; however, it must create a level of trust that is suitable for specific applications.

With Web 2.0 – the collaborative network, however, end-users, citizens and small enterprises are forced into a role in which they bear responsibility for their own image and private digital assets. Top security in data transmission is of little use in itself if users cannot – or will not – play their role in the security chain. Technology can offer users a broad range of possibilities for protecting their own data and activities. These must, however, be easy to handle so that users readily understand how to protect themselves and make maximum use of the available options.

In a fully digitized society, or a society with fully digitized processes, every individual embedded in this society is responsible for establishing and maintaining their digital identity. Alongside the responsibility of all individuals for their own data, it is in the interest of business enterprises to implement the appropriate technology and make it available for use.

When it comes to opportunities for influence by politics, these are correlated with the economic potential of the digital industry in its influence area. Such opportunities are greatest in places where business enterprises and customers at a location play a leading role in the global Internet economy. Accordingly, it is in the interest of politics to assume a helping/supportive role in establishing and expanding the location-related potential of the digital industry.

Dr. Bernd Wiemann
R&D,
Vodafone GmbH

II.1 Security in the digital world

The rapid spread of globally networked environments, foremost among them the Internet, is creating an increasingly digital world. Today, numerous aspects of our private (e. g., social networks), business (e. g., e-commerce) and public (e. g., e-government) lives have already gone digital. According to the second phase of the "Prospects and Opportunities of Information and Communication Technologies and Media. International Delphi Study 2030", developments in the course of the next ten years will see vast areas of people's lives going digital in Europe and the USA but not until much later in other parts of the world.

Development of a modern and open information society depends upon users, business enterprises and institutions accepting and placing trust in this digital world. Supporting measures, for IT security in particular, will need to be in place around the globe in order to minimize the risk of security incidents such as theft of payment information (e. g., credit card data). The first steps in this direction are already globally visible. A draft bill is currently being discussed in India, for example, that will impose high financial penalties on telecommunications operators in the event that a security incident (e. g., spyware infiltration) occurs in the equipment they use (see Business Standard 2010).

The topic of security in the digital world was examined in depth in this study with support from an online discussion among experts and an Internet-based expert survey.

Providers and users must now both take action

The discussion anchored the role of security as a basic technology:

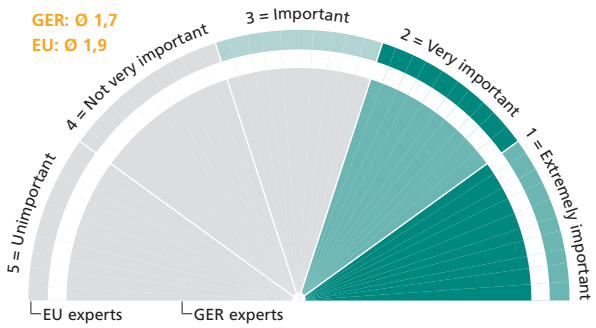
"Security is a base technology in the digitized world."

Alongside abstract protection goals such as confidentiality, integrity and availability, the experts see privacy as one of the key aspects:

Fig. II.1: Setting up / maintaining an ICT infrastructure providing comprehensive security – Importance

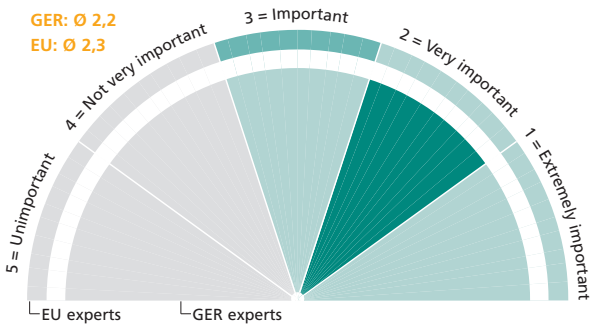
How important is setting up and maintaining an ICT infrastructure providing comprehensive security for economic / social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	2 %	2 %	13 %	35 %	49 %
EU experts[2]	0 %	0 %	21 %	47 %	32 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	2 %	5 %	28 %	42 %	23 %
EU experts[2]	0 %	11 %	37 %	21 %	26 %

■ ≥ 40 % of experts ■ 30 – 39 % of experts ■ 20 – 29 % of experts ■ < 20 % of experts ■ Averages

[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know / no answer

"Privacy is probably the most endangered objective in a digitized world."

In addition to providers, who the experts claim should make their data protection and security principles transparent –

"Service providers should make their security mechanisms and principles for data handling transparent in a way that laypersons can also understand."

–, users are also required to show awareness for the need to protect their data, for example in social networks. This awareness must be promoted in our society through suitable educational measures, which should go hand in hand with knowledge of the ease with which information can be found and propagated (e. g., search engines and their caches) in the digital world (see also Article I.2). The risk of revealing personal data unintentionally should be minimized through data protection and security measures that are easy to use. An important step in this context is the request from data protection specialists for binding international regulations governing data protection (see Data Protection Center 2010).

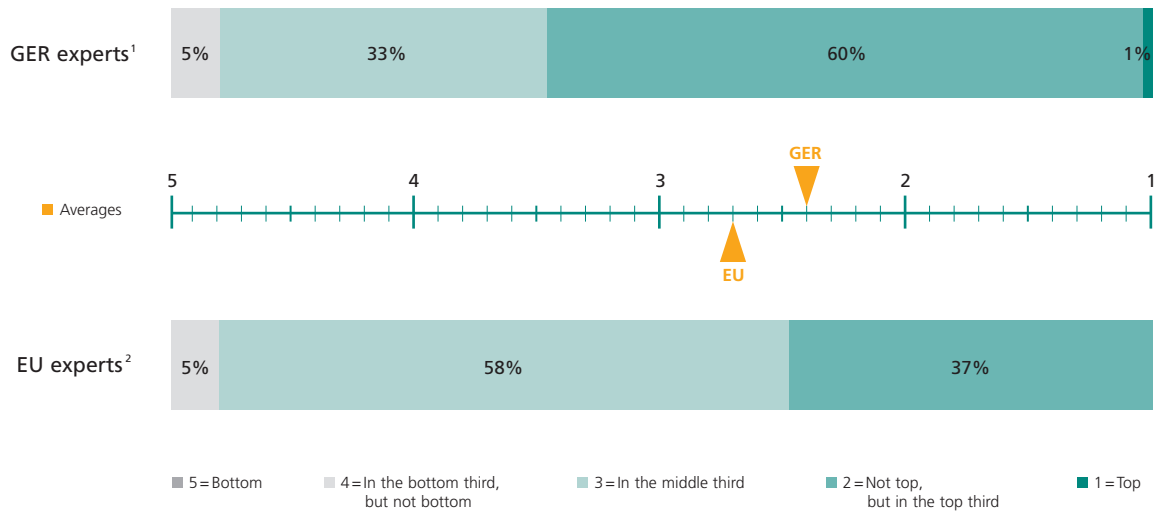
Digital vs. non-digital security

Analysis of the security characteristics that are specific to a digital world is insightful for recommending optimal action. Asked about this, the experts stress that the fast dissemination of digital information and the ease with which it can be found make the consequences of security vulnerabilities in the digitized world potentially more serious:

"This means security issues are much more important because security problems have much broader consequences."

Fig. II.2: Setting up / maintaining an ICT infrastructure providing comprehensive security – Position

And how do you think Germany (<country>) is positioned on setting up and maintaining an ICT infrastructure providing comprehensive security in an international comparison?



[1] Experts for Germany, n = 168; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

Added to this, the possibility of exploiting security anomalies is often not confined to local environments since it is possible for remote, distributed and automated attacks to be carried out. This is exacerbated by the fact that an anomaly which is identified at one point will usually also be found in numerous similar systems. The potential exploitation of a security loophole from a remote source makes it easier for attackers to remain anonymous – in contrast to a loophole that can only be exploited from a 'local' source.

On the other hand, some of the security mechanisms applied in the digital world are vastly superior to their counterparts in the non-digital world. For instance, it is very difficult – if not impossible – to forge a digital signature even when a specimen signature is available (with algorithms, key lengths, etc., used and providing these are state of the art) and normally requires specialist know-how and/or equipment (e.g., for side channel attacks). In contract, it is far easier to forge a handwritten signature when a specimen signature is available. Likewise, validating a digital signature supplies an unambiguous result whereas handwritten signature verification does not necessarily produce a conclusive result.

The user side was also discussed by the experts, in particular users' knowledge relating to the use of applications in a digital world. Expert ratings on this vary greatly, especially with regard to the necessary security settings. The same applies to risk awareness and risk-taking. In order to cater for the needs of all users, security functions in applications, above all in critical areas such as e-banking and e-government, must be designed in such a way that they can be used correctly even by users who lack expert know-how:

"[...] security features of online applications like banking or e-government need to be designed in such a way that people without expert skill are also able to use them securely."

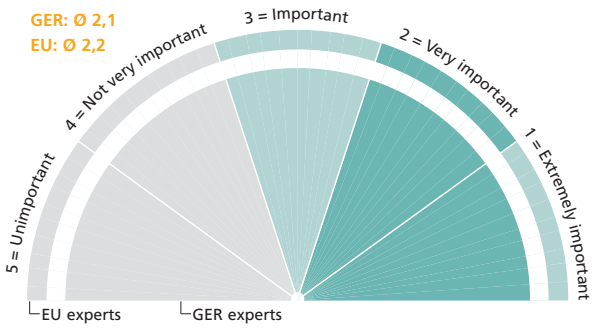
Fig. II.3: Ensuring the security of critical data – Importance

How important is ensuring the security of critical data in a digitized world for economic/social development in Germany (<country>)?

Economic importance

	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	1 %	2 %	13 %	29 %	55 %
EU experts[2]	0 %	11 %	16 %	37 %	37 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	1 %	6 %	24 %	36 %	32 %
EU experts[2]	0 %	11 %	21 %	37 %	26 %

≥ 40 % of experts | 30–39 % of experts | 20–29 % of experts | < 20 % of experts | Averages

[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N.B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

This requires security functions to be described and designed on a basis that is largely standardized across application boundaries. For reasons of confidentiality, interoperability, etc., it should be possible to use such security functions on basic secure ICT infrastructures.

Building and maintaining secure ICT infrastructures

The topic of secure ICT infrastructures was detailed in the online expert discussion as well as the Internet expert survey. The discussion focused first and foremost on the latest innovations in Germany such as electronic identification cards ("new ID card") and legally compliant and secure e-mail (e. g., De-Mail), which can play a vital role in securing an ICT infrastructure. Special electronic identity cards were seen to be a way of taking a key step forward:

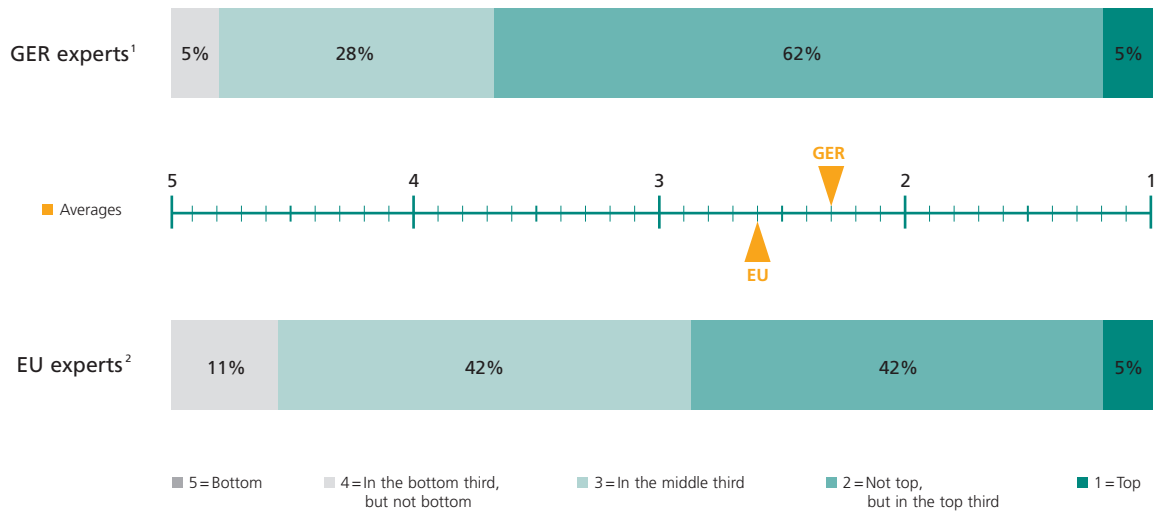
"One essential development which we urgently need for future safe living and business in the digitized world is an electronic identity card [...]."

An electronic identity card enables users to apply a standardized and secure method to prove their identity to an application (or provider) and also to verify the identity of a counterparty. This can also result in improved protection of their own digital identities (e.g., against phishing attacks). However, the experts associate the success of an electronic identity card with a series of prerequisites such as comprehensive support from applications across national boundaries, trustworthy card issue and creation of a clear legal framework.

In the Internet survey, the experts were asked to answer a set of questions relating to secure ICT infrastructures. One important result is the very great importance they attach to the establishment and maintenance of a secure

Fig. II.4: Ensuring the security of critical data – Position

And how do you think Germany (<country>) is positioned on ensuring the security of critical data in a digitized world in an international comparison?

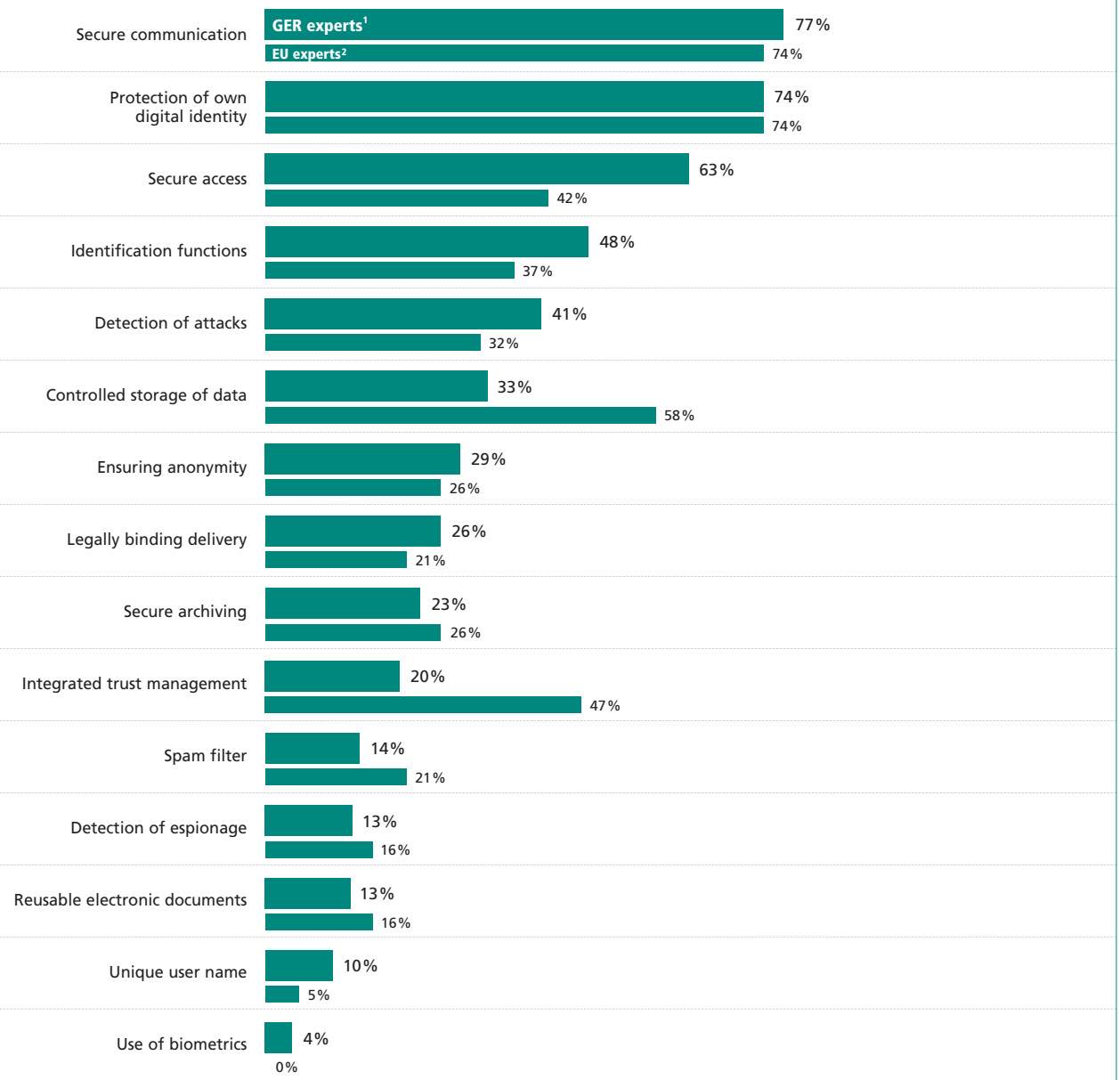


[1] Experts for Germany, n = 169; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

ICT infrastructure for the digital world: 84 percent of the experts for Germany and 79 percent of the experts for Europe rate it very important or extremely important for economic development in Germany. In terms of social development, it is estimated to be slightly less important (see Fig. II.1). However, two thirds of the experts for Germany and around half the experts for Europe still rated its importance in social development as very important or

Fig. II.5: The most important functions of a secure ICT infrastructure

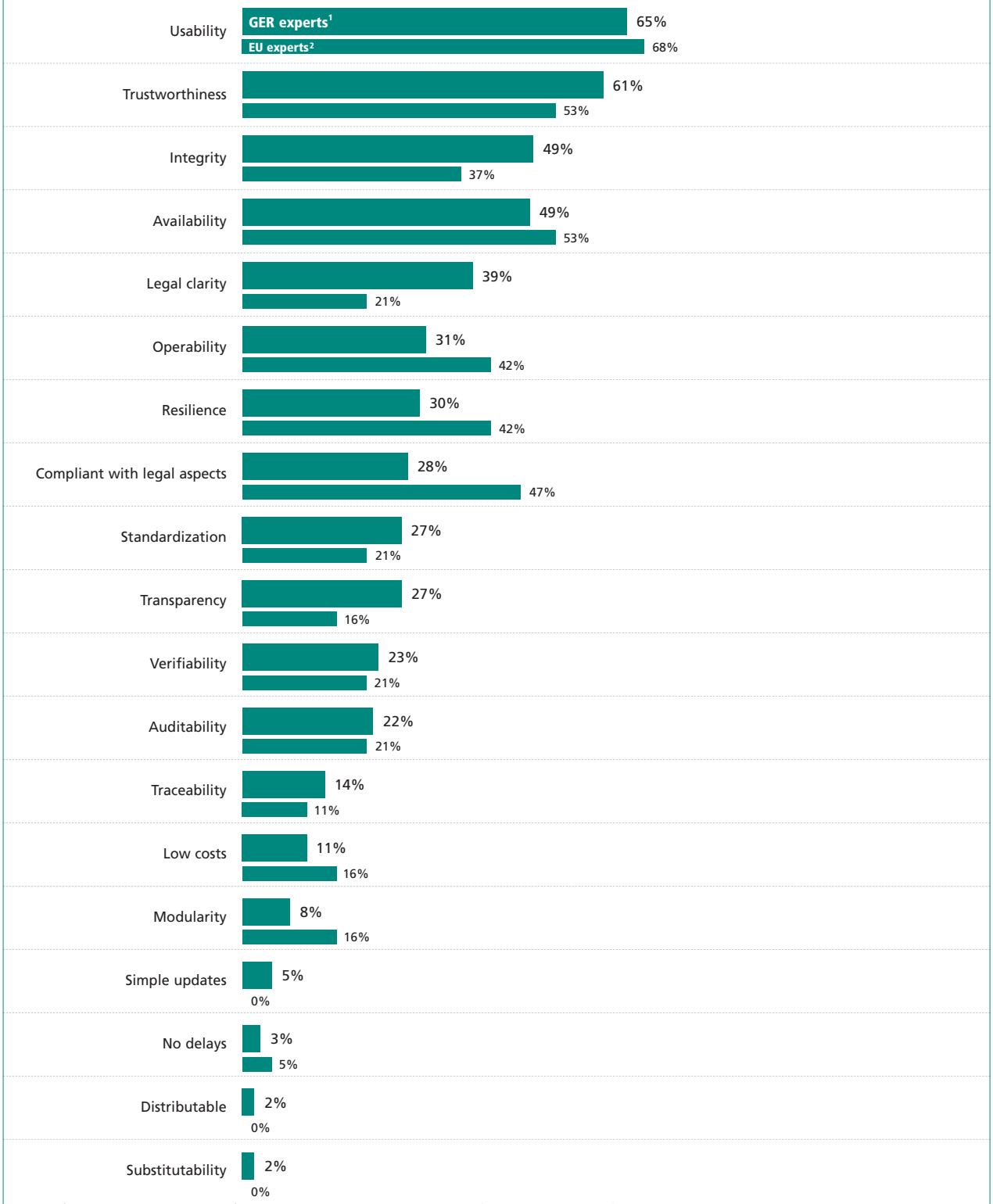
In your view, what are the five most important functions that a secure ICT infrastructure should perform? Please select no more than five features from the following list!



[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area

Fig. II.6: The most important features of a secure ICT infrastructure

In your view, what are the five most important features that a secure ICT infrastructure should have? Please select no more than five features from the following list!



[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area

extremely important. The experts were also asked to give their opinion on Germany's current position in terms of establishment and maintenance of a secure ICT infrastructure in an international comparison (see Fig. II.2). After all, 60 percent of them see Germany in the top third, while only five percent place Germany in the bottom third. In contrast, 58 percent of the experts for Europe place their own country in the center third in an international comparison.

Guaranteeing security for critical data

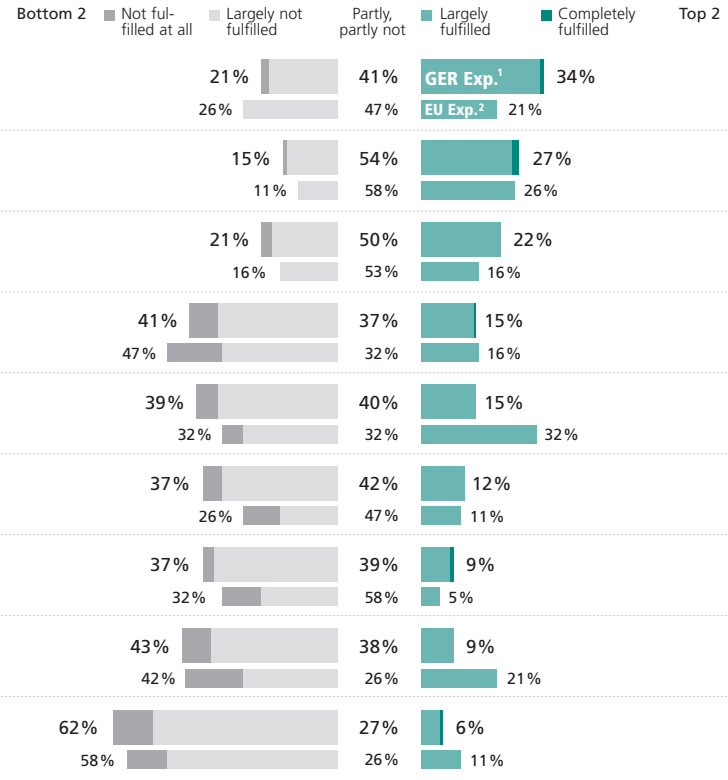
Similarly, the survey asked about the importance of guaranteeing the security of critical data in a digital world, initially for economic development in Germany. Here again, 84 percent of the Germany experts estimate this to be very important or extremely important. 74 percent of the experts for Europe give it an equally high ranking. By contrast, its importance is not considered to be so high for the social development (see Fig. II.3).

The next step was to assess Germany's current position in guaranteeing the security of critical data in an international comparison (see Fig. II.4). Around two thirds of the experts see Germany in the top third in an international comparison, only five percent of them see the country in the bottom third. 42 percent of the experts for Europe position their country in the top or center third.

The Germany experts consider the most important functions of a secure ICT infrastructure to be secure communication, protection of individual digital identities, secure

Fig. II.7: Leaders in ICT infrastructure

There are various parties who are responsible for ensuring there is a working, secure ICT infrastructure for the Internet. To what extent have the following responsible parties already fulfilled their tasks?



[1] Experts for Germany, n=173; [2] Experts for European countries, excl. Germany, n=19 (N.B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

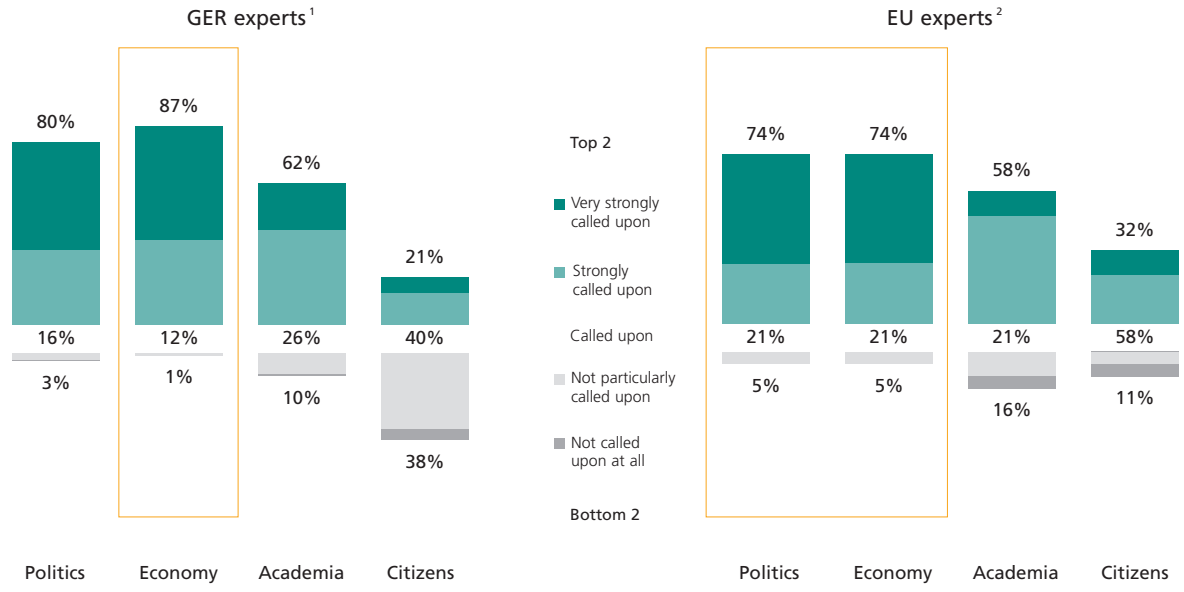
access and the identification functions (see Fig. II.5). A digital identity card could be useful for identification, secure access and digital identity protection functions. An infrastructure such as De-Mail could provide secure and legally binding communication in a specific application area (letters, shop orders). Interestingly, the experts for Europe give a far higher rating to two functions than the experts for Germany. Whereas only 33 percent of the Germany experts name the controlled storage of data as one of the five most important functions in a secure ICT infrastructure, this figure is 58 percent among the experts for Europe. There are also vast differences between the experts for Germany and Europe when it comes to assessing integrated trust management. 47 percent of the experts for Europe quote this as an important function, contrasted with only 20 percent of the experts for Germany. Furthermore, the expert survey reflected the most important features for a secure ICT infrastructure (see Fig. II.6). It showed the two most important features to be user friendliness (65 percent) and confidentiality (61 percent), according to the Germany experts. This confirms the prerequisites for emergence of a comprehensive digital world which we discussed at the start: acceptance and trust.

Bearers of responsibility for a secure ICT infrastructure

Another area spotlighted by the survey was the assignment of responsibilities for a functioning, secure ICT infrastructure. The experts assessed which of the various bearers of responsibility have already fulfilled their tasks and which have not (see Fig. II.7). Their answers make it possible to draw conclusions above all on who could play a pioneering role in this field and where the greatest backlog is seen. According to the experts for Germany, developers achieve the best rating. They have already largely fulfilled their tasks or have completely fulfilled them according to 34 percent of the respondents for Germany. It can therefore be concluded that the necessary technologies are already available. Following in the next positions are the business

Fig. II.8: Setting up / maintaining an ICT infrastructure providing comprehensive security – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to set up and maintain an ICT infrastructure with comprehensive security?



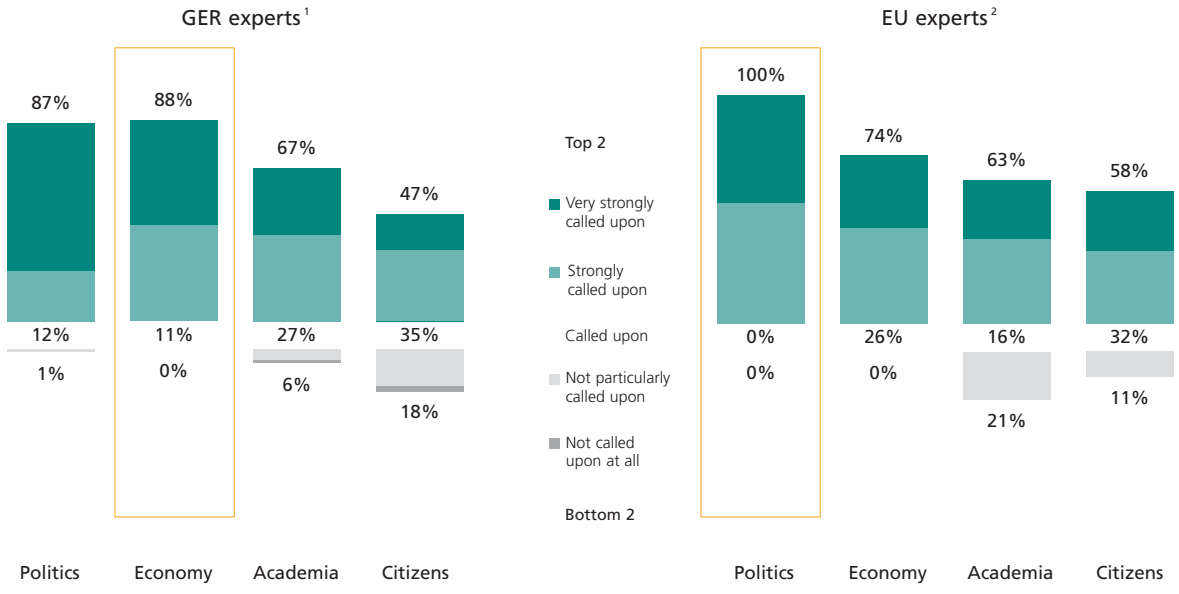
[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know / no answer

enterprises (as providers or customers). Here again, the percentage of people surveyed who see tasks largely or completely fulfilled exceeds (if only slightly) those who see the tasks as largely not completed or not completed at all. In the case of the legislator and public administration (as provider or customer), however, the majority of people surveyed see their tasks as not fulfilled: 39 and 37 percent of the experts for Germany consider that public administration has largely not fulfilled its tasks or has not fulfilled them at all. This is contradicted by the experts for Europe: 32 percent are of the opinion that public administration in their countries has largely fulfilled its tasks as provider. However, their assessments of the other bearers of responsibility are very similar. The last position, according to the experts, is given to private users. Some 60 percent of the people surveyed see the tasks of private users as not fulfilled at all or largely not fulfilled. The greatest need to deal with a requirements backlog to ensure a functioning, secure ICT infrastructure is seen among private users. This could indicate the need for increased efforts to protect infrastructure components within private users' areas of responsibility. It could also indicate the need to address the demand side, i. e., the demand for secure ICT infrastructures must come from users and must be a criterion for selecting between different providers.

When it comes to the future establishment and maintenance of a comprehensively protected ICT infrastructure, the experts for Germany see responsibility in the business world (87 percent highly responsible or very highly responsible), in politics (80 percent) and science (62 percent, see Fig. II.8). By contrast, the experts see citizens as less responsible or not at all responsible (38 percent). This is an interesting contrast to the question relating to the responsibili-

Fig. II.9: Ensuring the security of critical data – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to ensure the security of critical data in a digitized world?



1 Experts for Germany, n = 173; 2 Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

ties for a functioning, secure ICT infrastructure, which sees citizens likely to be less responsible for the future establishment of a secure infrastructure but more responsible for secure infrastructure functioning.

This picture differs only slightly for the future challenge facing players in guaranteeing the security of critical data in the digital world (see Fig. II.9). The Germany experts see this as the duty above all of the economy as a whole (88 percent) and of politics (87 percent).

Summary and recommendations

Security can only be achieved in the digital world if providers as well as users consider it as their duty. To this end, politics must reach agreement with the world of commerce on binding international data protection regulations. However, it will also be necessary to support educational measures that provide users with the requisite know-how on digital data dissemination and thus to raise their awareness for dealings with personal as well as with third-party data on the Internet.

In conclusion, it can be said that the experts assign very high importance to the establishment and maintenance of a secure ICT infrastructure. This is the duty in particular of politics and the economy. The key functions for a secure infrastructure include secure communication and identification. Given the right circumstances, an electronic identity card and De-Mail can also be advantageous. High priority should be given first and foremost to ease of use and confidentiality: it must be possible to use security functions without having expert know-how. It is now up to the world of technology to develop user-friendly security settings.

II.2 New openness, new framework?

The significance of open innovation and information structures for business and society

Fast and easy access to the latest knowledge with the ensuing information edge is not just a key advantage in our private lives but also in the world of business.

The possibilities offered by modern information and communication technologies and global networking are increasing the range of development and innovation resources available around the globe. Competitors are experiencing lower entry thresholds, since new business models can be established with minimum infrastructure and comparatively low investment. Business enterprises therefore now face a dramatic increase in competitive pressure. At the same time, technologies are changing faster and product life cycles getting shorter (see Bub & Schläffer 2008).

In the case of traditional innovation processes, in which innovations are based on the know-how and capacity available within a company and derived from the results of internal research, revenues can normally be expected to fall in relation to the costs of capital and resources employed.

The necessity therefore exists to optimize the innovation processes. This is where Open Innovation comes in, meaning the opening of enterprise innovation processes and thus the active strategic use of external ideas to increase their own innovation potential. Firms that open their own innovation and information processes and opt to exchange know-how and cooperate with other companies along with the fields of science and research look forward to easier access to complementary competences and assets along the value chain, intensive exchange of the informal knowledge that is so essential for innovation, reduction of their own research and development costs and, ultimately, less risk of taking the wrong path to market.

However, beside the opportunities already mentioned, open innovation and information systems present a number of challenges. For open innovation processes to function, suitable tools such as user-friendly IT platforms are indispensable. They also require business and science to play an active role and share the necessary resources and skills. These include technology expertise and enhanced communication and interaction competencies, internally and, above all, the overall will to share internal know-how with other organizations and to make use of external know-how inside the company. This often requires a major rethink in the organizations involved and has a profound impact on individual incentive systems.

Another important aspect is the need to reconcile the protection of intellectual property rights, copyrights and possibly even liability issues resulting from shared innovations, protection of privacy and reputation and the possibility of penalizing abuse, libel, fraud, etc., with the principles of openness.

The increasing use of open source software and the positive impact this has on providers as well as users coupled with a solid legal foundation show, however, that this dilemma can be overcome.

Where does Germany stand in the conflict between openness and security?

The results of the expert survey confirm how very important it is to open up innovation and information structures for use in a digitized world.

82 percent of the experts residing in Germany class open innovation and information structures as very or extremely important for economic development in Germany (see Fig. II.10).

The experts' estimate of their significance for social development is far lower. Here too, though, a majority of 57 percent of the GER experts still consider the expansion of open innovation and information structures to be very or extremely important.

The figures regarding the significance of open innovation and information structures in social development may be lower for various reasons: we can assume that the experts initially saw the immediate impact on the world of business. Open information structures are also very important for social development, although the information in this case usually differs from that involved in innovation. Open information structures and the transparency and public control they enable over political processes undoubtedly have a direct impact on democratic processes and, hence, on social development. The slight difference in weighting

could be accounted for by the variety of experts surveyed. According to the international Delphi Study 2030, information procurement, knowledge exchange and innovation development on the basis of open structures are likely to be part and parcel of the day-to-day life of the upcoming generation by 2019 at the latest.

The opinion voiced by the experts on the position their country takes in an international comparison in making open innovation and information structures usable is revealing. An alarming 49 percent of the GER experts see Germany only in the center third in the international comparison, 15 percent even see it in the bottom third. None of the experts consider that Germany leads the field (see Fig. II.11).

The Germany experts see, first and foremost, politics (69 percent), the economy (77 percent) and science (64 percent) as bearing responsibility for making open innovation and information structures usable. In contrast, only 28 percent of the experts think that individual citizens bear responsibility or bear great responsibility, while 42 percent consider that individuals bear little responsibility or no responsibility at all (see Fig. II.12).

This result is logical at first sight, since the main basis for open innovation and information structures such as easy, fast and secure access to a suitable infrastructure cannot be provided by individual citizens. Nonetheless, open innovation and information structures will only function if every individual makes a contribution.

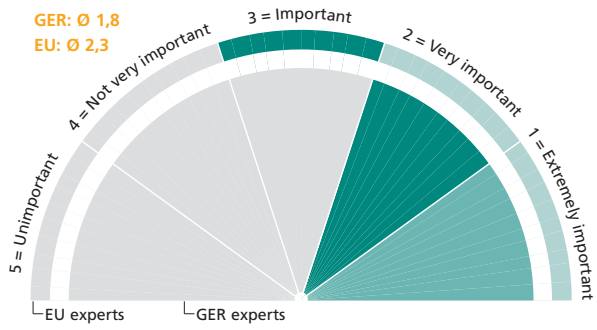
Requirements for openness vs. protection

"Information that appears on the Internet cannot be deleted," is a warning frequently voiced by HR consultants, teachers and data protection officers. Especially in the light of the current discussions relating to the digital 'eraser' (see de Maizière 2010), there are numerous demands for legislative measures relating to openness and protection.

Fig. II.10: Utilizing open innovation and information structures – Importance

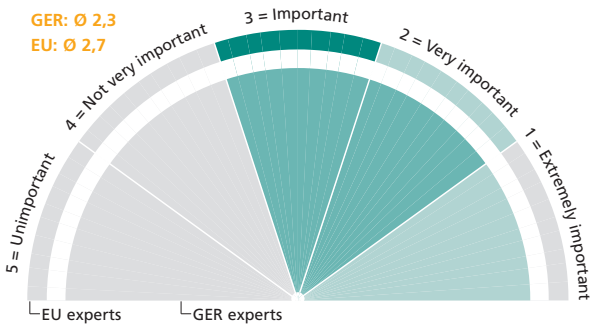
How important is utilizing open innovation and information structures in a digitized world for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	0 %	1 %	14 %	46 %	36 %
EU experts[2]	0 %	0 %	47 %	26 %	21 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	0 %	9 %	31 %	34 %	23 %
EU experts[2]	0 %	16 %	42 %	21 %	11 %

≥ 40 % of experts | 30–39 % of experts | 20–29 % of experts | < 20 % of experts | Averages

[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Digital Rights Management (DRM), electronic ID cards and electronic voting systems are important examples which the experts surveyed named on the online discussion platform as the main cornerstones that could be laid by the legislative to guarantee "protected openness". A standardized approach to digital rights management could give users of digital content more freedom as well as security. However, DRM itself should not be standardized but, instead, general DRM principles developed and implemented in global standardization groups. Expansion of the DRM concepts could go hand in hand with more intensive use of electronic identity documents – above all the electronic ID card – which could simplify access to and the provision of information in open environments and, at the same time, ensure that it is secure and transparent.

One particularly good example of the compromise between transparency and protection is the electronic voting system:

"The challenge for building a secure e-voting solution had been to ensure transparency of all the processes (why should I provide my data, how are they protected, who is liable in case of a loss, etc.), but people also want to assure their individual privacy (i. e., want to govern which data should go public – e. g., in a social network)."

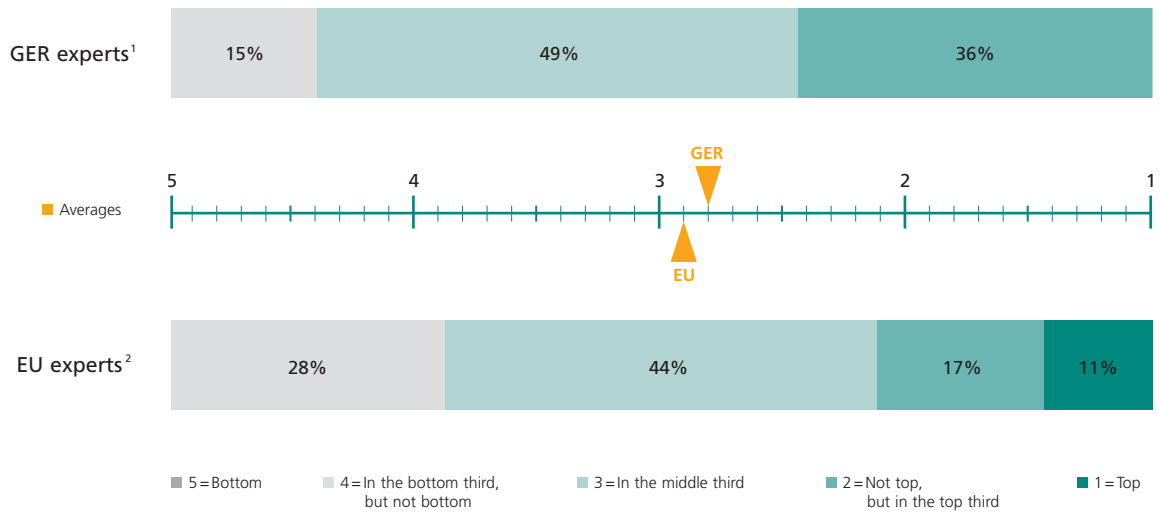
The overall requirements can be summarized as follows:

It must be possible for users to retain full control over their data. Both the transparency of processes and the protection of privacy are important for citizens.

Governments/the legislative should therefore take steps to ensure that the necessary infrastructure is available, reliable and trustworthy. And, in the experts' opinion, the governments/legislative should also make sure that personal data is used lawfully, that more effective action is taken against breaches and that the efficiency of any sanctions they

Fig. II.11: Utilizing open innovation and information structures – Position

And how do you think Germany (<country>) is positioned on utilizing open innovation and information structures in a digitized world in an international comparison?



[1] Experts for Germany, n = 158; [2] Experts for European countries, excl. Germany, n = 18 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

impose is monitored. A secure and trustworthy basis for this could be provided with national or even international electronic ID documents. Special attention should be paid to avoiding inconsistencies in legislation, above all with regard to innovation and information systems that are operated on a global basis.

The experts are of the opinion that, in turn, the public should ensure that governments do not misuse either the infrastructure or the data. An open information structure and procedures that can be verified by any citizen are factors that make it possible to exercise democratic control over national specifications and procedures.

However, even if they have access to the open information structures, not every citizen has the skills needed to evaluate the national procedures, making it vital to have regulatory bodies such as data protection authorities who perform these control functions on behalf of the public.

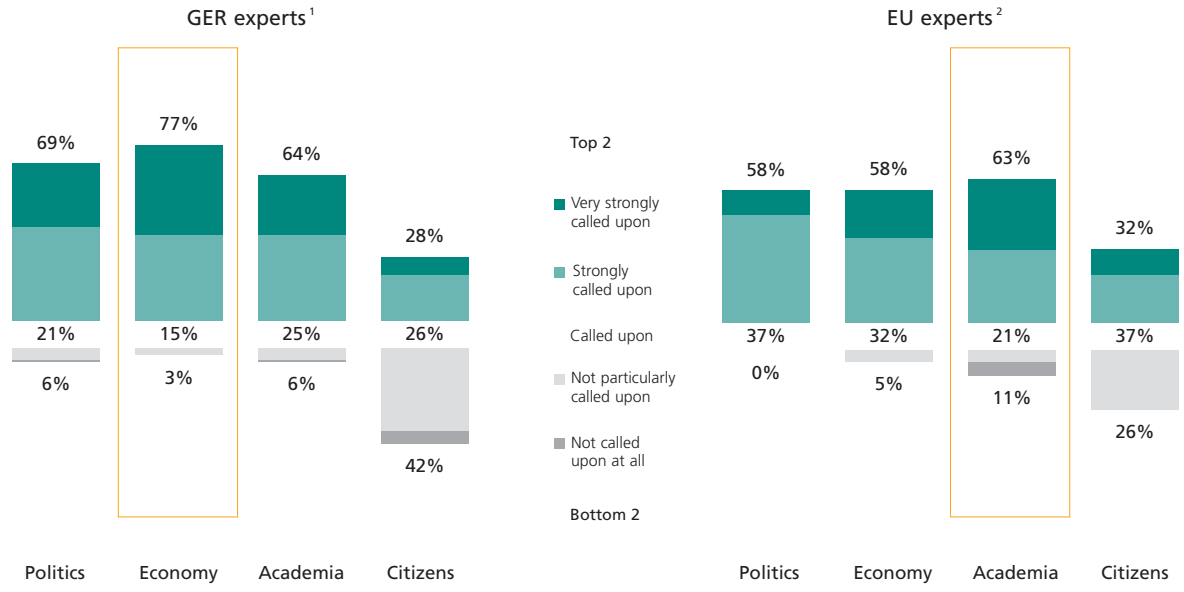
Through establishment of such regulatory bodies and the monitoring they perform, the public complies with its "obligation to ensure security". Such mutual control mechanisms are altogether lacking in political systems like the one currently found in China.

A completely different aspect is spotlighted by the demand for more education and training in the competent and secure use of online media and services (see also section I). Simply increasing the range of protection mechanisms and reinforcing barriers to access deepen the digital divide in society and fuel anxiety and skepticism.

So are our fundamental democratic structures at risk as a result of digitization and globalization? The digitization of society certainly has an impact on some of our basic democratic structures, as well as on general civil and human rights structures. The experts see the main dangers in

Fig. II.12: Utilizing open innovation and information structures – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to utilize open innovation and information structures in a digitized world?



[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

- Protection of privacy
- Free access to information, not just for the web-literate section of the population
- Transparency of processes, within which data, information and knowledge about individuals as well as about organizations, institutions and legal forms is collected, evaluated and processed
- The right to defense and
- The principle of the presumption of innocence.

At the same time, the experts recognize that intensified use of social media opens up new means of control by the public, supports access to information and thus enhances the right to information and freedom of expression.

"As a result, one could say basic democratic structures are in danger. On the other hand, Twitter and other social media have shown that they can be substantial means of public control and help to support the right for information and free expression of one's opinion. Thus the digitized society also supports basic democratic structures."

Increasingly, business enterprises are developing open innovation and information structures and establishing them in their organizations. The risks involved here appear to the experts to be managable, with the advantages far outweighing any disadvantages. Open innovation and information structures with standardized yet open interfaces are seen as strong drivers of innovation with a huge influence on competitiveness. According to the experts, open innovation also makes it easier to identify problems and take countermeasures. Despite the fact that open structures make spying, sabotage, hacking, eavesdropping and fraud possible, such attacks can be avoided if appropriate security systems and secure access regulations are in place. Nor is there any conflict between open innovation and the protection of intellectual property rights; in fact, companies have to harmonize these two concepts in their research and development strategies.

The conclusion drawn by the experts is that the risks that undoubtedly exist in open innovation and information structures can be avoided with a clear – open – innovation strategy.

Who will define the boundaries for a new, secure openness in the future?

The discussion revolving around who will or should define the standards for digital security in the future – the public sector, private organizations or business enterprises – showed that there is no generally valid answer to this question. Different bodies are called upon, depending on the required level of security, the economic and technological area of application, previous standardization practices and regional responsibility.

At national level it is more likely to be the governments, at a higher level the international standardization bodies, who will be responsible for specifying standards, whereby standards with global validity have huge advantages, as shown by GSM (international roaming in mobile communicators).

In retrospect, we see that international standards frequently emerge on the basis of de-facto standards that were driven by industry or public-private partnerships (PPP), hence powerful organizations and business enterprises are likely to increasingly set new standards in future.

Standards which have emerged without the key stakeholders being sufficiently involved in their design are viewed critically. For instance, the experts fear that users will not be sufficiently involved in the case of industry-driven standards. In turn, if standards are driven by the state alone, the necessary market acceptance is not likely to be generated.

"Standards defined by governments via regulation – without consultation of users, providers, manufactures, etc. – will not be adopted by the market."

One possible solution would be to organize standardization in transparent public-private partnerships, in which all relevant groups from society, business and the government are represented. This cooperative approach would also address the issue of mutual controls that was mentioned above: each party stands for its own interests and ensures that these are incorporated transparently.

"So it would be better if standardization efforts were organized as real PPPs from the beginning and were transparent with regards to the roles each party is playing."

Summary and recommendations

The new open innovation and information structures not only make our private lives easier but also give the business world the opportunity to gain new competitive advantages and expand existing ones. In terms of technology, Germany is already in a good position. However, measures are still required in some places in order to make it possible to benefit from this technology edge in the business world and, at the same time, to protect the privacy of the country's citizens:

- Provision of nationwide, easy-to-use, fast and secure access to a powerful infrastructure for open innovation and information structures.

- Creation of a basis for 'protected openness,' e. g., through a standardized approach to digital rights management.

- Monitoring the lawful use of personal data through a democratically authorized and controlled legislative.

- Avoidance of inconsistencies in legislation particularly with regard to innovation and information systems used on a global scale.

- Intensification of education and training with regard to the competent and secure use of online media and services.

- Organization of the necessary standardization activities in transparent public-private partnerships. The key aspect here is that all relevant groups from society, business and the government should be represented in such standardization bodies.

II.3 The role of the state: how much regulation does the Internet need?

The Internet makes it possible for private individuals, partners, firms, societies and state organizations to exchange data worldwide without any barriers but also without any protection. Since the Internet is technically a network of computers distributed around the globe, it is inherently difficult for national states to exercise control over it. This promotes the free exchange of information, creates transparency and defies autocratic systems. However, precisely this lack of state control can, in conjunction with Internet anonymity, be exploited for criminal purposes and cause financial damage. The question we must therefore ask is in what form state intervention is technically feasible and politically meaningful. This question is not easy to answer, as is shown by some controversial statements of experts taking part in the online discussion. Their opinions on the necessity of having a law that governs Internet security differ greatly, ranging from clear approval

"Yes, we need an e-security act!"

to emphatic rejection:

"[…] there is definitely no need for an e-security act […]."

A synthesis of the answers can be achieved if we look more closely at the reasons for approval or rejection: supporters of legislation criticize the lack of a legal framework for critical transactions such as those that occur in financial or e-government scenarios; critics fear that regulation could be too tight and hamper technological progress.

This article looks at the challenge of possible state action and focuses on the social consequences of electronic communication.

The role of the state

The art will be to assign the state the right role. To make this clearer, we can compare the electronic network with our road network. There is a colorful mix of drivers on the roads as well as users on the Internet, who comprise private, commercial and state users. These users are largely free to set their own individual objectives – no-one dictates or controls who should move from one place to another and what purpose they should pursue in doing so. The vehicles used by drivers to move about are, like the computers of individual Internet users, their own personal property and vary greatly in their characteristics – from bicycles to automobiles and buses. To enable traffic to flow smoothly and to avoid accidents, a highway code has been drawn up defining the basic rules of road usage. Although this set of rules has an effect on the technology, because it prescribes minimum standards, it is in principle technology-neutral and has not hampered innovation in vehicle construction over the last 100 years.

A similar set of rules to the highway code could also be applied meaningfully to the Internet. These rules should lay down general principles without hampering technological innovation. Such a regime could, for example, specify which individuals have what rights to certain data, how electronic declarations of intent can be presented, what characterizes an electronic document and when delivery of data to a recipient is considered legally binding. Another element of such a regime should be a definition of who is responsible for protecting data and what sanctions will be imposed for breaches of the rules. The experts surveyed also see politics as bearing special responsibility for security on the Internet and the data being transported on it (see Article II.1, Fig. II.8).

Need for regulatory action

Up to now the aspects described above have only been resolved in part, through the Digital Signature Act (SigG) for example. We lack a stringent, complete interpretation of a "highway code" for the Internet. As a result it is still difficult to handle business transactions from start to finish via an electronic channel. For example, if securities are purchased electronically through a bank's online banking portal, the contract note still has to be delivered on paper by standard mail. We do not have a legally binding delivery mechanism or a binding statement on what an electronic document must look like to be accepted by the customer's tax authority. The qualified electronic signature is, on its own, inadequate, since it neither guarantees delivery nor does naming a member of bank staff help the tax office assign the document to the issuing bank.

To remain with our traffic metaphor, the lack of any legal certainty results in certain electronic channels not, or only rarely, being used. We only have to think of e-government, or of electronic invoices and bank documents. The objective must be to complete a journey from start to finish via electronic channels instead of conventional roads. Like changing means of transport (from road to rail), each change from an electronic to a paper-based channel entails

major effort and costs. The task we now face is to avoid such inconsistencies. To do this, it is necessary to design the processes, or the "roads," from A to Z.

First users must identify themselves. In the electronic world, this function is to be handled via electronic identification (eID) with the new ID card (nPA). Reliable identification of citizens was already previously a state duty, which is now set to pass over to the electronic world. The approach taken by Germany's government is also supported by the experts in the discussion:

"Governments should be responsible for establishing a trusted infrastructure based on international ID documents."

In this context it is clear that, to use the new ID card, citizens have to keep their PINs secret and protect their own computers, a responsibility that the state cannot shoulder for them.

An electronic signature can be used if an electronic message has to be authorized by the sender. Independent companies have operated the infrastructure required for this for many years. The duties of the trust centers that this system uses are defined by law, with the private trust centers being supervised by the Federal Network Agency. This system served as the model for solving the issue of legally binding delivery of electronic documents. A letter is considered delivered when it is placed in the hands of the postal service. The postal service offers additional ways of documenting successful delivery, with registered letters or recorded delivery. As long as this possibility is not available for electronic business transactions, important documents such as tax assessment notices or bank statements have to be sent on paper – representing format discontinuity. De-Mail is expected to provide a remedy. It allows private providers to dispatch e-mails under the supervision of a federal authority, which are then legally considered to be delivered according to the De-Mail law (currently undergoing legislative procedures). The prerequisite is that both communication partners have previously registered as participants in the De-Mail system.

Generally speaking, the distribution of roles between the state and business is appropriate and reasonable for the electronic signature as well as for De-Mail. The only problem is that a large number of users is needed to make the operation of such infrastructures economically viable. Experiences with the (qualified) electronic signature are, however, disillusioning. In this case, the critical mass of users needed to ensure that the system will run cost-effectively has never been reached. This keeps the price of electronic signatures high. It is unclear at present whether the new ID card will succeed in driving use of the qualified electronic signature. Although it offers a signature function, citizens still have to pay to load the necessary authentication certificates onto the document. It remains to be seen whether this will prove an attractive proposition for citizens. If identification with the eID function is not sufficient to initiate a transaction, the fact that the electronic signature function is not in general use could create a bottleneck. The legislator must, in any case, specify which of the e-government processes can be transacted with the eID alone and which require electronic signatures to be used. This can be stated in the individual regulations for each specific application. Greater consistency could be achieved by addressing this issue within the framework of the law on Internet security mentioned above. The De-Mail system must take steps to ensure that it does not suffer the same fate as the electronic signature. Citizens are used to being able to set their signatures to documents without having to pay for doing so. They also receive mail and send e-mails without incurring any costs. Concepts under which citizens are made responsible for running costs, costly hardware procurement or obligations that are felt to be inconvenient are highly prone to failure.

Uncertainty also reigns with regard to the last stage in the process. Once citizens have received a response following electronic authorization, processing and delivery, they will often need to present the data involved to a third party, e. g., their local tax authority. Common examples of this are bills of purchase and bank documents. It must therefore also be possible to use the electronic data records as documents (and to archive them over the long term). Although signatures already make this possible in personal communications, we do not yet have a solution that guarantees that mass documents such as invoices, tax assessment documents or bank documents can be securely assigned to the legal entity issuing them. The Federal Ministry of Economics and Technology is currently examining the possibility of defining an electronic stamp (used synonymously with the term "electronic seal"), which is technically the same as a signature but can be assigned to a legal entity. These considerations should be rapidly brought to an end, whereby, here again, integration in a general law on Internet security should be considered.

Spanning all these fields is the issue of data protection: the easier it becomes to exchange data and the larger the volume of personal data that is placed on the Net, the more important it is to ensure that it is handled correctly. If we do not succeed in achieving a balance between availability and protection needs in the handling of personal data, we will – in the opinion of all the experts – be confronted with social problems. The experts for Germany are even more critical than the experts for Europe on this aspect. 84 percent of the Germany experts see control of companies that handle personal data as very or extremely important for social development in Germany – in contrast, only 58 percent of the Europe experts think the same way for their country (see Fig. II.13). Asked how they see their country's position in an international comparison with regard to control over firms that handle personal data, 45 percent of the Germany experts state that they see Germany in the top third (see Fig. II.14). In the experts' opinion, it is primarily the duty of politics and business as a whole to exercise control over firms that handle personal data (see Fig. II.15).

Standardization

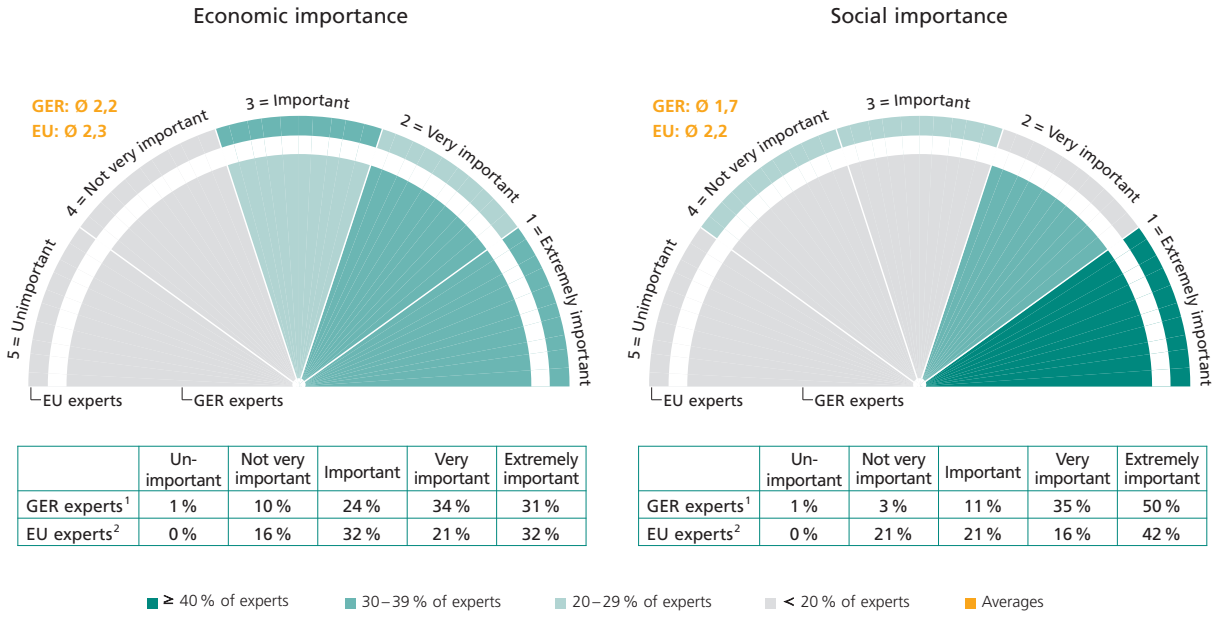
A question that is not easily answered is who should be responsible for defining technical standards. The experts do not agree on this issue, although it emerges from their statements that governments, large enterprises and international associations all play an important role. The degree to which electronic processes are standardized may depend on individual sectors of industry as well as on levels of internationalization. Despite the lack of boundaries on the Internet, most users visit national sites, simply due to language problems on other sites; private e-business and, more obviously, e-government are also largely national, so that national standards can be expected to emerge.

The experts' opinion

"[…] security standards will only be widely accepted if all relevant stakeholders are sufficiently involved in the standardization process."

Fig. II.13: Supervising companies that trade personal data – Importance

How important is supervising companies that trade personal data for economic/social development in Germany (<country>)?



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	1 %	10 %	24 %	34 %	31 %
EU experts[2]	0 %	16 %	32 %	21 %	32 %

	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	1 %	3 %	11 %	35 %	50 %
EU experts[2]	0 %	21 %	21 %	16 %	42 %

■ ≥ 40 % of experts ■ 30–39 % of experts ■ 20–29 % of experts ■ < 20 % of experts ■ Averages

[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

meets with consensus – although it is still not clear who the relevant stakeholders are in each case. It can be assumed that mechanisms of self-organization will also take effect in standardization, as has been the case with many technical standards. This is not critical as long as they do not present hurdles or obstacles to innovation. Statutory regulation should therefore remain as technology-neutral as possible. As on the road, it should always be possible to drive any car in any country, despite varying details in traffic rules (e.g., maximum speed). We face the risk that national states could introduce incompatible standards that create technical hurdles, either from the fair motive of protecting their citizens or from the base motive of avoiding transparency. Should this hinder free trade and, in consequence, economic development, it can be expected that nations will realize sooner or later that they have made a mistake. If their motive is political isolation, it can be hoped that the opposition will be strong enough to find ways of overcoming the hurdles. The global Internet, in particular, offers a range of possibilities for achieving just this and can hardly be suppressed, even by authoritarian systems.

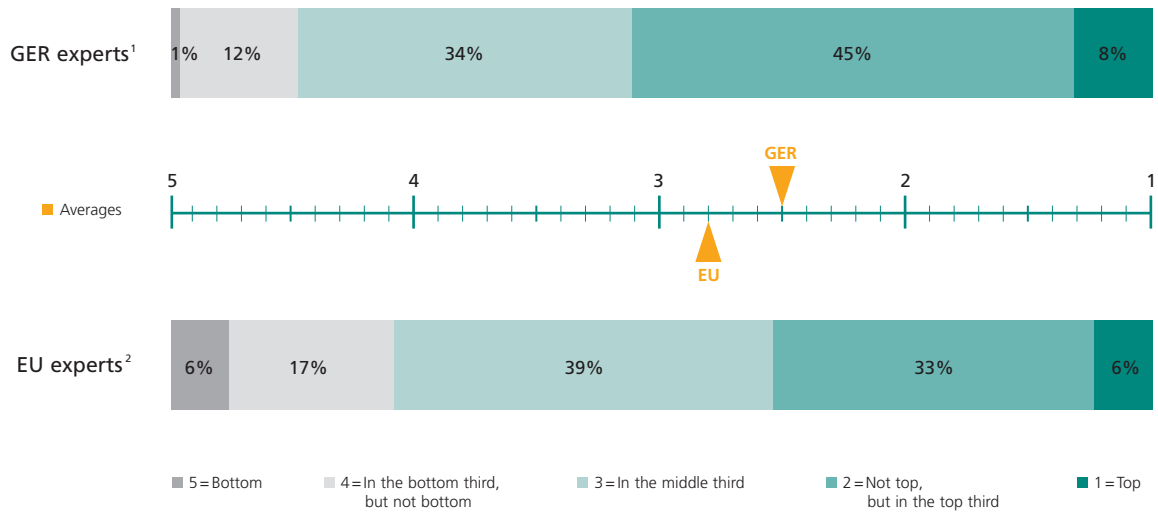
Impact on society

Electronic media offer direct, unfiltered access to information. Everyone can obtain information at source without having to rely on the press. In the same way, private or commercial sellers can meet and close deals with their customers in virtual marketplaces without a retailer being involved. In some countries, loans between private individuals are already being agreed in this way, without using a bank. However, the advantages of unhindered access to information and more favorable terms are offset by disadvantages such as the lack of the quality assurance normally performed by the press, the retail sector or a bank.

Nor does representative democracy remain unaffected by the technological change (see also "International Delphi Study 2030," 2009). Elements of direct democracy could increasingly establish themselves, for example online voting. This brings democracy to life and forges a closer link between citizens and the state – it could, however, also make decisions more volatile and inconsistent.

Fig. II.14: Supervising companies that trade personal data – Position

And how do you think Germany (<country>) is positioned on supervising companies that trade personal data in an international comparison?



[1] Experts for Germany, n = 165; [2] Experts for European countries, excl. Germany, n = 18 (N.B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

The consequences of social networks for society are not yet completely understood. This is reflected in the statement of one expert:

"[…] one could say basic democratic structures are in danger. On the other hand, Twitter and other social media have shown that they can be substantial means of public control and help to support the right for information and free expression of one's opinion."

The greatest concerns are for data protection. Nonetheless, social networks offer possibilities hitherto undreamed of for us to present ourselves as individuals and to keep in touch with other people. The downside is that, once placed on the Net, data may remain accessible for longer than intended and be available to recipients other than those intended. A photo showing a merry student party could prove to be damaging at a job interview in later years. Logically, the experts therefore demand that a user should have

"[…] full control over his data […]."

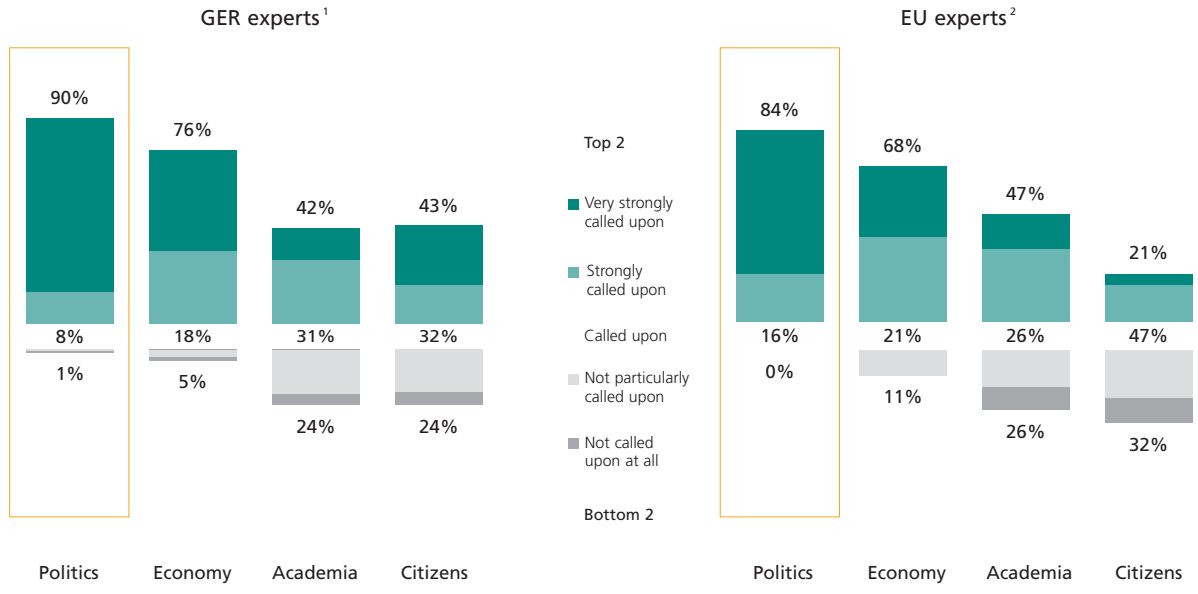
But how such informational self-determination can be achieved – technically and legally – on the global Internet remains unresolved. This will present educational institutions with the new task of training citizens in the use of electronic media, just as road safety found its way onto the school curriculum many years ago (see section I).

Summary and recommendations

Electronic media offer opportunities for all the parties involved, the state, business and citizens, simply because they provide access to information and markets without any major impediments. Even our democracy stands to gain. Conversely, the potential effects of misconduct are more serious, since the Net distributes data around the globe and has difficulty 'forgetting' it. In consequence, there is no alternative for citizens as well as business enter-

Fig. II.15: Supervising companies that trade personal data – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to supervise companies that trade personal data?



[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

prises to handling electronic media in general and personal data in particular with due diligence. This will also give rise to new tasks for educational institutions, in particular for schools.

National states have to establish a regulatory framework for e-business and e-government and to make a security infrastructure available through private providers. Incentives for private enterprise will be indispensable to ensure that they plan their investments and business models accordingly. Furthermore, national states should also confer and coordinate their activities at international level. It would, however, be deceptive to believe that laws could eliminate all the risks involved without overly restricting the opportunities with rigid regulations. In the future, it will therefore be the responsibility of all the parties involved, the state, its citizens and business, to ensure that electronic communications are secure.

II.4 ID cards for the future: possibilities and limitations

Identities and digital identities

We move around the virtual world of cyberspace as naturally today as we do in the real world. The Internet has advanced to become a socio-economic space in which many people spend large parts of their working and leisure hours.

Some of the elementary but nonetheless fascinating questions as to whether and how the Internet impacts our work and private lives relate to digital identity: Who am I, who do I communicate or cooperate with, which role do I want to assume? The term identity itself is not unambiguous, since various diverging definitions exist. The definition in the BITKOM guide to web identities published in October 2005 states: an identity is, in the context in which it is used, a unique, recognizable description of a natural or legal person or object (e.g., group of persons, company, computer, program, file).

Identities have an identity identifier (e. g., name, company personnel number, tax number, computer number) and attributes that describe additional characteristics (place of birth, age, interests, hobbies, cell-phone number, language skills, police clearance certificate, friends, etc.).

Digital identities are identities that can be understood and processed by a computer system. Here again, the criteria of uniqueness and differentiability apply.

Different types of identities can be defined on the basis of usage formats, e. g., personalized, anonymous, pseudonyms (i.e., traceable to the open identity) in the one dimension and non-binding or legally compliant in the other. Among these, unusual forms of identities certainly exist, such as anonymous and nonetheless legally compliant identities as required in electronic voting.

Protection and security of digital identities

Digital identities are data records which can potentially be copied and misused by third parties. It is therefore vital that these data records are protected, whereby a basic distinction is made between three main protection methods based on "knowledge", "ownership" and "inherence" factors. Protection with "knowledge" refers to passwords, by "ownership" we mean the use of hardware security tokens (e. g., smart cards with a security module), and protection through "inherence" involves biometric methods (e. g., facial image, fingerprints).

Experiences gained so far with these identity protection methods show that protection with knowledge is not adequate and that the use of biometric systems quickly encounters legal limitations or contravenes data protection regulations.

For these reasons, interest currently focuses on HW security tokens (smart cards, USB flash drives with security functions, microSD cards, etc.), which can store and process identities securely, often using cryptographic procedures. Despite the fact that experiences with such tokens have already been gained in many application areas, questions of technical feasibility, cost-effectiveness in practical usage and legal issues (liability) are still not fully resolved.

Germany's new ID card

The new German ID card (nPA) is due to roll out in November 2010. Today, over 60 million citizens use their identity cards as a means of identification with public authorities as well as in their private lives, for example to open a bank account, purchase age-restricted products or collect registered letters at a postal branch. The new ID card (nPA) now makes it possible to use this generally accepted and widely used means of identification on the Internet.

This fact was also emphasized by the experts' discussion:

"For the first time, the 'nPA' offers the possibility for every citizen to use the ID card also for identification / authentication on the Internet. This will be an improvement of the security level for almost every service on the Internet."

Using the nPA will dispense with the need to fill out a flood of new and re-designed forms and templates. The identity data that an Internet seller needs for business purposes and that may be retrieved following approval by the Federal Office of Administration is transmitted securely via an electronic channel without any media discontinuity. For each transaction, sellers must also verify to citizens/customers that they are authorized to read this data. Further-reaching security functions such as those needed for the legally-valid electronic signature can be loaded onto the nPA (at a charge).

So, alongside its state-oriented functions, the new electronic ID card also contains a separate electronic identification function for private use, e. g., in e-government or e-

commerce. In this context, one expert emphasized the following during the discussion:

"Anyway transparency is needed on how these procedures function to improve people's acceptance of the electronic ID card."

Seen overall, the nPA is a secure and easy-to-use identification instrument, which will be put to widespread use in the coming years. The reservations that are currently voiced, namely that the electronic ID card is not secure enough or that criminals could spy out the obligatory PIN, only apply when non-secure terminal devices are used. If the PIN has to be keyed in on a computer keyboard because a PIN pad and visualization on a card reader are not available, the security of this process will depend on how secure the computer is. If an invader has gained control over a computer, keyboard and monitor, it will be virtually impossible to conduct a transaction securely. However, this problem is not specific to the new electronic ID card.

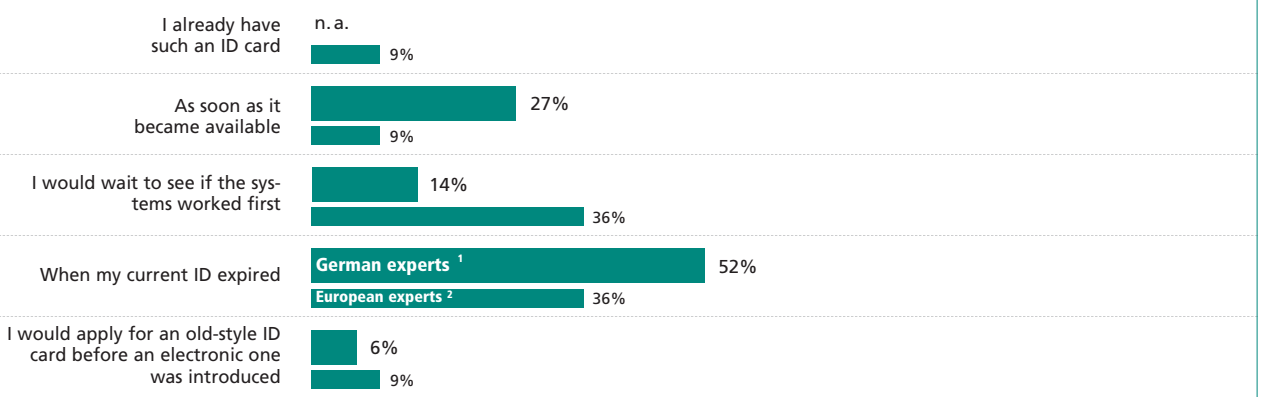
In this context, numerous experts discussed the possibilities for identity cards. They considered potential areas of application, what has been achieved so far, the conditions necessary for their use, and hurdles and impediments to widespread usage. And although a number of identity tokens have been in use for many years – a category that includes software solutions such as the T-Online Net card or Microsoft's InfoCard – the discussion soon focused on the new identity card.

Outstanding feature of the new nPA: it can be used on the Internet

It was generally acknowledged that the new electronic ID card will require a new complex infrastructure to be specified and established. An eCard API (application programming interface) links the nPA, modern NFC card readers (NFC: Near Field Communication), the client software in the PC or mobile device with the eID server in the Net, offering additional interfaces for certificate management, other identity management systems, connections to the application server, etc. This has now been technically implemented and is currently undergoing tests and continuous improvement. The fact that the new electronic ID card can be used on the Internet was deemed its outstanding feature. At the same time, however, it was set apart from other multifunction cards, which contain and process additional identity attributes, e. g., personnel numbers, sums of money or mobile communication IDs. Nor does the nPA solve the problem of secure visualization for sensitive data (except when expensive card readers with their own

Fig. II.16: Application of an electronic identity card

On November 1, 2010, the new ID card will be introduced in Germany. When will you personally apply for the new ID card? / If an electronic ID card was available in Germany (<country>), when would you apply for one yourself?

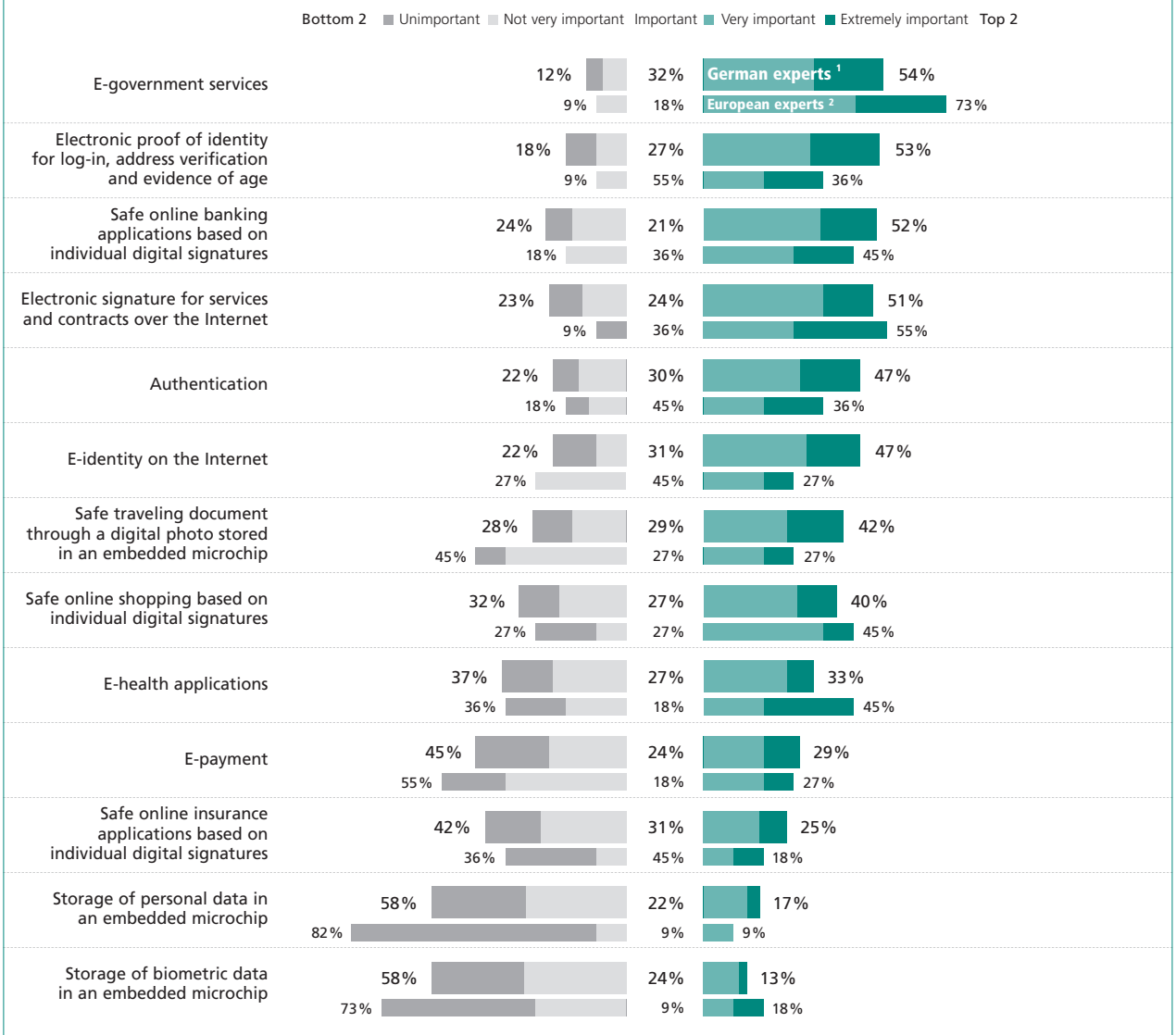


[1] German experts, n = 180; [2] European experts, excl. Germans, n = 11 (N. B.: Small sample size!); n. a. = not applicable
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know / no answer

display and PIN pad are used). The classic "chicken-and-egg" issue between smart cards and applications appears to be solved with the new ID card, since the new nPA smart card will have to be purchased by virtually all German nationals over the years. However, the problem of how to increase usage of the optional qualified electronic signature remains, in this case in the potential conflict area between the provision of (costly) certificates and application in legal transactions. Nonetheless, the qualified electronic signature can be expected to spread since it will no longer require a separate smart card to be produced.

Fig. II.17: Success functions of the electronic identity card

In your opinion, how important will the following functions be for the success of the new ID card?



[1] German experts, n = 180; [2] European experts, excl. Germans, n = 11 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

"Citizen-friendly explanations needed for acceptance of the new nPA functions"

According to the experts, the steps that will be necessary to ensure acceptance of the nPA's eID function include skillful promotion of the card based on marketing measures and "citizen-friendly" explanations of the new functions both in the registration office as well as in public. Another factor that the experts consider to be just as crucial to acceptance of the eID function is undoubtedly that applications are offered on the Internet:

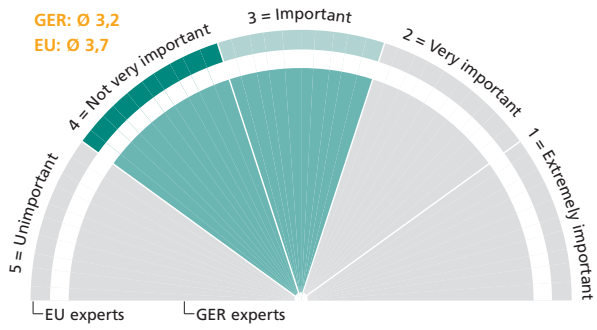
"There are two important drivers to increasing the number of nPA users:
1. Attractive additional e-business and e-government applications and services to motivate innovators and early adopters to use the nPA for those new services.
2. Trust in the security of the nPA and its business and e-government applications."

The crucial aspects here are login and registration processes as well as pseudonym usage, age verification, secure and automatic form filling, and authentication at machines. All in all, potential future applications need to offer greater variety and attraction than traditional procedures and applications. A card that could be used for many different applications would be the best solution to many citizens' needs. It is, however, also clear that the identity data supplied with the nPA will not fulfill all business and public administration needs for data about customers and citizens. The eID function can therefore only be one component in a comprehensive identity management system which holds additional data on customers. Use of the nPA for identification (e.g., at initial login) and authentication purposes (at subsequent logins) should become standard practice for all citizens and, consequently, the nPA their most important card. Finally, development options for the nPA were discussed, such as the addition of attributes as provided for in other identity management systems (e.g., OpenID). Likewise, the link to multifunction cards (e.g.,

Fig. II.18: Successfully introducing the new ID cards / an electronic ID card – Importance

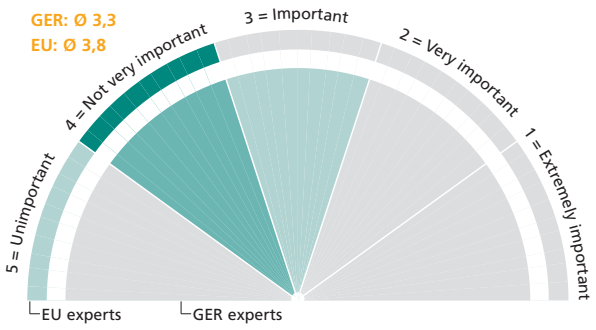
How important is successfully introducing the new ID cards / an electronic ID card for economic / social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	9 %	35 %	31 %	18 %	6 %
EU experts[2]	16 %	42 %	26 %	11 %	0 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	12 %	36 %	29 %	14 %	6 %
EU experts[2]	26 %	42 %	11 %	16 %	0 %

■ ≥ 40 % of experts ■ 30 – 39 % of experts ■ 20 – 29 % of experts ■ < 20 % of experts ■ Averages

[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know / no answer

SIM and UICC in mobile devices) and microSD cards was addressed. The eCard API, which is in principle open for other ID cards and already supplies the universal interface for cards in the healthcare sector (eGK: electronic health card, health professional cards), residence permits and ELENA, the electronic remuneration certification, etc., opens up major potential in this field.

The experts surveyed are themselves open to the nPA

Within the framework of the expert survey, participants were asked to state when they themselves expected to acquire the nPA. The skeptics are in a clear majority on this, with 79 percent of the GER experts stating that they would apply for the nPA either as soon as it becomes available (27 percent) or when their old ID cards expire (52 percent, see Fig. II.16).

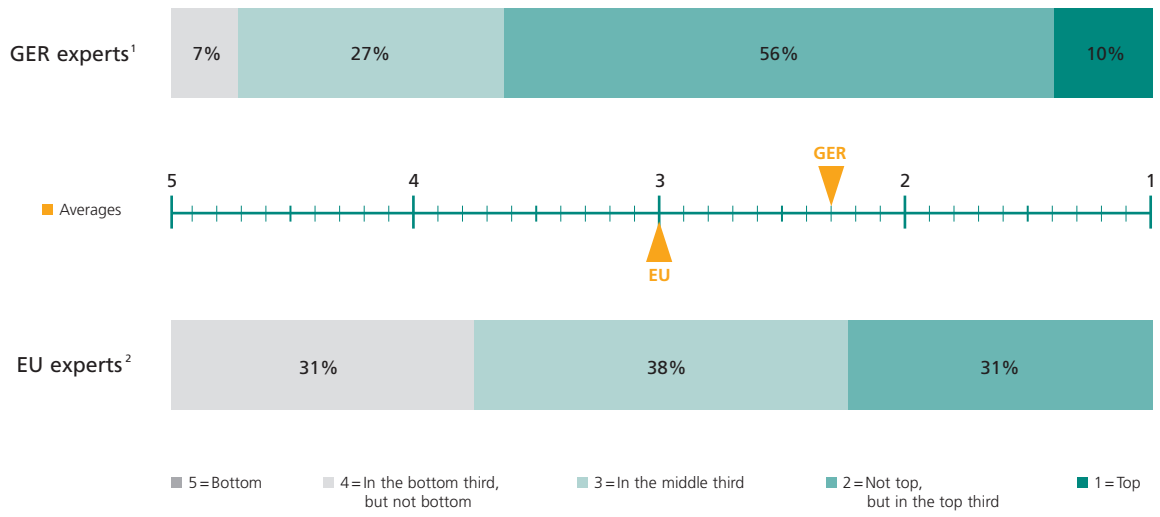
Asked about successful functions for the nPA, 54 percent of the experts for Germany quote e-government services, followed by identification at login and age verification (53 percent), and online banking (52 percent). The (optional) storage of biometric data landed in last place and is thus considered relatively unimportant (see Fig. II.17). The chart implicitly defines the key areas of nPA application, which have already been subjected to around 200 application tests.

The experts assigned the significance of a national electronic ID card or identity token for a country's economic development a low overall rating, with 44 percent of the experts for Germany holding introduction of the nPA to be less important or not important at all for Germany's economic development, a similar result to that obtained for social development (see Fig. II.18).

The GER experts expect the German nPA to play a pioneering role: 10 percent of the experts put Germany in first place in an international comparison, with another 56 per-

Fig. II.19: Successfully introducing the new ID cards / an electronic ID card – Position

And how do you think Germany (<country>) is positioned on successfully introducing the new ID cards / an electronic ID card in an international comparison?



[1] Experts for Germany, n = 156; [2] Experts for European countries, excl. Germany, n = 16 (N.B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

cent positioning the country in the top third (see Fig. II.19). They criticize the fact that – despite the security of the data and transaction channels – users still have to key in a PIN before their identity data can be transmitted to the provider (via a tap-proof line). This is not the case in other countries. In the year 2020, all German citizens will be in possession of an nPA and will use its inherent electronic ID function for a wide variety of applications.

Boundless perspectives for Germany's new electronic ID card

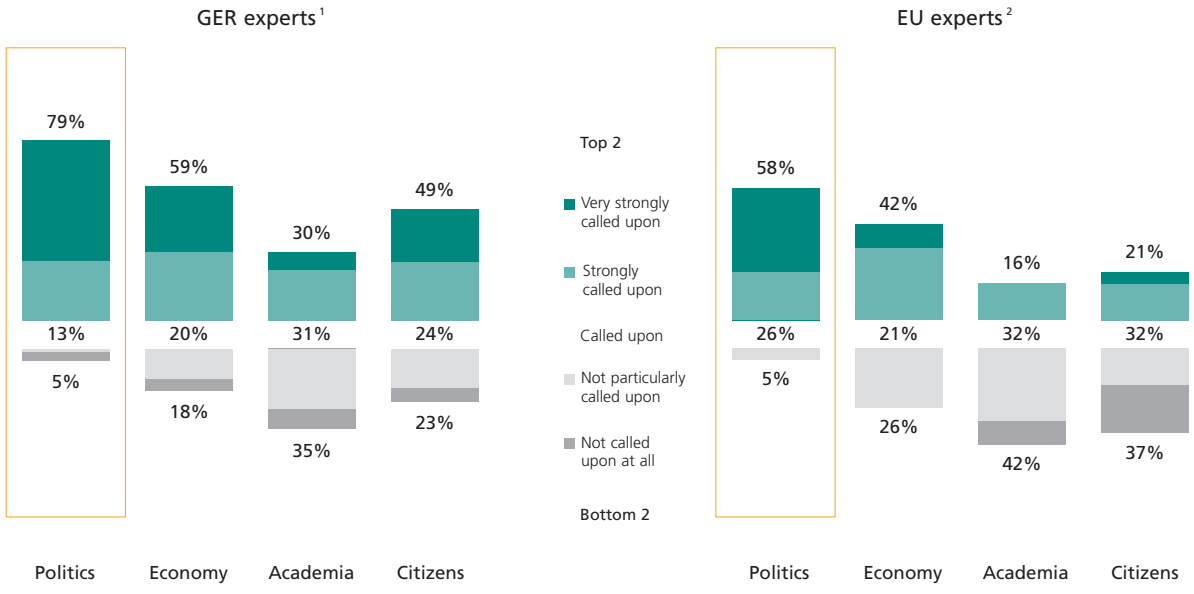
The European project known as STORK (Secure idenTity acrOss boRders linKed) is trying to establish interoperability between the different European states which are introducing electronic identity tokens, and have – in some cases – widely diverging developments. The object is to operate login and identification processes in such a way that they are familiar to citizens, even when they access portals in other countries.

Irrespective of this, it can be hoped that the new electronic ID card technology (eCard middleware, eID server, certificate management) will, subject to its acceptance and use as the sole means of identification in Germany, also gain a foothold in other countries, both in Europe and beyond. The nPA represents a German innovation in the security market and opens up a major perspective for Germany's IT industry and Germany as an ICT location.

The response from the experts on the question as to the key players that will be needed for successful introduction of the new identity card was unanimous. Of the proposed players – politics, the overall economy, academia and citizens – politics was assigned a clear pioneering role – 79 percent see politics as bearing high or very high responsibility in this area (see Fig. II.20).

Fig. II.20: Successfully introducing the new ID cards / an electronic ID card – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to successfully introduce the new ID cards / an electronic ID card?



[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know / no answer

Summary and recommendations

The electronic ID card provides users with a tool for documenting their identity at any time – offline or online – in a self-determined way, transparently and securely. With its electronic identification function it can replace the wide range of identification and authentication procedures based on passwords, user names, e-mail addresses and any combination of these and, at the same time, will make its way into everyday use. The nPA is, however, not a universal remedy to all threats emanating from the Internet. For example, the software on the device (known as the "ID app") and in the environment in which it is active has to be free of malware, e. g., Trojans, which could otherwise basically cancel out the security factor. Here it is the duty of the manufacturers, who must offer intuitive, easy-to-use security services , and the Federal government – and here in particular the Federal Office for Information Security (BSI) – to provide the necessary information on the residual risk.

The logical demand for technically feasible, economically profitable and legally compliant security solutions can only be fulfilled in a constructive partnership between technology, the economy and the regulator.

II.5 IT security: the responsibility of the user

The increase in ICT-based services is paving the way for new business models that make it possible to design more effective digitized processes for areas such as online retailing, the media industry and logistics. ICT-based processes require data to be complete, correct and available precisely when it is needed. Private users, business enterprises, public authorities and their staff therefore face the permanent dilemma of having to disclose data and information on the Internet in order to exploit the advantages of these ICT processes. At the same time, they have to accept the inherent risk of losing control over sensitive and private data that they disclose. Technology developments such as cloud computing, geo data services like Google Street View and social networks such as Facebook are putting more pressure on users and business enterprises to disclose personal data on the Internet.

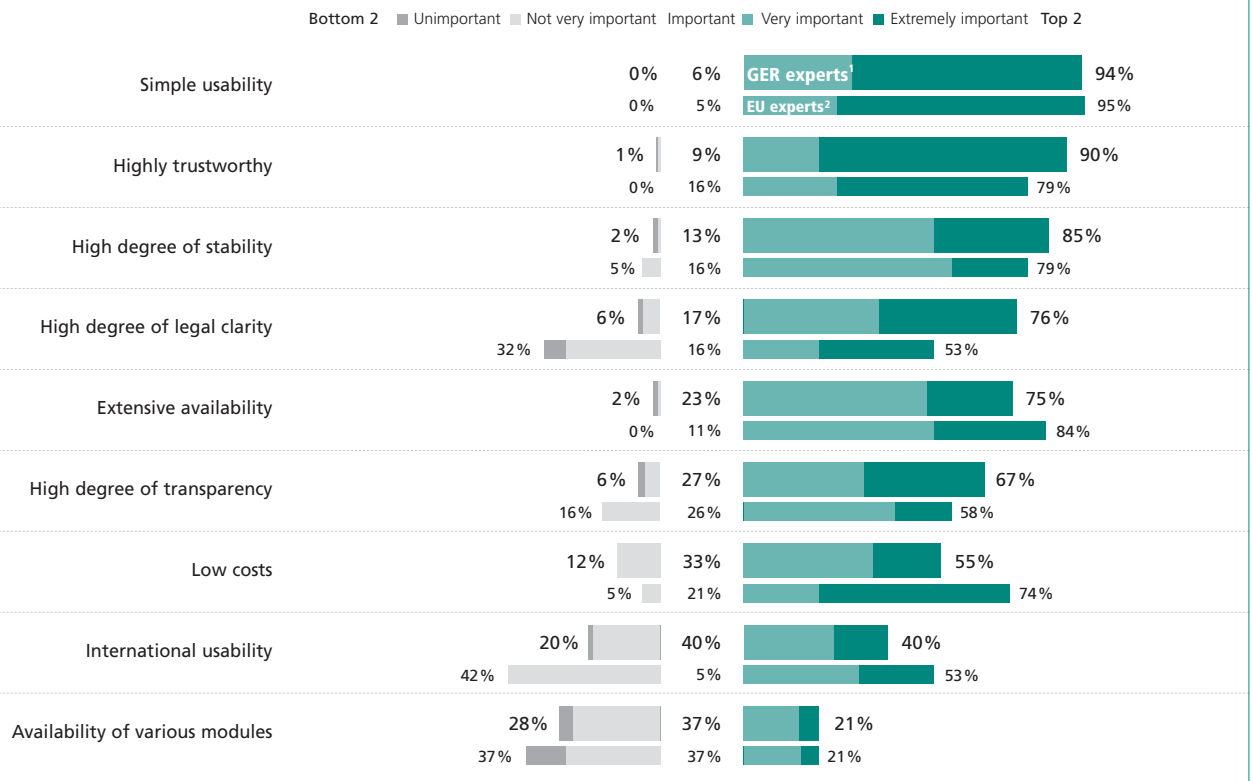
Responsibility for handling personal data

As a consequence, the expert discussion held during the study examined the responsibilities that individual citizens can, or possibly must, assume in order to guarantee that their personal data remains secure. The discussion also looked at the issue of how people can satisfy this responsibility, and what role the state and private enterprise can or must play.

The results show clearly that the question of personal responsibility depends to a large degree on the particular role in which a user is active. In fact, the conditions for responsible action vary greatly, depending on whether people assume the role of citizens, of employees in a business enterprise, of customers or of private individuals. Again,

Fig. II.21: Security criteria for acceptance of ICT

How important are the following IT security criteria for widespread acceptance of ICT in the population?



[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N.B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

this requires citizens to be aware of their individual roles and of the responsibilities, rights and duties associated with each of them. The experts therefore call on business enterprises, public authorities and state institutions to install suitable measures in order to inform employees and citizens about these rights and duties. Autonomous actions require appropriate enlightenment about the potential dangers and risks involved in an excessively liberal approach to disclosing digital data.

"People must be aware that the Internet is a public place and that everything I am posting on the Internet is immediately and forever publicly accessible."

The experts demand that public education should lay the necessary foundation for security to be included in teaching curricula in schools as well as in further education institutions (see also Article I.3).

"People will need to acquire new skills and awareness for handling their own data […]."

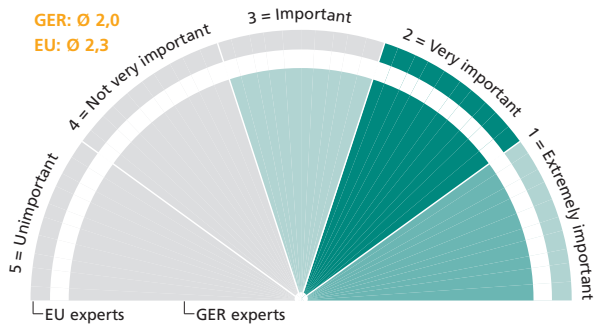
Introduction of an "Internet license" to be renewed at regular intervals was also proposed as a useful instrument (see also Article I.3).

Sets of normative rules that specify binding conditions for service providers in private enterprise as well as for commercial and private users and thus protect confidence are indispensable as flanking measures to be introduced by public authorities. Consequently, the experts call for legal, normative and regulatory provisions and standards, which would have to be complied with by Internet service providers, cloud providers and software vendors.

Fig. II.22: Simplifying security technology on the Internet for the user – Importance

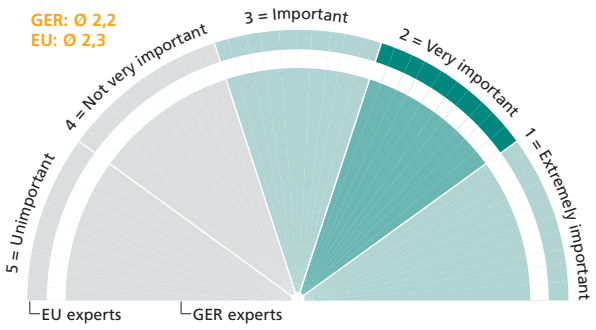
How important is simplifying security technology on the Internet for the user for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	2 %	3 %	20 %	45 %	30 %
EU experts[2]	0 %	16 %	16 %	47 %	21 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	3 %	9 %	24 %	38 %	26 %
EU experts[2]	0 %	16 %	21 %	42 %	21 %

■ ≥ 40 % of experts ■ 30–39 % of experts ■ 20–29 % of experts ■ < 20 % of experts ■ Averages

[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

User-friendly security technologies as a key factor

A key role in the protection of future systems will be played by the degree to which security technology is accepted by end-users. Many end-users continue to reject security technologies, seeing them as complex ballast that is difficult to operate and an unnecessary cost factor. 94 percent of the Germany experts who were questioned for the study and 95 percent of the Europe experts therefore assigned the ease-of-use factor the highest importance for a security product (see Fig. II.21). The expert discussion also confirms this opinion:

"The three keys are:
ease of use, ease of use, ease of use!"

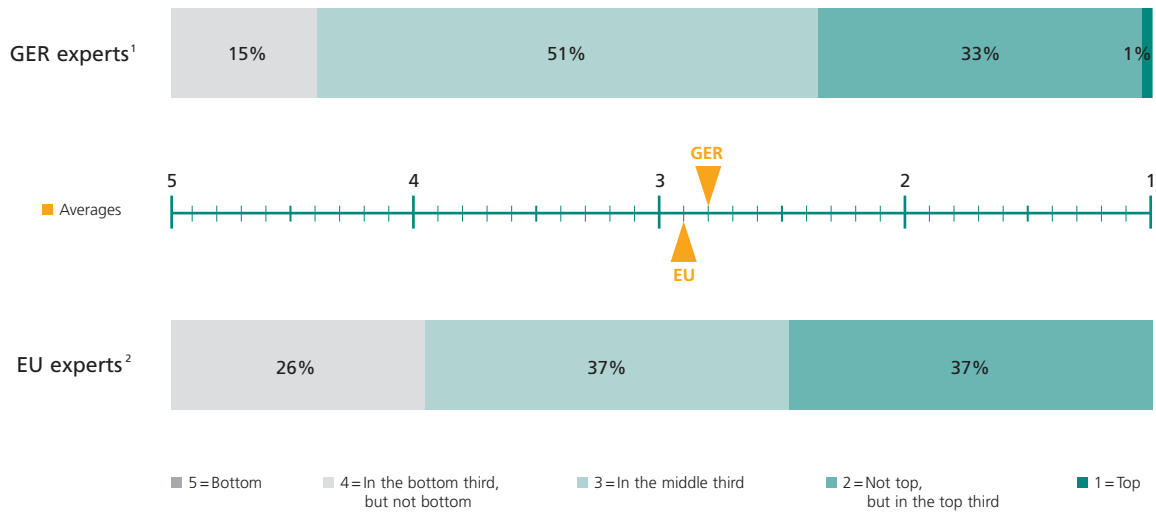
75 percent of the GER experts surveyed see the economic importance of making security technology simpler for users as very or extremely important. Its social significance is also rated to be very high, according to 64 percent of the experts (see Fig. II.22). Nonetheless, half the experts place Germany in the center third on this issue in an international comparison (see Fig. II.23).

In addition to this, the experts for Germany also consider product trust (90 percent) and legal certainty (76 percent; see Fig. II.21) to be very important. Consistent with this, during their discussions the experts called on private enterprise to develop trusted security technologies that are intuitive and easy to use. They must integrate seamlessly in technical systems and processes. Security must become standard practice. The experts for Germany (86 percent) and Europe who were surveyed believe that responsibility for simplifying security technologies on the Internet lies with the economy as a whole (74 percent, see Fig. II.24). The world of science is another area that bears high responsibility in this field, according to the experts.

A mix of incentive measures and obligations represents a

Fig. II.23: Simplifying security technology on the Internet for the user – Position

And how do you think Germany (<country>) is positioned on simplifying security technology on the Internet for the user in an international comparison?



[1] Experts for Germany, n = 158; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

conceivable approach to raising acceptance for security technologies. Financial incentive systems could, for instance, be linked to reductions in insurance premiums or special discounts in online shops for users who bring proof that the security technology they use is rated suitable for this specific purpose.

Control and/or controllability of personal data

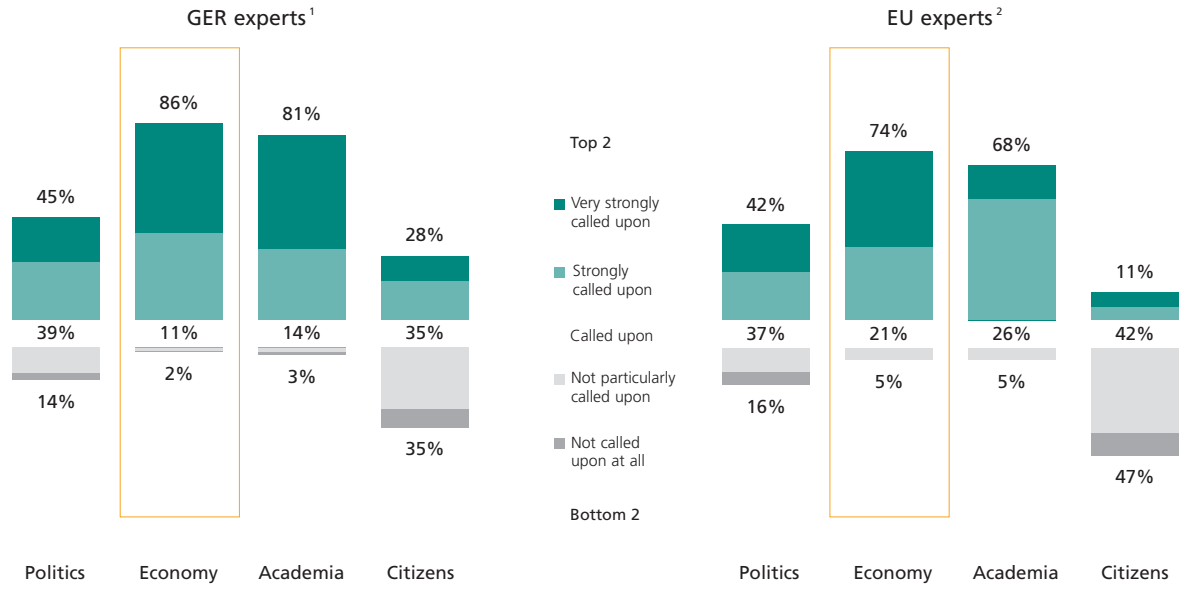
Closely linked with the question of responsibility for personal data is the issue of how to control the subsequent processing of data that has been disclosed on the Internet. Since all and any digital media can be copied without loss, advanced technological measures are urgently required to control the passing on of information, to make copying more difficult or at least to retrieve and delete copied content at a later date.

"I want to know where what information about me can currently be seen on the Internet."

This necessitates special, personalizable search engines such as Crawler, of which some already exist. Even if personal information can already be traced with these technologies, the problem of how to delete the data remains (see Article II.2). In addition, it is not possible to trace private copies of data on hard drives, USB flash drives, etc., with today's Internet search engines. First and foremost, therefore, we need technologies that will prevent the unrestricted disclosure and copying of data. Filter technologies, already found in enterprise Information Rights Management systems (IRM), are basically suited to protecting business-critical data from unauthorized third-party access. To do this, data can be automatically anonymized and confidential content removed prior to disclosure, with access permissions defining which individual persons and institutions are to have access to the data under what conditions, e. g., exclusive purpose-related access during performance of a service. However, experts consider this approach to have very limited relevance for the handling of private data on the Internet:

Fig. II.24: Simplifying security technology on the Internet for the user – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to simplify security technology on the Internet for the user?



[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

"Although technically possible, I do not believe that this will work on a large scale due to organizational issues. At least not with personal data […]."

Once data has been disseminated and published, deleting the data on the Internet presents an immense problem. New encryption technologies are required that restrict the visibility of specific data content, and special systems will have to be developed to restrict data access to a specific period, e.g., by limiting key validity. In their discussions, the experts largely agreed that it is not only the responsibility of users to take due care when handling their data but that, in particular, product manufacturers and service providers should be obliged to market trusted products that enable users to maintain control over their data. Legal framework conditions and rules for manufacturers, even going as far as product liability, are seen as an appropriate regulatory framework that will motivate them to manufacture trustworthy products. In addition, we require legal regulations to be harmonized around the globe. Although this will not completely eradicate data abuse, any offense of this kind that is committed would automatically have legal consequences.

"[…] I expect that the legal framework will strengthen the position of the private user."

Summary and recommendations

To summarize, citizens of the future will have to assume far greater responsibility than at present for the security of data that is published and processed on the Internet. However, private enterprise will have to play an even greater part. It must develop high-quality security solutions that are easy to use and give citizens full control over access to their personal data on the Internet, to their dissemination and their deletion. It is up to the state to provide the appropriate information in order to educate its citizens on the dangers, rights and duties involved in handling personal data. In addition, a legal framework of regulations will be needed to oblige manufacturers and vendors of products and digital services to verify that their products comply with high technical quality standards.

This could open up a lucrative market for German industry, since the "Security made in Germany" label enjoys a high international reputation, and significant market share is forecast for products that offer a high standard of security and ease of use.

II.6 IT security – an economic and location factor

In recent years, the Federal Republic of Germany has advanced to become a leading location of international development and sales for IT security innovations, products and services. One of the reasons for this is the high innovation potential of Germany's software engineers in individual segments, generating trust and a high reputation for Germany's "e-security industry"– including the neutrality which is crucial in this context.

"The German e-security industry has a very high reputation in the world […]. The e-security technology is seen as trustworthy and neutral […]."

Another reason is enhanced security awareness and equally advanced technical requirements on the demand side – in industrial as well as consumer environments. Besides this, Germany has an institution with a long history and an outstanding national and international reputation. The Federal Office for Information Security (BSI) plays a pioneering role in setting technical standards, wording requirements for IT security in different application areas, certifying and providing the "basic IT protection" software solution, a role that bears considerable weight and also attracts interest at international level (see BSI 2010).

Germany's legal system was one of the first to give data protection and data security constitutional status as an element of free democratic principles on the basis of the "Right to informational self-determination", which the Federal Constitutional Court introduced with its census verdict of 1983, all the way through to the "Right in Confidentiality and Integrity of Information Technology Systems", which it established in 2008. Introduction of Article 91c of German Basic Law, the "Law on Strengthening Security in Federal Information Technology", the "Law on Introduction of the Electronic ID Card" and the extensive amendment to the Data Protection Act – all in the year 2009 – and the pending employee data protection act plus numerous other legislative and regulatory measures underline the vital importance of IT security in an institutional context. Furthermore, in its "Law on Securing Employment and Stability" in 2009, the legislator budgeted around EUR 220 million of a planned total investment package of EUR 500 million in information and communication technologies for investments and development programs in IT security, including encryption-capable mobile communication technologies, encryption technologies, measures to improve network security, basic IT protection certification and measures involving the new electronic ID card.

International competitiveness

The experts in the online discussion forum consider the IT security industry in Germany and Europe to be competitive at international level:

"The security industry in Germany/the EU is capable of competing in an international market […]."

Germany's IT industry actually has a clear competitive advantage in the special area of embedded systems. The dynamic progress made by IT, networking and miniaturization is increasing the significance – as well as the vulnerability – of such systems. As a supplier of high technology, Germany's industry is a pioneer of embedded systems, was quick to recognize inherent security issues and develop appropriate solutions.

"If we include in e-security all measures taken in embedded systems that increase the security of these systems by implementing security functions in the electronic hardware and the embedded systems, the competitive advantage is clear."

At the same time, however, we see that Germany lags some way behind its full potential when compared with other countries. In the discussion, one expert criticized the lack of self-confidence and, as he saw it, of the necessary support at EU level as well as from the German government. The scheduled development program mentioned above could go some way to change this opinion.

At the same time, we note that, at international level, Asia could see a major rise in demand, for example if public authorities at municipal level make e-security an obligatory requirement. Just one or more mega cities could set off a significant trend here.

Significance for Germany's development as a center of business and need for action

The necessity to intensify activities in the field of IT security is self-evident, with the economic harm caused to German business both at enterprise and at consumer level through weak IT security or IT security vulnerabilities (including industrial espionage and product piracy) now reaching an annual level of double-digit billions, not to mention a significant loss of jobs, which is hard to quantify.

Seen overall, the experts assign "security" high importance as a location factor for economic development. 82 percent of the experts resident in Germany rate the "security" location factor very or extremely important for Germany's economic development. In contrast, only 63 percent of the Europe experts acknowledge this economic significance (see Fig. II.25).

Germany's economy is short on natural resources and geared principally to retailing, processing and knowledge-based products and services. According to the experts, the issue of "security" therefore plays a central role that must not be underestimated for Germany as a center of business.

Surprisingly, despite this high importance the experts do not see Germany in a leading position on the "security" issue in an international comparison, with the majority of them placing it in the top third (60 percent, see Fig. II.26).

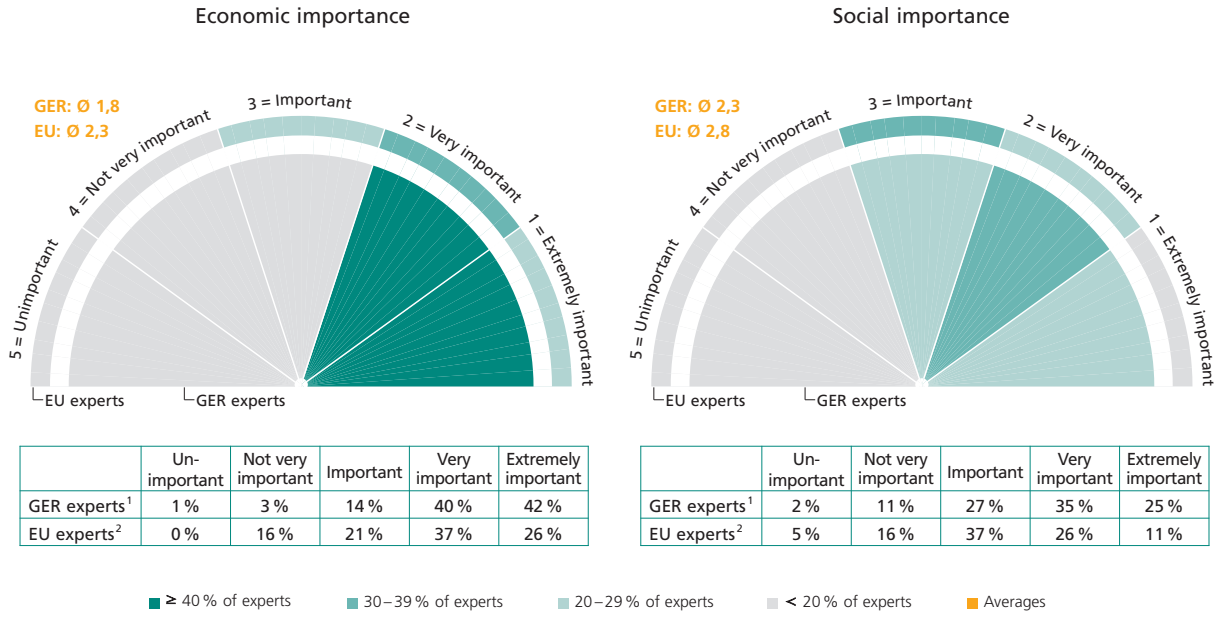
In view of the fact that security is extremely important, this may indicate insufficient coverage. On the supply side it could be a sign of inadequate positioning in the international business arena – even if this is merely a subjective impression. The participants in the discussion forum also see a need for greater global publicity for the high security standard of solutions from Germany and for specific control over the development of security-relevant standards and norms at national as well as international level.

With regard to Germany's social development, 60 percent of the GER experts also consider the "security" factor to be very or extremely important (see Fig. II.25).

Asked about the players that should bear most responsibility for optimal exploitation of the "security" location factor, the majority of the Germany experts cited the state or politics (86 percent) and the economy overall (85 percent). An overall economic analysis must take into account that,

Fig. II.25: "Security" as a location factor – Importance

How important is "security" as a location factor for economic/social development in Germany (<country>)?



	Unimportant	Not very important	Important	Very important	Extremely important
GER experts[1]	1 %	3 %	14 %	40 %	42 %
EU experts[2]	0 %	16 %	21 %	37 %	26 %

	Unimportant	Not very important	Important	Very important	Extremely important
GER experts[1]	2 %	11 %	27 %	35 %	25 %
EU experts[2]	5 %	16 %	37 %	26 %	11 %

≥ 40 % of experts | 30–39 % of experts | 20–29 % of experts | < 20 % of experts | Averages

[1] Experts for Germany, n = 173; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

in setting framework conditions and technical requirements, the state largely controls its own demand for IT security and therefore exerts a major impact on this growth market. The world of science is another area that will need to commit itself heavily to this cause, according to the experts (62 percent, see Fig. II.27).

The economy has a vested interest in the active design of (de facto) standards and, if necessary, voluntary self-control during the introduction of compatible security standards, including appropriate gradations. In the science field, it will be vital to make security an integral component of ICT research and teaching, and to do so by networking it with other, specifically technical, training programs. It is important that we commit ourselves to conveying basic ICT security know-how during the "native" phase of "emerging" ICT users.

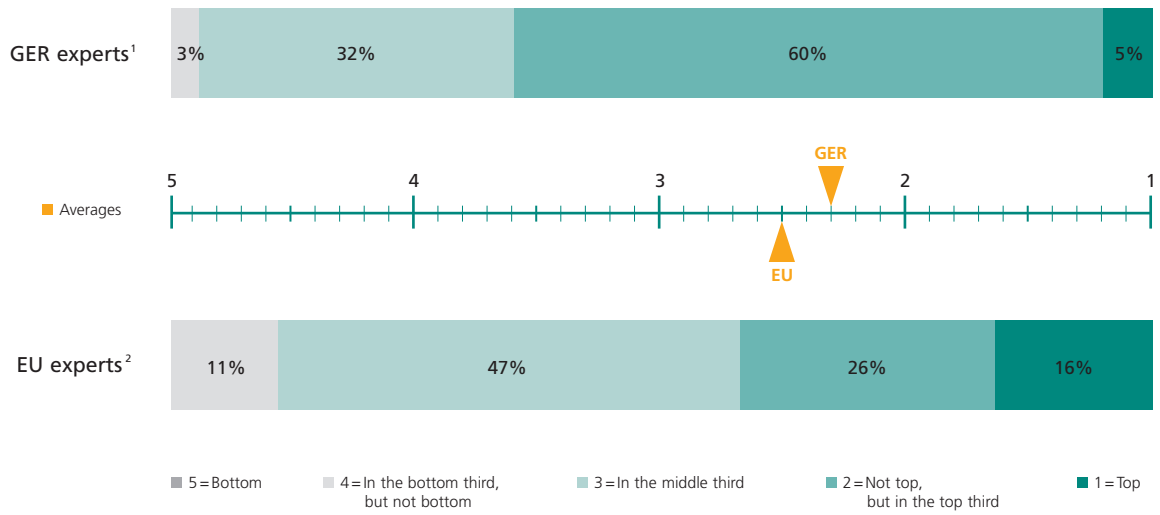
E-security as a mandatory prerequisite for web-based ICT usage

Germany is one of the countries most strongly affected by bot networks, the principle technical hazard format assumed by Internet-based attacks on IT security (see BSI 2010). This applies equally to traditional IT infrastructures and individual web-based applications. With the latter, in particular however, IT security that functions correctly and satisfies the highest requirements is crucial to successful implementation of the business model. Long-term success in the sale of virtual products and services can only be achieved if vendors take account of their customers' enhanced security awareness and satisfy their demand for IT security.

"E-security is a must for any internet 2.0 application."

Fig. II.26: "Security" as a location factor – Position

And how do you think Germany (<country>) is positioned on "security" as a location factor in an international comparison?



[1] Experts for Germany, n = 165; [2] Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

Consumer awareness and requirements

Surprisingly, IT security in web-based applications is not subject to any real competition in terms of "more or less" security. According to the experts, there is insufficient awareness and corresponding market demand that would enable vendors to ask a higher price for increased IT security, and insufficient willingness to accept the direct opposite, namely that a low price for comparable web-based products and services goes, or can go, hand in hand with a lower level of IT security.

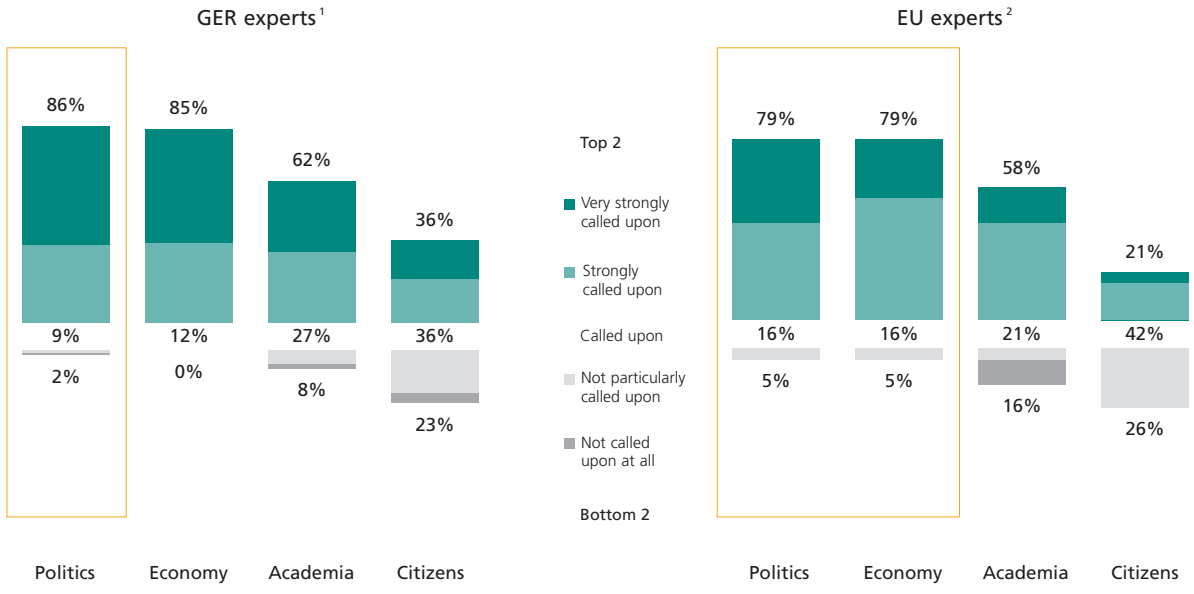
Up to now, there has been little to indicate that consumers are willing to accept restrictions or varying IT security products offered by one and the same provider. Consequently, selection of IT security providers takes place, if at all, at manufacturer rather than at product level. Equally, an open approach to market differentiation based on graduated security criteria appears to be lacking to date. On the contrary, IT security tends to be viewed as an absolute factor. Here, it will be necessary to establish different security grades and to provide market participants with the information they need to heighten their awareness for the potential dangers involved in insufficient security and the adequacy of individual security levels.

In highly sensitive areas such as online banking, the idea that a service featuring greatly improved IT security should also cost more cannot be conveyed to or discussed with customers, since this would immediately imply that the security of online banking solutions used up to now has been inadequate.

In the less sensitive area of general Internet business, the

Fig. II.27: "Security" as a location factor – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to establish "security" as a location factor?



1 Experts for Germany, n = 173; 2 Experts for European countries, excl. Germany, n = 19 (N. B.: Small sample size!)
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

question arises as to whether secure and improved electronic payment systems can be used to define the costs of IT security more precisely so that providers of virtual products and services need make less effort when it comes to IT security and can thus reduce overall transaction costs for the benefit of users.

E-government is another area in which absolute security is expected from the demand side, according to current estimates, although it is not suitable or necessary for numerous functionalities and, in places, can hardly be guaranteed. As a result, it is not possible to exploit the full potential of e-government usage at present, despite its far lower risk latency.

Summary and recommendations

For providers of IT security, the trust factor plays a greater role than in virtually any other area of ICT. This is one of the reasons why Germany enjoys an outstanding global reputation as an IT security location, which reaches beyond the actual quality of its individual products and solutions: "Germany's IT security industry has a high reputation outside the country. Its technology is considered reliable and vendor-neutral." (IT security sector 2010).

IT security has a major impact on complex and diversified production and management processes, and therefore affects the entire enterprise services value chain. As a result, there is great demand for holistic, internationally scalable services which satisfy the security needs of networked international enterprises. As a center of business, Germany also offers small and mid-sized enterprises excellent business openings as providers of IT security solutions. In this area, one of the fundamental needs is that the state establishes the framework for stronger cooperation between business enterprises, especially by supporting the development of international standards and practicing appropriate, non-discriminatory export controls.

This is also an important action area for the world of science, which needs to make security an integral component of ICT research and teaching by networking it with other, specifically technical, training programs. In addition, it should insist on early communication of basic ICT knowledge for "emerging" ICT users.

Last but not least, it will be vital to address another important issue: IT security tends to be viewed as an absolute factor. Here, security grades will have to be devised and market players provided with specific information to heighten their awareness for the potential dangers involved in inadequate security and the adequacy of specific security levels.

III. ICT for new business areas

What contribution can ICT make toward designing the future? How can apparent threat scenarios – such as rapid climate change, advancing urbanization and demographic change – be turned into opportunities and new areas of business? Which action areas in ICT are the most important ones against this background?

As an interdisciplinary technology, ICT has an impact on every significant sector and industry. Accordingly, a strong ICT industry is a decisive competitive factor for both Germany and Europe as a center of business. In future, the influence lost in the entertainment and microelectronics sectors in Europe are to be compensated through a long-term ICT leadership in the traditional industries.

Although technologies and markets have always faced far-reaching changes, this transformation is proceeding ever faster under the pressure of globalization. Accordingly, research, politics and industry have to demonstrate a high degree of flexibility. In general, one of the key topics in coming years is to create and supply powerful, innovative products and services for the new, evolving ICT markets – building on the foundation of ICT-based innovations – that meet users' demands and expectations and gain widespread acceptance.

Important issues in the area of industry and infrastructure are raw material consumption and waste disposal, machine and plant controllers, and efficient control and management processes. Ongoing climate change and increasing energy demand require an optimization of all available energy sources and a steady increase in energy efficiency. At the same time, increasingly decentralized energy supply in future will be more complex, requiring the introduction of intelligent concepts using the electricity network of the future, such as the smart grid. In the healthcare sector, the monitoring of patients in their familiar home environments will become more and more important, with the corresponding need to provide data and information on demand for specific situations. Another challenge here is to protect privacy while collecting this sensitive data.

Six central aspects will be examined in detail in the articles below:

ICT is playing an ever more important role in all areas of life and business, making the recognition and initiation of ICT trends an important tool for ensuring the future of key industries. At the same time, there are clear differences for German and European business with regard to the individ-

Prof. Dr.-Ing. Reinhold E. Achatz
Corporate Vice President,
Siemens AG

ual technologies and areas of use. In addition, standardization is being promoted as a key topic for successful innovation.

ICT is considered to be an enabler in numerous industries, where it can have a fundamental impact, yet also has the potential to endanger or even eliminate established industry sectors. Which industries will undergo fundamental transformation through ICT in the next ten years and where ICT will only have a minor impact is discussed in the next section. The status quo in the media sector, for example, which has already undergone wrenching changes through ICT, is discussed.

The ICT sector will play a key role in stimulating the German and European economies and increasing their competitiveness. Above all, this will require creating a climate that helps to bring ICT innovations to market. At the same time, shifts are taking place in conventional sectors; new partnerships and alliances are forming that entail radical changes to business.

ICT has fundamentally changed business in the last 40 years. 61 percent of the workforce in Germany now uses PCs. Debate has shown that (modern) ICT must be deployed effectively at companies. At the same time, the "wrong" use also harbors myriad dangers ("over-ICT-ization"). The objective must be to deploy ICT properly at companies and manage the ICT processes.

Established market players are often confronted with new paradigms and disruptive innovations. In such cases, they should take the initiative themselves, behaving proactively as visionaries. This dilemma can be dealt with successfully with the use of ICT and the "right" enterprise structures and corporate cultures. Examples of concepts and approaches that are discussed and practiced in this context include Open Innovation and spin-offs.

For Europe to continue to play host to a competitive ICT sector, the value creation potential associated with the new areas of business must remain in Europe. Accordingly, a specific goal of all those involved must be to address key topics together and make rapid decisions to help Europe remain a center of business.

Dr. Uwe Kubach
Vice President,
Head of SAP Research Center Dresden,
SAP AG

III.1 Technology trends and their significance for the sustainability of the German economy

The future sustainability of the German economy depends largely on its capacity to innovate and to compete in the international arena. Information and communication technologies (ICT) already represent crucial interdisciplinary technologies for many key sectors of industry today (see also "International Delphi Study 2030", 2009; "Future of German ICT", 2008). In fact, the pace of development of ICT will influence or even drive innovation processes in many key industries.

These interrelationships are generally not contentious. Nonetheless, the question arises as to which role Germany has to take in the ICT development process to maintain long-term success in its key industries. Is the innovative deployment of available ICT enough or do ICT trends have to be shaped actively? In which areas of ICT is a pioneering role especially crucial? How can we ensure that successful technological developments convey business benefits – in other words, how can innovations be implemented profitably?

This article summarizes the results of the underlying expert survey and discussion that support this study in four sections. It first examines the importance of setting ICT trends as the key to business success. After discussion of the business relevance of selected technological trends, an overview of future ICT technologies and trends that are considered to be especially relevant is provided. The fourth section examines standardization as a potential lever for successful innovations. Last but not least, the summary points out, among other things, which players are essential to strengthening Germany's position.

Setting ICT trends as the key to success

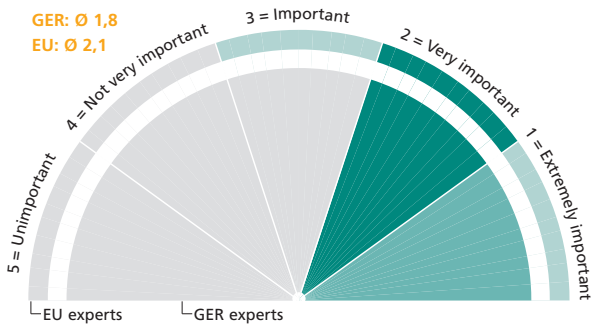
The following statement by a participant in the online expert discussion illustrates the significance of information and communication technologies and the importance of setting ICT trends:

"ICT will penetrate more and more all areas of life and business."

Fig. III.1: Setting ICT trends – Importance

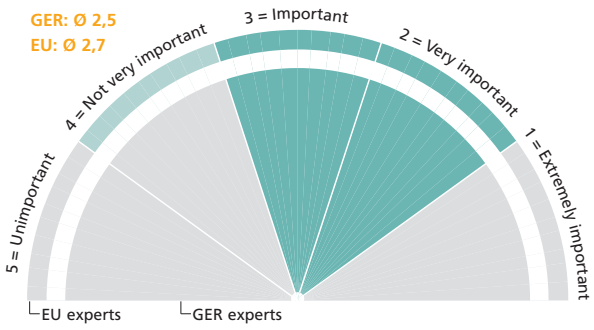
How important is a leading role in setting ICT trends for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	0 %	1 %	15 %	49 %	35 %
EU experts[2]	0 %	4 %	27 %	48 %	21 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	2 %	11 %	38 %	37 %	12 %
EU experts[2]	0 %	23 %	35 %	35 %	8 %

≥ 40 % of experts | 30–39 % of experts | 20–29 % of experts | < 20 % of experts | Averages

[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

If we postulate these extreme importance of ICT, the question arises as to whether the innovative deployment of ICT developed by third parties is sufficient in the critical key industries or whether ICT trends have to be shaped actively.

As the expert survey shows, setting ICT trends is considered to be a key for economic success in Germany: 84 percent of the experts for Germany believe that a leading role in setting ICT trends is very important or extremely important for economic development in Germany (see Fig. III.1).

If we contrast this claim with the assessment of Germany's actual position in setting ICT trends, however, the surveyed experts only gave Germany an average ranking. 47 percent of Germany experts believe that Germany lies in the center third in an international comparison of setting ICT trends – surely too low to maintain international competitiveness in the long term (see Fig. III.2). The Europe experts have a similar opinion: 46 percent see other European countries in the center third as well in an international comparison.

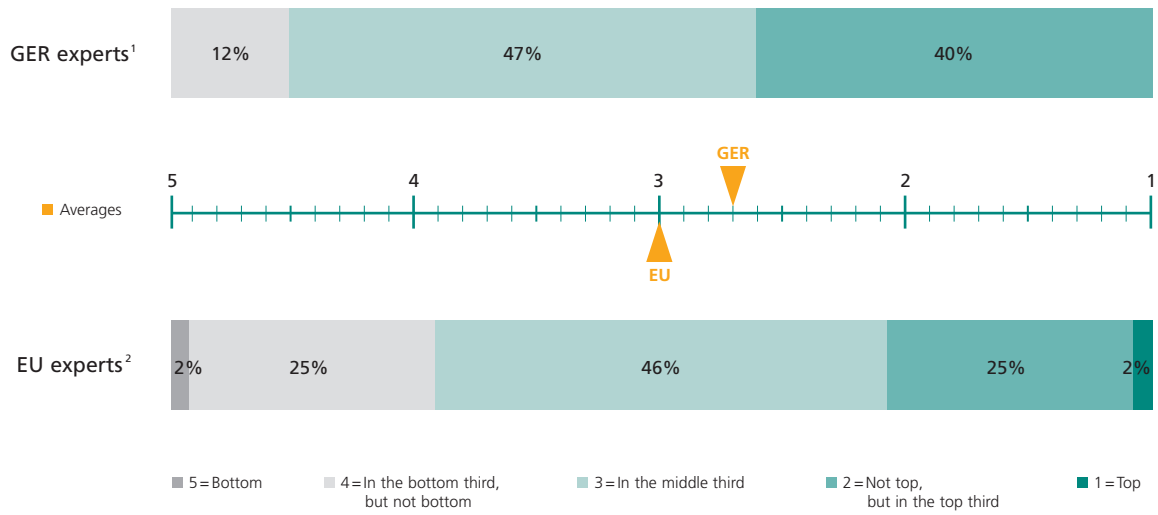
One possible factor in Germany's classification is that the step from technical innovation to an economic breakthrough is often lacking in Germany. Among other things, the experts attribute this to the local framework conditions for entrepreneurs:

"[…] German and European entrepreneurs were able to offer innovative and promising solutions and services even in the field of consumer-related Internet business. However, they lacked the competence and / or the financial averages to spread their good ideas globally and were either bought up by their international competitors or were merely marginalized by them."

One of the recommendations that can be derived for ICT in Germany is to intensify research and development of ICT, particularly in the context of the strong application areas in Europe, and improve the framework conditions for turning

Fig. III.2: Setting ICT trends – Position

And how do you think Germany (<country>) is positioned on a leading role in setting ICT trends in an international comparison?



[1] Experts for Germany, n = 509; [2] Experts for European countries, excl. Germany, n = 52
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

innovations into business successes. In particular, this includes the availability of suitable financing models, as well as expanding skills in the marketing and branding areas. Article III.3 deals with this deficit in marketing and flexible business models, which are especially relevant in highly dynamic ICT markets.

But what exactly do the surveyed experts think are Europe's options for actively shaping ICT trends by playing to its known strengths?

In the expert discussion, it became clear that designing and integrating complex, distributed systems is a highly developed skill in Europe. Requirements of this type will be found in numerous domains in future due to the increasing distribution and multi-disciplinarity of systems. Examples range from the previously mentioned domains to connected homes, elaborate logistics systems and smart cities. Another central point in system integration are the interfaces between subsystems and components. Standardization is a way to achieve the interoperability of such systems and components at all levels – from data transport to data models. The participants of the expert discussions also warn that Europe must not fall behind in its own use of ICT and in the expansion of broadband infrastructure.

Economic significance of technology trends

The proper utilization of technological trends can help improve the economic importance of Europe and Germany – as the following comment from the expert discussion shows, for example – and even enable Europe to succeed in the domain of (Internet) applications, which has been dominated so far by the United States:

"Due to the trend toward open operating systems such as Android, there is a chance for Europe to become a recognized player in the evolving market of application-oriented software."

During the experts' discussions, it became extremely clear that a mastery of decisive future technologies is of essential importance to securing Germany's top economic ranking, although the individual technologies and application areas can vary in importance. To provide an initial framework for further discussion and classification of the most important information and communication technologies and trends, the basic technology areas and ICT application contexts are first weighted against one another below.

In the analysis of the survey result, it is apparent that the Germany experts feel security technology (81 percent) and mobile broadband (80 percent) top the list of the most important technology trends for Germany's economic development (see Fig. III.3). Due to its central role and the various security issues that must be differentiated in detail, security is the subject of a separate section (see section II).

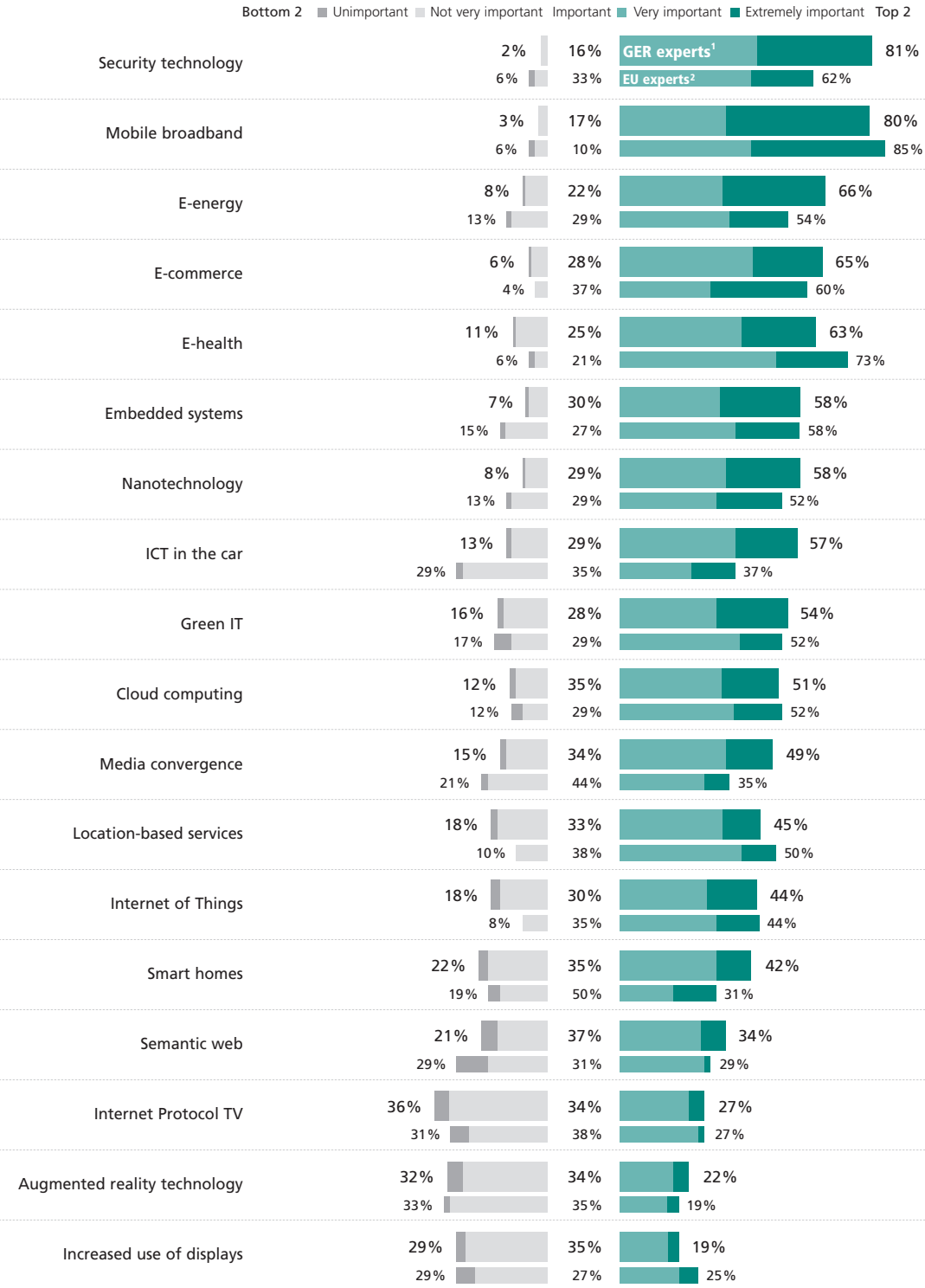
Mobile broadband coverage opens an entire category of novel applications beyond those afforded by landline broadband expansion, although the latter is no less important, whose coverage gaps in rural areas in Germany have already been pointed out at length. As such, mobile broadband is not only a service to increase efficiency in Germany, but also an opportunity to generate international markets with new mobile applications. The results of the International Delphi Study 2030 once again emphasize the importance of the mobile Internet: by 2019, at the latest, more people will regularly use the Internet through mobile devices than through stationary computers.

According to the Germany experts, new, ICT-supported variations of known application areas such as energy (66 percent), retail (65 percent) and healthcare (63 percent; see Fig. III.3) are also extremely important for the German economy.

In the **energy** area, regenerative energy sources, controllable loads and electric vehicles that are distributed through information and communication technologies can be combined with electronic marketplaces to form a stable smart grid. However, this will require ongoing status assessment and automation of the distribution grid, aggregation and processing of consumption data, and forecasts of generation and consumption. The integration of the necessary smart meters and the processing of the measurement and consumption data will require a variety of communication technologies and large-scale data processing – possibly involving cloud computing, another technology considered to be crucial.

Fig. III.3: Importance of technology trends for economic development

How important are the following technology trends for economic development in Germany (<country>)?



[1] Experts for Germany, n = 513; [2] Experts for European countries, excl. Germany, n = 52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

In the **retail** application context, electronic retailing through Internet platforms, and especially in the business-to-business area, is already the basis for controlling flows of goods and thus an essential prerequisite for modern business transactions.

In the area of ICT-supported healthcare solutions, the relative uncertainty over business models for **e-health**, such as in the German healthcare systems, seems to be expressed – by the somewhat higher number of cautions answers (eleven percent of the experts for Germany felt this area was less important or not at all important). However, in the discussion of future ICT trends, it once again became clear that e-health will be one of the answers to the challenges of demographic change (see "International Delphi Study 2030", 2009).

In all these scenarios, however, the surveyed experts expect that established markets will change when previously specialized, closed-off domains are addressed by the new "players" in the IT world.

Important ICT trends of the future

The expert survey mentioned in the section above assessed embedded systems as highly relevant to the economy – 58 percent of the experts for Germany and other European countries feel that embedded systems are extremely important or at least very important to economic development.

Embedded systems are hardware/software units that are typically not directly visible to their human users and that assume monitoring, controlling and regulating tasks. They are of considerable importance in many high-tech sectors – including automation and logistics, energy generation and distribution, modern traffic and transport systems and high-performance medical equipment.

When asked about the next trend in embedded systems, the experts see a clear development toward networked embedded systems.

"The next trend is currently starting with the transition of 'Embedded Systems' to 'Networked Embedded Systems'."

Often referring to it as the "Internet of Things", experts describe the development of integrating computing capacity and communication ability in all kinds of devices, creating a net of distributed, networked, intelligent systems. Examples range from sensor networks for patient monitoring and distributed home automation to car-to-car telematics services and distributed control of low-voltage systems for the smart grid.

Whereas the networking of embedded systems based on the Internet Protocol (IP) will adhere to a widespread standard, ensuring interoperability at the network level, experts emphasize that the greatest challenges lie in the higher protocols of the application level and the underlying data models. Currently, hardly any standards exist in these areas, particularly in industrial environments. The same applies to the context information of the devices, such as location information, which is also a source of valuable information for numerous applications.

Another challenge seen by the experts is processing the huge volumes of data that are created in such distributed systems and feeding it into the higher-level business processes (e. g., through semantic technologies). Networked embedded systems have to be integrated with the service-oriented architectures of the application levels – which is also described as connecting the "Internet of Things" with the "Internet of Services".

Since the area of technical integration is considered to be one of Germany's strengths, this topic is also attached due to importance in the German standardization strategy (see "The German Standardization Strategy", 2009). In general, according to the experts' opinion, Europe can rely on its experiences in the standardization area with this type of challenge.

In addition to these important trends from the **Internet of Things**, the following topics were emphasized in particular:

- ICT as an answer to the challenges of demographic change. This involves the approaches of e-health and ambient assisted living (AAL), as well as simple usability of devices and services and their auto-configuration. In fact, the latter can be seen as a general challenge, regardless of age group (see also "International Delphi Study 2030", 2009).

- The transfer of familiar Web 2.0 Internet services such as Twitter and Facebook to and within companies, to improve collaboration and increase the speed of innovation (also see article III.4).

- Semantic tools and filters, combined with information aggregation and abstraction to make the huge volumes of data in the Internet practical for users and combine information from myriad sources to create knowledge.

Standardization – a lever for successful innovation

The subject of standardization is attributed a major role for Germany and Europe as a center of business. Although companies can succeed in markets without setting standards, the expert discussion clearly showed that standards are especially essential to the integration and interoperability of large, complex systems.

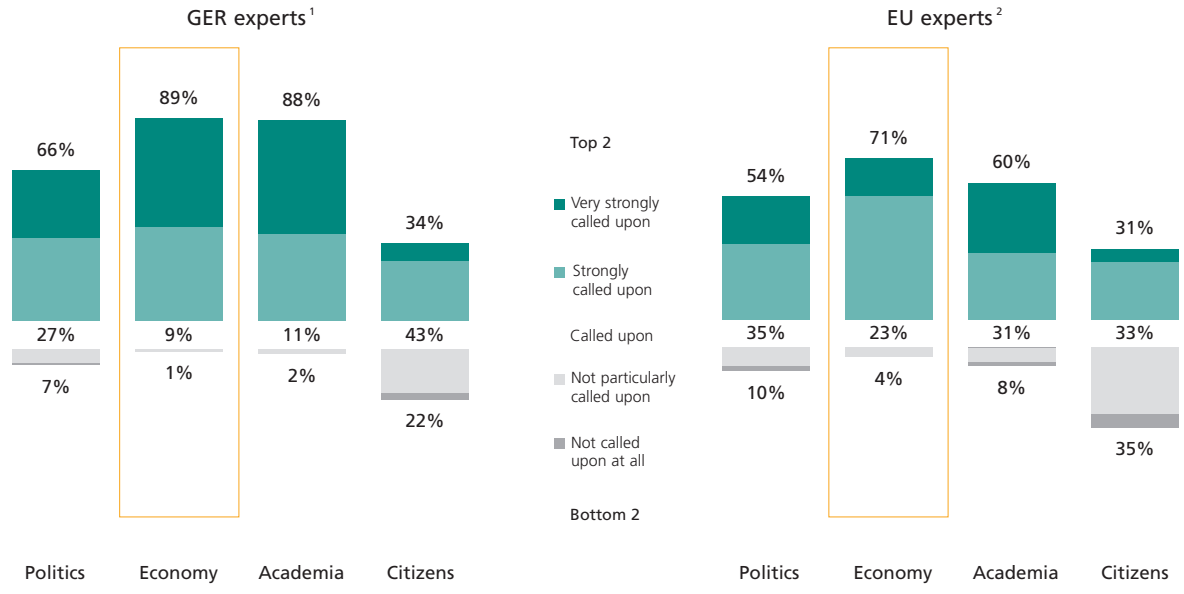
The importance of standardization can be seen from several different perspectives:

- Standardization is not necessary, or even beneficial, for all industrial sectors or products. Standardization is less relevant in the area of applications, for example, and can even prevent the implementation of new, disruptive ideas in some cases, due to its drawn-out processes. Speed is often more important in such situations – and quasi-standards are formed from the market success.

- On the other hand, standards also convey cost benefits to products and solutions, and are even essential to guarantee interoperability in extended, networked multi-vendor systems. When integrating complex systems – an economically significant area, as described above – standards for interfaces are of enormous economic benefit. In particular, the protocols and data models above the network level must be examined.

Fig. III.4: Setting ICT trends – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to ensure that Germany (<country>) plays a leading role in setting ICT trends?



[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

One of the participants in the expert discussion concisely summarized this thought as follows:

"I don't think that a general 'European Standardization Strategy' is needed, instead the various areas have to be analyzed and it must be decided what has to be standardized to ensure interoperability but also allow for competition."

On this condition, European standardization can help strengthen its position against the international competition, thus securing long-term business. However, it remains crucial to emphasize the strategic value of standardization in Europe and to ensure that companies increasingly make active contributions – despite the effort required – and that governments provide the appropriate support.

"If Europe and in particular European industry wants to play a more important role in standardization, the necessary human and monetary resources must be made available for participation in all relevant activities. Otherwise the European position will not get heard sufficiently."

Summary and recommendations

As a consequence of the comprehensive advance of ICT into all areas of life and business, setting ICT trends is a crucial instrument for ensuring the future of key German industries. As the expert survey shows, business (89 percent) and academia (88 percent) face obligations as the main agents; politics (66 percent), which must create the appropriate framework, also plays a central role (see Fig. III.4).

In conclusion, the following priorities for action must be set:

- Intensify the development of ICT in connection with application areas in which Germany has traditional strengths (such as energy, medicine and the manufacturing industry)
- Expansion of the subject of "networked embedded systems" (the Internet of Things) as a technical foundation
- Use of and support for skills involved in "systems integration" as a business factor
- Strategic standardization as a lever for sustained success

III.2 Growth markets and opportunities from ICT

The structural relevance of ICT

Information and communication technologies (ICT) can affect business areas in two very different ways. The impact is either indirect – which means the ICT merely affects the execution and control of business processes in existing industries, without changing the actual core of the industries involved – or the impact is directly on the central element of the affected value chain. In the latter case, ICT can not only fundamentally change an existing business area, but quite possibly make it disappear altogether. In theory, all business areas whose central element is information processing and in which physical products play only a subordinate role are susceptible to such radical changes.

Under this criterion, media, the public sector, the credit and insurance sectors and the area of education are subject to potentially revolutionary changes. In contrast, retail, the service sector, the transportation industry, healthcare and social services, energy and water supply, manufacturing, the hospitality industry, agriculture and forestry, construction and mining will be less affected. The expert survey confirms this.

The experts were asked to estimate how strongly ICT will change specific markets and business sectors by the year 2020. A majority of experts for Germany specified that ICT will trigger very strong or extremely strong changes in the media area (88 percent). They also predicted that education (56 percent) and the public sector (50 percent) would also be highly affected (see Fig. III.5).

More surprising, however, is how the Germany experts see the impact on retail (67 percent) and the service sector (65 percent) – especially considering that ICT is relatively widespread in these areas and obvious rationalization potential has already been captured.

In addition to the media market, where the experts foresee extremely strong changes, this article will also examine the expected impact of ICT on the transportation sector (62 percent), healthcare and social services (57 percent) and energy and water supply (49 percent) in more detail.

Media market in wrenching transformation

The market facing the most wrenching changes is the media market, as digital convergence transforms it fundamentally. The experts generally agree that the Internet is transforming media distribution and consumption, with a relatively resistant bastion for the print media in Germany: 88 percent of the Germany experts and 92 percent of the experts for other European countries expect very strong to extremely strong changes through ICT; just two percent of the experts in both groups feel the media area will hardly be affected at all. Electronics manufacturers are competing to integrate radios and television sets with the Internet, seamlessly integrating familiar operation and experience with the new medium. This breakthrough has yet to arise in the printed media area – although Amazon already sells more e-books than hardcover editions (see Amazon 2010) – for two reasons: the devices do not yet meet the expectations of the average consumer and the distribution of revenues along the value chain is also changing radically.

When we compare Germany with other countries, it is apparent that the experts for Germany feel that strengthening the position of domestic media companies plays a more important role for business and society than the experts from other European countries. The discrepancy is particularly apparent in the opinions on the societal relevance of a strong domestic media sector: 41 percent of the experts for Germany said this was very important or extremely important, compared to 21 percent of the experts for Europe (see Figure III.6). This result reflects an understanding of the social responsibility of the media in Germany, which the experts apparently no longer feel is taken.

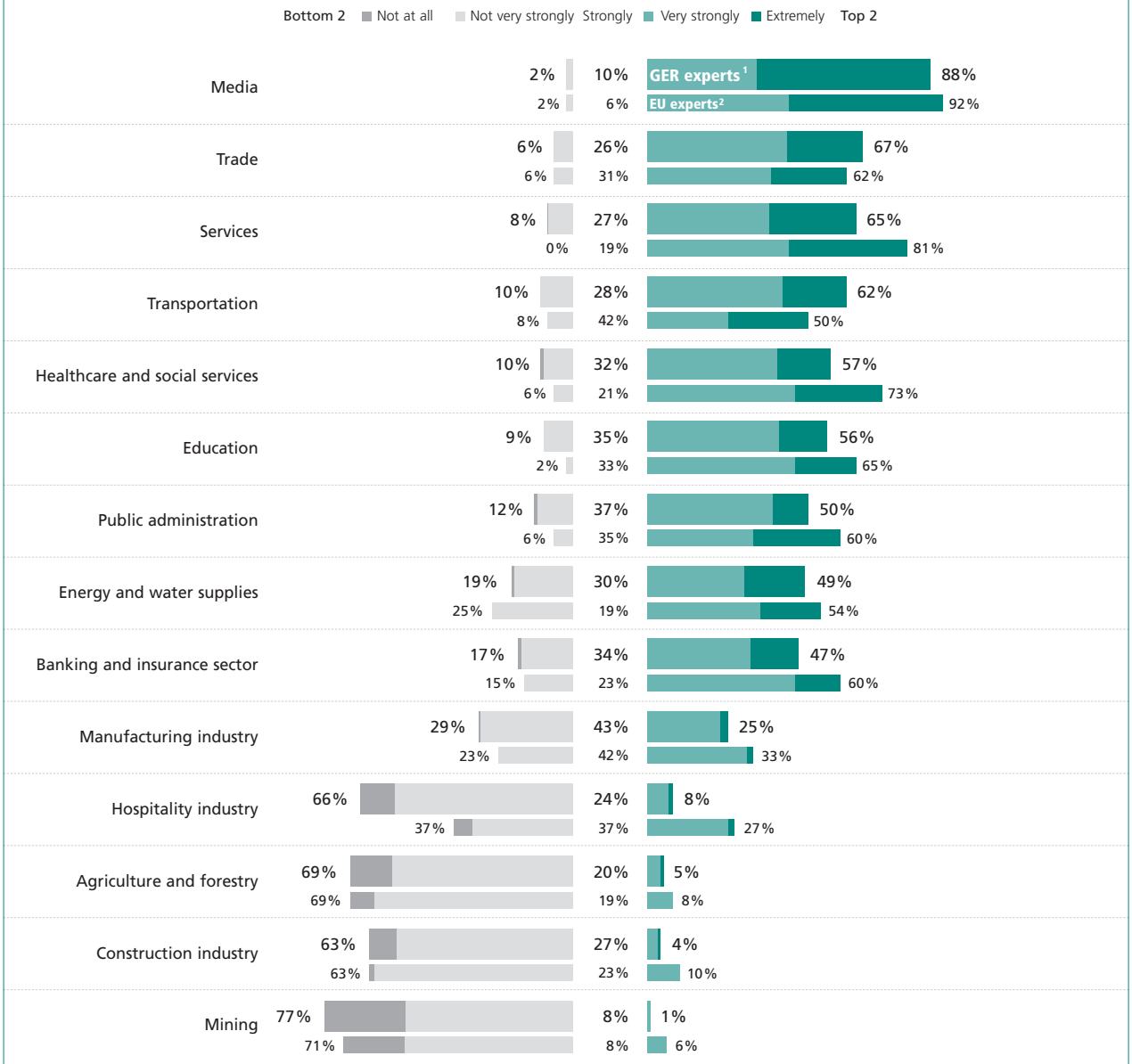
"However, for the time being, media and content are very much dominated by US-based companies like Google, Facebook, etc."

Aside from the fact that the important news agencies are international, and therefore not German companies, the impact of non-media companies on media reception on the Internet is noteworthy and increasing. The three most

famous companies Google, Facebook and Apple are creating an information universe that helps itself to individual pieces of information and content available on the Internet, but places it in a custom concept that takes away control and intention from the original "creators". These increasingly important companies are not from Germany, either – fear of losing one's cultural identity might also play a role in the experts' assessments.

Fig. III.5: Changes of ICT

To what extent will information and communication technologies change the following economic sectors and markets by 2020?



[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

If we compare the experts' estimation of Germany's role in strengthening the international position of German media companies with those of the Europe experts for their respective countries, it is noteworthy that Germany is not seen in first place (see Fig. III.7). 56 percent of the experts for Germany place their country in the center third only. This positioning by the experts could also be seen as the expression of a certain helplessness. We're not that bad, but we're not that great, and the direction we'll be taking isn't clear yet. Nonetheless, it became apparent during the expert discussion that Germany and Europe have strengths to challenge the dominant role of U.S. companies, particularly in "new media". The discussion participants pointed to the diversity of language as a major factor, one that gives Europe an opportunity to capture international markets better – Latin America was named as an example.

"The size of Europe and the split into 30+ countries with different cultures and languages is […] also an opportunity for smaller European companies."

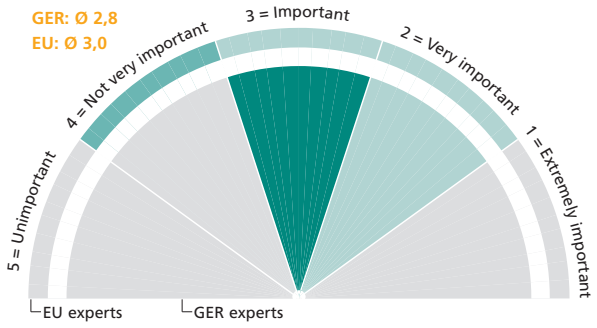
Still, a majority of experts feels that much still needs to be done to strengthen Germany's position, as the next results show. The primary agents that face a strong or very strong need to act are the overall economy (59 percent), followed by politics (53 percent). Academia and citizens also have important roles to play, but only a third of the experts believe these groups are under obligation to act (see Fig. III.8).

The fact that the overall economy and politics are thought to be nearly equal in the burden they share indicates a particularly strong need for action – a joint effort is required here. At the same time, it also indicates the complex situation that the German media companies currently face – a situation for which clear support options are difficult to define.

Fig. III.6: Strengthening the position of media companies in the international environment – Importance

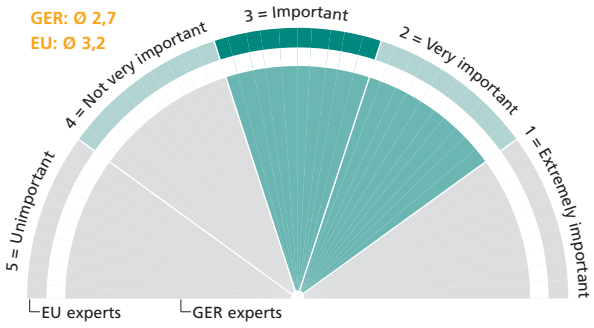
How important is strengthening the position of domestic media companies in the international environment for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	2 %	19 %	41 %	28 %	7 %
EU experts[2]	4 %	31 %	29 %	27 %	6 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	2 %	15 %	38 %	33 %	8 %
EU experts[2]	4 %	29 %	42 %	21 %	0 %

≥ 40 % of experts | 30–39 % of experts | 20–29 % of experts | < 20 % of experts | Averages

[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Growth markets

The outlook is much brighter where the combination of "conventional" industry and ICT leads to expectations of interdisciplinary changes.

"The big opportunity […] is the combination of ICT with so-called 'conventional' industry […]."

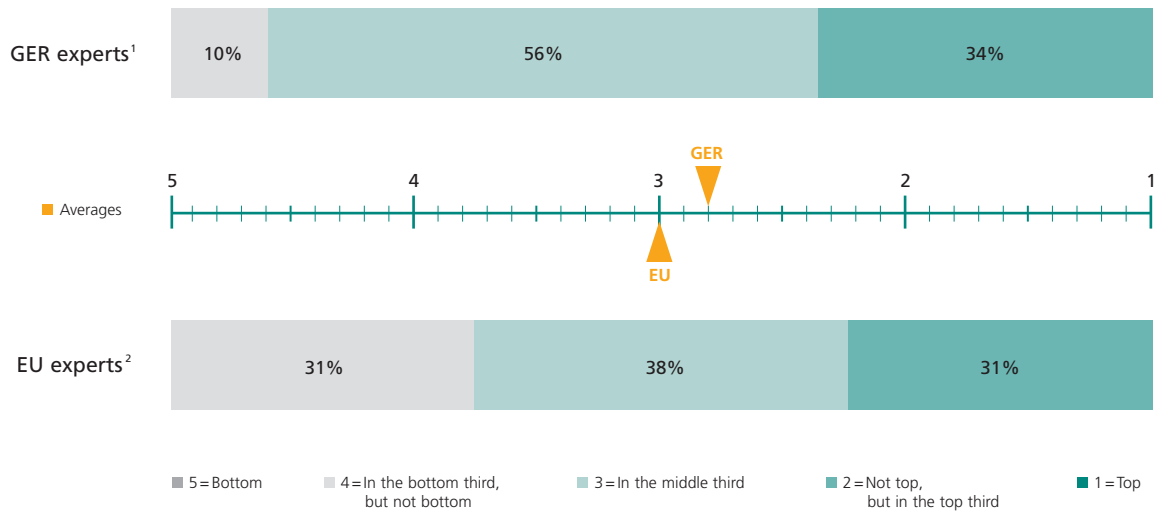
Four areas outside of the media sector have been selected here:

- Transportation
- Energy and water supplies
- Healthcare and social services
- Construction

In the **transportation sector**, nearly 60 percent of the experts for Germany feel it will be strongly affected by future changes due to ICT by the year 2020 (see Fig. III.5), due largely to the possibilities presented by better traffic routing and comprehensive increases in safety through ICT. In addition, the e-mobility area also presents an interesting challenge, due to its integration with energy supply. Self-driving cars might emerge by the end of the forecast period, which would trigger a massive market shift in commercial vehicles in particular. Still, autonomous vehicles still seem to be very far off, as emphasized in the International Delphi Study 2030: this study, conducted in 2009, asked over 550 international experts when they think autonomous vehicles will be allowed in general traffic. 32 percent of the experts for Germany do not expect this to happen before 2030.

Fig. III.7: Strengthening the position of media companies in the international environment – Position

And how do you think Germany (<country>) is positioned on strengthening the position of domestic media companies in the international environment in an international comparison?



[1] Experts for Germany, n = 461; [2] Experts for European countries, excl. Germany, n = 48
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

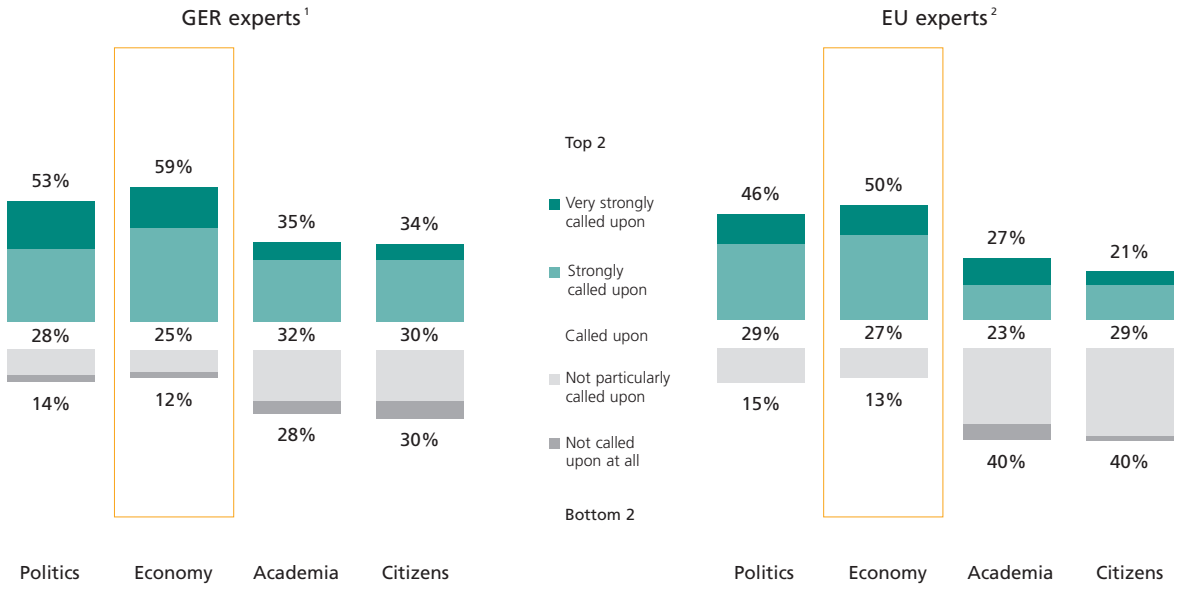
The automotive industry must be mentioned in any analysis of the transportation sector. Although not considered part of the transportation sector, but instead included with manufacturing – where experts only see comparatively lesser changes (only 25 percent of the experts for Germany expect strong or very strong changes; see Fig. III.5), the changes to the automotive industry through ICT are enormous, although they have been continuous for many years now. They include automated and semi-automated manufacturing processes, which would not be possible without the necessary IT systems, as well as the continuous addition of ICT components to vehicles for vehicle control and safety. The future will bring an increase in options for passengers to use ICT in cars, turning them into rolling ICT devices (also see "International Delphi Study 2030", 2009).

49 percent of the Germany experts believe the **energy supply** area will be strongly or extremely strongly affected by ICT (see Fig. III.5), but the options for intelligent control of consumption through ICT alone are far overestimated, at least until more capacity for temporary storage becomes available. This problem is intensified by the unpredictable nature of generation at the multiple, distributed mini-power plants for renewable energy sources, such as wind and solar power. In this context, the potentially large temporary storage capacities in electric cars seem to be a promising future candidate. In **water supplies**, aside from minimizing leakage – particularly through instant feedback to consumers – a certain change of thinking is expected, but the direct impact of ICT is expected to be small overall.

Estimations of the impact of ICT on **healthcare and social services** are particularly interesting: 57 percent of the Germany experts and nearly three-quarters of the experts for other European countries expect a very strong to extremely strong impact (see Fig. III.5). Indeed, the amount of media disruptions and lack of transparency point to vast rationalization potential in this sector, which is intensified through ongoing political discussion in Germany. The numerous existing projects and concepts that are in the

Fig. III.8: Strengthening the position of media companies in the international environment – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to strengthen the position of domestic media companies in the international environment?



[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

implementation pipeline are an indicator that the "reform backlog" in this sector will continue for some time to come.

One area that the experts for Germany and the rest of Europe feel will be less affected by ICT is the **construction sector**: only four percent of the Germany experts and ten percent of the experts for Europe expect a very strong or extremely strong impact (see Fig. III.5). Like in the transportation sector, however, the deployment of intelligent robots by the end of the forecast period (2020) could trigger a transformation similar to that caused by the use of robots in industrial mass production in the previous century.

Local factors and opportunities

The participants of the online expert discussion presented a mixed picture in their estimation of the local factors for Europe. On one hand, there are various, strong non-ICT industries with a high cross-section potential for ICT in Europe, such as the automotive industry and the public sector; but on the other hand, essential investments in infrastructure have been neglected.

The upgrade of communication networks can stand up to international comparison in most areas, in the experts' opinion, but opportunities to build structures above the network levels (cloud) have been largely missed; attempts by late starters are associated with greater economic risk.

The participants of the expert discussion give cultural factors a high weight. The lack of entrepreneurship and individual risk appetite, in particular, obstruct small, innovative companies in western Europe, while the heavy fragmentation of regional markets causes problems in eastern Europe. In the experts' opinions, this is also reflected in the financial sector: individual entrepreneurs who suffer one downturn have hardly any options to overcome the crisis, not to mention start again, since the venture capital market is poorly developed in Europe in general, and there are few competent venture capital companies that can provide active support in such cases.

"A company or person who failed once with a business model or idea is hardly able to get financing."

The experts' recommendations on remedying this situation aim largely at promoting entrepreneurship among young people and reforming incentive and pay systems at companies.

"For the established industries, it could be helpful to change reward/incentive systems in organizations and to actively encourage 'non-conformity' or non-routine behavior."

Summary and recommendations

Germany and Europe should utilize their strengths in the interaction between ICT, conventional industries and cautious accompanying regulation in the important areas of transportation, energy and healthcare. This will help strengthen both local infrastructure and international export opportunities.

The commercial race may have already been lost in the media area, but an education policy aimed at promoting the formation of media skills among citizens can help to limit negative effects at the societal level.

III.3 ICT market in flux

The ICT sector will play a key role in stimulating the German and European economies and increasing their competitiveness. Modern information systems stimulate new, innovative business ideas (startups) and help to modernize conventional industry structures. They help to create new jobs and protect existing ones. Therefore, private investment and investment incentives to build and expand this ICT infrastructure are enormously important for the overall economy. Only with a powerful, efficient communication infrastructure will Germany and other knowledge-intensive economies in Europe succeed in consolidating their valuable, yet regionally distributed expertise. Modern communication systems are a precursor and elementary link of innovations. The network effects of ICT in Germany and Europe will fulfill the prerequisite for keeping pace in the worldwide race for ideas and patents, and thus in the innovation and marketing of new products. The first section begins with this issue. It examines the economic and political climate that experts feel is necessary to generate ICT innovations and make them successful on international markets.

At the same time, the access channels and marketing mechanisms have changed rapidly at the enterprise level in recent years: e-commerce, along with information and rating platforms, have become primary influencing factors for retail, market, and company success. In addition, new players have established themselves on global ICT markets that offer hybrid services, varying conventional product portfolios and thus successfully entering the conventional areas of business of established (brand-name) companies. This process is accompanied by fundamental changes to market structures. The increasing diffusion of the Internet, the liberalization of telecommunication markets and affordable user devices for the mass market have changed the competitive landscape permanently. The variety of offerings, the associated cost pressure and an ongoing decrease in prices have resulted in an incredible dynamism of market entries and exits, more than in any other industry. In these changed markets in mind, the second part of the article addresses the question of which competencies are required at the company level to succeed in this new competitive environment and which contribution is required by politics, academia and society to promote them.

The third section examines the necessity of cross-industry collaboration with ICT companies that is resulting from the growing share of ICT in "conventional" products and services. The associated increase in complexity and transience of such products and services is posing considerable problems for companies whose core competencies lie outside of the ICT area. The battery of questions developed here analyzes the willingness of business to engage in cross-industry collaboration and investigates the political and academic framework needed to do so. It also discusses options for increasing willingness for cross-industry collaboration.

Development of ICT innovations much better than their marketing

In the question regarding the framework conditions for ICT developments, the Germany and Europe experts assess the situation for their countries quite optimistically. 58 percent of both groups believe that the framework conditions are positive to very positive. The question about the framework conditions for marketing ICT innovations received a much different answer: just 35 percent of the experts for Germany believe that the framework conditions in that country are positive. The Europe experts have a slightly higher estimation for their own countries, at 40 percent (see Fig. III.9), but both values indicate a significant deficit in the marketing of ICT innovations. For the level of context factors of economic development, the results show that the existing excellent foundation for developing technologies and products in Germany and Europe are not yet matched by good conditions for their marketing.

This conclusion seems to indicate that the existing innovation paths, such as a concentration on technology and organization, are still very pronounced in Germany, while a focus on marketing has not gained any ground in past years. This is particularly true of industries on which ICT developments only have an indirect impact (also see section III.2). If we examine Europe in this context, the requirements for the new global ICT markets must be seen critically, with positioning among the global competition being one of the main challenges for the future.

Cultural capital – the most important success parameter for marketing ICT innovations by far

When asked about the relevancy of factors for the successful global marketing of ICT innovations, the Germany experts agree that cultural capital is the most important influencing factor by far: education was mentioned by 87 percent of those surveyed, while 83 percent mentioned the entrepreneurs' appetite for risk. Research funding and venture capital, two factors that are often emphasized in debates on Germany as a center of business, are also ranked highly – at 62 percent and 58 percent, respectively – but clearly behind the competencies at the participant level (see Fig. III.10).

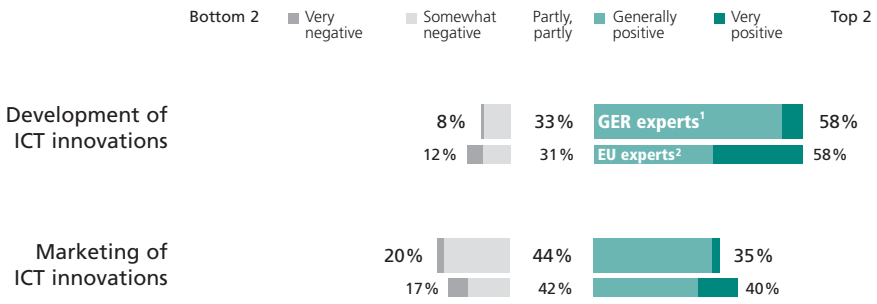
Although the influence of standards (54 percent) and the overall entrepreneurial environment (50 percent) are assessed relatively highly, the experts believe technology paths and established industrial clusters are less important: at 44 percent and 38 percent, respectively, they rank in the bottom third. As such, the result correlates with the finding that previous strengths and development paths have declined in relevance when faced with the strong dynamism of ICT markets and disruptive innovations. The influence of politics (35 percent), regulation (22 percent), and bureaucracy (18 percent) on the marketing of innovations rank at the bottom of the scale (see Fig. III.10).

To improve the marketing of ICT innovations, however, the results seem to indicate that it will be nearly impossible to close this competency gap quickly. A major desideratum exists at the level of the players, their collective resources, and attitudes toward marketing and entrepreneurship. Since these structures are "long-lasting" (see Braudel 1958), which means breaking them down will require significant effort in the institutional transformation of schools, universities and the prestige of career paths, a broad alliance of societal groupings and a longer-term business policy strategy are required.

Whether internationalization and digitization can have an accelerating impact here remains to be seen. In particular, an opening for marketing collaborations could provide crucial impetus to reduce or even eliminate this lag (also see section III.5).

Fig. III.9: General conditions for innovation in ICT

How positive or negative do you consider the general conditions in Germany (<country>) to be for the development / for the marketing of ICT innovations?



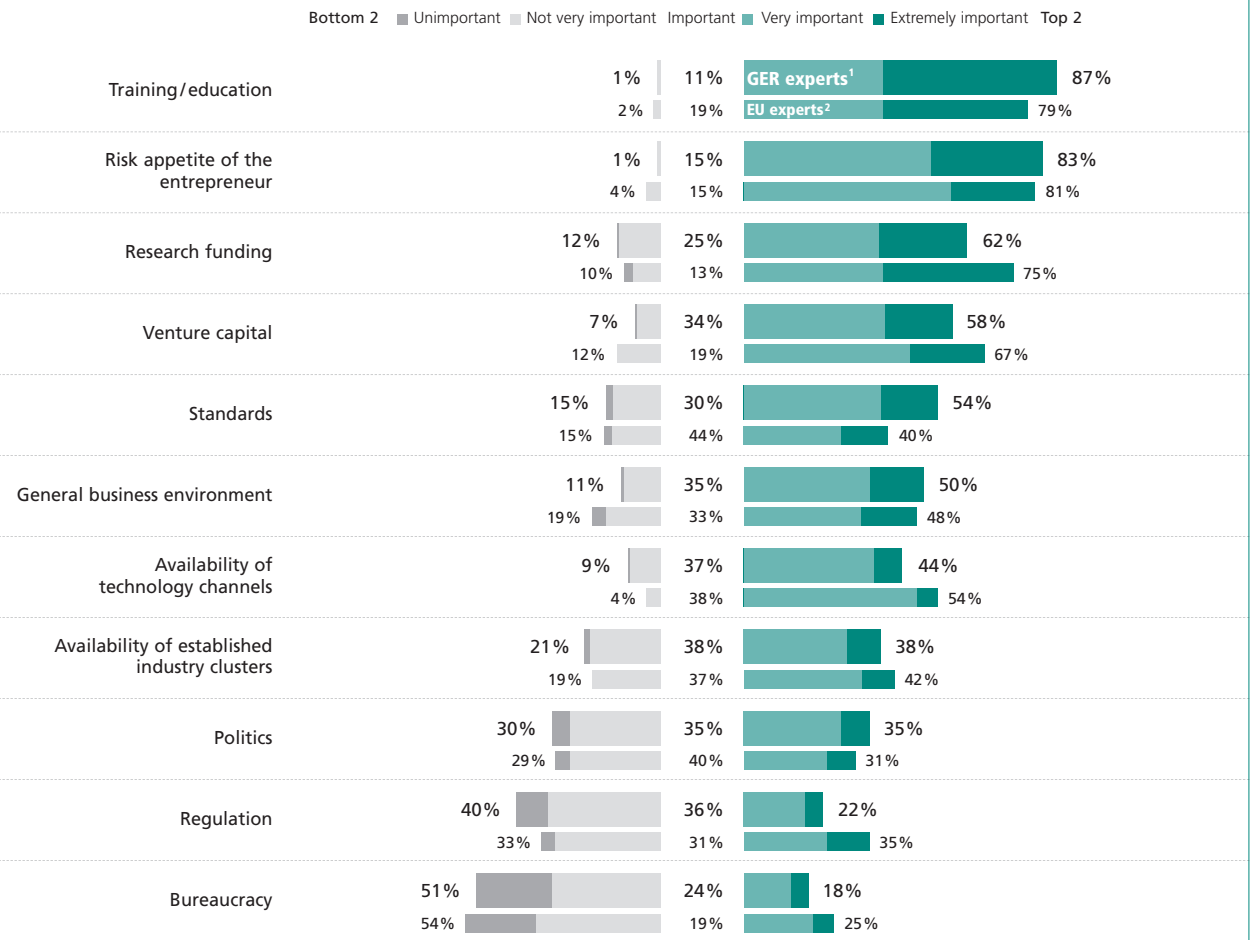
¹ Experts for Germany, n = 513; ² Experts for European countries, excl. Germany, n = 52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know / no answer

ICT increases market dynamism and promotes growth, productivity and innovations – the Internet offers new ways to challenge established market players

In the series of questions on market players and market changes resulting from ICT, the discussion was characterized by various market structures, their forms and their duration. The experts in the online discussion largely agreed that ICT promotes the trend toward more dynamic market structures. A new phenomenon is the speed with which existing market structures can be broken down as the result of Internet-based ICT. A prime example of this is Google, which overtook Yahoo, the previous market leader, in just two years. Amplifying effects for companies in the network industries occur, for example, through perpetuating references (placement in search engines and rating systems) and user attractiveness through large numbers of participants (Facebook and business platforms such as LinkedIn and Xing). As a result, new companies (second movers/newcomers) repeatedly succeed in successfully challenging the primacy of existing enterprises.

Fig. III.10: The performance criteria for the marketing of ICT innovations

Please indicate how important the following parameters in Germany (<country>) are for globally successful marketing of ICT innovations:



[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Market dominance in ICT markets is more volatile than in conventional industries

"Once an ICT company becomes dominant, its dominance may not last long. In other words, an ICT company has worse chances to become monopolistic or keep its monopolistic position than its slowly changing 'traditional' counterpart."

ICT markets owe their dynamism largely to the impact of network effects. Again and again, these effects allow newcomers not only to catch up to established market leaders, but even overtake them – only to be overtaken, in turn, by even new newcomers as a result of strong competition. Dominant market positions are difficult to defend in the long term. Among others, the experts cited the example of Apple's recent successes in the core business of Samsung, Nokia, Motorola etc.

"[…] innovators always have to stay ahead in the development of new services and make every effort to stay first mover."

The better availability of information and broad customer coverage with relatively little investment are constantly lowering the barriers to market entry for newcomers. This also applies to conventional markets.

According to the surveyed experts, these changes also strengthen the position of users and consumers: Firstly, Web 2.0 enables them to become directly involved in the development of new products and services. Secondly, they have greatly increased the flexibility of users, who are now capable of simply switching their providers of ICT products and services at negligibly low costs.

New business models have good prospects for success

It is typical that the competition is not only created through new products and services, but also – and increasingly – through new business models. Apple, for example, has had incredible success with iTunes, which created a novel ecosystem for its products and services. By launching Android, Google has entered the market for operating systems, a domain previously unexplored by the company. As these examples show, companies can repeatedly achieve success with innovations, even outside of their core competencies. With new business models and market strategies, companies repeatedly succeed in entering the core businesses of other market players and challenging them successfully.

"But rapid technological change also allows new entrants to disrupt industries and become significant players for some time."

As a result of the comparatively high innovation speed, market players are forced to rethink their roles more often. Their inherent logic of market power through size, constant structures and incremental change processes (by buying innovative, growing companies, for example, or imitating a competing product that was pushed with massive investments) often only has limited success in an environment characterized by radical, not incremental innovation. The old logic of crowding out the competition has lost nearly all its validity. Instead, the new market demands that its players address "hybrid innovations" and a new structure of supply and service. The concept of "hybrid innovations" as innovations that aim at developing a hybrid product – an integrated bundle consisting of at least one service and one physical product that provides customer-specific solutions (see Schmitz 2008) – should go even further in this context, including the supply structure and the business model in the concept. This extends the understanding of the customer-specific solution with the component for specific customer loyalty. Examples of this include cloud computing and software-as-a-service – two technological developments that created the foundation for new business models and enable new business processes for customers.

"For fast changing markets, the speed/time-to-market plays a more important role than the bigness. It is usually the 'faster' fish which will devour the 'slower' one even if the latter is bigger […]."

ICT has created new ecosystems and value chains

In the experts' opinion, ICT has provided important stimulation for the creation of new ecosystems, both in inter/intracompany collaboration and in the value creation processes for products and services. Modern ICT, along with the associated standardization and certification of interfaces and processes, made it possible to create new, more flexible value creation processes. Firstly, modern ICT solutions enable more efficient collaboration with partners in broader circles, for example, in the innovation and development process. Secondly, collaboration with customers makes it possible to implement improvements and customer requests directly, through web-based feedback contributions.

"Communication systems with open interfaces offer the opportunity for the development of new ecosystems. Already today the classical linear value chain it moving towards a value network with many different players."

In addition, ICT is significant for the development process for new technologies itself. Digitization – for example, new, more powerful models and tools in the simulation area – makes it possible to run through technical solutions in multiple variants prior to actual construction, enabling an implementation that is much faster and cost-effective.

ICT is changing working and learning structures

The experts see new opportunities to increase productivity and innovation through ITC at the level of the individual actors as well. Modern ICT-based solutions are particularly gaining in relevance for new learning methods and strategies. Already used for training programs at many companies, new, web-based forms of learning can help change the way we gain knowledge – through the simple location of information (in the context of a semantic web), for example, or through new forms of display, such as images and pictograms that give the general public intuitive access to complex topics. The experts also point out negative aspects of digitized living and working, however: modern means of communication has increased speed in business significantly. Although business processes and individuals' time can be scheduled better, and Internet tools allow efficient remote working, fragmentation has also increased. The increased speed of communication, especially e-mail, means analysis capability and depth can be lost. The general public first has to learn to use ICT efficiently; there are limits to the flexibility that can be achieved in working life. In the year 2009, 60 percent of the Germany experts believed that by 2019, 75 percent of the working population would need to use the Internet skillfully to deal with their day-to-day work (see "International Delphi Study 2030", 2009). 19 percent of the Germany experts and 24 percent of the Europe experts felt it highly unlikely that 75 percent of office workers would use a home office or mobile office regularly (see "International Delphi Study 2030", 2009).

"[…] new 'digital' ecosystems will be established but probably they cannot be planned […]."

The global network economy has another impact on market development as well: transparency and insecurity have become new market factors. Companies used to know their few competitors, suppliers and customers, but globalization and Internet-based ICT have created new dynamism in the relationships between market players. Not only can value chains change (relatively) quickly, but customers can also solicit offers and change suppliers much faster. The interchangeability of suppliers and turnover of customers have increased greatly. On the positive side, this can be seen as a new agility and flexibility of companies, which the experts believe offer many opportunities – particularly for start-ups – to integrate themselves in the networks of global corporations. On the other hand, demands are increasing as a result of the faster change, and competitive pressure is also increasing.

"Open innovation and mass customization will be major aspects of new business strategies which would not be feasible without ICT."

Growing share of ICT in "conventional" products presents new challenges to industry

In these times of a rapidly increasing share of ICT even in "conventional" products and services, legacy industry can no longer shut itself off to cross-industry collaboration. A typical example is the increasing networking of cars with the outside world, made possible through mobile data communication. BMW in particular has played a pioneering role with its Connected Drive system. The Internet is piped to the vehicle through mobile communication, not only giving driver and passengers more up-to-date traffic information and an emergency call function, but also making it possible to retrieve e-mail and the latest news. Automobile manufacturers are no longer capable of creating this type of systems by themselves; they require cross-industry collaboration with telecommunications providers, manufacturers of mobile communication devices and Internet providers. This means several different players that are vastly different – not only culturally, but also in terms of technology – and who have significantly different product life cycles and might even speak a different language all have to work together.

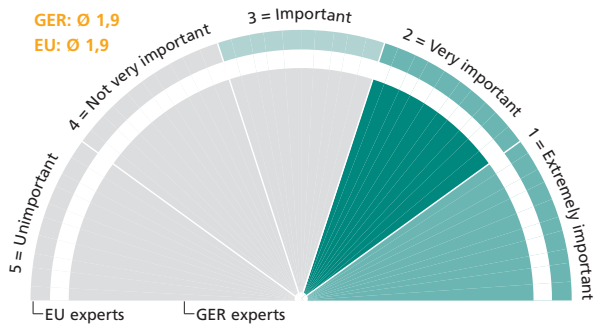
European integration requires cross-industry collaboration

The experts in the online discussion share the opinion that Europe has a major advantage in dealing with cross-industry collaboration: its experience in dealing with different cultures that was gained through European integration. Although cross-industry collaboration primarily involves different corporate and industry cultures that need to be brought together, with typical cultural characteristics of specific only playing a subordinate role, recent European history gives the collaboration partners advantages over their competitors from the U.S. or Asia. The experts were much more pessimistic last year: 56 percent of the Germany experts and 50 percent of the Europe experts believed that Europe would never catch up to the United

Fig. III.11: Promoting cross-industry cooperations of ICT companies – Importance

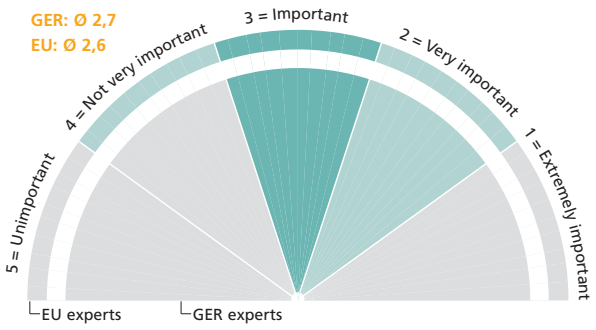
How important is promoting cross-industry cooperations of ICT companies for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	0 %	3 %	18 %	40 %	37 %
EU experts[2]	0 %	2 %	25 %	37 %	35 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	4 %	19 %	35 %	27 %	12 %
EU experts[2]	0 %	23 %	35 %	21 %	19 %

■ ≥ 40 % of experts ■ 30 – 39 % of experts ■ 20 – 29 % of experts ■ < 20 % of experts ■ Averages

[1] Experts for Germany, n = 513; [2] Experts for European countries, excl. Germany, n = 52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

States' competitive lead in the ICT sector – not even through targeted investments in R&D and software competencies (see "International Delphi Study 2030", 2009). Today, in contrast, the experts believe Europe has a major advantage with regard to collaboration: experience with integration and dealing with different cultures.

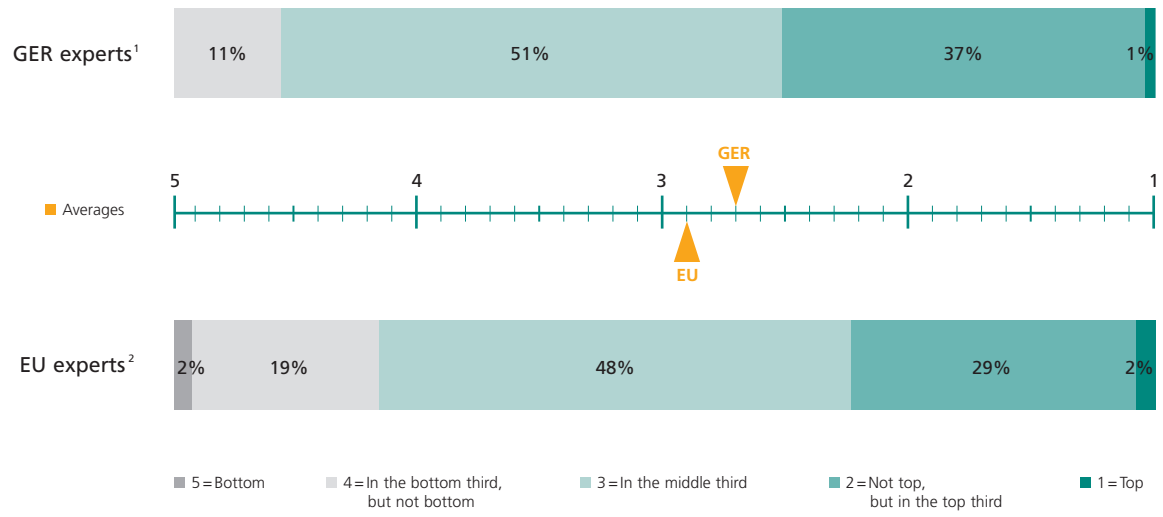
In the experts' opinion, an essential component for successful cross-industry collaboration is a stable basis for trust between the partners – which first must be created. Once this foundation exists, the next step involves formulating common goals, which must deliver real benefits to all the collaboration partners. According to the experts' opinion, products and services for an aging society and to ensure future mobility are particularly predestined for cross-industry collaboration. In addition to a strong ability to innovate in core technologies, these products and services will require close collaboration between the various players – such as researchers and advanced developers from industry, network experts and service providers from the mobility and healthcare sectors.

Cross-industry collaboration promotes economic development

Both the Germany experts and the Europe experts believe that support for cross-industry collaboration is of major importance for economic development in their respective countries. At 78 percent, the share of Germany experts who believe this type of collaboration is very important or extremely important is even higher than the share of Europe experts with the same opinion, at 71 percent (see Fig. III.11). If we compare the results with the expert opinions from 2009, trust in the concept of Open Innovation and its potential to increase the efficiency of innovation processes seems to be increasing. In 2009, 34 percent of the experts for Germany expressed the opinion that the concept of open innovation would likely never be used comprehensively by more than half of companies in Germany (see "International Delphi Study 2030", 2009). One reason for this could be the current funding policy in Germany, where both the Federal Ministry of Education and Research (BMBF) and the Federal Ministry of

Fig. III.12: Promoting cross-industry cooperations of ICT companies – Position

And how do you think Germany (<country>) is positioned on promoting cross-industry cooperations of ICT companies in an international comparison?



[1] Experts for Germany, n = 459; [2] Experts for European countries, excl. Germany, n = 48
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

Economics and Technology (BMWi) have long provided funding to support the establishment of cross-industry collaboration.

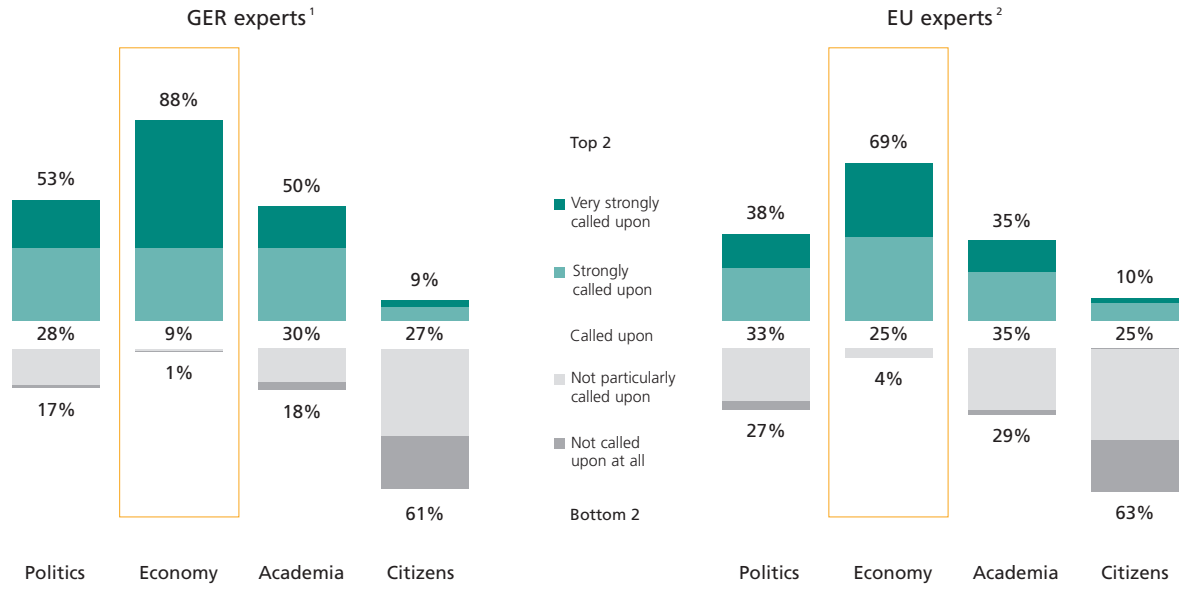
Strikingly, the experts feel that support for cross-industry collaboration is much less important for societal development in the respective countries. 23 percent of the surveyed Germany and Europe experts believe cross-industry collaboration is less important or even completely unimportant for societal development in their respective countries; only 40 percent believe that such collaboration is very important or extremely important (see Fig. III.11). As such, it is not unreasonable to conclude that the experiences gathered through dealing with different cultures in the industrial environment cannot be completely transferred to societal aspects.

The opinions of the Germany and Europe experts vary widely in their estimation of their countries' relative positions in an international comparison of support for cross-industry collaboration: while only a few experts – one percent of the Germany experts and two percent of the Europe experts – believe their countries take a leading position in international comparison, 37 percent of the Germany experts and 29 percent of the experts for Europe believe that their respective countries are in the top third. 51 percent and 48 percent of the experts, respectively, see their countries in the middle third, while 19 percent of the Europe experts see their countries in the bottom third – more than the surveyed experts for Germany at eleven percent (see Fig. III.12).

The fact that the Germany experts estimate their country's position in the support for cross-industry collaboration with ICT companies better than many of the Europe experts leads us to conclude that the funding policies of BMBF and BMWi have a positive impact on the ability of German companies for cross-industry collaboration. At the same time, since only one percent of the Germany experts see Germany in the top spot, there is clearly a need to act in this area, even though Germany is still competitive on an international scale.

Fig. III.13: Promoting cross-industry cooperations of ICT companies – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to promote cross-industry cooperations of ICT companies?



[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

The framework for cross-industry collaboration has been established – now it must be used

The greatest need for action in supporting cross-industry collaboration lies with the overall economy. 88 percent of the Germany experts believe this is highly or extremely necessary. Politics and academia follow at 53 percent and 50 percent, respectively (see Fig. III.13). This can be interpreted that the political and academic framework for cross-industry collaboration is there, but there is still great potential for business to utilize this framework. State support for cross-industry collaboration projects is surely one option to increase willingness for this type of cooperation. However, it alone is not sufficient, as the expert opinions indicate. The important thing is that companies facilitate the openness needed for cross-industry collaboration and teach their employees that such collaboration harbors more opportunities than risks. This will require a significant rethinking in conventional industries, as well as a willingness for far-reaching changes in the corporate culture.

Summary and recommendations

The results of the study show a clear need to act. Reduced to a point, German companies continue to follow a highly technology-oriented path of development and do not deliver enough emotional, customer-focused, service-oriented solutions to the market. This is especially true of the new ecosystems for value creation and innovation. "Hybrid innovations" – cross-industry, cross-company collaboration that leverages the potential beyond the largely technologically characterized product innovations – are lacking. This is especially true of new fields of business and new combinations of products and services. The ICT markets demonstrate a high level of dynamism that repeatedly challenge the market positions of leading companies and open numerous possibilities for new market players. At the same time, this also requires a willingness for entrepreneurship – particularly in high-tech segments – that Germany needs to develop and grow.

This also requires a rethinking of existing working and learning structures. Even though personal contacts are still considered essential to business success, it is also important to promote the use of modern ICT-based communication solutions, such as Web 2.0 applications, within and outside the company. Only in this way can companies prepare themselves for increasingly tough global competition, in which speed and flexibility are increasingly determining the success or failure of a company. A positive attitude is especially important, in which dynamic markets and globalization are not seen primarily as a danger, but instead as an opportunity for further development and renewal.

There is also a need for action in the area of cross-industry collaboration, which is becoming much more important in these times of increasing integration of ICT in all products and services. The political framework for such collaborations have been created, but the companies still have to promote their use internally. This is particularly true of "old" industries, such as the automotive and energy sectors, which find it relatively difficult to work together with the more short-term focus of ICT companies. But persuasion is still needed in companies in the ICT sector, as well, to ensure that both sides are open to one another and that collaboration is not limited or even prevented by cultural differences.

III.4 ICT in and for companies

Information and communication technologies (ICT) have changed companies significantly in the last 40 years. The closing report for the first phase of the international Delphi Study clearly showed: ICT changes how people work (see "Future of German ICT", 2008). According to the experts surveyed in the following year, it will do so more and more over time: the experts for Germany assume that by the year 2019 at the latest, 75 percent of the working population will need to know how to use the Internet effectively to manage their day-to-day work (see "International Delphi Study 2030", 2009). Consequently, PC and Internet/intranet have become indispensable tools for data processing and communication, whether in the office, in research and development (R&D) or on the factory floor. Even the often-mentioned "paperless office" is increasingly becoming reality. But the digital revolution has only just begun!

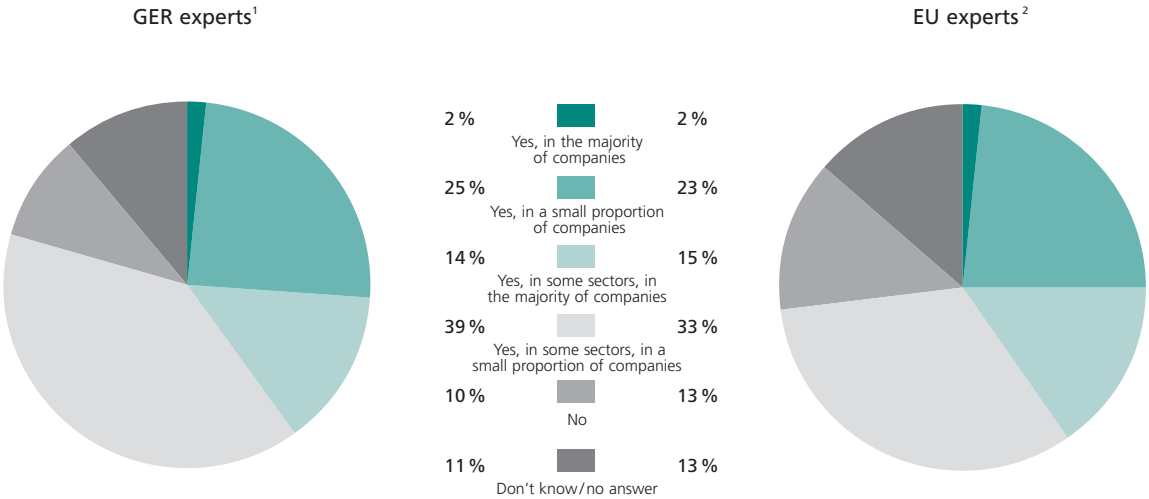
The transformation of ICT is built on new Internet-based – web-based, to be specific – forms of communication and communication techniques. It has an impact on both internal communications within companies and communication with external partners (such as customers, suppliers and development partners). At the same time, however, this development is also creating new business opportunities. We can therefore differentiate between two aspects of this transformation, to the extent that ICT can be used effectively at companies.

- Use of ICT for internal company communications
- (New) business opportunities through the deployment and use of modern ICT

The aim of these statements is to concentrate on the deployment of ICT at companies and examine the specific chances and opportunities that are being created. The deployment of modern ICT and development of new business opportunities are not examined in more detail below (for more information on these aspects, see sections III.2 and III.3).

Fig. III.14: Use of Web 2.0 in business

Is Enterprise 2.0, i. e., the use of Web 2.0 in companies, already put to good use in Germany (<country>) today?



[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area

Internal company communications: from telephone to "Enterprise 2.0"

A powerful digital communication system remains the backbone of every company, even in the year 2010. Voice communication is still clearly the central aspect. All the same, trends in ICT are enriching this situation with a variety of additional functions, such as unified communication (UC) and presence functions.

In addition, companies are increasingly deploying web technologies as well, which can be classified – somewhat fuzzily – as "Web 2.0".

The specific deployment of Web 2.0 at companies – often combined with collaboration tools – is usually called "Enterprise 2.0" (E 2.0). In this section, E 2.0 is understood as follows:

E 2.0 encompasses a wide pallet of web-based tools and methods for efficient

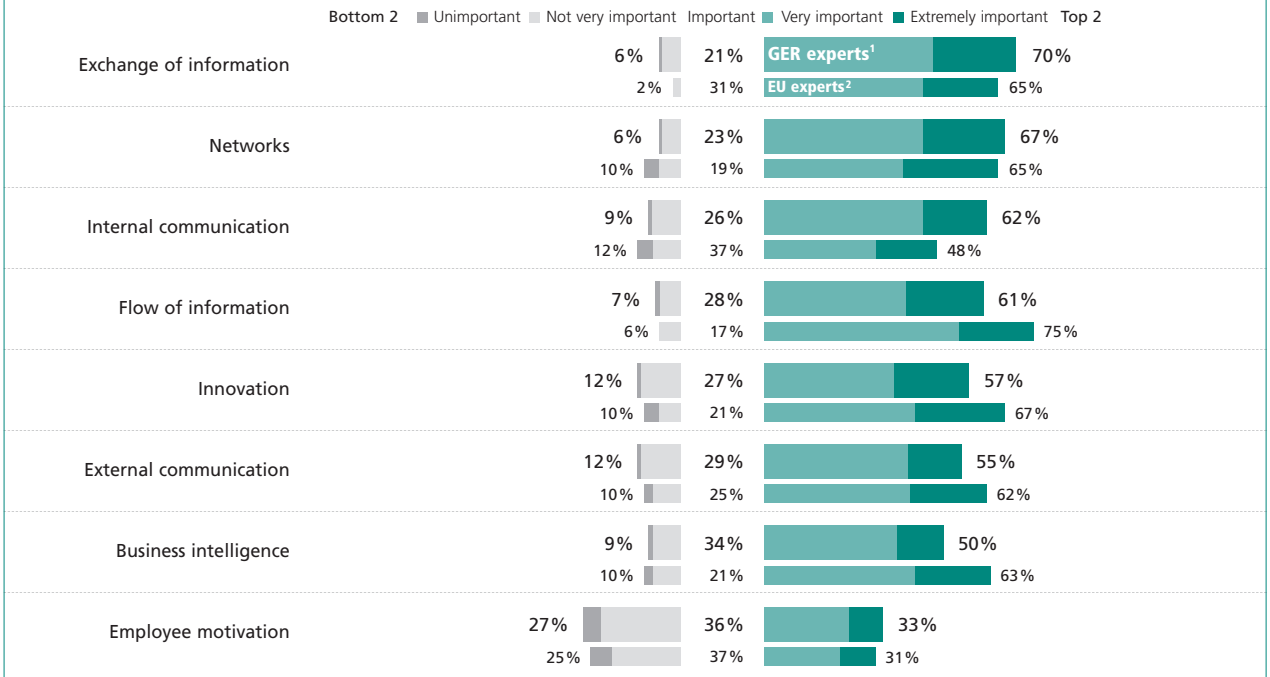
- Searching
- Linking
- Authoring
- Tagging
- Signaling

data of all types (see also Wikipedia, "Enterprise Social Structure", 2010).

Thus the technology represents a central aspect of E 2.0. The other side is made up of people, which means E 2.0 can simply be defined as follows: "The self-organized networking of customers, partners and staff" (Buhse 2010). In other words, "social media".

Fig. III.15: Future importance of Web 2.0 usage in enterprises

How important will Enterprise 2.0, i. e., the use of Web 2.0 in companies, be for the following requirements in Germany (<country>) in the future?



[1] Experts for Germany, n = 513; [2] Experts for European countries, excl. Germany, n = 52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Various types of tools can be used for this, including:

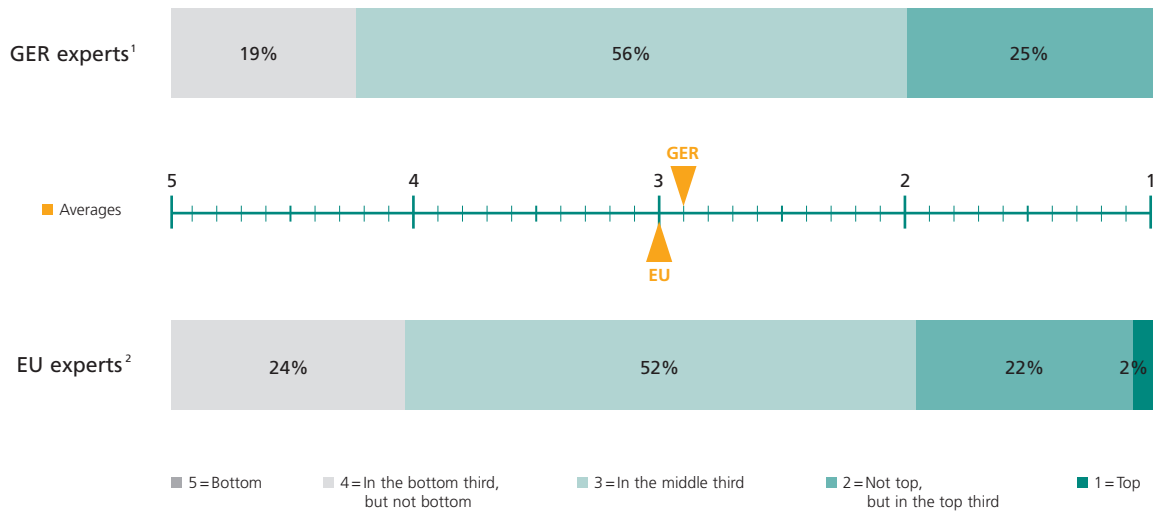
- Wikis
- Weblogs
- Idea banks
- RSS feeds

According to the experts surveyed for this study, popular social media applications such as wikis and blogs, which are already used widely in the personal sphere, are only used in a small minority of companies – despite their ease of use and ability to link large numbers of participants. Only two percent of the experts for Germany and the rest of Europe believe that E 2.0 is already used sensibly at a large portion of companies; in the experts' estimations, ten percent of the companies in Germany and 13 percent in the rest of Europe do not use these possibilities at all (see Fig. III.14). Consequently, internal communications is mostly limited to telephones and e-mail. Tele-collaboration tools like NetMeeting are only rarely used. The intranet is there largely to transport data.

Nonetheless, the surveyed experts for Germany believe that use of Web 2.0 at companies will be very important or extremely important for a variety of requirements. E 2.0 is seen as significant, in particular, in the areas of exchanging information (70 percent), forming networks (67 percent) and general internal communications (62 percent). Whether or not the use of E 2.0 is important for motivating employees is judged quite differently by the experts for Germany: while 33 percent of these experts judge it to be very important or extremely important, 27 percent feel that the use of E.2.0 is less important or not at all important for motivating employees (see Fig. III.15). Furthermore, the expert discussion also makes clear that true added value for the individual – and thus an increase in personal motivation – will only occur if the ICT deployment expands personal freedoms instead of restricting them (as was/is the case in many conventional IT systems). Otherwise, the opposite effect can occur.

Fig. III.16: Use of Web 2.0 in business – Position

And how do you think Germany (<country>) is positioned on driving forward the widespread use of Web 2.0 in companies in an international comparison?



[1] Experts for Germany, n = 477; [2] Experts for European countries, excl. Germany, n = 50
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

E 2.0 can also increase the ability to innovate and have a positive impact on staff creativity. After all, Web 2.0 can help make innovations faster and more market-friendly, since it enables direct contact with customers. In addition, the simplified exchange of information makes company-wide – and even cross-company – knowledge management possible. This approach has already been tested at a wide variety of companies and is used daily by many (see Faller 2010).

"Creativity and motivation come from the fact that the employees see what is going on in the world much better than in the past."

However:

"Nothing beats the creativity of two or three people discussing face to face!"

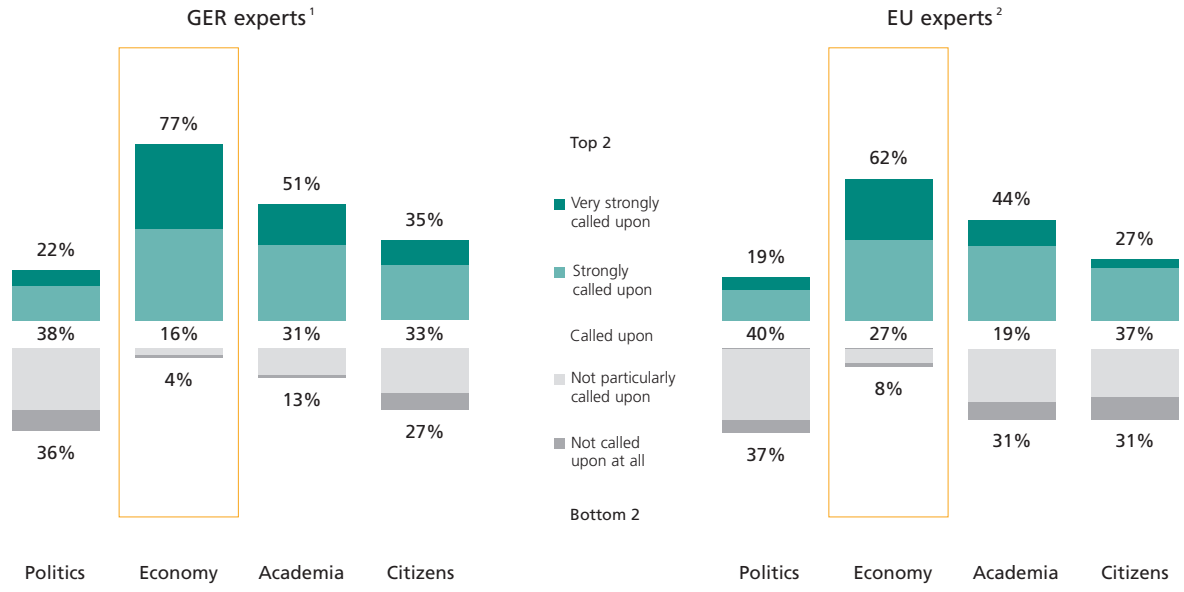
Despite the benefits that the deployment of modern ICT at companies can create, the inappropriate use of modern tools can result in interruptions in workflows, for example, due to constant changes of status indicators ("partner is online", "I'm at lunch", etc.).

Accordingly, it will be necessary to introduce clear, binding rules at companies as a form of communications etiquette.

In the experts' opinion, Germany is merely average in Web 2.0 use (56 percent; see Fig. III.16). The continued advancement of Web 2.0 at companies in Germany, according to the experts' opinion, poses the most challenge to the companies themselves (77 percent) and academia (51 percent; see Fig. III.17). In contrast, politics (22 percent) and citizens (35 percent) who like to use the new technologies anyway – and would prefer to transfer them to their work environments anyway – will not face major challenges in future. The majority of experts for Germany rates

Fig. III.17: Use of Web 2.0 in business – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to drive forward the widespread use of Web 2.0 in companies?



[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

the overall economic importance of promoting the use of Web 2.0 at companies as important (38 percent; see Figure III.18). At the same time, however, a number of other factors are also important to the economic success of a country, for example, a favorable regulatory framework, an entrepreneur-friendly culture and an excellent system of education and higher learning.

In addition to the use of Web 2.0 at companies, another alternative for voice communication should be examined in more detail: video telephony.

The extent to which videoconferencing (VC) and personal video telephony – future technologies that have been predicted for decades – will finally become established is still open in the opinion of many experts. It is possible, as some suspect, that the availability of VC functions on every PC and smartphone is triggering a paradigm shift in this area. It could be strengthened by the increasing use of Skype and similar tools for multimedia communication, which enable the simple establishment of a video link in addition to the audio link. The general opinion, however, is that the quality – particularly the video quality – of currently available multimedia communication systems is still much too poor to be used productively. In turn, this is largely due to a lack of transmission bandwidth.

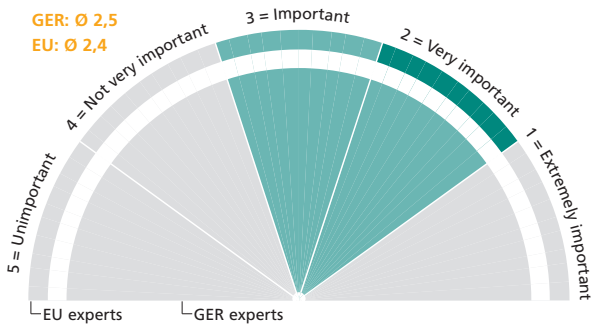
In general, we can say that the new forms of communication still require improvement and are increasingly developing in the real time direction.

The background of this development is that users often reject the asynchronous nature of these new communication forms – that is, the time disconnect between sender and recipient. The necessity of this development became very clear in the expert discussion: users increasingly expect a "near-time" reply to send messages, despite the temporal disconnect.

Fig. III.18: Use of Web 2.0 in business – Importance

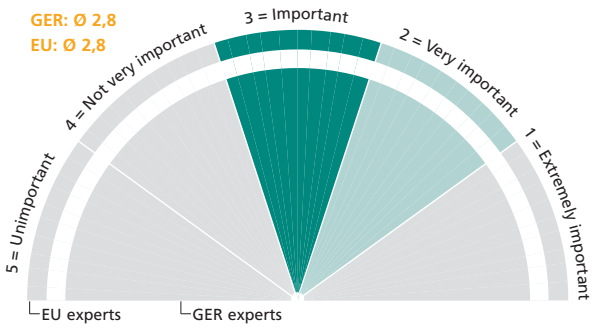
How important is driving forward the widespread use of Web 2.0 in companies for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	2 %	11 %	38 %	33 %	13 %
EU experts[2]	2 %	10 %	33 %	42 %	13 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	2 %	19 %	40 %	27 %	7 %
EU experts[2]	4 %	12 %	52 %	25 %	8 %

≥ 40 % of experts | 30–39 % of experts | 20–29 % of experts | < 20 % of experts | Averages

[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Still, many experts believe that – despite progress in communication technology, up to and including 3D VC – personal, synchronous communication will continue to be preferred to electronic communication for critical meetings and talks, provided the geographical distance allows it, because:

"An intensive and engaged discussion cannot be done by electronic averages."

Excellent ICT is necessary to remain competitive

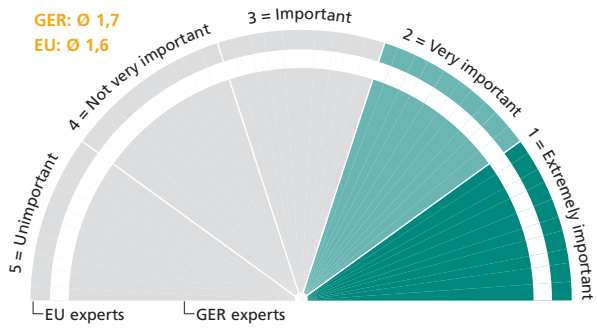
Both large and small companies are dependent on the availability of powerful ICT. However, the challenges posed by modern ICT differ by company size: at large, globalized companies, modern, digital, networked information and communication systems are used to "virtually" link enterprise-wide structures, units, departments, processes etc. The use of ICT can help at least partially mitigate the structural disadvantage of large companies – namely weaker links among employees and units – compared to small and medium-sized enterprises (SME). Employees at small companies are work close to each other and can communicate directly, including frequent face-to-face meetings, whereas employees at large companies must rely on electronic communication as the standard method. On the other hand, ICT lets employees at large companies draw on more comprehensive knowledge resources – when available – such as wikis. The seamless workflow integration of these new tools is considered extremely important in this context, as it is essential to improve process efficiency.

For small and medium-sized enterprises, powerful, broadband, reliable Internet access and the use of modern IT services are matters of sheer survival.

Fig. III.19: Promoting the importance of SMEs in the ICT environment – Importance

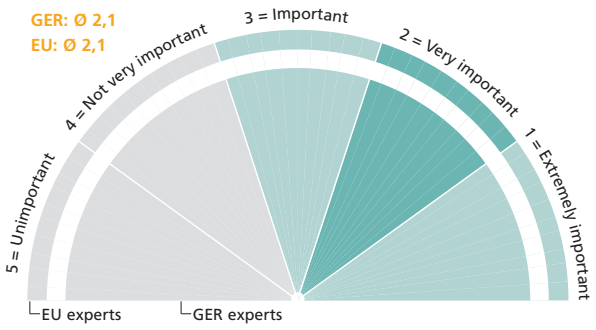
How important is promoting the importance of SMEs (small and medium-sized enterprises) in the ICT environment for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	0 %	1 %	16 %	33 %	49 %
EU experts[2]	0 %	0 %	12 %	37 %	52 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	0 %	9 %	23 %	39 %	28 %
EU experts[2]	0 %	8 %	27 %	37 %	29 %

≥ 40 % of experts | 30–39 % of experts | 20–29 % of experts | < 20 % of experts | Averages

[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

SMEs are becoming more and more networked – as suppliers to large companies, partners in R&D networks, with universities and with customers. Communication with customers must take place in real time; successful marketing and product communication require access to data outside of one's own company. In this way, ICT can help SMEs to make better decisions more quickly.

With the help of suitable ICT support and faster networks, even the smallest companies will be able to act like large companies in future, on a global scale. This is especially important for the heavily export-oriented German SMEs, as well as SMEs in rural areas, which are often found in Germany.

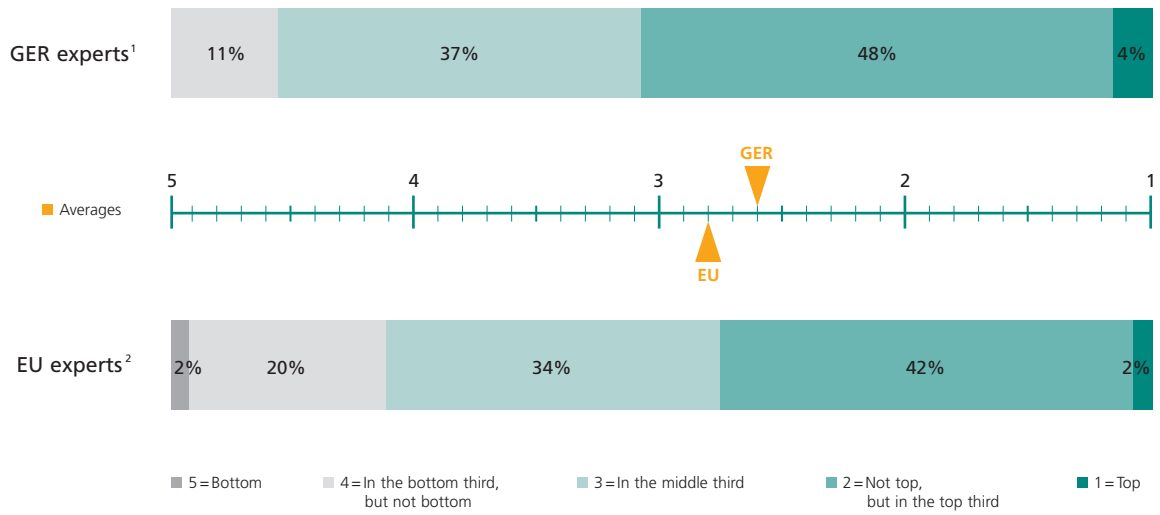
A barrier to the use of ICT, however, particularly among SMEs, is the fear of out-of-control costs. New tools that require constant maintenance and updates require steady funding and staffing. In this vein, the expert discussion also emphasized the following: ICT systems will have to reduce costs at the SMEs and avoid bloating processes or they will not establish themselves. Accordingly, "lightweight" ICT systems are needed that are (or at least can be) tailored to the needs of SMEs.

Nearly half the experts for Germany state that promoting the importance of SMEs in the ICT area is especially important for economic development (very important or extremely important: 82 percent; see Fig. III.19). The results show that Germany is deemed to have a good position in international comparison: 48 percent see Germany in the upper third; 37 percent of the surveyed Germany experts see Germany in the middle third (see Fig. III.20). To maintain or improve this position, activities will be needed from both politics (84 percent) and the overall economy (79 percent; see Fig. III.21).

"ICT would enable SMEs in rural areas to be as competitive as in urban areas. That would help to create new businesses in less developed regions."

Fig. III.20: Promoting the importance of SMEs in the ICT environment – Position

And how do you think Germany (<country>) is positioned on promoting the importance of SMEs (small and medium-sized enterprises) in the ICT environment in an international comparison?



[1] Experts for Germany, n = 483; [2] Experts for European countries, excl. Germany, n = 50
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

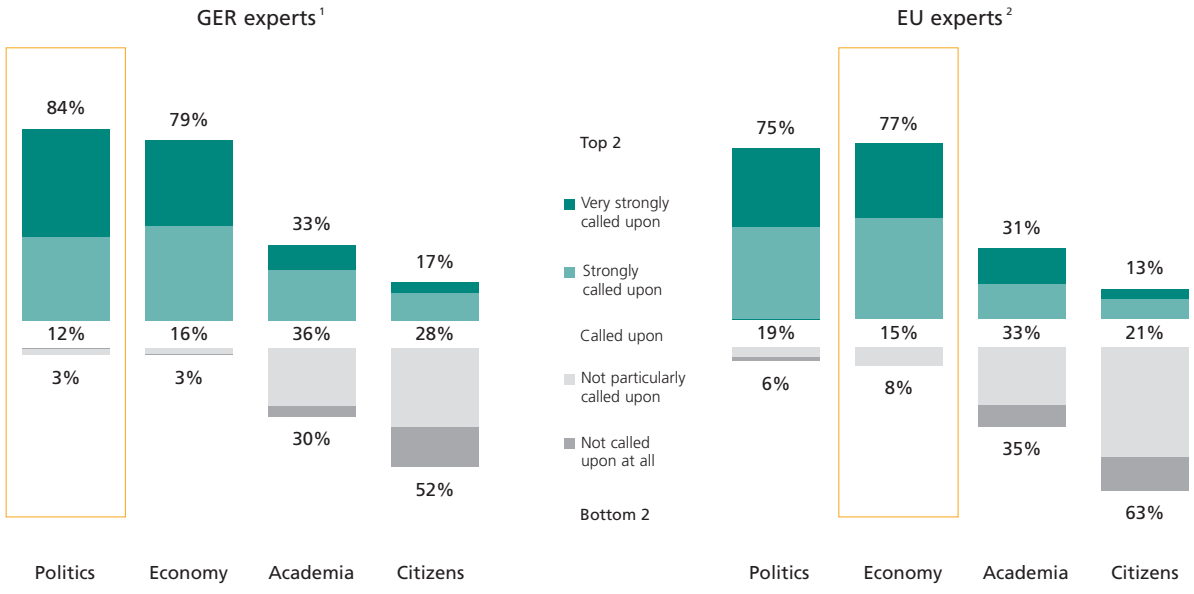
Summary and recommendations

Information and communication systems, as well as their use, are of strategic importance for nearly every company, both today and in future. Optimizing internal and external communication and adapting it constantly to new requirements – without succumbing to the temptation to overdo the ICT aspect – is a challenge for SMEs and large companies alike. As new forms of communication come into use at companies, communication etiquette must be introduced as well.

In general, surveys have shown that broadband infrastructure and the careful selection of the ICT tools and methods to be used are basic prerequisites for the successful use of ICT at companies. Germany has a good position overall in the area of ICT use, however, the constant changes in ICT require a permanent innovation effort by the companies.

Fig. III.21: Promoting the importance of SMEs in the ICT environment – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to promote the importance of SMEs (small and medium-sized enterprises) in the ICT environment?



[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

III.5 Organization for innovation

Innovation and creativity are decisive factors in the competitiveness and growth of companies. In an international survey of CEOs conducted by IBM, the majority of the top managers named creativity as the most important leadership characteristic in the new economy (see Global CEO Study, 2010). Companies must reinvent themselves constantly and radically create new products or business models to remain successful in the long term.

This study investigated which company structure and organization needs to be created to stimulate innovation. In particular, the experts discussed the role that information and communication systems play in this process, as well as which forms of organization at the edges of companies harbor the promise of creating new business areas and bring new ideas and technologies into the company from outside. This opening of enterprise boundaries is often referred to as "Open Innovation". The trend toward this form of innovation was already identified in the International Delphi Study 2030 from the previous year. This year's study focused on the question of how ICT can be used to bring innovations from the market to companies.

The key results of the expert discussion and expert survey on this subject are discussed in the section below.

Company culture and management are decisive for a company's ability to innovate

If innovation and creativity are so decisive for the success of companies, why do companies continually fall behind and become threatened – or even ruined – by new products or new business models? Companies obviously face a variety of barriers and challenges when it comes to bring innovations to market successfully or adapting quickly enough to an innovative attacker. Accordingly, the study pursued the question as to how companies can improve their ability to innovate in future: according to the surveyed Germany experts, the innovation success of companies can be explained primarily by the factors of company culture (86 percent) and human resources management (72 percent).

Other important factors for the ability to innovate are management principles and methods (59 percent) and the use of ICT (64 percent). Last but not least, the experts also believe internal (66 percent) and external collaboration (61 percent; see Fig. III.22) are very important. Internal collaboration help avoid the not-invented-here syndrome and silo mentality. Fruitful collaboration between the Research and Development (R&D) department and Marketing can help to reduce friction between what is technically feasible and what can actually be sold to customers, as well as help turn inventions into products that meet customer demands.

External collaboration helps companies to utilize resources from other companies and make innovation projects more efficient. Collaboration can also improve the probability of success and reduce the development time of innovations. As discussed in the previous section at the industry level, the experts also confirm the high relevance of collaboration for the micro level of company activities (also see section III.3).

Interestingly, the experts believe physical location is only of minor importance (22 percent). This belief is rather remarkable in light of the works of Richard Florida on the concentration of creative workers in certain cities (see Florida 2003).

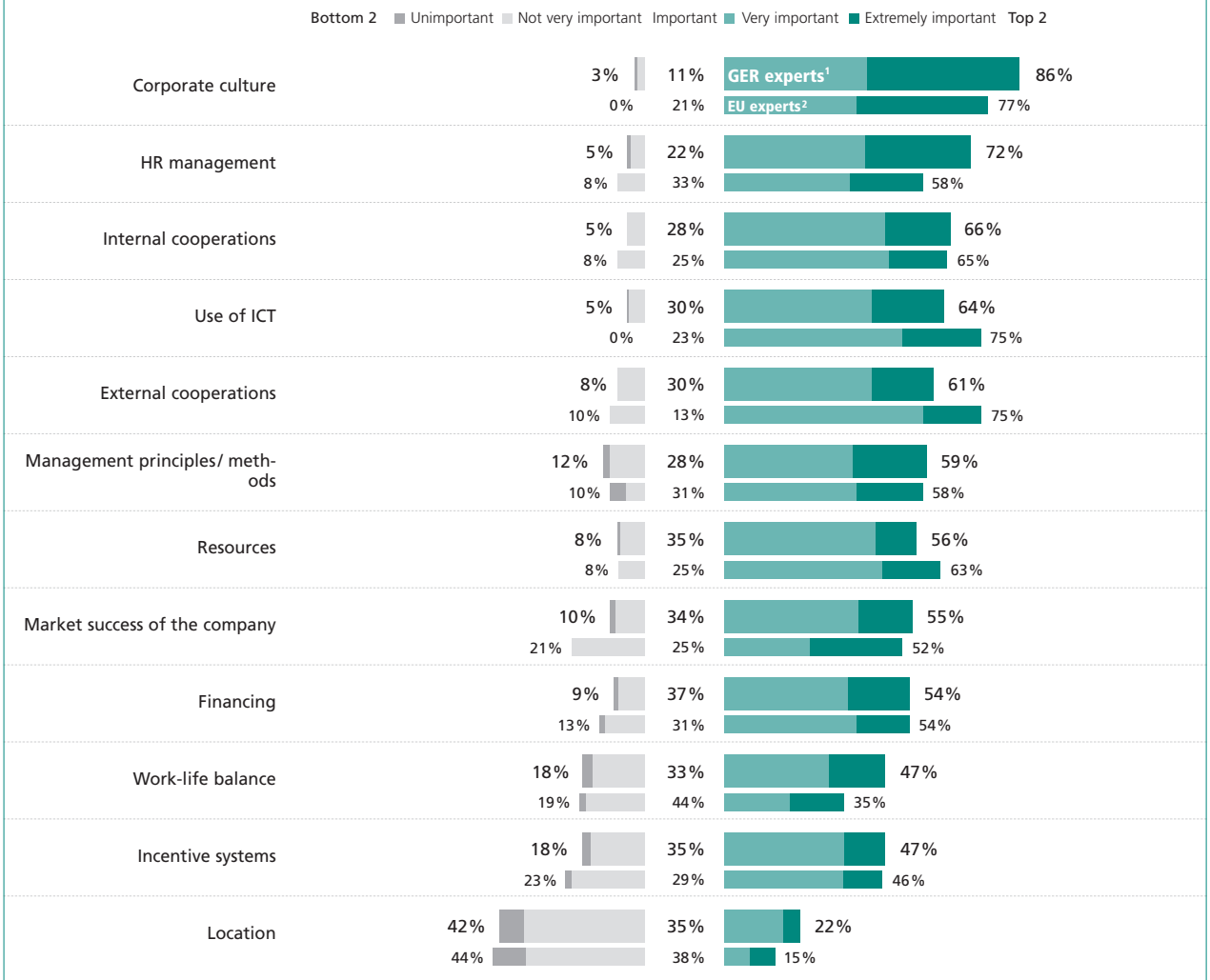
Criteria such as resource allocation, market success of the company, financing, work/life balance and incentive systems are attributed middle importance. One possible interpretation of these results is that these characteristics are essential basics: it is very difficult to innovate without them, but their presence does not make a decisive difference. All the same, the relatively low assumed impact of incentive systems (47 percent) is astounding. This could be explained by the fact that employees involved in innovations have comparatively high motivation in any case. Apparently, the experts assume that external incentive systems have a relatively low impact or possibly are difficult to implement.

Dealing with disruptive innovations is a major challenge to large companies

Disruptive innovations are new products, technologies and business models that are often inferior to solutions already available on the market in some criteria, but are still highly interesting to niche markets due to cost advantages or special characteristics. Because these innovations attract relatively few customers at the start of the product life cycle, the competing products are largely ignored by established companies, who fail to address the new markets with their own solutions. Over time, the attackers continue to develop the product until it achieves mass-market relevance. At this point, the established companies have a huge competitive disadvantage that can even result in their destruction. As such, by focusing exclusively on the needs of current mass-market customers, companies may fail to develop products for future mass-

Fig. III.22: Criteria for the innovation ability of companies

How important are the following criteria for the ability of companies to innovate?



¹ Experts for Germany, n=513; ² Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

market customers. This phenomenon is also called the "Innovator's Dilemma" (see Christensen 1997).

One of the topics of the expert discussion was how companies can pursue disruptive innovations while avoiding the innovator's dilemma. In particular, they examined how ICT can aid this process.

ICT can help to bring disruptive innovations to market more quickly

The experts do not see ICT as a driver of disruptive innovations per se. Instead, development time, balancing different cultures between R&D and product marketing, the involvement of top management and organization and company culture are seen as playing important roles in dealing with disruptive innovations.

"ICT can help in making it technically easier to bring those ideas to maturity and to market, but will not solve the basic issues that disruptive ideas are facing in a corporate environment."

ICT makes it easier for large companies to develop disruptive innovations and bring them to market more quickly from a technical standpoint, but not solve the basic problems that this type of organization has in dealing with disruptive innovations in general. For example, technical platforms can simplify the sharing of information within the company and with partner companies. The speed of the Internet and the availability of information through blogs, Twitter etc. make it possible to identify disruptive technologies and business models from start-up competitors more quickly, easily and cost-effectively than before.

Learning from mistakes and willingness to accept failure seen as critical cultural factors in dealing with disruptive innovations

Experts see the existing structures, organizations and risk incentives for managers as major reasons for the failure of disruptive innovations at large companies. They conclude that the possibility of failure must be accepted as an important part of disruptive innovations. Accordingly, start-ups are generally more successful in marketing disruptive innovations than large companies. German companies should see the entrepreneurial culture of large U.S. companies – such as Google and Apple – as a role model, to try out new things and evolve them based on customer feedback.

Furthermore, according to the experts, an innovative, creative, entrepreneurial culture requires the "right" people and the right mix of people with different experiences, sector-specific skills and age levels. As such, the study underscores the relevance of diversity as a factor in a company's power to innovate.

Intra-company start-ups can be an organizational solution to the innovator's dilemma

Entrepreneurial actions and mindsets at companies can also be supported through explicit organizational means, as incubation or spin-off. To facilitate this, the panel experts propose defining the establishment of start-ups and spin-offs as personal targets for R&D managers. R&D staff should be encouraged to pursue entrepreneurial thinking and develop business plans for their developments. This should be supplemented by training courses and support from other departments, such as marketing and controlling. As a framework for intra-company start-ups, the focus should lie on gaining initial customers and generating revenues. The team should finance itself through its own revenues and be measured by its generated sales.

Here, once again, the involved people play the decisive role in the experts' opinion. If a shortage of "natural entrepreneurs" exists within a company's own ranks, it can be useful to add entrepreneurial types or external experts to the team for the launch phase of the internal start-up.

"So, new concepts of involving employees for a time, but giving them the chance to drive their own vision in parallel would create a different culture."

Opening companies to ideas and solutions from suppliers and customers

Conventional closed Research and Development departments are increasingly becoming too slow and too expensive. As a result, more and more companies are trying to open themselves, to bring external ideas into the company and utilize external solutions for their markets and customers, thus saving time and money. This development is referred to as "Open Innovation" and has become a management fashion in its own right (see Chesbrough 2003, etc.). Chesbrough defines Open Innovation as follows: "[Open innovation] is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology (Chesbrough 2006)." Although the expert survey identified Open Innovation and collaboration as important factors for a company's ability to innovate (see Fig. III.22), the participants in the expert discussion see a deficit in this area: specifically, they criticize a lack of openness for new ideas at companies. The expert discussion contributed a series of specific approaches to opening companies.

ICT simplifies and accelerates the opening of companies to external ideas

Modern information and communication tools enable Open Innovation to a large extent; it was therefore hardly feasible or practical in earlier times. ICT can help speed up and simplify the opening of companies to the outside world through electronic idea platforms such as NineSigma, InnoCentive and yet2.com. In addition, search engines and industry portals make it easier to identify the relevant technology and product suppliers around the world.

In addition to opening a company to suppliers, universities and competitors, Open Innovation also encompasses involving customers and their ideas in the innovation process. Companies such as Dell and Starbucks, for example, use idea platforms to let their customers rate the submitted ideas directly and inform them of the status and implementation progress of submitted ideas. Creative competitions for customers can be held for fixed periods on online platforms such as Atizo, IdeaCrossing and HYVE. In addition, ICT can also be used to test new product concepts with customers visually, prior to production:

"Today, a well done website can reveal a great deal of the vision and capabilities of a new product at very low cost."

Fixed value chains change into fluid value networks

The increasing complexity of products is demanding collaboration among multiple partners across traditional sector boundaries, to create attractive products and services for customers.

"Globalization and technical progress lead to a change in the value-added chain of companies. Value-added chains become value-added networks, with many companies taking on different responsibilities in a research, development and production process."

This is creating myriad new challenges. Different companies and industry sectors have different standards and product life cycles, for example, which have to be coordinated and integrated to create an attractive portfolio for the market. To resolve these conflicts, the involved parties need common goals and a foundation of trust. The total benefit must be greater than that of a single company. One example of the successful establishment of this type of innovation network is the iPhone ecosystem and its App Store.

The integration of IT systems and collaboration across geographical boundaries requires a secure, functioning network between the participating enterprises. This includes

high-quality broadband communication links that enable the exchange of high-resolution moving images for video-conferencing, cloud storage and the collaborative editing of documents. The security of this shared information – protection against unauthorized access – is a high priority for companies, to prevent the outflow of mission-critical information and knowledge.

Summary and recommendations

To succeed among the global competition, increasing one's ability to innovate is of major importance. Unfortunately, the results of the survey are discouraging to those who hope that introducing a few management methods and IT systems will be enough to develop a company's innovative strength. To the contrary: the experts believe that factors such as management team, company culture and collaboration – which are difficult to influence and nearly impossible to change in the short term – have the greatest impact on the ability to innovative.

At the same time, a variety of activities in the organizational development area have been identified to increase the success of developments from company R&D departments. Spin-offs are seen as an important approach to promoting innovative ideas. They permit new ideas to develop without competing directly with existing core business. The opening of previously closed research and development centers at companies – through Open Innovation – is also ascribed high potential to improve the quality of ideas while simultaneously reducing development times and costs. The use of ICT can help to speed up implementation and improve process flows for the involved companies. Last but not least, process-changing activities such as the above can provide critical impetus to transforming outdated structures and restrictive company development paths.

III.6 Europe as a center of business

State of the European market

Information and communication technologies (ICT) play a significant role in today's European economy and are a decisive innovation driver. Europe holds a leading position in telecommunications (equipment and system technology) and continues to hold first place in research and development (R&D). This is especially true for wireless communication, where Europe continues to hold a leading role globally, due to the development of GSM (Global System for Mobile Communications), UMTS (Universal Mobile Telecommunications System) and, most recently, LTE (Long Term Evolution). SAP is a recognized global player for business software and European media companies are competitive internationally in their markets. The consumer electronics industry, however, has nearly completely disappeared from Europe.

Compared to the leading position of the United States in the ICT area, Europe has fallen far behind and will likely never be able to make up the lost ground. This was also confirmed by the study "Prospects and Opportunities of Information and Communication Technologies (ICT) and Media. International Delphi Study 2030": the majority of the surveyed experts stated that Europe will not be able to eliminate the lead of the United States with regard to competitiveness in the ICT sector – not even through targeted investments in research and development – and in software competency in the foreseeable future (see International Delphi Study 2030, 2009).

Thanks to innovative, educated engineers and software developers, as well as excellent R&D resources, new players such as China, South Korea and India have entered the market over the last ten years. They have established themselves in their large domestic markets and – even more importantly – benefit from more favorable conditions (labor costs, government regulation and public funding) than European companies. As such, it is no surprise that the surveyed experts place Germany and other European countries in the top or middle third in a global comparison of ICT trendsetting ability (see section III.1, Fig. III.2).

The surveyed experts believe that having a leading role in shaping new ICT trends is of vital importance for future economic development in Germany and Europe (see section III.1, Fig. III.1). At the present time, however, major elements of the ICT industry are not available in Europe. For example, Europe has failed to keep up with the Internet's transformation to an entertainment media, in which radio and television have converged. Attractive products like the iPad are extremely important, however, because they close the gap between "lean forward" (that is, more active) and "lean backward" (that is, more passive) media consumption.

Therefore, Europe will be forced to build leading ICT markets in new and up-and-coming areas to offer products and services based on flexible, interdisciplinary, powerful innovations. Technology and markets are undergoing rapid transformation, which means research and industry will have to demonstrate extreme flexibility. The Internet of the future, for example, will not only require the ability to generate knowledge and future standards, but also implement new technologies.

Some experts from the discussion forum hold the opinion that the trend toward open operating systems such as Android presents an opportunity for Europe to become a serious contender in the new market for application oriented Internet software.

"Due to the trend to open operating systems such as Android there is a chance for Europe to become a recognized player in the evolving market of application oriented software."

When we examine Europe's position, it is clear that Europe is clearly leading in the development of infrastructure and integrated system technology and in the design of application-specific integrated circuits (ASICs) and embedded software and systems. In the transportation sector, for example, Europe is the global leader thanks to the high ICT share in automobiles, heavy trucks and trains. Since ICT plays a major role in these consumer products, they can indirectly be considered ICT markets. European companies also hold a leading position in the creation of intelligent systems, such as driver assistance and traffic efficiency. A key characteristic of these systems is that they combine and integrate different technologies – such as material, hardware and software – to create a complex solution. Another strength of the European economy is their balanced system of major corporations, small and medium-sized enterprises (SMEs), research institutes and universities. The networking and collaboration between these partners is an essential prerequisite for maintaining the economic strength of the European ICT sector. Nearly three-quarters of the surveyed experts hold the opinion

that ensuring added value in the ICT sector is of very high or extremely high importance for the economic development of the respective country (see Fig. III.23). The majority of the surveyed Germany experts see Germany's position in the middle third in international comparison; the Europe experts rate the positions of their respective countries similarly (see Fig. III.24). When asked which players are responsible for ensuring added value in a given country, the majority of both the Germany (88 percent; see Fig. III.25) and Europe experts (71 percent) responded the overall economy. At the same time, the experts also believe that politics must play an important role (Germany experts: 70 percent; Europe experts: 65 percent).

Future ICT market potential in Europe

Information and communication technologies are a trend-setting factor for the economy, society, and every individual. The user of ultramodern technologies based on ongoing, groundbreaking innovation in ICT and their convergence with other technologies in the areas of energy, automation, mobility, construction and healthcare – to name just a few – underscore their importance. Global challenges such as climate change, urbanization and demographic changes will continuously unfold myriad potential and new business concepts for industry and society in Europe.

Fiber optics

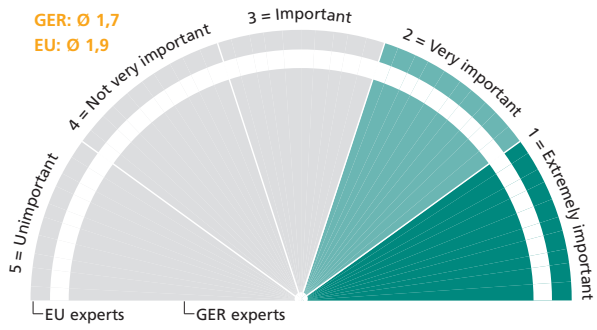
One market that is developing at nearly blinding speed, and in which Europe absolutely must play an active role, is fiber-optic technology for high-speed Internet access. The U.S. and many Asian countries invested in new fiber-optic infrastructure and rapidly rolled out their fiber-based networks long ago, while Europe fell behind. Accordingly, new business areas and applications will develop outside of Europe.

A major reason for this development is that Asian communication infrastructures are subsidized and controlled by the state. In contrast, Europe follows a market-based

Fig. III.23: Ensuring value creation in the ICT environment in your own country – Importance

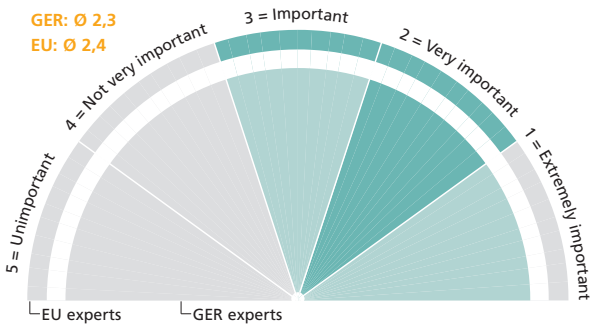
How important is ensuring value creation in the ICT environment in your own country for economic/social development in Germany (<country>)?

Economic importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	0 %	3 %	12 %	39 %	45 %
EU experts[2]	0 %	4 %	19 %	37 %	40 %

Social importance



	Un-important	Not very important	Important	Very important	Extremely important
GER experts[1]	1 %	8 %	29 %	37 %	23 %
EU experts[2]	0 %	12 %	33 %	37 %	17 %

■ ≥ 40 % of experts ■ 30 – 39 % of experts ■ 20 – 29 % of experts ■ < 20 % of experts ■ Averages

[1] Experts for Germany, n = 513; [2] Experts for European countries, excl. Germany, n = 52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

approach, which makes it more difficult to connect rural areas – which in turn prevents these areas from capturing new business potential. Since the onset of the financial crisis, however, Europe has tried to change the regulatory regime to promote investment and expansion; these efforts are to be intensified to avoid falling further behind. After all, upgrading the broadband infrastructure is an essential prerequisites for the activities that will be critical to services in the information age, such as multimedia applications. Moreover, an upgraded infrastructure is necessary to design and develop competitive premium products and services, as the participants of the online expert discussion emphasized:

"The improvement in broadband infrastructure is an essential prerequisite not only for businesses to participate in the services of the information age, i. e. multimedia services, but to innovate and develop competitive, cutting-edge products and services."

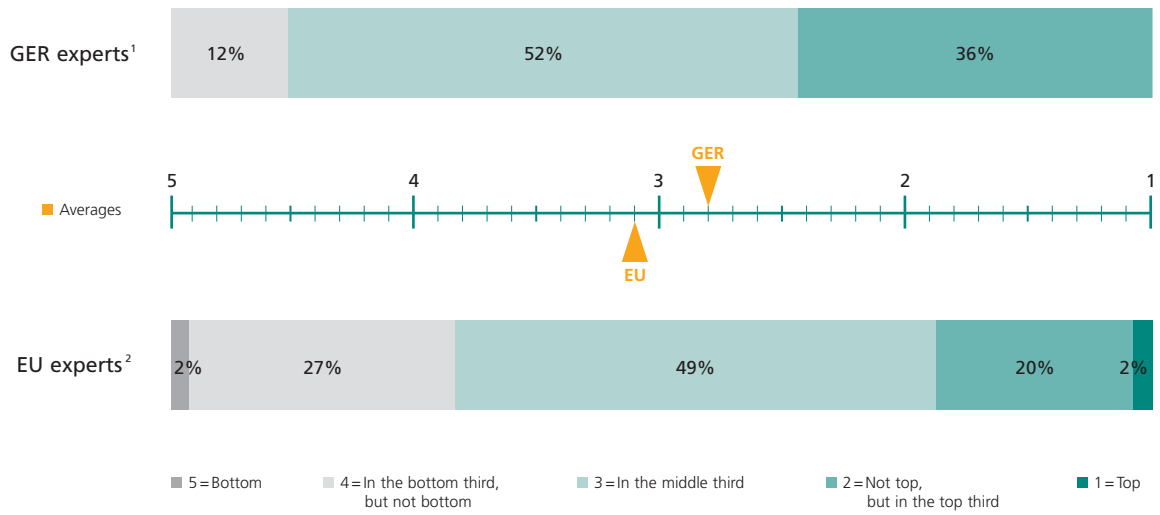
Unfortunately, there are no simple solutions for business models or for the financing of investment in broadband networks, since the regulatory framework differs widely throughout Europe and public budgets are already overstressed. Nonetheless, Europe must find solutions to these problems – the faster, the better.

ICT in industrial applications

The convergence of ICT with other technologies – in the areas of biology, energy and healthcare, for example – not only emphasizes their importance, but also opens new business potential for industry and society in Europe. Since Europe, and especially Germany, render outstanding services for system integration and the technical development of complex service systems, this represents a major opportunity to enter the global ICT market, where these skills are needed.

Fig. III.24: Ensuring value creation in the ICT environment in your own country – Position

And how do you think Germany (<country>) is positioned on ensuring value creation in the ICT environment in your own country in an international comparison?



[1] Experts for Germany, n = 477; [2] Experts for European countries, excl. Germany, n = 49
Basis: All people surveyed with special expertise in the topic area; information based on valid responses

If Europe wants to boost the economic value of ICT, it also needs to intensify its efforts for financing R&D, particularly in the area of new applications such as energy-efficient cars, smart electricity grids, e-health and autonomous robots to assist everyday life.

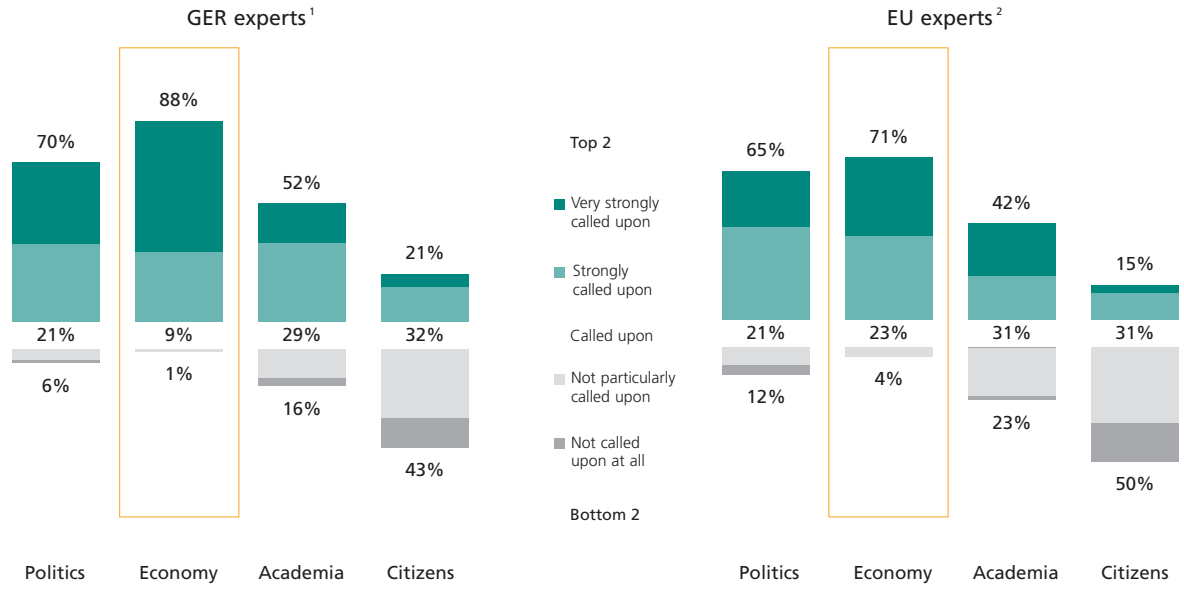
The financing levels for these initiatives are far lower in Europe than in the United States and China, however. But Europe will only survive in an ICT economy if it commits to at least the same funding levels as these countries. Whether cutting-edge cars, sophisticated machinery, robotic technology equipped with embedded systems, environmental technology and even biotechnology – Germany is one of the leading nations in these areas. However, it has fallen behind in the areas of digital media, consumer electronics, content management and entertainment products. By all appearances, Europe has not yet come to terms with new markets for digital media. Therefore, it will be difficult to raise the necessary financial resources and find the right people who are needed to drive innovative ICT forward in this area.

Internet technology and applications

When considering which products and services Europe should concentrate on in future, the respective current life cycle status is a crucial factor. A strong commitment toward products that are already established makes no sense, because the profit margins – and thus the contribution to European prosperity – are insignificant. This is true of the media sector in particular, but also of the semiconductor industry. As to new developments such as the iPhone, Europe no longer has an industrial base to become active in these areas. Since costs are high in Europe, the region has to concentrate on products and services with the greatest future potential. As such, it is crucial to promote innovation efforts more than is the case today.

Fig. III.25: Ensuring value creation in the ICT environment in your own country – Players

When you think about Germany (<country>), to what extent will the following players be called upon in the future to ensure value creation in the ICT environment in your own country?



[1] Experts for Germany, n=513; [2] Experts for European countries, excl. Germany, n=52
Basis: All people surveyed with special expertise in the topic area; excluded from 100 percent: don't know/no answer

Europe also trails in the areas of Internet technology and applications, as their development efforts formerly focused on telecommunications networks, services and applications. Still, the intensive growth of the Internet is increasingly resulting in the convergence of communication networks and Internet applications. Just as the concept of NGNs (next generation networks) was gaining in importance, however, European manufacturers of telecommunications equipment exited the market. This technology was not a traditional strength of the European suppliers and was therefore neglected.

On the other hand, the Internet is based on the global availability of telecommunications networks and on sufficient capacity to support a wide spectrum of current and future services and applications. In fact, the increased use of video applications will require even greater capacity in communication networks – both fixed-line and cellular/wireless. In addition, there is a global trend toward combining ICT systems with other applications – for example, intelligent energy, transportation and logistics solutions to deal with the "future challenges" of climate change, demographic change and urbanization. The increased use of ICT and Internet technologies in other sectors helps to boost the efficiency of processes and resource consumption. Since the development and integration of complex system is a European strength, this presents new potential for the ICT sector and research community to help enhance the Internet – in combination with ICT and other sectors – within the framework of an end-to-end approach. Technical developments need to be combined with the necessary application scenarios to meet the challenges and design the architecture of future systems.

Standards are a European business area

Normally, individual countries do not have sufficient influence to develop and set standards on their own. Standards are of major importance in ICT markets, although they are often implemented unofficially at first, as de facto standards, and are only ratified by the official standardization bodies later. Industry-wide and cross-industry standards have to be developed and implemented for many of the business areas mentioned above. Therefore, these groups have to develop coordinated proposals for suitable standards and interfaces, a task that requires the support of neutral committees of experts who can help to design open platforms.

In the expert discussion, it became clear that European companies are increasingly withdrawing from standardization bodies. From the individual company point of view, however, participation in standardization bodies should be considered whenever a newly developed product or service has to conform with certain standards. The company could then benefit if it were able to influence the standards positively. GSM in the 80s and 90s is a good example of this, while today LTE, broadband, AAL (ambient assisted living, systems to assist the elderly), smart metering, car-to-car communication and other innovations are subjects of increasing interest.

"I don't think that a general 'European Standardization Strategy' is needed, instead the various areas have to be analyzed and it must be decided what has to be standardized to ensure interoperability but also allow for competition."

As soon as products and services become part of a (complex) system, however, standardization bodies no longer represent the sole path to success. From this point, the trend is moving toward national or even international groups of experts, such as the National Platform for Electromobility in Germany. The members of this committee come from the manufacturing industry, academia, politics, local authorities and consumer organizations. All these partners benefit from their early, active participation in the respective topic at hand and have made contributions to defining standards.

Barriers to the European ICT sector – lack of entrepreneurial drive

The ICT sector in Europe faces several barriers, but one of the most important is the lack of entrepreneurial drive. Innovations and new, sophisticated, breakthrough concepts have to be developed by both SMEs and large companies. In addition, the large companies have to promote a strong entrepreneurial spirit and the corresponding practical activities. This involves certain risks and demands a deviation from conventional behavior, which is anything but an easy step for a company that is already successful in its market segment. This mindset was widespread in the traditional European telecommunications market. In the short term, established industries could change their incentive systems and actively promote "non-conformist" (i.e. unconventional) thinking and actions. In the long term,

they will have to focus on training young people to be entrepreneurs, not just technical specialists. One extremely successful product that has pursued this line of thought successfully for many years now is the Center for Digital Technology and Management (CDTM), a center of excellence founded jointly by the Ludwig Maximilian Universität München (LMU) and the Technische Universität München (TUM). The degree program "Technology Management" was established in 1998 as an elite course of study to give students practical experience in technology research, product development, information systems management, business planning and entrepreneurship, in addition to application-based theory and method knowledge. Another large-scale project is the EIT ICT Labs, an initiative of EIT (the European Institute of Innovation and Technology) aimed at closing the gap in entrepreneurial drive and innovative strength. This program strives to establish excellence through collaboration in education and research and systematically drive the transfer of innovations to the market.

Public funding and venture capital management

Europe needs to maintain a high level of investment in R&D to preserve its leading position in ICT development. However, its corresponding culture of venture capital management and financing is not sufficiently developed. Accordingly, funding often poses the greatest obstacle for development projects, especially at small companies. 82 percent of the surveyed experts believe the financial support of small and medium-sized enterprises to be very important or extremely important to Germany's economic development (see section III.4, Fig. III.19).

Europe has launched ICT programs and developed the concept of a European Research Area (ERA) since the year 2000. The initial idea was to achieve the critical mass that is required to improve Europe's position among the global competition, with the aid of the involved partners and institutes. In the meantime, a European research and innovation system has been established to harmonize national interests and guidelines. There are public funding programs at the national and European levels (such as FP7) that enable a longer-term perspective and thus even more groundbreaking innovations. In the ICT area, the "Future Emerging Technologies" (FET) program is dedicated to interdisciplinary basic and applied research to promote scientific discoveries and technological innovations.

Small and medium-sized enterprises contribute actively to the ICT program. Custom-tailored financing instruments to distribute risk need to be introduced to reflect the SME-specific funding demands. When a small company requests financial support for a project, it may be positioning itself in that precarious area between investment and profit. For this reason, only few companies are willing to invest in interesting new projects. Financing programs have to be modified to take this fact into account.

As a result of strong fragmentation and debilitating red tape, public funding programs lose their attractiveness over the years. Accordingly, the EU should pursue more risk-tolerant, trust-based funding policies. A simplification must be given absolute priority, as the new EU commissioner for research and innovation has already recognized (see European Commission 2010).

Another obstacle that must be overcome is the acquisition of additional marketing skills. In some cases, European entrepreneurs have been able to offer innovative, promising solutions and services, even in the B2C area in the Internet. Nonetheless, they lacked the skills and/or financial means to market their innovations globally and were subsequently either bought out or marginalized by their international competitors.

Nonetheless, 58 percent of the Germany experts rate the framework conditions for developing ICT innovations in Germany as largely positive or very positive (see section III.3, Figure III.9).

Europe primarily a small, multilingual region

Although the total revenues generated in Europe are significant, the markets are split into small segments that always have to be examined from two perspectives: language and regional administration of justice and regulation. If a company tried to implement an electronic payment system in the euro zone, for example, the mountains of regulations that would have to be met would be unbearable for a small company and at least fraught with risk for a large one. As a result, the testing and maturation process for many innovative ideas takes place in other markets (such as the U.S.) first, which is clearly disadvantageous for European development and value creation.

Instead of viewing the language and regulatory differences

of the European market as obstacles, they should be embraced and turned into advantages for the ICT market. After all, this market is ideal for developing new services and devices for other (new) markets first. Moreover, this market peculiarity can also represent an opportunity for small European companies, which can offer custom-tailored systems and services for individual countries.

Summary and recommendations

The future sustainability of the European economy depends largely on its capacity to innovate and to compete in the international arena. Therefore, a strong ICT sector must be the primary goal of all market players. To achieve this, it is essential to create the necessary framework.

Information and communication infrastructures, along with media, are taking on a central role in business and society. The positive development of ICT and media is highly dependent on the correct location factors. When we examine Europe, it is clear that certain basic conditions that are essential to securing a competitive position are currently not provided in international comparison. Specifically, the promotion of entrepreneurship and the corresponding funding of new projects. There is a definite need for activity in this area; politics and the economy must provide the appropriate impetus. Several promising initiatives, such as the EIT ICT Labs, have been launched. To benefit from unconventional approaches in future, however, additional initiatives will have to be started and supported.

The future position of Europe will depend largely on how it deals with new methods and markets. Europe has already missed trends in the entertainment sector and microelectronics; the experts believe these deficits can never be made up (completely), even in the long term. Therefore, it is essential to make sure that no further trends are neglected. In the experts' opinion, it is essential to concentrate on Europe's strengths and utilize them to tread new paths.

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