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ICT as innovation driver

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Text and editing

TNS Infratest Business Intelligence

Overall Responsibility:

Dr Sabine Graumann, Prof Dr Irene Bertschek

Project Management: Tobias Weber

With the collaboration of Anselm Speich, Dr Jörg Ohnemus,

Dr Christian Rammer, Thomas Niebel, Patrick Schulte,

Michael Weinzierl, Tobias Rachidi, Felix Schörner

Design and production

Kathleen Susan Hiller, viaduct b.,
PRpetuum GmbH (cover)

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Malte Knaack

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Central procurement service:

Tel.: +49 30 182722721

Fax: +49 30 1810272271

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Welcome

The Digital Economy plays a strategic role in Germany's future viability. Whether it be Industry 4.0, smart services or intelligent networks: the digital transformation concerns all sectors. Furthermore, the Digital Economy is a main innovation driver. Since the beginning of 2013, 36 percent of German industrial companies have come up with product or process innovations or new business models where the use of ICT plays a key role.

The positive effects of digitisation can only unfold if the digital transformation is firmly rooted in the centre of society and is accepted and actively shaped by all societal groups and the industry. This means that a strong Digital Economy is essential for safeguarding Germany's future economic strength. The report shows that the German ICT sector accounts for 4.7 percent of commercial value creation – placing it on par with the automotive industry and ahead of the mechanical engineering sector. Compared to the leading 15 ICT-nations, Germany remains in a good fifth place. However, there is some catching up to do, for example when it comes to internationalization of the German small and medium-sized enterprises (SMEs) and their export rate. If we could improve here, this could provide new stimuli for growth and move Germany further up the ranking.

The shaping of the Digital Economy and society is a key task for the Federal Government which we are implementing across departments and Ministries through the Digital Agenda. I regard the digitisation of the economy (Industry 4.0), the systematic digitisation and net-



Matthias Machnig,
State Secretary at the Federal Ministry for
Economic Affairs and Energy

working in the energy, health, education, transport and government sectors, ensuring a high level of IT security and supporting new companies, company founders and medium-sized firms as key parts of the Digital Agenda. However, the Digital Economy and society can only be shaped successfully if all stakeholders from the industry, society, science and politics work closely together. In implementing the Digital Agenda, we want to seize the opportunities that digitisation presents and rise to the challenges ahead. As a central platform for digitisation, the National IT Summit is geared to the Digital Agenda and is being developed further.

I would like to thank all of the experts who contributed to this successful monitoring study by taking part in workshops and discussions. I look forward to working with everyone involved from the fields of politics, industry, science and society in the future – whether it be during the IT Summit or as part of the continuous monitoring project.

Management Summary

€ 226 billion ICT sector
turnover

4.3 % of global
ICT turnover

€ 85 billion Internet economy
turnover

over **1,000,000** in the ICT sector
jobs

5th place for
global performance

4.7 % through the ICT sector
of value creation

7.2 % start-up rate
in the ICT sector

36 % of industrial companies with
ICT-based **innovations**

Management Summary

ICT as an innovation driver

The Digital Economy is opening up tremendous opportunities for improving our economic vitality and future viability. The penetration of all areas of the economy with new information and communication technologies (ICT) and applications is a decisive factor in Germany's current and future competitiveness. Whether it be Industry 4.0 (i. e. networked production), intelligent networks or new Internet applications, the innovative nature of the Digital Economy is revolutionizing the way we live our lives, learn, work and manage our affairs.

In the “Monitoring-Report Digital Economy 2014”, TNS Infratest Business Intelligence together with the Center for European Economic Research (ZEW) Mannheim have analysed the added value that the Digital Economy generates for Germany. How Germany as a business location compares with other nations and how far information and communication technologies act as innovation drivers is analysed in this report.

Central results

Germany's Digital Economy is in a good fifth place in the global performance ranking of the leading 15 ICT nations. Germany has retained its fifth place in the global ranking from last year. As far as ICT turnover is concerned, Germany is well positioned. Accounting for 4.3 percent of global ICT turnover, the country is in fourth place.

With over 91,000 companies and more than a million employees, the ICT sector is an important sector of the German economy. The ICT industry accounts for 4.7 percent of the overall German commercial value creation. It is on par with the automotive engineering sector and actually ahead of the mechanical engineering industry. When it comes to investments, the ICT sector is well ahead of the other sectors, too. In 2013, € 15.4 billion was invested. This equates to nearly 3.6 percent of all investments in the commercial economy. In 2013, the sector generated a total turnover of around € 226 billion.

The Digital Economy is an innovation driver for the traditional industries. Since the beginning of 2013, a total of 36 percent of all industrial companies based in Germany have introduced ICT-driven innovations.

The German Digital Economy compared to that of other nations

In order to measure the global performance of Germany as a business location, we identified and collected data on 33 key indicators which illustrate the market strength of the Digital Economy, the overall infrastructural framework conditions and the extent to which applications and technologies are used from individuals, businesses or governments. These quantitative data were indexed, aggregated and weighted in order to measure the performance of the locations in one figure which would allow to aggregating all findings to an international comparison and ranking.

Global performance: In terms of the performance of its Digital Economy, Germany remains in a good fifth place with 47 out of 100 points. The country has retained its position from last year. At the same time Denmark has moved up to rank four which was in Germany's fifth place last year. The leader in the 15-nation ranking are the USA with 81 points, followed by South Korea in second place with 54 points. Great Britain performed better in a number of key performance indicators and finished in joint third place together with Japan (53 index points each). The field is very tight from fifth place onwards. Only three index points separate Germany (the first of the next-placed group of countries) in fifth place and France in tenth place.

Germany has reached seventh place in the **market performance**. As far as the assessment of **infrastructure** is concerned, Germany finished in sixth place. In the **usage** analysis, i. e. the use of new technologies and applications by citizens, companies and government agencies, Germany moved up a place and is now fifth-highest in the ranking. Germany ranks higher for global performance in the fifth place because the other nations perform better in subcategories but considerably worse in the majority of others. This means that they fall back in the overall ranking.

DIGITAL SECTOR index: development of digitisation in the various sectors

This year, the DIGITAL SECTOR index was calculated for the first time. The index measures how far digitisation has progressed in various sectors. Among the 21 sectors examined, the telecommunications companies have the highest DIGITAL SECTOR index score (83 points), closely followed by further sub-sectors from the service sector. Automotive engineering, one of the traditional sectors in the manufacturing industry, was in sixth place with 72.2 index points. With around 40 index points, the highest increase in the number of points in the period from 2003 until 2011 was recorded by the textiles, clothing and leather industry. In spite of considerable gains since 2003, the construction industry remains in last place with 36.6 points. A one percent increase in the DIGITAL SECTOR index is accompanied by an average 0.28 percent increase in productivity. In addition, the final demand for ICT generates just under € 70 billion of added value in other sectors and helps to secure around 421,000 jobs outside the ICT sector itself.

Key findings & figures relating to the Digital Economy in Germany

In order to measure the importance of the German Digital Economy, we have analyzed selected key performance indicators for the ICT sector. We have compared the results with the key figures from other economically significant sectors such as automotive engineering or the chemicals and pharmaceuticals industry. In order to provide information for the entire Digital Economy, we have calculated what turnover is generated in the Internet economy, i. e. through the Internet.

Value creation: Since the financial crisis, the ICT sector's gross value creation increased significantly to around € 89 billion in 2013. With a 4.7 percent contribution towards commercial value creation, it remains on the same level as in the previous two years and is on par with automotive engineering (4.7 percent) but ahead of mechanical engineering (4.5 percent).

Turnover: In 2012, the ICT sector generated an overall turnover of around € 222 billion. In 2013, this figure was around € 226 billion. This is approximately € 4 billion more than in 2012 but still around € 2 billion less than

in 2011. In 2013, the ICT hardware manufacturers are largely responsible for these fluctuations in turnover. In contrast, the ICT service providers have recorded constant turnover growth since 2010.

Jobs: 1,034,433 people (including self-employed persons) currently work in the ICT sector. As a result, the level of employment in the sector has risen by around one percent compared to the previous year. Since 2009, the number of people working in the ICT sector has increased by 12.9 percent. In absolute terms, this means that almost 118,000 additional jobs have been created within the sector. The ICT sector accounts for 4.2 percent of all commercial employment in Germany. It lies ahead of automotive engineering and well ahead of the chemicals and pharmaceuticals sector.

Gross fixed capital investments: In 2013, the ICT sector invested a total of € 15.4 billion in capital equipment that they either acquired or produced themselves. This equates to around 3.6 percent of all gross fixed capital investments for the German commercial economy. This means that investments in the ICT sector increased by just under 3.7 percent between 2012 and 2013.

Internet economy: In 2013, the Internet economy was worth nearly € 85 billion. This figure equates to around 3.1 percent of gross domestic product. Between 2011 and 2013, the Internet economy grew continuously, both in terms of its value and its contribution to GDP.

Start-ups: In the ICT sector, around 7,000 companies a year were established between 2011 and 2013. In relation to all existing companies, this corresponds to a start-up rate of 7.2 percent. This figure is higher than in all the other sectors. For example, the consultancy and creative sector achieved a start-up rate of just 5.2 percent in the same period.

However, the start-up rate is declining overall. In 2013, the number of start-ups in the ICT sector decreased for the fourth year in succession and fell below the level in 2008. This means that the minor start-up boom between 2009 and 2011 is now over. The ICT service providers are responsible for this decline. For the first time in one and a half decades, the number of start-ups in 2013 fell well below the level encountered in the mid-1990s.

ICT as an innovation driver in Germany

Spending on innovations: In 2012, the companies in the ICT sector in Germany spent € 13.3 billion on innovation projects. Compared to the previous year, this equates to a fall of 12 percent. The ICT sector accounts for 10.2 percent of spending on innovations in Germany. ICT service providers spend the largest part of the ICT sector's innovation budget (€ 10.06 billion). In 2012, the ICT hardware sector spent around € 3.29 billion on new products or processes.

Innovator quota: The “innovator quota” refers to the proportion of companies that have introduced at least one new product or process within a three-year period. In 2012, the innovator quota, i.e. the proportion of innovative companies in the German ICT sector was 77 percent – three percent below the figure for the previous year. Nevertheless, no other sector achieves such a high innovator quota as the ICT sector. The ICT sector is well ahead of the next-placed sectors, namely the chemicals and pharmaceuticals industry (71 percent) and mechanical engineering (70 percent).

Innovations through ICT: Since the beginning of 2013, more than half of ICT companies have come up with product or process innovations or new business models where the use of ICT played a key role. In industry, this figure is 36 percent. Across all sectors, software and the Internet are key components for companies that have come up with ICT-based innovations since the beginning of 2013. More than half of companies in the ICT sector are planning ICT-based product or process innovations before the end of 2015. In the media sector, this figure is just under half, while it is over a third among knowledge-intensive service providers and industrial companies. Regardless of the sector, companies working on ICT-based innovations believe that software and the Internet will be the most important components between now and the end of 2015. The importance of IT hardware and telecommunications for innovations should not be underestimated in industry and the media sector. Cloud services and embedded systems are particularly relevant for knowledge-intensive service providers.

Recommendations & fields of action

With the Digital Agenda, the Federal Government adopted a key guide for economic and innovation policy. The Federal Ministry for Economic Affairs and Energy, the Federal Ministry of the Interior and the Federal Ministry of Transport and Digital Infrastructure established a cross-departmental “Digital Agenda” steering committee and are jointly responsible for implementing it. The Digital Agenda sets out guidelines for the Federal Government's digital policy and bundles together all measures in seven main action areas. Based on the analyses in the “Monitoring-Report Digital Economy 2014” as well as discussions with experts and workshops, we can come up with the following recommendations for the main actions areas of the Digital Agenda in Germany

I. Digital infrastructure

Compared to other nations, the level of fiber optic penetration in Germany is far below average. With a fiber optic penetration rate of just one percent, Germany is in last place on a European level. Although the latest technologies such as vectoring allow relatively high speeds, coverage will not be sufficient in the medium to long term. Companies will no longer accept to set up operations in a country which does not offer comprehensive, high-speed broadband connections. High-speed networks are also crucial for innovation in Germany.

Mobile broadband is helping to accelerate the provision of universal broadband access. However, the relevant infrastructure will need to be further developed and upgraded on a continuous basis in order to keep pace with the increasing need for data.

Politicians and industry should therefore work together to push ahead with the development of high-speed network infrastructures. Investments in networks are essential for innovations to foster ICT applications. The companies based in Germany require not only high-speed, ubiquitous networks. Networks must be secure in order to reap the full benefits of digitisation for the German society and its economy.

II. The Digital Economy and digital workplace

Networked production (Industry 4.0) will fundamentally change value creation chains. New business models will arise as a result. The DIGITAL SECTOR index shows that the degree of digitisation will have a massive impact at the very heart of our economy. According to the experts key areas of concern are:

- ▶ **Technological megatrends:** There should be a particular focus on the opportunities resulting from technological megatrends such as cloud computing, 3D, mobile apps and social collaboration (especially relevant are the emerging fields of industry, i. e. energy, health, traffic and education in particular).
- ▶ **Data are the new “oil”:** Ever greater volumes of data (so-called “big data”) are being interconnected to build smart data, resulting in new products and smart services. The various options offer significant opportunities for generating smart services in all sectors and in numerous application fields.
- ▶ **Industry 4.0:** Medium-sized German enterprises will have a good chance of achieving growth if they work together with large players in the field of Industry 4.0. Links or interconnected cooperations between big companies and small and medium-sized firms, i. e. networked production or “Industry 4.0” have the potential to recast value added chains and will dramatically influence the business models of Germany’s leading industry sectors such as plant and mechanical engineering, car manufacturing, electrical and medical engineering.

III. Innovative public administration

The Federal Government should play a leading role in implementing a digital transformation within the public sector. The State, as a major procurer of IT services, should play a leading role in promoting innovation and security in IT.

The e-government services offered by the State should be attractive, user-friendly and secure services to be further promoted. To date, the provision of electronic services for public administration has not yet come to a breakthrough in Germany. Compared to other nations, Germany is only in tenth place here. German citizens are expecting digital services from public authorities in the same efficiency and user-friendliness as from private service providers.

IV. Shaping digital environments in society & work

Digitisation is resulting in huge changes in the world of work. The focus of civic work and engagement is increasingly shifting online. Digital processes and products play an important role in anything from knowledge work to production. For example, 40 percent of German companies use cloud computing, and 90 percent have their own company website. It is important to actively shape, communicate and support the opportunities and benefits offered by the ongoing digitisation of work (especially in light of the lack of specialized personnel). We must empower all those living in our country to control their own access to and engagement with the digital daily environment.

V. Education, science, research, culture and media

Germany should attach importance to its digital and technological supremacy in the field of ICT and must always be in a position to develop its own modern systems. Independent IT research cannot take place without any own industrial IT production in the country.

Value-creating innovations are no longer the result of technological developments alone. They are also achieved through process innovations and by introducing new technologies in existing value chains. Compared to other sectors, the innovation focus of ICT companies remained very high in 2012, while there were sharp falls in the innovator quota in certain other sectors. No other sector achieves such a high innovator quota as the ICT sector. Small and medium-sized enterprises (SMEs) should profit from this unique opportunity.

In the area of education, Germany as a business location needs to encourage interdisciplinary study courses in order to speed up the development of concepts such as Industry 4.0 or innovations in the smart services field. These steps will better equip people to meet the requirements of the digital working environment and the knowledge society. After all, there is still room for improvement when it comes to technical or management qualifications and specialists' international experience. We must analyse more effectively training needs, further training and continuing education and where necessary develop and / or enhance measures to implement them. Despite the fact that Germany moved up from sixth to fourth place as regards the quality of mathematical and scientific trainings in 2013, companies themselves should continue to provide training.

VI. Building security, protection and trust within society and the economy

Data protection and security are key requirements to reap the full benefits of digitisation for the German society and its economy. As far as users are concerned, the aim is to protect the privacy of individuals and their communication on the Internet. We must ensure that every individual is in a position to protect themselves and their data online. We must help people to increase their awareness and knowledge of online security. After all, just under 60 percent of German Internet users still do not take adequate precautions to protect themselves when online. From a technical point of view, it is important that all relevant stakeholder groups work closely together in order to further increase the level of security online. These include politicians who define the rules for the Internet, appropriate authorities who are combating Internet crime as well as the manufacturers and providers of new applications who need to take into account security issues when designing their products or services.

VII. European and international dimensions of the Digital Agenda

From an economic policy point of view, rules and conditions for the global network cannot be created solely at national level, but must be rooted and supported at European and international level. German digital policy must be embedded in a European and worldwide context. Coming up with a Europe-wide data protection directive and harmonized copyright laws in the EU are examples of the necessary measures to protect and expand an open, free and secure global Internet. It is important to come up with laws which ensure the same conditions for all market players.

Outlook

The “Monitoring-Report Digital Economy 2014” shows that the Digital Economy in Germany is a fundamental building block of a competitive service society. The fact that technological megatrends such as big data or smart services, cloud computing, 3D, mobile apps, social collaboration and Industry 4.0 are coinciding is a one-off phenomenon. All companies or customers from virtually all sectors are involved in the digital transformation. This is resulting in groundbreaking changes in economic, scientific, political and social fields. Digital value creation and networking will stimulate future growth and drive efficiency in our digital world.

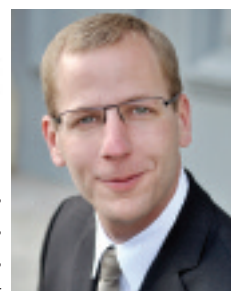
The Digital Agenda covers seven main action areas describing how to implement it. One of the key issues is the alignment of the IT Summit with the Digital Agenda. The implementation of the Digital Agenda requires a continuous and close dialogue of all relevant groups and stakeholders under a single umbrella. We should open up the German national IT Summit as a platform for collaboration between policymakers, industry, science and civil society to facilitate a process of broad social and economic dialogue.

At this point, we would like to thank all of the experts who contributed to this study by taking part in workshops and discussions.



Dr. Sabine Graumann,
Senior Director,
Business Intelligence,
TNS Infratest

S. Graumann



Tobias Weber,
Project Manager,
Business Intelligence,
TNS Infratest

Tobias Weber

The added value of the Digital Economy

4.7 % through the ICT sector
of value creation

Over 1,000,000 in the ICT sector
jobs

€ 226 billion ICT sector
turnover

€ 85 billion ICT Internet economy
turnover

€ 15.4 billion in the ICT sector
gross fixed capital investments

The added value of the Digital Economy

ICT as a growth driver for all sectors

What added value does the Digital Economy, i.e. the ICT sector and the Internet economy, create for Germany? This question is answered in the first part of the “Monitoring-Report Digital Economy 2014” from TNS Infratest Business Intelligence and the Center for European Economic Research (ZEW) Mannheim.

DIGITAL SECTOR index: ICT penetration in other sectors

This year, a DIGITAL SECTOR index was calculated for the first time. The index measures the progress of digitisation in various sectors. In 2003, the DIGITAL SECTOR index score for the electrical equipment and mechanical engineering sector was 38 points. By 2011, a score of 66 points was achieved. The level of digitisation in this sector increased by 74 percent between 2003 and 2011. In the automotive engineering sector, the DIGITAL SECTOR index rose from 46 points in 2003 to 72 points in 2011. A one percent increase in the DIGITAL SECTOR index is accompanied by an average 0.28 percent increase in productivity. In addition, the final demand for ICT generates just under **€ 70 billion of added value** in other sectors and helps to secure around 421,000 jobs outside the ICT sector itself.

The ICT sector accounts for almost five percent of overall commercial value creation

With over **91,000 companies** and **more than a million employees**, the ICT sector is an important industry of the German economy. The ICT sector accounts for **4.7 percent** of the overall German **commercial value creation**. It is on par with the automotive engineering sector and ahead of the traditional mechanical engineering sector. When it comes to investments, the ICT sector is well ahead of the other sectors compared in the study, too. In 2013, € 15.4 billion was invested. This equates to nearly **3.6 percent of all investments in the commercial economy**. In 2013, the sector was expected to generate a **total turnover of around € 226 billion**.

Turnover from the Internet economy accounts for 3.1 percent of GDP

In 2013, the Internet economy was worth just under € 85 billion. This figure equates to around 3.1 percent of gross domestic product. Between 2011 and 2013, the Internet economy grew continuously, both in terms of its value and its contribution to GDP.



Irene Bertschek

Prof. Dr. Irene Bertschek,
Head of the ICT research section,
ZEW Mannheim

Jörg Ohnemus

Dr. Jörg Ohnemus,
Senior Researcher,
ZEW Mannheim



Germany in global comparison with other nations

5th place for
global performance

7th place in the global
ICT & Internet market development

6th place in the global
infrastructural
framework conditions & legal environment

5th place in the global
usage intensity
by individuals, businesses & governments

Germany in global comparison with other nations

Germany in fifth place for overall performance in the 15 nations benchmark

The success of Germany's Digital Economy is measured in three pillars: developments in the different market segments, infrastructure and business environment, usage of new technologies and services by individuals, businesses and governments.

1st pillar: In order to analyze the strengths of the market and compare the overall importance of the digital markets of the 15 nations, this study looks at supply and demand side, at turnover developments or the share of ICT exports as percentage of total exports. On the basis of twelve key performance indicators, the 15 ICT and internet markets in the benchmark can be compared with each other.

2nd pillar: In order to assess each of the 15 countries as locations for business, the infrastructural conditions, the regulatory, legal and political framework as well as the business environment and the educational system must also be taken into account. On the basis of twelve key performance indicators, the infrastructures in the benchmark are compared with each other.
















3rd pillar: Individual or business or governmental users play a key role in any assessment of a country's location for digital business. In this section penetration rates of newest technologies are analysed as well as the quality of school, vocational education and continuous training. We must ensure basic competencies to enable that

all of us can participate in digitisation. We need a critical mass of different types of users in order to put in place new fields of application or business models. On the basis of nine key performance indicators, the usage intensity in the benchmark is compared with each other. In this report, the overall performance of the 15 most important ICT locations is analyzed by aggregating all 33 key performance indicators from the different pillars into one figure. To enable global comparison of data from a wide variety of sources measured in different units, index values were calculated for each of the key indicators. The "best-in-class" country forms the yardstick for comparison, and is given the maximum index value of 100 points. The other nations are then positioned in relation to the best in each class and to the gap between them and the global leader.

Global Benchmark: Germany in fifth place

For the global performance of its Digital Economy in all three pillars (market, infrastructure, usage), Germany reached a good fifth place with 47 points. The leader in the 15-nation ranking is the USA with 81 points, followed by South Korea in second place with 54 points. The United Kingdom performed better in a number of key performance indicators and finished in joint third place together with Japan (53 index points each). The field is very tight from fifth place onwards. Only three index points separate Germany (the first of the next-placed group of countries) in fifth place and France in tenth place.

Global performance, 2013

1.	(1.)	USA		81	(80)
2.	(2.)	South Korea		54	(55)
3.	(4.)	United Kingdom		53	(52)
3.	(3.)	Japan		53	(53)
5.	(5.)	Germany		47	(47)
6.	(7.)	Finland		46	(46)
6.	(5.)	Denmark		46	(47)
8.	(9.)	China		45	(45)
8.	(7.)	Netherlands		45	(46)
10.	(9.)	France		44	(45)
11.	(12.)	Brazil		37	(35)
11.	(11.)	Italy		37	(36)
13.	(12.)	Spain		36	(35)
14.	(14.)	Poland		31	(32)
15.	(15.)	India		25	(24)

Source: TNS Infratest, 2014; Previous year's figures in brackets

Market Development

7th place in the global
market assessment

4.3 % of global
ICT turnover

€ 391 annual spending on
online shopping

30 % of total
advertising expenditure online

Market Development

Germany's ICT market performance ranked seventh. Weak in ICT good exports

Two segments are particularly important for the development of the global ICT and internet markets: the **strengths of each of the markets**, i.e. the turnover (developments) generated through ICT and the Digital Economy, and the **attractiveness of the markets**, i.e. the expenditures on ICT and the Internet economy from different user groups. In this pillar, twelve different key performance indicators are analysed for all the countries included in the benchmark.

USA way ahead of the other ICT nations

As regards the overall market developments, the USA remains global leader with 84 index points. China is once again in second place with 40 points, followed by Japan with 35 points and South Korea with 32 points. The next country is Great Britain in fifth place. With 25 points, Germany is in seventh place – as it was in the previous year. Although Germany remained stable in seventh place in global comparison, the market growth rates and the degree of internationalization of German small and medium-sized enterprises (SMEs) could be higher. Poland was in last place with just 11 index points.

Germany's market share of ICT turnover is stable

As far as the market share of ICT turnover in the global market is concerned, Germany is well placed. Accounting for 4.3 percent of global turnover, this makes Germany the ICT country with the fourth best performance. However, the United Kingdom is catching up. Having increased its global share of turnover, it has now drawn level with Germany for the first time.

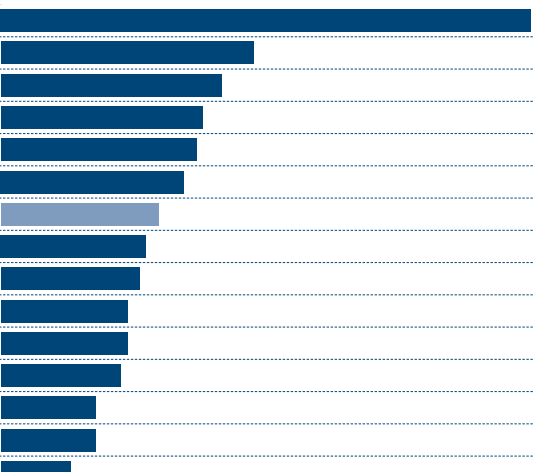
Export of ICT goods are declining

When measured against Germany's otherwise strong export performance, ICT exports remain well below average. The proportion of ICT good exports as proportion of total exports was just under nine percent. This means 12th place in the international ranking only. This is due to increasing competition and declining market prices of ICT goods (i.e. hardware).

Telecommunication expenditures far below average

With telecommunication spendings accounting for 2.4 percent of GDP, Germany only reached 12th place. Although this may mean that costs and prices are low, it can also be seen as an indicator that margins and thus companies' scope for investment are low. The telecommunication turnover has fallen slightly, too (minus 1.0 percent).

Average performance in the Market category, 2013

1.	(1.)	USA		84	(83)
2.	(2.)	China		40	(41)
3.	(3.)	Japan		35	(36)
4.	(4.)	South Korea		32	(33)
5.	(5.)	United Kingdom		31	(31)
6.	(6.)	Brazil		29	(28)
7.	(7.)	Germany		25	(27)
8.	(8.)	France		23	(26)
9.	(9.)	Denmark		22	(24)
10.	(10.)	Netherlands		20	(22)
10.	(11.)	Finland		20	(21)
12.	(12.)	India		19	(16)
13.	(12.)	Italy		15	(16)
13.	(14.)	Spain		15	(14)
15.	(14.)	Poland		11	(14)

Source: TNS Infratest, 2014; Previous year's figures in brackets

Infrastructure

6th place in the global
Infrastructure assessment

89 % of households with
computers

119 %
mobile communications
penetration

4th Place for the quality of
mathematical and scientific
education

Infrastructure

Infrastructures and other framework conditions must be improved on an ongoing basis

Technical infrastructure paves the way for growth and innovations. In order to assess Germany or the other countries included in the benchmark as a location for business, the technical, regulatory, legal and political frameworks as well as the business environment and the educational systems must be evaluated. These aspects are covered by twelve key performance indicators belonging to the pillar “infrastructure”.

Global infrastructural performance: Finland ranked first, Germany sixth

With 92 index points, Finland did best in developing the overall infrastructural framework of the 15-nation ranking. Second place goes to the Netherlands with 83 points. Denmark and South Korea were in joint third place with 81 index points each. Germany scored 78 index points and thus remains – as in the previous year – sixth in the international ranking. India was in last place with just 34 points. As far as infrastructure and basic framework conditions are concerned, ongoing and continuous further development is needed in order to keep pace with the rapid developments in digitisation.

Best performance: Penetration of computers: 89 percent penetration in German private households

With 93 index points, Germany is only seven points behind the Netherlands in first place when it comes to the penetration of computers in private households. This means third place in the international ranking. This is the best performance Germany shows in the infrastructural pillar.

Smartphone penetration in Germany far below average

If the penetration of smartphones in Germany is analysed, the result is different. With just 53 index points, Germany is well behind South Korea, the country in first place. Germany ranks eleventh only. This is the weakest performance Germany shows in the infrastructural pillar.

The quality of the technical education is high in Germany

Experts from the World Economic Forum (WEF) rate the “quality of mathematical and scientific education”, i. e. the intended and taught curriculum in this area, high. With 78 points, Germany is ranked in a good fourth place, the second best result Germany can achieve in this pillar.

Average performance in the Infrastructure category, 2013

1.	(1.)	Finland	92	(92)
2.	(2.)	Netherlands	83	(86)
3.	(3.)	Denmark	81	(82)
3.	(3.)	South Korea	81	(82)
5.	(5.)	United Kingdom	79	(80)
6.	(6.)	Germany	78	(76)
7.	(7.)	France	76	(75)
8.	(8.)	Japan	74	(74)
9.	(9.)	USA	73	(73)
10.	(10.)	Italy	66	(64)
11.	(10.)	Spain	65	(64)
12.	(12.)	Poland	63	(62)
13.	(13.)	China	53	(51)
14.	(14.)	Brazil	50	(48)
15.	(15.)	India	34	(35)

Source: TNS Infratest, 2014; Previous year's figures in brackets

Usage

5th place in the global
usage assessment

3rd place for
music downloads

51% of Germans have
mobile Internet access

4th place for the usage of
new technologies within businesses

Usage

Global usage readiness – Digital music in Germany is on the up

Individual, business and government usage have to be taken into account when assessing Germany or the other countries included in the benchmark as a digital business location. Markets only develop if new technologies are used intensively. This is the only way to ensure not only that the Digital Economy can realize its cross-sector benefits throughout the whole economy but also that the necessary knowledge of new applications and technologies is actually available. The usage readiness is measured by analyzing nine different key performance indicators.

Global usage readiness: South Korea ranked first, Germany moves up to fifth place

Regarding the global usage readiness, Germany improved slightly and achieved **fifth place** with 79 index points in the 15-nation ranking. As in the previous year, South Korea is in first place with 83 index points. The USA remained in second place with 82 points, closely followed by Great Britain in third place with 81 points. When it comes to the usage of new technologies and applications, India is in last place with just 32 index points.

Music download: third place for Germany

Music downloads are playing an increasingly important role. The turnover in the German music sector is continuously increasing. With more than 1.4 billion tracks downloaded, digital music is most popular in the USA.

Accordingly, the United States top the international ranking when it comes to the number of music downloads per inhabitant. From a statistical point of view, every citizen of Great Britain downloads four songs a year. This means second place in the international ranking. On average, each German downloads two songs a year from the net. This means that Germany's score has improved by six points. With 36 index points, the country is now in joint third place with Denmark.
















Usage of new technologies – Germany ranked fourth

As far as the usage of new technologies within businesses is concerned, Germany is in fourth place in the 15-nation ranking as in the previous year. In 2013, cloud solutions were used more, but also with greater care. While 40 percent of companies used cloud computing, the majority of them used private clouds via an internal network.

German “ICT use and government efficiency” improved

Germany has seized the opportunity to improve efficiency through the usage of ICT and has moved up from ninth place last year to sixth place in the 15-nation ranking. Germany reached 87 points and is ranked fifth together with Denmark and France. The top four remain South Korea, Finland, the Netherlands and Great Britain. Italy and Poland are in last place when it comes to the use of ICT to improving efficiency.

Average performance in the Use category, 2013

1.	(1.)	South Korea		83	(84)
2.	(2.)	USA		82	(78)
3.	(3.)	United Kingdom		81	(77)
4.	(4.)	Japan		74	(73)
5.	(6.)	Germany		67	(64)
6.	(5.)	Denmark		66	(65)
7.	(7.)	Netherlands		65	(62)
8.	(8.)	France		63	(59)
9.	(9.)	Finland		60	(58)
9.	(10.)	Italy		60	(55)
11.	(11.)	Spain		58	(54)
12.	(12.)	China		50	(46)
13.	(12.)	Poland		48	(46)
14.	(14.)	Brazil		42	(40)
15.	(15.)	India		32	(31)

Source: TNS Infratest, 2014; Previous year's figures in brackets

Start-ups and innovations with- in the German ICT sector

7.2 % in the ICT sector
start-up rate

26 % of turnover in the ICT sector with
product innovations

77 % in the ICT sector
innovator quota

10.2 % of
spending on innovations in Germany by the ICT sector

Start-ups and innovations within the ICT sector

ICT service providers driving start-ups in Germany

In the ICT sector, around 7,000 companies a year were established between 2011 and 2013. In relation to all existing companies, this corresponds to a start-up rate of 7.2 percent. This figure is higher than in all the other sectors. With a start-up rate of 7.4 percent, the ICT service providers are driving the above-average start-up activity in the ICT sector. When it comes to ICT hardware, the start-up rate was just four percent.

ICT start-up rate declining in Germany

In 2013, the number of start-ups in the German ICT sector decreased for the fourth year in succession and fell below the level in 2008. For the first time in one and a half decades, the number of start-ups in 2013 fell even well below the level encountered in the mid-1990s. This means that the minor start-up boom between 2009 and 2011 is now over. The ICT service providers are responsible for this decline. Although the start-up rate remains high compared to other sectors, the rate at which new businesses are being started within the ICT sector is declining.

ICT sector accounts for 10.2 percent of spending on innovations in Germany

In 2012, companies in the ICT sector in Germany spent € 13.3 billion on innovation projects. Compared to the previous year, this equates to a fall of 12 percent. The ICT sector accounts for 10.2 percent of spending on innovations in Germany. ICT service providers spend the largest part of the ICT sector's innovation budget (€ 10.06 billion). The ICT hardware sector spent only around € 3.29 billion on new products or processes.

77 percent of German ICT companies are “innovators”

The innovation intensity of companies within a sector is measured by the proportion of companies that have introduced at least one new product or process within a three-year period. This so-called “innovator quota” reached 77 percent in the German ICT industry – three percent below the figure for the previous year. In 2012, no other sector achieved such a high innovator quota as the ICT sector. The innovation focus of ICT companies remained very high in 2012, while there were sharp falls in the innovator quota in certain other sectors. The ICT sector is well ahead of the next-placed sectors, namely the chemicals and pharmaceuticals industry (71 percent) and mechanical engineering (70 percent).

Expert workshop: ICT as an innovation driver



Expert workshop: ICT as an innovation driver

As part of the “Monitoring-Report Digital Germany 2014”, TNS Infratest Business Intelligence held an expert workshop at the Federal Ministry for Economic Affairs and Energy (BMWi) on 3 September 2014. During the workshop, chaired by the Parliamentary State Secretary at the BMWi, Brigitte Zypries, 70 renowned representatives from the ICT sector and other key industries as well as ICT scientists and researchers took part in a lively discussion. Key questions were: Which innovations in the Digital Economy affect other industries? What are the major opportunities and challenges for Germany as a business location? How important are the measures proposed by the new German Digital Agenda?

In the following, the statements of the participants are summarized in the form of key theses.

Basic principles of the digital German policy

Technological megatrends such as big data, smart data, cloud computing, 3D, mobile apps, social collaboration and Industry 4.0 are coinciding. This is a one-off phenomenon affecting all companies and customers from virtually all sectors. It is resulting in groundbreaking changes in economic, scientific, political and social fields. It will no longer be possible to operate and drive growth without using digital technologies.

The digital transformation has become a central challenge for industry, science, society and policymakers. The opportunities presented in these areas are emerging in the fields of industry, agriculture, energy, health, traffic and education in particular.

Start-ups and innovations in Germany

Above all, start-ups and small and medium-sized firms must be to be globally competitive. Not enough is being done when it comes to internationalization or accompanying measures to encourage this process.

Value-creating innovations do no longer emerge from pure technological developments. They are more and more achieved through process innovations or by combining new technologies with familiar components.

Modern, scalable solutions which allow the needs of customers to be taken into account during research and product development are needed. Germany needs a cross-sector innovation strategy, but one which also allows companies to gain their own competitive advantages. There is still a large gap between invention and innovation.

Germany should attach importance and continue to extend its autonomy and ability to take action in the area of information and telecommunications technology. We have to ensure that our foreign policy gives due regard to maintaining our technological sovereignty in key areas.

Growth areas in Germany

Industry 4.0: The transition to networked production or “Industry 4.0” has the potential to recast value added chains and dramatically influence the business models of Germany’s leading industry sectors which are of great economic importance. Medium-sized German enterprises will have a good chance of achieving growth if they closely work together with big companies in the field of “Industry 4.0.” Cooperation and “intelligent connections” between large and small or medium-sized companies when developing innovative services or products in this area can only be of benefit to both sides. Germany must strive to common norms and standards to ensure the seamless integration of traditional industry with ICT.

Smart services: “Data are the new oil”: Ever greater volumes of data (so-called big data) are being interconnected to build smart data, resulting in new products or smart services. The various networking options for generating smart services offer particularly good opportunities, for further digitisation.

Technological megatrends: There should be a particular focus on the groundbreaking opportunities resulting from technological megatrends (e. g. smart data, cloud computing, 3D, mobile apps and social collaboration, etc.). Digitisation and interconnectivity in these areas help to boost the productivity of the basic systems used in our community.

Digital infrastructure in Germany

Compared to other nations, the level of fiber optic penetration in Germany is far below average. With a fiber optic penetration rate of just one percent, Germany is in last place on a European level. Although the latest technologies such as vectoring allow relatively high speeds, coverage will not be sufficient in the medium to long term. Companies will no longer accept to set up operations in a country which does not offer comprehensive, high-speed broadband connections. High-speed networks are crucial for innovation in Germany.

Mobile broadband is helping to accelerate the provision of universal broadband access. However, the relevant infrastructure will need to be further developed and upgraded on a continuous basis in order to keep pace with the increasing need to manage high data volumes.

Politicians and industry should therefore work together to push ahead with the development of high-speed net-

work infrastructures. Investments in networks are essential for innovations to foster ICT applications. The companies based in Germany require not only high-speed, ubiquitous networks. Networks must be secure in order to reap the full benefits of digitisation for German society and its economy.

Education and further training, qualifications in Germany

In the area of education, Germany as a business location needs to encourage interdisciplinary study courses in order to speed up the development of concepts such as Industry 4.0 or innovations in the smart services field.

After all, there is still room for improvement when it comes to technical or management qualifications and specialists' international experience. We must analyse more effectively training needs, further training and continuing education and where necessary develop and /or enhance measures to implement them.



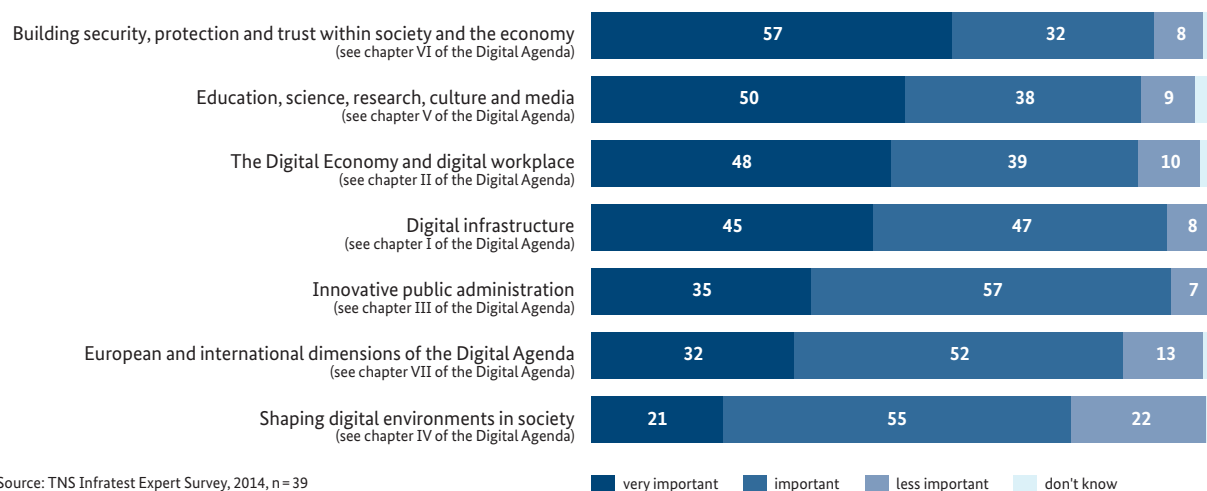
Expert Survey: Digital Agenda

“Building security, protection and trust” is a matter of priority

During the workshop, TNS Infratest carried out a survey among the renowned experts. The aim of the survey was to find out what the most important seven action areas are and how their individual measures should be prioritized. The results of the survey reflect the opinions of the experts representing the users and providers driving digital transformation.

Building security, protection and trust within society and the economy is a matter of top priority. The education campaign for the digital knowledge society is of utmost importance. Accelerating the digital transformation in science, research culture and media is a key issue. The increasing digitisation of the economy as well as the development of the digital infrastructure are of secondary importance.

Ranking of all seven action areas of the German Digital Agenda according to importance



Ranking of all individual measures of the German Digital Agenda according to importance

- Boosting education campaigns to further develop the digital knowledge society
- Exploiting digitisation's potential for innovation
- Safeguarding access to knowledge as a basis for innovation
- Supporting and promoting the digitisation of industry
- Modern data protection for the information age
- Developing a sustainable regulatory framework for the Digital Economy
- Promoting mobility and supporting new services
- Further developing a future-viable framework for the Digital Economy
- More security in cyber space
- Strengthening digital infrastructures to create a trusted space
- Greater online protection for citizens and companies
- Cooperation on Internet management processes (Internet governance)
- Supporting the young Digital Economy
- Protecting consumers in the digital world
- Integration of the Digital Agenda for Germany in the international context
- Ensuring digital access for rural areas
- Government IT: protecting its autonomy and ability to take action
- Ensuring secure government communication
- Integration of the Digital Agenda for Germany in the European context
- Offering digital services to government
- Accelerating the digital transformation in science
- Shaping work in the digital world
- Harnessing the potential for health care
- Understanding the digital transformation through research
- Making digital participation a reality
- Developing “international network law” and the protection of human rights
- Strengthening digital media skills for all generations
- Engaging in greater dialogue with social groups
- Promoting the transition to renewable energy and green IT
- Making digital participation a reality
- Shaping digital environments: supporting family life and equal opportunities
- Digitisation in development cooperation
- Culture and media

Source: TNS Infratest Expert Survey, 2014, n = 39

Case study: ICT as an innovation driver

36 % of industrial companies with
ICT-based innovations

15 % of industrial companies
cooperate with start-ups

6 % in the media sector
IT specialists

Software and the **Internet** are the
most important innovation drivers

Case study: ICT as an innovation driver in Germany

Information and communication technologies (ICT) are catalysts for innovation in all areas of the economy. This is reinforced by the increasing digitisation. New ICT applications which are to a large extent based on the further development of the (mobile) Internet or on the availability of big data have developed. New products or services include cloud services, big data, smart data or the networked industry ("Industry 4.0"). However, also "classic" ICT components such as hardware, microchips or embedded software (embedded systems) developed further. As a result, new functions, processes or applications, for example in automation, became possible, driving digitisation in the industry.

In this context, Brynjolfsson and McAfee (2014) refer to the "second industrial age". Thanks to significant technological progress and powerful ICT components future scenarios from decades ago have already today become a reality. This can be anything from the driverless car to the fully automatic production facility.

The rapid technological developments allow new products and services to be created, existing ones to be improved. Production and business processes are more efficient and new business models emerge. The digital transformation is opening up a vista of opportunities for the German economy, particularly for its medium-sized companies.

In order to gain an idea of the current use of new ICT applications and their role as a catalyst for innovation, the Center for European Economic Research (ZEW)

Mannheim carried out a representative survey among German enterprises in June 2014. Companies from the ICT sector (ICT hardware and ICT service providers), media service providers, knowledge-intensive service providers (e. g. market research organisations) as well as companies from industry (printed goods, chemicals / pharmaceuticals, metal products, instrument systems, electrical engineering, mechanical engineering and automotive engineering) were surveyed. These sectors account for around 70 percent of value creation in the industry. The survey provides an overview of the current status and development of ICT as an innovation driver, both now and until the end of 2015. It looks at various ICT components while examining the role of internal IT specialists and partnerships with start-ups as a source of creativity and innovation. At the same time, it adopts a user perspective, i. e. the questions of the survey were answered by users of ICT services or products.

ICT is a key driver of innovation in Germany

ICT can make a significant contribution towards the development of innovations, for example if companies use digital platforms to cooperate on innovations. However, it is often an ICT component as part of a new product or service which allows to creating a new function (e. g. embedded systems which enable cars to be parked). Furthermore, ICT can foster new or improved business models or production and business processes (e. g. such as the app that provides up-to-date media content via mobile devices or the software that links together and optimizes production and business processes).

Contact

**Tobias Weber**

Project Manager “Monitoring Report Digital Economy”

TNS Infratest Business Intelligence
Email: tobias.weber@tns-infratest.com
Telefon: 089 5600 1760

Downloads and more informationen: www.tns-infratest.com/bmwi

