

GROWTH PERSPECTIVES FOR POLISH

ICT SECTOR

BY 2025



MINISTRY
OF ECONOMIC
DEVELOPMENT



INVESTIN

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ICT SECTOR

BY 2025

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**Mr Tadeusz Kościński,
the Undersecretary of State at the Ministry of Economic Development**

The development of information technologies is a foundation of growth, not only for the ICT sector, but for the entire economy and society. Competitiveness of Polish industries is to a large extent based on availability and quality of ICT sector solutions. In the era of global changes this is one of the key sectors for future growth.

The significance of the ICT sector in global and Polish economies continues to dynamically increase. Key trends in the ICT sector shall include cloud technologies, Big Data, the Internet of Things and cybersecurity.

Poland faces the challenge of replacing present growth drivers, such as low cost of labour, EU subsidies and increase rate of productivity, and of balancing future disadvantageous regulations and socio-economic factors. Polish companies must seek sources of competitive advantage in original, proprietary solutions and exploitation of market niches.

Government investments and creation of innovation friendly environment shall be an important driver for stimulating growth of the ICT sector. The increased effectiveness of key sectors through implementation of IT solutions may become a driving force of overall economic growth.

The huge growth potential of the ICT sector is also confirmed by a large number of newly created start-ups. More than 50% of start-ups are established in the ICT sector. The number of Polish enterprises in the sector increases in the average annual rate of 10.1%.

Polish ICT sector is in good condition, recording the average annual increase of turnover amounting to over 8.6%. This is the highest growth in Europe. However, relatively lower productivity of Polish ICT sector is manifested through the size of turnover per employee, which is lower by almost half than in German economy. This situation points to the need of further stimulation of the sector, as well as investment, both in infrastructure and education.

Investments from the government and enterprises in innovation should be the drivers of further increase of productivity. One of the conditions to stimulate investment activity of Polish enterprises is development of a transparent and stable legal system regulating activities in individual areas of the ICT sector and ensuring better safety of investment. Polish ICT sector is characterised by significantly higher innovativeness than other sectors of Polish economy. This strengthens its perception as a good field for investment.

This is one of the reasons the Polish Development Fund (PFR) has been established. It is a group of financial and advisory institutions for entrepreneurs, local governments and private individuals, investing in sustainable social and economic growth of the country. Together we develop practical solutions for common success and safe future. PFR offer includes packages of financial and non-financial services, designed to suit specific needs. Our objective is to create a complete market for acquisition of capital and growth instruments at all stages of development of a given undertaking. We are active in the area of banking, insurance, investment, advisory in international expansion and development of entrepreneurship and innovation.



MINISTRY
OF ECONOMIC
DEVELOPMENT



**Mr Ireneusz Piecuch,
the President of the Polish Chamber of Information Technology and Telecommunications (PIIT)**

In 2018 we shall celebrate the 70th anniversary of Polish computer science. Last year we celebrated the 20th anniversary of GSM telephony in Poland. The time between the jubilees will surely be filled with hard work for the development of the information technology and telecommunications sector in our country. It is thus good that it is thanks to the Ministry of Economic Development that we get a document discussing the presence of the sector in Poland and its future potential.

The ICT sector is the most pro-innovative one for the modern economy and will surely be one of the foundations for its further growth. As the report shows, Poland ranks 6th in Europe in terms of the level of employment in the sector and – what is important, is the country recording one of the strongest dynamics of employment growth. It is Poland where more than 850 shared service centres have been created, employing more than 193 thousand workers, of whom 37% are IT specialists. Companies such as IBM, HP, Intel, Nokia or Samsung have located their centres in Poland.

Shared service centres of software laboratories are not all. Poland is also a country, where companies making first steps on the path to become global companies are created. Groups such as Asseco or Comarch are recognised not only in the European market, but also globally. It is worth to remember about companies such as CD Projekt, the makers of “The Wither” – a global leader in the gaming market, one of many Polish companies taking global markets by storm. They include 3D printers manufacturers, which will play a significant role in industrial revolution 4.0 happening right now.

The content of the report shows that despite all this success the ICT sector in Poland is characterised by a relatively low level of investment. This has a negative and unsatisfying impact on the size of the market. Hence the huge stimulating role to be played by the new development strategy designed by the Polish government. All this with the participation of commercial companies active in the information and telecommunications market.

With the dynamics of the entire Polish economy in mind, the continued growth of its competitiveness and effectiveness and resistance to turbulence in global markets (Poland is the only European country, which avoided post-2008 recession), it seems that doubling the size of Polish ICT market in 2025 perspective is entirely realistic.

On behalf of the Polish Chamber of Information Technology and Telecommunications I invite you not only to read the report, but also to be courageous and determined in betting on new technologies. By investing in ICT technologies you give your companies the velocity and dynamics necessary to step into the world of the fourth industrial revolution. The revolution, which according to many leading authorities will dramatically change the world we know.



The Polish Chamber of Information Technology and Telecommunications (PIIT) is a partner both in the legislative processes and in issuing opinions on day to day decisions of government administration and regulatory bodies.

The authorities of the Chamber attain their objectives through cooperation with legislative bodies, state and local administration, providing them with relevant information, comprehensive analysis and constructive assessments of phenomena and activities important for the ICT market.

PIIT has had a fundamental and significant influence over the shape of legal acts and tax, customs, certification and copyright provisions, as well as on public procurement procedures. PIIT's experts participated in drafting and amending of

a number of acts - the telecommunications law, on protection of personal data, on electronic signature, public procurement law, on copyright and related rights and many others. The Chamber has won an opinion of a reliable and constructive partner in discussions and negotiations and an expert in explaining new technological solutions. Representatives of the Chamber actively participated in the Council for Information Technology Development, Telecommunications Council and many others.

Promotion of Polish telecommunications market and companies operating in it is very important to us. Our activities include co-organisation of Polish Information Technology Congresses and providing support to Polish companies in organisation of their presentation at CeBIT in Germany. The Chamber provides

patronage to the largest Polish ICT events.

We were established in 1993, now associating more than 120 largest companies from the information and telecommunications sector.

The Polish Chamber of Information Technology and Telecommunications is a member of the international organisation DIGITALEUROPE, which gives us an opportunity to have an impact on the shape of the European legislation in the area of information and communication technology.

More on PIIT: www.piit.org.pl



The Polish Agency for Enterprise Development (PARP) is a government agency established in 2000 to support micro, small and medium-sized enterprises. Over more than 15 years of its existence the Agency has developed numerous forms of support, including: financing for enterprises, development services, education and information activities as well as actions aimed at enhancing entrepreneurship culture and innovation in Poland. The areas of PARP activity evolve along with economic development and with emerging new trends in business and innovation. Thus, over the years, PARP has become a forerunner in creating new support areas and developing various ways of assistance (Financing, education, promotion). The new instruments under the EU Financial Perspective 2014-2020 serve to stimulate entrepreneurship, innovation and competitiveness of Polish businesses. PARP is engaged in the implementation of three new operational programmes co-funded from the EU finds, namely: Smart Growth, Eastern Poland, Knowledge Education Development.

If you are interested in information on support programmes offered by PARP, addressed to entrepreneurs and business environment institutions, you can contact the helpline operated by the PARP Information Centre:

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Polish ICT Promotion Program

In the years 2016-2019 the Polish Agency for Enterprise Development is responsible for implementation of the Polish ICT Promotion Program.

The aim of the program is to present Polish ICT products and services to a wide audience of investors, distributors, business and technology partners, and potential end-users.

We will organise 14 promotion stands at ICT trade fairs and conferences in Brasil, Japan, South Korea, USA, Spain, Germany, Austria and Portugal, including events dedicated to startups.

The program is financed from the European funds in the framework of the Smart Growth Operational Programme, sub-measure 3.3.2.

Learn more about the Polish ICT Promotion Program:

<https://ict.trade.gov.pl/en>

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European Union
European Regional
Development Fund



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POLISH ECONOMY

IN THE FACE OF TRANSFORMATION

Good condition of Polish economy, dynamic development, as well as economic stability are a strong magnet for foreign investment in Poland. Retaining the present growth rate and high economic predictability will have a positive impact on the position of Polish ICT sector in the international arena.

POLAND AS A MAGNET TO FOREIGN INVESTORS

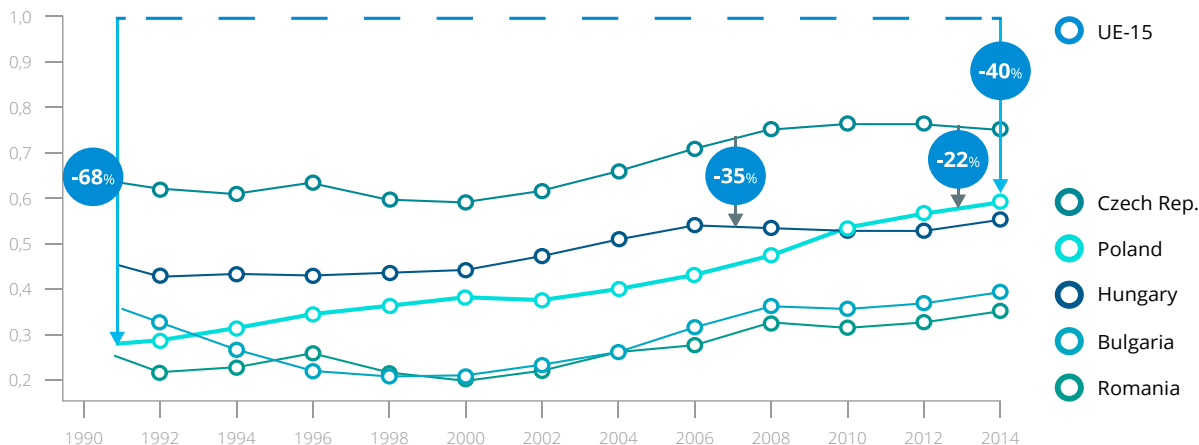
Poland ranked 26th in the Global Competitiveness Report 2016-2017 elaborated by the World Economic Forum. It is an advancement by 5 places in comparison to 2015 and at the same time the best place for Poland in the history of the ranking. 14 000 companies from 138 countries across the world, including 214 from Poland, participated in the study. Our economy has been classified in the transitional group – aspiring to the group of countries, which are most competitive thanks to innovation. Economies of Switzerland, Singapore and the United States have been deemed most competitive in the report.

The position in the WEF ranking does not change the fact that Poland is one of the most dynamically growing economies. In the past 25 years Poland's real GDP doubled. The growth was not halted in 2008-2009, at the times of the global financial crisis. Entire Europe, save for Poland, sank into recession. This was because Polish economy had been growing sustainably already before the crisis. Both public and private sectors had been less indebted than in other countries of our region. Also the external debt had been lower in comparison to other countries. This stability and balance have been retained until today. Since the beginning of 2014 the GDP has been growing at the rate of at least 3.1% annually. The share of the ICT sector in the GDP amounts to around 8%.

Poland has been enjoying huge interest on the part of foreign investors for many years. According to the Polish Information and Foreign Investment Agency (PALIIZ), high share of foreign companies, which had invested in Poland, do it again. 98% of companies are satisfied with their decision to locate part of their business in Poland. In the rankings of investment attractiveness, Poland has continuously taken leading places for several years, ahead of countries such as the Czech Republic, Hungary, Ukraine or Turkey. In recent years Polish cities have become one of the most attractive locations for the BPO/SSC sector, while Cracow has been recognised as one of the 10 best places for outsourcing in the world.

GDP PER CAPITA BASED ON PURCHASING POWER PARITY (PPP)

UE-15=1



Source: Eurostat

Poland holds a number of advantages for foreign investors over the rest of the EU countries. It is characterised by strong internal demand, low costs, high human resources potential, stable financial sector, as well as an independent currency. However, it is viewed negatively in the context of innovativeness. It stems i.a. from low level of investment in R&D activities.

STRENGTHS AND WEAKNESSES OF POLISH ECONOMY

Since 1990 Poland has been open to foreign investment, irrespective of a political party in power. Relatively low remuneration, high educational attainment of workers, flexible labour market and geographical location have been the primary magnets attracting foreign companies to Poland. Having own currency helps to keep the entire economy at the competitive level. Thanks to systematic weakening of Polish zloty against euro or dollar, it has been possible to retain price competitiveness of exports. Large and absorbent internal market with a stabilising

impact on economy also plays an important role. For our smaller neighbours, such as the Czech Republic or Slovakia, export is of key importance for the economies, which makes them more sensitive to turbulences in global markets. The financial sector in Poland is stable and in good condition, which is demonstrated by the results of Polish banks, when compared to foreign institutions. In recent years road infrastructure has been significantly improved. In 2007-2013 1500 kilometres of motorways and express roads were commissioned. As a result the total length of this type of roads increased by around 150%. It is the improvement of infrastructure that investors point to as the biggest positive change in recent years. It is the international companies, which had an impact on initiating qualitative changes in Polish economy. The industry has undergone significant modernisation. The level of technological advancement has increased, which has translated into increased effectiveness of enterprises.

Various forms of tax allowances and subsidies for investors increase investment attractiveness of Poland. Since the time of joining the European Union in 2004

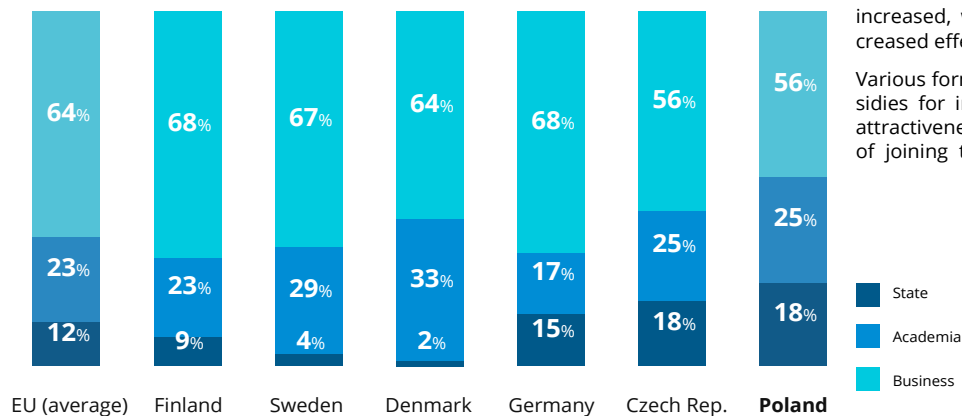
Poland has effectively been using the EU funds granted. In 2014-2020 Poland shall receive more than EUR 82 billion for the development of the economy. The funds shall be distributed by both central and regional institutions. There shall be a lot of focus on R&D processes. Moreover, already today there are 14 special economic zones operating in Poland, offering special conditions for investors.

At the same time international rankings assess Poland poorly in terms of innovativeness, energy efficiency, as well as poverty and social exclusion.

According to the Innovation Union Scoreboard 2015 Poland ranked 24th among the European Union Member States, ahead of Romania, Bulgaria, Latvia and Lithuania. In 2014 the expenditure for R&D in Poland amounted to slightly over PLN 16 billion, i.e. only 0.94% of GDP. Leading EU countries allocate around 3% of their GDPs to R&D. According to the Strategy for Innovativeness and Effectiveness of the Economy, this indicator is to amount to 1.7% in Poland in 2020. The share of remuneration in added value in Poland amounts to 45%, which places Poland among countries competing on costs. At the same time, the positive aspect of the changes lies in the fact that companies have an increasing share in financing of research and development work. The primary source of financing of innovation are own funds of enterprises. The supporting sources include bank loans, EU funds or funds from the state budget.

STRUCTURE OF R&D EXPENDITURE

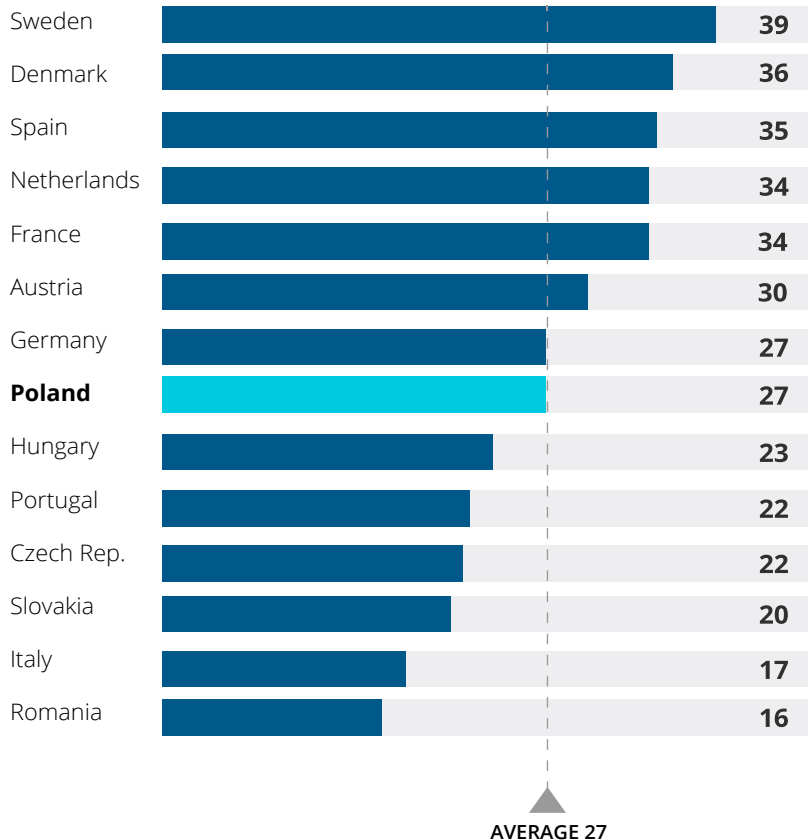
by source of financing (2014)



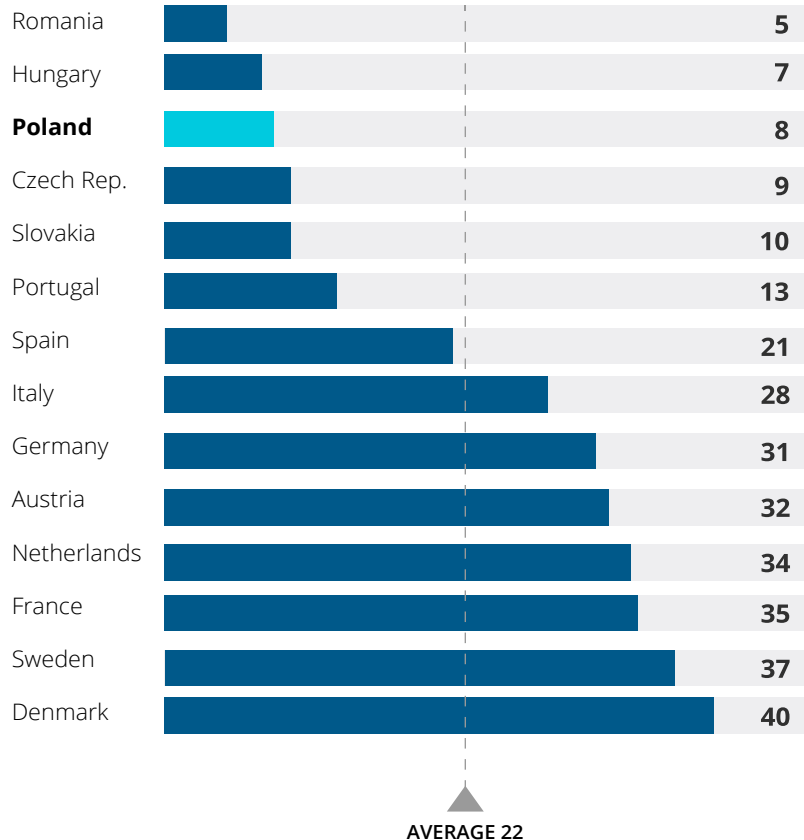
Source: World Economic Forum

POLISH LABOUR MARKET IS CHARACTERISED BY QUALIFIED LABOUR FORCE AND LOW COSTS OF LABOUR

The share of university graduates 2014
(in percentage of persons in 25-64 age group)



Costs of labour, 2014 (EUR/hour)



Human capital in Poland is assessed very favourably. Poland has large resources of qualified personnel, while still keeping the cost of labour at a low level. However, both legal regulations and the difficulty in acquiring funds for high risk investments are rated poorly.

The transparency of the tax law, labour market regulations and instability of the economic policy were rated most poorly in WEF questionnaires. Legal regulations, despite some symptoms of positive changes, continue to be primary factors hindering the economic growth. Presently, the law is perceived as too complex and incomprehensible. It often imposes a great number of obligations on entrepreneurs, thus generating excessive costs

of business operations. Numerous minor legislative amendments are perceived as actions targeted against entrepreneurship. These factors pose barriers to smaller investments undertaken by foreign companies from the SME sector. Also financing of high risk investment has been rated poorly in the WEF ranking. In this category Poland ranked 96th.

Polish labour market is viewed as relatively flexible. Entrepreneurs have a possibility to adapt remuneration and the costs of dismissals are low. The problem is to effectively use the resources in the labour market. In 2014 the share of working population aged 20-64 in the total population amounted to 66.5%. It is one of the poorest results in the EU. According to the Europe 2020 strategy by 2020 this indicator is to amount to 71%. The employment rate among young people is also lower than the EU average and amounts to 43.8%. It should be noted though that the employment rate among young persons is unsatisfactory in most of the EU countries. The overall unemployment rate in July 2016 amounted to 8.6%, which is the lowest result in more than 25 years. On one hand it is the result of growing Polish economy, on the other of the economic migration of Poles, which is the strongest in the EU. According to the statistics, since Poland's accession to the EU more than 2 million people migrated for economic reasons. Initially these were persons with low educational attainment, who emigrated. With time, more and more educated and well qualified persons started to leave. Primary directions of migration include Germany, the United Kingdom, Ireland, the Netherlands and Norway.

It is also worth noting that since 2014 the migration processes to Poland have gained momentum. The influx of people from the eastern border is felt particularly strongly. Political and economic destabilisation in Ukraine was an important contributing factor. Official data mention several dozens of thousands of people annually granted work permits in Poland. A realistic assessment of the scale of this phenomenon shall be possible in two or three years.

Progressing restructuring of Polish economy contributes to changes in the structure of demand for workers. It calls for adaptation of workers' qualifications and an increase of their mobility. It is easier for young people with higher education to adapt to the changing labour market. At the same time upskilling in not common in Poland. The younger and better educated a person, the bigger the chance that it will take action to gain more education and adapt to the labour market.

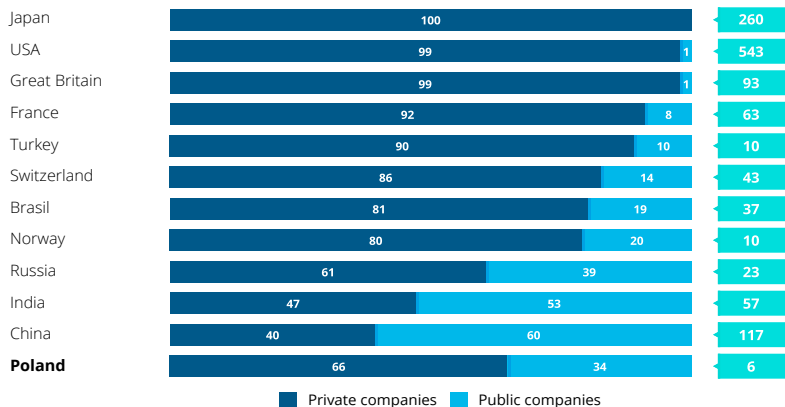
STRENGTHS AND WEAKNESSES: A CHANCE FOR A NEW OPENING

Primary drivers of the growth so far are slowing down - the value of foreign investment and the increase rate of productivity based on low labour cost are decreasing. After 2020 the EU funds shall probably shrink and we shall feel a strong negative impact of demographic changes. Furthermore, with time the expectations of reduction of carbon dioxide emissions in the context of climate change shall prevail, which is particularly disadvantageous for Poland because of rich carbon deposits. Polish companies must start to

THE SHARE OF LARGEST COMPANIES CONTROLLED BY THE STATE IS

higher than in developed countries, but lower than in developing ones

The share of public and private companies in the "Forbes" Global 2000 ranking (in %)



The number of companies in the "Forbes" Global 2000 ranking

1. The share of private and public companies in Poland has been calculated for 50 largest companies according to "The list of 500" ranking by "Rzeczpospolita".

2. Companies with more than 50% of shares held by the State Treasury

Source: „Forbes” Global 2000 ranking, 2011; OECD report „State-Owned Enterprises”, 2012; McKinsey’s analysis

Poland faces the challenge of replacing present growth drivers, such as low cost of labour, EU subsidies and the increase rate of productivity, and of balancing future disadvantageous regulations and socio-economic factors. Polish companies must seek sources of competitive advantage in original, proprietary solutions and exploitation of market niches.

Government investments and creation of innovation friendly environment shall be an important driver for stimulating growth of the ICT sector. The increased effectiveness of key sectors through implementation of IT solutions may become a driving force of overall economic growth.

look for advantages other than costs. In the long run it shall be impossible to retain competitiveness through low prices. It will be of key importance that companies develop their own, original solutions and enter new market niches. More and more often Polish entrepreneurs decide to invest abroad. Many companies have earned a strong position in the home market. Further growth calls for implementation of bold strategies allowing to gain market share outside of the country borders. Investment activities cover also regions from outside of the EU, such as Asia, North and South America or Africa.

In its report "5 opportunities for Poland" McKinsey identified five areas, which should be improved in order for the Polish economy to equal to the European leaders:

- 1:** Increasing productivity in all sectors of the economy, and particularly in four sectors with the highest potential for improvement in relation to Western Europe (mining, energy, agriculture, manufacturing) and improvement of the position of Polish companies in the value generation chain.
- 2:** Preparation of additional investment projects and securing the capital in the amount of up to PLN 2 billion for their financing over the next decade.
- 3:** Investments in innovativeness of the economy as the new stage after the "low cost" phase.
- 4:** Counteracting negative demographic trends in the labour market.
- 5:** Stronger support for business and improvement of the level of public services.

Among the assets, which will help Poland to catch up with Western Europe, the following are mentioned: educated and cost competitive labour force, strategic geographical location, large internal market, large area of agricultural land (4th place in the EU).

In the "Poland 2025" report McKinsey has also clearly defined, what activities should be undertaken in the next few years:

- Creation of high-tech clusters facilitating better cooperation in large technology projects and exchange of knowledge.
- Strengthening of ties between business and academic community in order to adapt curricula to the need of the high-technology sector and to better use the results of research in business, e.g. through introduction of the requirement of equal share of private and public funds in research and development.
- Allocation of more funds spent under public procurement for research and development projects.
- Provision of support from the state in order to limit the risk related to large capital projects (for example through loan guarantees).
- Increase of targeted expenditure for research and development through removal of tax barriers and facilitating of access to sources of venture capital financing.
- Possible allocation of direct public expenditure to national research programmes.

The support of the Monetary Policy Coun-

cil shall be important throughout the process. Among external factors influencing volatility of prices in Poland, the Council pointed to the uncertainty of economic growth in the world, as well as very aggressive monetary policies of largest central banks (FED, EBC). Among internal factors, overall economic situation, situation in the labour market, fiscal policy and situation in the lending market are listed. In the assumptions for 2016 the inflation target of 2.5% has been retained. At the same time, according to forecasts, inflation at the end of 2016 shall amount to around -0.5%.

According to a PwC report, in the long-term perspective, by 2050, Poland shall achieve the highest average growth rate among all large EU economies. Forecasts indicate that average growth of Polish GDP by 2050 shall amount to 2.7% annually (2.9% per capita). By 2020 the forecasted growth rate amounts to 3.4%, up to 2.8% annually in 2012-2040 and 2% annually in 2041-2050. The key factors slowing the growth shall include demographic factors and hindered growth accompanying transformation of Polish economy into a developed one.

ICT ACROSS THE WORLD

The development of information technologies is a foundation of growth, not only for the ICT sector, but for the entire economy and society. Competitiveness of Polish industries is to a large extent based on availability and quality of ICT sector solutions. In the era of global changes this is one of the key sectors for future growth.

The flow of information and development of information technologies are now foundations for the development of competitiveness and impulses for economic or social development of any developed or developing country. Availability and quality of information are key elements for growth and competitiveness.

This is how the Central Statistical Office defines ICT:

“Information and communication technologies mean a family of technologies processing, collecting and transmitting data in an electronic form. Information technologies (IT) are a narrower concept and they refer to technologies related to

computers and software, not connected however to communication technologies and those related to networks. The development of these technologies results in a situation, where both of these concepts become increasingly coherent, while being a driver for civilisation, social and economic development.”

Practically any aspect of modern life - in business, culture or even at home, depends on the flow of information and use of information technologies. The global communication network is the largest and most broadly implemented undertaking in the history of modern world. According to the UN data there are now more than 7 billion telephone subscribers, 1.4 billion households are connected to TV network and each year there are several dozens of millions of new Internet users. Together with the development of GPS and similar networks, several hundreds of millions of people also started using satellite network, and almost every cell phone user has a possibility to send data via Bluetooth. Increased importance of ICT, and thus the increased level of availability of information, led to the development of the so-called information society - a trend in societies forced by a significant increase of the importance of information and electronic services in public administration and everyday life. Therefore, the capacity of citizens of a given country to acquire and use information through information and communication technologies is an important driver of economic growth.

Adequate use of information by citizens brings a lot of positive results. Efficient

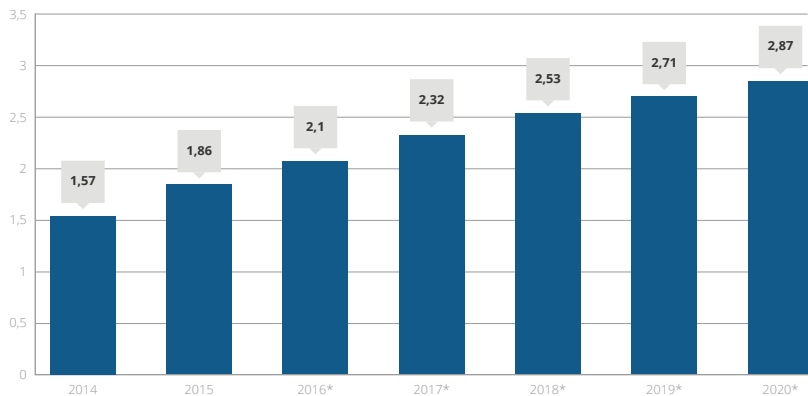
flow of coherent information on monetary flows makes it possible for tax authorities to shorten or simplify procedures or minimise errors in tax collection systems. Making use of relevant data helps limit the risk of fraud in the public sector, while analysis of trends and social attitudes with the support of Big Data could facilitate more effective communication between the state and citizens and business environment.

Good cooperation of the state with entrepreneurs, characterised by the adequate level of information flow, facilitates identification of common development goals. The consequence of such situation is growth of employment, in this case in the sector of new technologies. If the market adequately reacts to the changes in the economic situation, employment is moved to sectors with higher productivity. In the long term, such situation results in the growth of GDP per capita and improved living standards of citizens.

It is hard to find a better example of the use of information and information technologies, than activities of all types of enterprises. In large companies each component, structure or process is digitalised and analysed with a view to optimisation of processes, costs or organisation of work stations. Access to specialised data bases and relevant tools to establish dependencies between individual pieces of information on potential candidates for a specific job provides a possibility to select best suited options, thus limiting costs, recruitment period and ensuring high effectiveness of the recruitment and selection process. Persistent and accelerating

FORECAST:

the number of smart-phone users in 2014-2020



* forecasts

The significance of the ICT sector in global and Polish economies continues to dynamically increase. Key trends in the ICT sector shall include cloud technologies, Big Data, the Internet of Things and cybersecurity.

growth of ICT continues to provide new business opportunities.

The analysis of connections in such extensive data sets would not be possible with the use of only analogue technologies, or would be too labour consuming, costly and ineffective to meet the basic requirement of profitability.

From a point of view of a citizen, who is just a consumer, broader flow of information also means a broader choice, savings and better matching products with needs. In this case structured flow of information means more competition - consumer has a possibility to compare prices and quality of products and services offered by companies and to verify fairness of individual sellers in data bases collecting opinions of clients on their purchases. Transparency of the market also facilitates better communication and easier matching of consumers and products.

It is also worth to mention another aspect related to increased competition, i.e. focus on specialisation. It is time consuming, but in the long run it helps to optimise prices, thus increasing availability of products and services to consumers, at the same time not reducing profits of enterprises thanks to minimisation of waste of resources used.

A country with a high level of digitalisation shall be ready to compete in new markets based on technological development. Also in the light of increasing competitiveness of European, Asian and American companies, digitalisation is no longer a choice, but a necessity. In order to be ready, business and government leaders

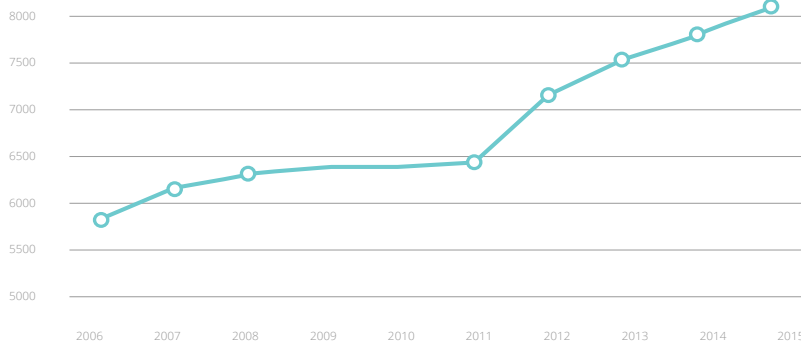
must continue to invest in digital technologies, adapt to the market and increase competitive advantage of a company or a country.

According to the indicators of ITU (International Telecommunication Union) - the organisation acting on behalf of the UN and measuring i.a. the level of digitalisation of societies, saturation of all aspects of economic activities with ICT technologies is a foundation for growth, building key competences and valuable resources, thus supporting development of subsequent generations of more technologically advanced products and services. According to the most recent report, the list of countries with a high level of social digitalisation is topped by South Korea, Denmark, Iceland, the United Kingdom, Sweden, Luxembourg, Switzerland, Norway and Japan. These countries have based their national competitiveness on ICT of products and services.

Key trends in the ICT sector in the next few years shall include cloud technologies, Big Data, the Internet of Things and cybersecurity.

Cloud computing is a model of data processing based on the use of services provided by a service provider via Internet. It eliminates the need to buy software servers or bear the cost of equipment administration. In this model consumers pay for using the service. Cloud computing facilitates functioning of IT resources in the so-called "cloud". Access to dispersed disk space or computing memory brings a significant change to a consumer. They can use and pay only for resources they use, easily adapting services use to current need, avoiding costly investment in IT infrastructure. Furthermore, storage and processing of data in a cloud facilitate access to information shared by many users. A study commissioned by the European Commission has shown that savings

SPECIALISTS EMPLOYED IN ICT (EU-28)



Source: Eurostat. Data given in thousands.

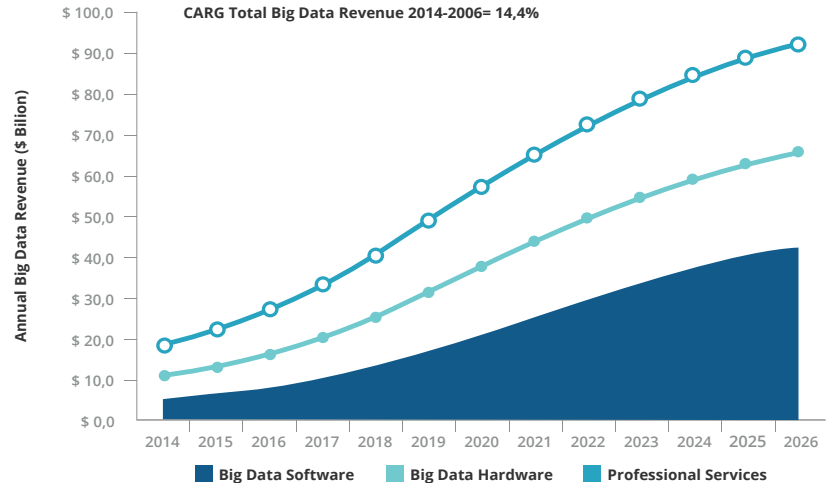
Segments covered by key trends in the sector develop at the rate between around a dozen and several tens of percent annually. This is because they provide significant competitive advantages and bring savings. For example, implementation of cloud solutions brings 10-20% savings on IT costs. Issues related to safety of information and legal regulation hinder the growth of the most innovative segments.

resulting from implementation of cloud solutions amount to 10-20% of the cost of entire IT. It is estimated that over the next few years the model of work in a cloud will be used more and more frequently by individual and corporate users. The entire market is developing at the rate of around a dozen percent annually. The primary factor slowing the market so far was users' concern about data safety. However, according to experts, it is the insufficient number of qualified employees that may slow down the growth of cloud services market.

Big Data is a concept applied to data sets, which at the same time are characterised by large volume, diversity and complexity, and require application of innovative information technologies, tools and method to extract new and useful knowledge from them. Progressing digitalisation of economy and technological development have opened access to large volumes of data. This brings a number of consequences. Part of these data are publicly available, which increases transparency in a number of fields. Organisations may collect data or use external data sets to increase effectiveness and make better decisions. Big Data helps companies to better segment their clients, thus facilitating better adaptation of their offer. Use of available data facilitates also better design of subsequent generations of products and services. Analytics is the key area of Big Data as it makes it possible to interpret data and identify competitive advantages. It is estimated that markets related to data analysis will grow at the rate of 20-40% annually in the next few years.

WIKIBON BIG DATA SOFTWARE

Hardware & Professional Services Projection 2014-2026 (\$B)



Source: Wikibon Big Data Project, 2016

The Internet of Things (IoT) is a concept, whereby each device is connected to the Internet, which will facilitate collection and processing of data from such a device. According to Gartner, a company specialising in technology related research, in 2015 the number of connected devices amounted to 4.9 billion. Gartner estimates that by 2020 this number shall increase to 25 billion, i.e. around twice as many as there are smartphones, tablets and computers combined. It is the IoT data that will result in an even greater influx of information facilitating optimisation of processes inside organisations.

At the same time the increasing number of network connected devices gives rise to concerns about data and user safety. According to Deloitte, with the scale and rate of development of cyber threats, one can assume that every organisation has either already been digitally attacked or shall be attacked in future. Primary sectors in the area of network safety are cloud data security, security of mobile devices and security analytics. The growth rate of the market is estimated at around 10% annually over the next few years.

ICT

IN THE FACE OF DIGITAL TRANSFORMATION

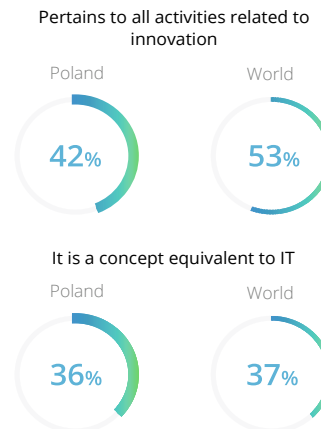
On average, digitally advanced sectors grow 2.8 times faster than other sectors. Polish specialisation include IT services consisting in software development, outsourcing services (shared services centres in particular) and development of games. However, telecommunications remain the leading sector in terms of generated revenue.

Presently, all markets see the process of digital transformation. Use of digital technologies is possible in many areas of each company's activities. At the same time 100% of application of digital opportunities call for the total change of the way of thinking about company's operations. Thanks to the use of digital technologies the transformation cover the entire process, from product design to customer service. Digitalisation involves the use of technologies such as social media, mobile, data analysis, and cloud computing. In manufacturing companies "smart" manufacturing systems emerge, which apply data analysis and ensure communication between individual components of a line. Large flexibility and reduced manufacturing costs are an advantage of these types of systems.

In order to fully use advantages embedded in digitalisation, it is necessary to fully understand new technologies and their benefits. According to PwC CEO Survey, 86% of presidents of management boards believe that the use of digital technologies is of key importance. 31% of respondents claim that over 15% of company revenues are invested in technologies covering operations of entire companies. At the same time for slightly more than one third of respondents, the concept of digitalisation equals IT. It means that this very group of interviewees perceives digitalisation processes too narrowly to fully understand the scale and potential of digital revolution.

According to the respondents the biggest challenges related to digitalisation included integration of new technologies

HOW IS THE DIGITAL TRANSFORMATION UNDERSTOOD



Source: PwC, Digital IQ report

with existing ones and effective use of the huge volumes of data available. The primary reason for the latter is shortage of qualified employees. Apart from competences in data analytics, the respondents pointed to skills related to UX/UI (user experience), system architecture and strategic planning as the most important ones. At the same time, more than three quarters of interviewees confirmed that companies were aware of the increasing threat of cyber attacks and undertook prevention measures.

ICT IN POLAND

In Poland 430 000 people find employment in the ICT sector and the share of ICT industry in GDP amounts to around 8%.

The number of ICT companies increased by 24.5% in 2011-2014. The number of persons working in the sector increases at the rate of around 6% annually. More than three quarters of persons employed in the sector work in ICT services, of which most are persons employed in IT services. The largest revenues in the sector are generated by services, telecommunications in particular. IT companies are responsible for two thirds of the revenues in the sector.

IN THE PAST 5 YEARS IN POLAND

digitally advanced sectors were growing almost 3 times faster than less advanced ones

The increase of total sales - average values by sectors (CARG 2010-2015, in %)



Service companies with operations based on the work of Polish programmers have the largest share in IT exports. ITO (Information Technology Outsourcing) centres have been opened in Poland by companies such as Luxoft, Tieto, BLStream, Sii, and C&F. According to forecasts, up to 240 thousand persons could work in Polish BPO, ITO, R&D and call centres in 2018.

Every year ICT sectors companies spend more and more money on research and development. Companies providing ICT services are responsible for 90% of the increase. At the same time the ICT sector

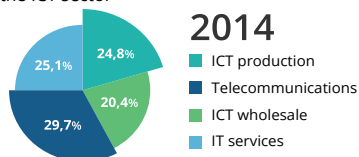
One of the key challenges faced by employers and investors in the ICT sector is finding qualified employees. In this area Poland holds one of the leading positions in the EU, however further activities stimulating supply of qualified IT specialist continue to be necessary.

demonstrates more innovativeness than other sectors of the economy.

Alongside the development of software on request and outsourcing services, development of computer games is a Polish speciality. Popularity of titles released by studios such as CD Projekt Red („The Witcher” series), CI Games („Sniper” series), Techland („Dead Island”, „Dying Light”) or 11bit Studios („This war of mine”) significantly influenced popularity of this sector in Poland. The market for computer games is strongly globalised and the origin of the publisher is less significant than in other ICT branches. At the same time the revenues of Polish game developers are relatively small in comparison to other ICT branches. The revenues of CD Projekt RED, Techland and CI Games, definitely the largest game developers in Poland, amounted to less than PLN 1.5 billion in 2015.

STRUCTURE OF NET REVENUE FROM SALES

in the ICT sector



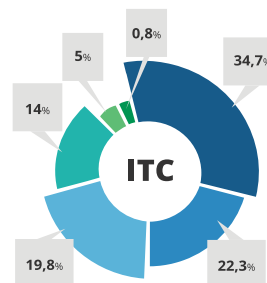
11% of people aged 20-29 have recently graduated from universities. 2.2% are graduates of scientific faculties. Poland ranks 4th in the EU in this respect. The cost of labour in ICT is 45-70% lower than in the Western Europe countries. One of the primary factors hindering the devel-

Segment	carg (2013-2018)	Value of the market (in USD million)		Share in IT services market	
		2013	2018	2013	2018
Application Management	6,6%	7,26	102,18	2,4%	2,6%
Information System Outsourcing	0,0%	193,92	194,34	6,2%	4,9%
Network and Desktop Outsourcing	0,5%	122,95	119,73	3,9%	3,0%
Hosted Application Management	17,6%	26,53	59,58	0,8%	1,5%
Hosting Infrastructure Services	17,5%	173,40	388,86	5,5%	9,9%
Total		591,06	864,69	18,8%	21,9%

Source: ABSL own elaboration based on IDC data

opment of the ICT sector, and IT in particular, is the shortage of qualified employees. At the same time, as statistics indicate, there is a shortage of several dozens of thousands of programmers in the territory of the European Union, and these values continue to grow every year. Also in Poland CEOs of companies point to this factor as one of the most significant problems. Programmers experienced in Java, .NET, C++, Objective C, HTML, CSS, Javascript, Python are most sought after. Re-qualification of a programmer from

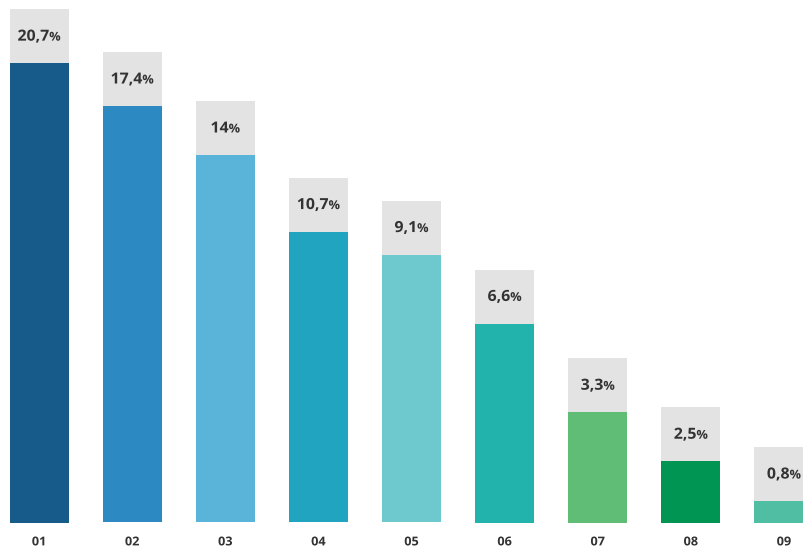
one programming language to another is definitely simpler and cheaper than training a new one. It does not alter the fact that in the next few years the situation in the IT labour market will continue to deteriorate from the point of view of employers. Demographic trends have a negative impact on the number of students and graduates of universities. Employers are looking for new, flexible forms of employment, which will facilitate better use of freelancers. The hope lies also in popularisation of robotisation and machine



WHAT IS THE POLISH ICT SPECIALISATION?

- Software development on request
- Development of games
- BPO/ITO services
- Internet technologies
- Research and development in the area of software
- Research and development in the area of hardware

The financial sector is the most digitalised in Poland. Despite substantial changes in recent years, the remaining sectors still lag behind the EU average. Government spending on digitalisation, including e-administration, is a very important driver of ICT sector development. Public procurement supported by EU funds represents around 25% of the demand for ICT services.



THE BIGGEST PROBLEM PRESENTLY FACED BY YOUR COMPANY*

- Availability of qualified staff
- Level of taxes and fees provided by the law
- Low turnover
- Competition from other entrepreneurs
- Bureaucracy
- Cost of labour
- Complexity of legal provisions
- Limited access to public procurements
- Corruption

*share of answers pointing to this factor as the most important one

learning, which in some areas will take the burden off human resources and will make it possible for programmers to get involved in other tasks.

DIGITALISATION OF ECONOMY

Polish e-economy represents 4.1% of GDP.

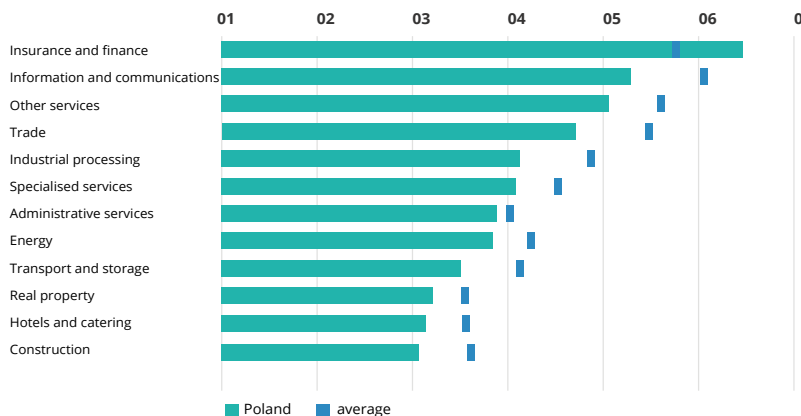
According to Deloitte's forecast this value will increase to 5% in 2016 and as much as 9.5% in 2020. Thanks to progressing digitalisation, the cost of running companies shall be decreasing over the next few years. Also, exchange of information within companies shall improve and customer service shall become easier.

In 2008-2016 GDP per capita increased by 31%, and the Economy Digitalisation Indicator by 70%. Poland ranks 4th in the EU in terms of the increase of the digitalisation indicator. At the same time Poland ranks 6th in Europe in terms of improvement of digital competences and 10th in terms of improvement of business environment. At the same time it should be noted that Poland is relatively poorly developed in terms of digitalisation in comparison to the most developed economies in Europe. Digitalisation should improve effectiveness also in sectors, which are least connected with digitalisation, such as mining or industrial production. Meanwhile, the only sector with digitalisation better than EU average is the financial sector. Inclination approach of the Financial Supervision Authority to technological novelties, openness of customers and high competitiveness of the sector, resulted in a situation, in which Poland possesses a user friendly banking system. Remaining sectors are weaker than EU average in terms of digitalisation. It may result from the fact that small and medium-sized enterprises in Poland are usually smaller than their counterparts in Western Europe.

In 2008-2014 huge effort was made improving the quality of e-administration. This work shall continue under the new EU perspective. The use of ICT technologies in the public sector continues to call for improvements. The Ministry of Economic Development has made it its objective for 50% of the society to handle 80% of official matters electronically within 2-3 years. Furthermore, one of the priorities is to increase non-cash turnover. The Digital

Main areas of government expenditure supported with EU funds shall include access to fast Internet, e-administration, digital competences and technical assistance, implemented via the Digital Poland Operational Programme.

POLISH SECTORS COMPARED TO THE EUROPEAN AVERAGE IN THE ECONOMY DIGITALISATION INDICATOR (PTS)



Source: Polityka Insight

Poland programme envisages introduction of widespread ICT services, broadening of online administrative procedures and other actions supporting digitalisation of Poland.

Public procurement supported by EU funds represents around one quarter of the demand for ICT services in recent years. The Digital Poland Operational Programme shall be the primary programme continuing this trend in 2014-2020. The total amount of funds allocated to the programme shall exceed PLN 10 billion, of which 80% are EU funds. The programme has been divided into the following priority axes:

- Common access to high-speed Internet,
- E-government and open government,
- Digital competences of the society,
- Technical assistance.

The axis "Common access to high-speed Internet" focuses on provision of broadband Internet, with a minimum capacity of 30 Mbit/s, in areas where necessary infrastructure could not be provided without support from the state. The objective is to provide the access to broadband Internet in the entire territory of Poland by 2020. In 2015 slightly more than 70% of households had a broadband access to the Internet. At the same time almost one quarter of households still do not have Internet, of which households without children are a decisive majority. The reason given for the absence of Internet in these household is the lack of need to use the network.

13.7% of Internet users aged 16-74 used disk space in a cloud. This is a 5.7 percentage points increase in compari-

son to 2014. Most of these persons are young people, with higher education and self-employed persons.

Under the axis "E-government and open government" public institutions shall be granted aid to broaden the scope of e-services, integration of services at the ePUAP platform (Electronic Platform for Public Administration Services), streamlining of services within administration, digitalisation of processes and procedures and provision of more data within the public sector.

The axis "Digital competences of the society" shall support persons willing to improve their digital competences and people at risk of digital exclusion. Moreover, support shall be offered to programmers, which will facilitate better use of the potential of this resource.

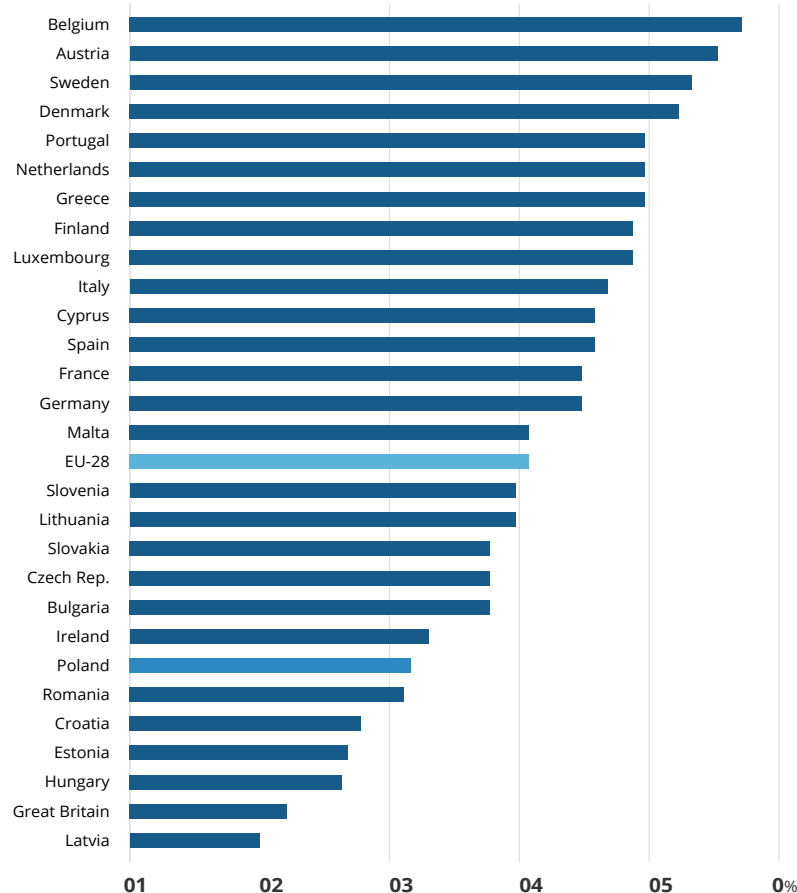
The axis "Technical assistance" focuses on provision of tools and human capital necessary for implementation and day to day management of the Digital Poland programme.

„Polityka Insight” centre issued a number of recommendations, which are to accelerate the digitalisation process in Poland:

- To guarantee shaping of digital competences at each stage of education.
- To encourage public institutions to make data and services available online.
- To create a single government service to handle official matters.
- To support and develop educational programmes on personal data.
- To regulate access to personal data

There is still a large disproportion in diffusion of ICT solutions in the economy. Smaller companies often do not have a possibility to implement modern solutions or to employ qualified specialists. Tax allowances and financial supports may be the answer.

COMPANIES USING ERP SYSTEM IN EUROPEAN UNION MEMBER STATES IN 2014



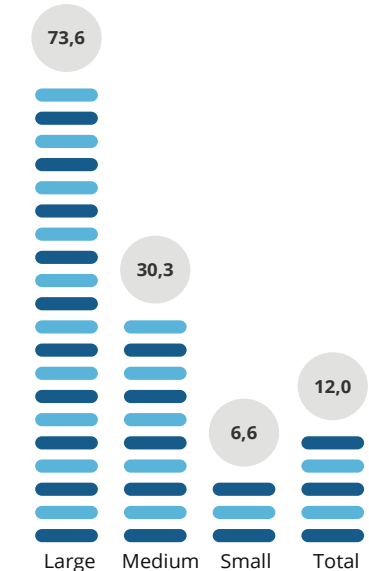
Source: Eurostat database

taking into account all groups.

- To invest public funds only in selected, prospective sectors.
- To design a system of tax allowances for purchases of innovative technological solutions.
- To support investment in broadband infrastructure to ensure universal, high-quality access to the Internet.
- To facilitate business activities.
- To coordinate the process of execution of IT procurement by administration.

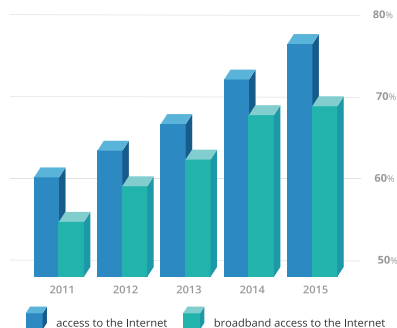
COMPANIES EMPLOYING PERSONS WITH SPECIALIST

skills in ICT by size and types of activity in 2015



The e-commerce sector develops at the rate of 20% annually. Its value amounted to PLN 32 billion. Despite the fact that presently it represents a relatively small percentage of trade exchange, its share shall systematically grow. It is expected that the revenue of the sector shall double in the coming 5 years.

HOUSEHOLDS WITH INTERNET ACCESS AND BROADBAND ACCESS TO THE NETWORK



E-COMMERCE

The value of the e-commerce sector in 2015 amounted to PLN 32 billion and was higher by around 20% in comparison to 2014. The revenues of the sector are expected to double in the next 5 years. However, the sector continues to represent a small share of trade exchange.

In 2015 11 million persons aged 16-74 made at least one purchase via the Internet. Two thirds of these persons have a degree. Men buy online more often than women. Nowadays consumers are very well informed. Thanks to the Internet they can quickly find products they want, at the best possible price. They are used to have their need fulfilled immediately, on good

conditions. Therefore competitiveness in this sector is governed by different rules than those of the traditional trade. E-commerce is characterised by rapid changes in consumers' habits. Companies, which shall quickly and effectively adapt new technologies and react to changes in customer preferences stand the biggest chance of remaining in the market. One of the key factors will be effective use of big data.

POLISH START-UPS

As the study of Deloitte shows, half of start-ups in Poland carry out activities related to the ICT sector. The most frequently mentioned areas of start-ups' activities include mobile technologies, e-commerce, business software, education, Internet of Things and Big Data. The structure of financing of young companies is changing. Most companies start their activities using own funds, avoiding costly investments until they generate enough revenue. In substantial majority from the start of operations start-ups intend to sell their services and products outside of Poland. At the same time, as in the entire sector, shortage of qualified employees is a problem. Already one in every four start-ups employs foreigners as ICT specialists. The progressing computerisation of the society is an opportunity for start-ups from the ICT sector and companies already established in the industry. With every year more and more households are connected to the Internet (75.8%) including broadband. This trend leads to the increase of the target group for many ICT solutions, endogenously stimulating the demand for products of Polish com-

SECTORS, IN WHICH START-UPS OPERATE

ICT and digital transformation solutions



Creative industry and multimedia technologies



Technologies for optimisation of energy consumption and renewable energy sources



Biotechnologies and medical technologies



Nanotechnologies and material technologies



Robotics and other industrial technologies



Others



Source: mBank

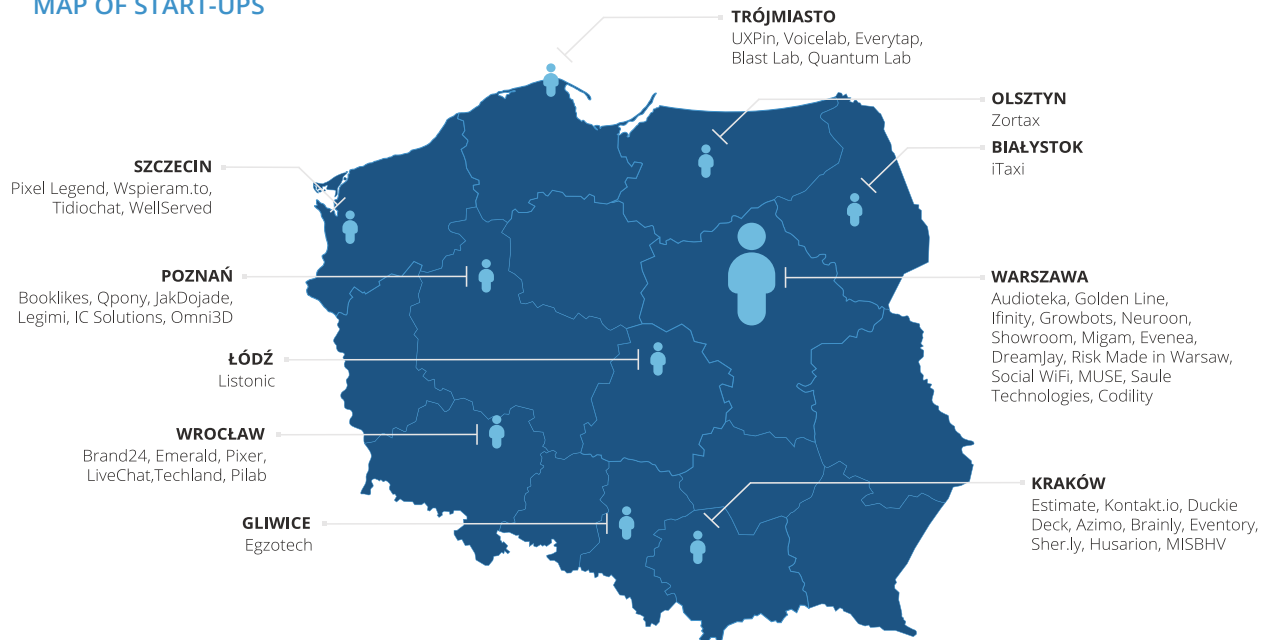
The huge growth potential of the ICT sector is also confirmed by a large number of newly created start-ups. More than 50% of start-ups are established in the ICT sector.

panies from the sector. The change of consumer behaviours, including transferring of a large part of day to day activities to the Internet, is a significant stimulant of the sector. Computerisation continues to affect more and more aspects of lives of citizens and companies. One of the strongest trends is the increased use of mobile devices. This is very well exemplified by more customers logging in from mobile devices than from traditional ones to one of the leading banks in Poland in

November 2014. These data clearly justify the statistics indicating that more than 50% of start-ups are established in the ICT sector. A very dynamic development of the sector can be expected in the coming years, as well as its continuously growing significance to the economy. At the same time one should remember that in order to keep the sector in a good condition substantial efforts are required, especially in the form of investment and allowances from the government. The needs

include provision of financing for high risk projects, introduction of allowances (e.g. tax allowances) for enterprises investing in R&D and computerisation and retaining of the level of public expenditure supported by EU funds. Without an active approach of companies and the state, the retention of positive results of the sector may prove very difficult at the time of growing competition and decreasing cost advantage of Poland.

MAP OF START-UPS



Source: The map has been elaborated by Startup Poland ambassadors

THE ANALYSIS OF POLISH ICT SECTOR

STATE OF PLAY
AND INTERNATIONAL STANDING

The ICT sector includes all services and products performing a function of processing and transmitting information electronically.

For the needs of this report, the ICT sector has been defined in line with the framework presented by the Organisation for the Economic Cooperation and Development, which had been presented in document DSTI/ICCP/IIS(2006)2/FINAL „Working Party on Indicators for the Information Society” of 5 March 2007. The guidelines identify the sectors of the economy, which should be included in the ICT sector. The segmentation is in line with the framework of the Statistical classification of economic activities in the European Community - NACE Rev. 2, which ensures its compatibility with an overwhelming majority of commonly used classifications. In general, the ICT sector comprises services and production of goods fulfilling the functions of information processing and its communication by electronic means, including transmission and display, or using electronic processing to detect, measure and record physical phenomena or to control physical processes. It must be noted that statistical definitions are not perfect and some values may differ depending on the adopted classification of the ICT sector.

The complete analysis of the situation of the Polish ICT sector is possible thanks to combining the qualitative and quantitative analysis tools. The qualitative analysis focuses on examining the key, quantifiable parameters monitoring the situation and trends in the sector. Such data include those describing i.a. turnover, employment, profitability, significance of the sector for the economy or innovation. The results of the analysis of the main indicators describing the sector, as well as Po-

Table 1: DEFINITION OF THE ICT SECTOR

NACE Rev. 2 code / Polish Classification of Activities (PKD) code	Description according to NACE Rev. 2	Description according to Polish Classification of Activities (PKD)
261	Manufacture of electronic components and boards	Produkcja elementów elektronicznych
262	Manufacture of computers and peripheral equipment	Produkcja komputerów i urządzeń peryferyjnych
263	Manufacture of communication equipment	Produkcja sprzętu telekomunikacyjnego
264	Manufacture of consumer electronics	Produkcja elektronicznego sprzętu powszechnego użytku
268	Manufacture of magnetic and optical media	Produkcja magnetycznych i optycznych niezapisanych nośników informacji
4651	Wholesale of computers, computer peripheral equipment and software	Sprzedaż hurtowa komputerów, urządzeń peryferyjnych i oprogramowania
4652	Wholesale of electronic and telecommunications equipment and parts	Sprzedaż hurtowa sprzętu elektronicznego i telekomunikacyjnego oraz części do niego
5820	Software publishing	Działalność wydawnicza w zakresie oprogramowania
6110	Wired telecommunications activities	Działalność w zakresie telekomunikacji bezprzewodowej
6120	Wireless telecommunications activities	Działalność w zakresie telekomunikacji bezprzewodowej, z wyłączeniem telekomunikacji satelitarnej
6130	Satellite telecommunications activities	Działalność w zakresie telekomunikacji satelitarnej
6190	Other telecommunications activities	Działalność w zakresie pozostałej telekomunikacji
6201	Computer programming activities	Działalność związana z oprogramowaniem
6202	Computer consultancy activities	Działalność związana z doradztwem w zakresie informatyki
6203	Computer facilities management activities	Działalność związana z zarządzaniem urządzeniami informatyki
6209	Other information technology and computer service activities	Pozostała działalność usługowa w zakresie technologii informatycznych i komputerowych
6311	Data processing, hosting and related activities	Przetwarzanie danych, zarządzanie stronami internetowymi (hosting) i podobna działalność
6312	Web portals	Działalność portal internetowych
9511	Repair of computers and peripheral equipment	Naprawa i konserwacja komputerów i urządzeń peryferyjnych
9512	Repair of communication equipment	Naprawa i konserwacja sprzętu telekomunikacyjnego

Source: Own study based on NACE Rev. 2 and the Polish Classification of Activities (2007).

In terms of the number of entities, the Polish ICT sector accounts for 7.6% of the EU market. The number of Polish enterprises in the sector increases at the average annual rate of 10.1%.

land's place on the international forum, are presented below. The data include aggregated results of individual groups of the Polish Classification of Activity comprising the ICT sector.

SIZE AND SIGNIFICANCE FOR THE ECONOMY

The analysed factors include: turnover in the sector, value of the sector's production, added value, employment, turnover per employed person, employment dynamics, dynamics of gross operating surplus, value of investment per employed person, investment rate, remuneration, profitability rate, value of investment expenditure, share of the ICT sector in the GDP, share of the ICT sector in total employment, share of the ICT sector in export, share of the ICT sector in import, innovation expenditure, share of revenues from sale of improved products in revenues from sales.

Poland is at the high, fifth position among the European countries in terms of the number of registered enterprises in the ICT sector. The above data demonstrate the large potential of the sector for both the economic growth and directly for employment. The large number of enterprises constitutes a potential which provides foundations for further international success of Polish enterprises. Polish companies account for approximately 7.6% of enterprises operating in the sector in the European Union. This points to the importance of these companies both from the Polish and the European perspective. The growth rate of the number of enterprises allows to forecast that the position

Table 2: NUMBER OF ENTERPRISES IN THE ICT SECTOR

COUNTRY/YEAR	2008	2009	2010	2011	2012	2013	2014
Great Britain	132943	...	128957	...	...	...	163325
France	...	69900	95204	94627	108515	126702	131835
Italy	108507	105331	104614	103239	103075	101893	102330
Germany	70134	71252	74973	80767	82554	86378	97972
POLAND	42833	48517	52566	57887	63462	69169	76302
Netherlands	30898	33998	47953	51135	55825	70914	73131
Spain	...	...	44222	45095	48986	49863	52204
Sweden	39215	40041	41876	43925	44186	43903	44913
Romania	19519	19190	17157	16127	17318	18188	19485
Austria	13617	13466	14420	14798	15088	15388	15795
Slovakia	2906	1512	9847	11719	11838	13022	14324
Denmark	10624	10797	11650	12396	12733	13074	13619
Portugal	12408	12052	11747	12004	12035	12680	12975
Norway	12113	11345	11237	11215	11546	11817	11939
Greece	...	...	...	9054	8939	8975	9455
Bulgaria	5752	7126	7279	7685	8228	9024	9452
Finland	7402	7344	7517	7679	7825	8130	8185
Slovenia	4162	4703	5170	5422	5676	6091	6614
Croatia	4432	4879	5111	5134	5187	5438	5630
Latvia	2559	2780	3151	3406	4391	5063	5432
Lithuania	2415	2270	2532	2779	3435	3818	5127
Estonia	1849	1934	2266	2731	2917	3364	3527
Luxembourg	1554	1618	1694	1755	1838	1960	2054
Macedonia	...	...	...	947	1065	1143	1170

Source: Own study based on Eurostat; Legend: "e" – own estimation, "..." – no data available; Values expressed in the number of enterprises

of Poland at the international arena will be further strengthened. The average annual growth rate of the analysed variable in the years 2009-2014 exceeded 10.1% (CAGR). This places Poland at the seventh position in terms of average growth rate among all analysed European countries. It is also worth noting that among 10 countries with the largest number of enterprises Poland was classified at the third place. The increasing number of enterprises in

the ICT sector means growth of the sector's capacity to generate innovative solutions of international significance.

In terms of gross revenues from sales of goods and services supplied by the ICT sector, Poland ranks seventh among the analysed European countries. This position, when compared to the size of the sector expresses by the number of enterprises, points to a lower effectiveness of Polish enterprises compared to the European market leaders. The conclusions from the analysis of the changes of the said indicator are optimistic. In the years 2009-2014, Poland recorded an average annual turnover growth rate at the level exceeding 8.64% (CAGR). The overall growth rate in the years 2010-2014, i.e. the period not including the financial crisis, amounted to 16.72%. In terms of the first indicator, the Polish ICT sector recorded the highest growth rate among all analysed countries. As regards the second indicator, Poland was classified as second.

The above data reveal a positive global trend in the Polish ICT sector. Turnover generated by the ICT grows dynamically and places Poland at a high position among the European countries. However, the efficiency of Polish enterprises should be further improved. The turnover dynamics of the sector is still lower than the growth rate of the total number of enterprises. The instruments employed to improve the situation should include mainly the government and the EU support programmes aimed at increasing the efficiency of enterprises. The areas that should receive support include innova-

The Polish ICT sector is in a good condition, observing an average annual increase in turnover of over 8.6%. This is the highest growth rate in Europe.

Table 3: TURNOVER OF THE ICT SECTOR

COUNTRY/YEAR	2008	2009	2010	2011	2012	2013	2014
Germany	263027	253818	274263	290581	287483	291077	306922
Great Britain	...	...	220139	229077*	238016*	246955*	255894
France	...	191174	201816	213050*	211170	209306*	195195
Italy	130590	121830	125910	123958	121750	116652	115575
Spain	...	...	91473	88443	83217	80229	81589
Finland	...	44397	45052	45717*	46392*	47077*	47772*
POLAND	...	25676	32720	34081	35371	36362	38190
Austria	25262	24130	24231	26348	27254	27851	28425*
Norway	...	...	25204	26059*	26059*	27771	27314
Denmark	...	...	25382	25426	25470*	25514*	25558*
Portugal	17092	16251	15589	14623	14028	13353*	12711*
Romania	12005	10612	11426	11859	10911	11609	12702
Slovakia	11326	11235	12097	11749	12087	12295*	12506*
Greece	...	...	...	10364	10165	9312	9062
Bulgaria	4241	3976	...	...	4095	...	4563
Slovenia	3646	3565E	3485E	3404	3271	3370	3424

Source: Own study based on Eurostat; Legend: "e" – own estimation, "..." – no data available; Values expressed in EUR million

tion, internationalisation or cost-reducing solutions.

Poland is classified as sixth in Europe in terms of production volume in the ICT sector. The indicator informs about the value of products and services produced by enterprises from individual groups of PKD/NACE Rev. 2 comprising the ICT sector. The leaders in terms of production (in the course of the entire analysed period) include the United Kingdom, Germany, France and Italy. Another country is Spain, but it produces almost a half less goods and services than the last country from

the group of leaders, i.e. Italy. As regards the groups of leaders, the United Kingdom and Germany stand out, since apart from being at the leading position, they also record a constant high growth dynamics, thus strengthening their position at the first two places. They recorded high growth rates in average annual terms and in absolute terms in the years 2010-2014. They stood at 4.4%-5% and 19.98% for the United Kingdom and 1%-8% and 17% for Germany. Poland recorded an average annual growth rate at 0.46%-24.8%, while the growth rate in the entire period 2010-2014 amounted to 6.7%. In terms of arith-

Table 4: VALUE OF PRODUCTION OF THE ICT SECTOR

COUNTRY/YEAR	2008	2009	2010	2011	2012	2013	2014	2015	2016
Great Britain	...	...	168668	177097*	185526*	193954*	202383	211816*	221690*
Germany	17630	167653	168167	181688	180270	188832	197133	201011*	204965*
France	...	145348	155172	158415*	161658	162351*	163044	166875*	170797*
Italy	110623	107332	111213	109506	108052	103432	100532	98974*	97440*
Spain	...	...	58891	57900	55515	53782	53412	52129*	50877*
POLAND	...	21864	27292	27495	28061	28190	29129	30959*	32905*
Finland	...	26529	26625	26722*	26818*	26915*	27012*	27110*	27208*
Norway	...	...	20491	21389E	22287E	23185	22725	23329*	23949*
Austria	15169	14179	13815	14900	15103	15441	15513*	15586*	15660*
Denmark	...	...	18398	17493	16632E	15814*	15036*	14296*	13593*
Portugal	13535	13040	13060	12196	11517	11066*	10632*	10215*	9815*
Slovakia	9655	9499	10443	10060	11217	10413*	10583*	10755*	10930*
Greece	...	...	...	7148	7005	5965	6037	5722*	5424*
Bulgaria	3096	3117*	3139*	3160*	3181	3265*	3350	3394*	3439*
Slovenia	2571	2577*	2583*	2589	2591	2585	2617	2615*	2633*

Source: Own study based on Eurostat; Legend: "e" – own estimation, "..." – no data available; Values expressed in EUR million

metic mean of average annual growth rates, Poland ranks first among the European countries. However, it should be noted that the average is overstated due to a very high growth rate in 2011 which amounted to 24.8%. Taking into account the total growth of production in the years 2010-2014, Poland developed at the above-average rate, but considerably slower than the United Kingdom and Germany. The situation suggests that despite the extraordinarily good results, the Polish ICT sector still has a large unused potential. If Poland wants to become one of the leaders in the sector, it must intensify

The United Kingdom, Germany and France are the leaders in production in the ICT sector. With the average annual growth rate of 6.7%, Poland efficiently catches up with the leading countries, but still records a significantly lower value of production.

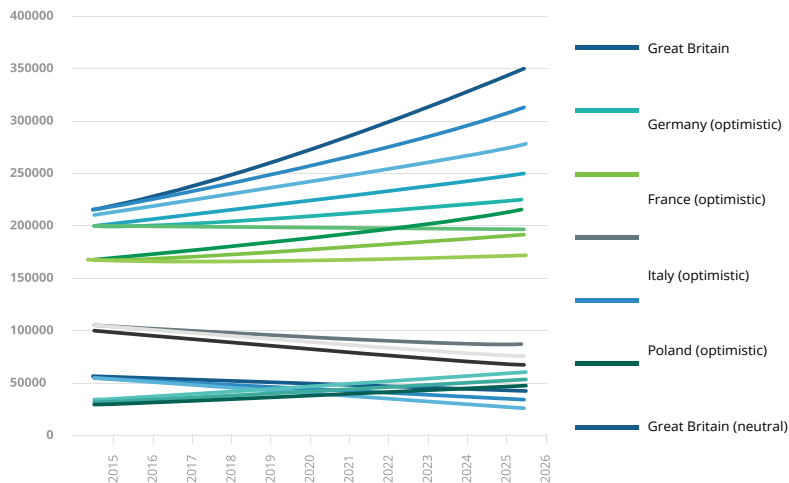
activities stimulating the production by Polish enterprises from the sector.

Poland is characterised by a relatively high growth rate, higher than in the majority of European countries, including also the sector leaders (on average 6.3% CAGR). However, it is worth noting that the sector leaders, although their growth dynamics is lower, achieve higher growth rates in absolute terms. Since the disproportion of absolute value of the sectors is high among the countries, Poland must develop much faster if it wants to catch up with the leading countries. If the current growth rate trend in Poland is maintained, the countries with the largest ICT

production will still be far ahead. The situation is well illustrated by a significant gap between the production volume of Poland and France, which will decrease only slightly, if the growth rate of the Polish sector does not change until 2026. The above figure presents the growth forecasts of the leading (United Kingdom, Germany, France) and the aspiring countries (Poland, Spain, Italy). The forecasts present three possible variants of changes: optimistic, i.e. maintaining the average growth rate from the years 2008-2014, neutral, i.e. reduction of the growth rate by 1 pp, and conservative, i.e. reduction of the growth rate by 2 pp. All variants are based on an assumption that during the forecast period no actions will be taken that could have a significant impact on the condition of the Polish sector (apart from maintenance).

accounts for 4% of total employment. The value is relatively low compared to other countries. In Germany it amounts to 5.2%, in Denmark to 9.2% and in Finland to 7.19%. It is important that Poland records a significant upward trend in the share of employment in the ICT sector in total employment. It amounted to 0.168 pp annually on average. The share of the ICT sector in employment is expected to increase over the next years. It should be noted that the trend is strongly influenced by two factors, namely, the talent drain by other economies and by a decreasing cost advantage of Poland. In the long term, those factors will have an adverse impact on employment in the sector and thus may cause a drop in the share of employment in the ICT sector in total employment.

FORECAST OF THE VALUE OF PRODUCTION OF THE ICT SECTOR



Source: Own study (forecast) based on Eurostat. Values expressed in EUR million.

In Poland, the share of the ICT sector in the GDP amounted to 6.1% in 2014. The result places Poland at a relatively distant position compared to other European countries. For example, the figure for Hungary is 11.46%, for Bulgaria 9.76% and for Germany 8.38%. In most countries, the share of the ICT sector in GDP has declined in the analysed years. However, the decline in Poland was relatively low. The further decrease in the share of the ICT sector in GDP is likely to be halted or reversed due to dynamic development of the sector and the GDP growth rate. If the situation does not change, the trend from previous years may lead to a decrease in the share of the ICT sector in GDP to 6.06%.

THE SHARE IN AND THE SIGNIFICANCE OF THE SECTOR FOR INTERNATIONAL TRADE

The share of the ICT sector in total export and import in 2014 amounted to 7.47% and 7.28%, respectively. In absolute terms, the total export in the years 2011-2014 increased by PLN 134.8 billion, which marks a growth by 24%. The export of the ICT sector increased by PLN 17.3 billion, i.e. by 50%. This demonstrates the growing significance of the ICT sector for the Polish export and its potential for further development at a rate exceeding the average for other sectors. The data demonstrate that Polish enterprises have a great opportunity for expansion on foreign markets and that they are in fact using it.

Employment in the ICT sector in Poland

Table 5: SHARE OF THE ICT SECTOR IN THE GDP

COUNTRY/YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015 ^e	2016 ^e	2017 ^p
Sweden	13.9 0%	13.7 8%	13.0 7%	...	...	...	...	...	...	...	...	...	...
Great Britain	13.3 0%	12.7 5%	13.2 7%	11.7 6%	11.3 8%	11.0 0%	...	...	...	...	...	...	...
Hungary	14.0 0%	12.8 2%	11.6 7%	11.5 7%	11.5 2%	11.4 4%	11.9 2%	11.6 5%	11.7 7%	11.4 5%	11.2 2%	10.9 8%	10.7 5%
Bulgaria	...	11.6 1%	11.9 6%	9.98 %	9.74 %	9.82 %	9.36 %	9.22 %	9.38 %	9.76 %	9.57 %	9.39 %	9.20 %
Estonia	9.77 %	9.28 2%	9.14 %	8.81 %	9.95 %	9.58 %	10.0 %	9.33 %	9.12 %	9.69 %	9.70 %	9.71 %	9.72 %
Denmark	9.89 %	10.1 8%	10.4 8%	9.28 %	9.71 %	9.33 %	9.31 8%	9.23 8%	9.15 9%	9.08 9%	9.00 %	8.92 %	8.85 %
Czech Republic	...	...	...	...	8.94 %	8.86 %	8.76 %	8.76 %	8.80 %	8.62 %	8.56 %	8.50 %	8.43 %
Germany	9.26 %	9.30 %	9.43 %	7.92 %	8.24 %	7.76 %	8.04 %	7.98 %	8.13 %	8.38 %	8.30 %	8.23 %	8.15 %
Slovakia	...	9.47 %	9.62 %	8.82 %	7.38 %	9.32 %	8.97 %	9.47 %	8.88 %	8.28 %	8.20 %	8.12 %	8.04 %
Croatia	...	...	...	8.33 %	8.17 %	9.28 %	8.14 %	7.82 %	8.26 %	8.28 %	8.30 %	8.31 %	8.33 %
France	9.00 %	8.88 %	8.84 %	8.07 %	7.98 %	8.05 %	8.13 8%	8.03 8%	7.87 %	7.71 %	7.58 %	7.46 %	7.33 %
Belgium	10.3 6%	10.0 1%	9.77 %	9.29 %	8.80 %	8.96 %	8.18 8%	8.23 %	8.06 %	7.68 %	7.43 %	7.19 %	6.96 %
Latvia	...	...	...	6.60 %	6.80 %	7.10 %	6.60 %	6.98 %	7.48 %	7.54 %	7.72 %	7.90 %	8.09 %
Slovenia	...	...	8.17 %	6.68 %	6.85 9%	7.02 %	6.98 8%	7.14 8%	7.24 %	7.24 %	7.14 %	7.03 %	6.93 %
Italy	7.81 %	7.87 %	7.73 %	6.80 %	6.82 %	6.84 %	6.86 %	6.98 %	6.52 %	6.48 %	6.35 %	6.23 %	6.11 %
Portugal	7.96 %	7.64 9%	7.32 %	7.00 %	6.86 %	6.92 %	6.64 8%	6.64 8%	6.55 9%	6.47 %	6.32 %	6.18 %	6.04 %
Spain	7.68 %	7.60 %	7.72 %	7.04 %	6.98 %	6.85 %	6.78 8%	6.68 %	6.56 %	6.34 %	6.21 %	6.08 %	5.95 %
Austria	8.94 %	8.82 %	7.52 %	6.41 %	6.32 %	6.26 %	6.52 %	6.32 %	6.48 %	6.24 %	6.01 %	5.79 %	5.57 %
Norway	...	...	...	...	6.88 %	6.74 %	6.80 %	6.38 %	6.36 %	6.23 %	6.11 %	6.00 %	5.88 %
Romania	...	7.18 %	6.86 %	6.54 %	6.54 %	6.19 %	6.15 %	6.33 %	6.24 %	6.18 %	6.07 %	5.96 %	5.85 %
POLAND	...	...	...	...	6.18 %	6.36 %	6.52 %	6.24 %	6.00 %	6.10 %	6.09 %	6.07 %	6.06 %
Finland	16.1 2%	16.4 1%	18.2 6%	13.3 6%	10.0 6%	10.4 0%	8.70 %	7.30 %	6.60 9%	5.96 9%	5.38 %	4.86 %	4.40 %
Lithuania	5.69 %	5.55 9%	5.40 %	4.32 %	4.57 %	4.82 %	4.86 %	4.98 %	4.80 %	5.19 %	5.15 %	5.12 %	5.09 %
Greece	5.49 %	5.46 9%	5.42 %	5.22 %	4.74 9%	4.26 %	4.13 %	4.08 %	3.96 %	3.68 %	3.52 %	3.37 %	3.23 %

Source: Own study based on Eurostat; Legend: "e" – own estimation, "p" – projection, "..." – no data available; Values expressed in %.

Table 6: SHARE OF THE ICT SECTOR IN EMPLOYMENT

COUNTRY/YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015 ^e	2016 ^e	2017 ^p
Sweden	9.6 3%	9.52 %	9.58 %	...	...	...	...	...	...	...	...	...	...
Switzerland	...	...	...	...	6.44 %	...	5.8 2%	...	6.18 %	...	...	...	...
Denmark	7.2 2%	7.38 %	7.28 %	6.51 %	6.33 %	6.48 %	8.3 3%	8.66 9%	8.94 9%	9.23 9%	9.5 3%	9.8 5%	10.1 5%
Estonia	5.9 2%	6.05 %	6.46 %	5.82 %	6.15 %	6.42 %	6.5 6%	6.82 %	6.96 %	7.21 %	7.3 5%	7.5 5%	7.72 %
Finland	9.5 8%	9.21 %	9.06 %	8.12 %	8.10 %	7.89 %	7.7 3%	7.66 %	7.42 %	7.19 %	6.9 7%	6.7 6%	6.55 %
Hungary	7.2 8%	7.30 8%	7.42 %	7.05 %	6.75 %	7.20 2%	7.3 2%	7.24 %	7.03 %	6.80 %	6.7 5%	6.7 %	6.66 %
Great Britain	7.4 9%	6.96 %	7.20 %	6.67 %	6.50 %	6.62 %	6.4 %	6.18 %	6.64 %	6.55 %	6.4 6%	6.3 7%	6.28 %
Latvia	3.4 2%	3.28 %	3.42 %	3.57 %	3.83 %	4.10 %	4.3 0%	4.94 %	5.24 %	6.06 %	6.4 7%	6.9 %	7.36 %
France	6.2 2%	6.2 %	6.34 %	6.10 %	5.86 %	5.62 %	6.6 %	5.8 %	5.67 %	6.02 %	6.0 0%	5.9 %	5.96 %
Netherlands	...	6.89 %	6.71 %	6.46 %	6.2 %	6.08 2%	6.1 %	6.08 %	6.04 %	6.0 %	5.9 0%	5.8 0%	5.7 %
Norway	...	...	...	...	5.58 %	5.7 %	5.7 3%	5.72 %	5.72 %	5.81 %	5.9 0%	5.9 1%	5.95 %
Czech Republic	...	...	...	...	5.52 %	5.41 %	5.5 7%	5.58 %	5.52 %	5.62 %	5.6 4%	5.6 6%	5.68 %
Slovakia	...	5.48 %	5.84 %	4.96 %	4.40 %	4.44 %	5.6 %	5.58 %	5.56 %	5.53 %	5.5 1%	5.6 %	5.65 %
Belgium	5.9 4%	5.72 %	5.98 %	5.86 %	5.73 %	5.69 %	5.4 2%	5.36 %	5.48 %	5.29 %	5.2 2%	5.1 3%	5.10 %
Germany	5.1 4%	5.18 %	5.37 %	4.66 %	4.52 %	4.52 %	4.7 6%	4.7 %	4.94 %	5.2 %	5.2 2%	5.2 %	5.25 %
Slovenia	...	...	5.44 %	4.1 9%	4.37 9%	4.64 %	4.6 %	4.82 %	5.04 %	5.04 %	5.0 2%	4.9 %	4.97 %
Austria	5.6 4%	5.62 %	5.08 %	4.62 %	4.59 %	4.54 2%	4.6 %	4.76 %	4.84 %	4.94 %	4.8 8%	4.8 %	4.75 %
Italy	5.3 6%	5.28 %	5.26 %	4.9 %	4.84 %	4.78 %	4.7 2%	4.74 %	4.76 %	4.64 7%	4.5 4%	4.5 0%	4.43 %
Lithuania	3.6 9%	3.44 9%	3.19 %	3.09 %	3.34 %	3.58 %	3.7 6%	3.97 %	4.15 %	4.64 %	4.5 6%	4.5 7%	4.6 7%
Spain	3.8 4%	3.90 %	3.98 %	3.90 %	3.97 %	4.04 %	4.1 9%	4.40 %	4.38 %	4.42 %	4.4 9%	4.5 6%	4.63 %
Bulgaria	...	3.42 %	3.38 %	3.12 %	3.42 %	3.58 %	3.7 8%	3.4 %	3.42 %	4.25 %	4.38 %	4.5 2%	4.6 8%
Croatia	...	...	...	...	3.7 %	3.54 %	3.84 %	3.8 %	3.79 %	4.34 %	4.38 1%	4.5 %	4.6 5%
POLAND	...	...	...	...	3.16 %	3.41 %	3.5 3%	3.68 %	3.82 %	4.0 9%	4.1 %	4.4 0%	4.61 %
Romania	2.6 2%	2.9 %	3.3 %	3.1 %	2.94 %	2.9 %	3.1 %	3.42 %	3.68 %	3.9 8%	4.0 8%	4.2 %	4.48 %
Portugal	2.9 0%	2.9 %	2.9 %	2.91 %	3.08 %	3.13 %	3.3 %	3.52 %	3.69 %	3.87 %	4.0 0%	4.1 3%	4.27 %
Greece	2.8 8%	2.83 %	2.78 %	2.81 %	2.69 %	2.56 %	2.6 %	2.88 %	2.68 %	2.9 %	2.9 1%	2.9 %	2.92 %

Source: Own study based on Eurostat; Legend: "e" – own estimation, "p" – projection, "..." – no data available; Values expressed in %.

The dynamic development of the ICT sector is also visible in the foreign trade balance. The share of the sector in export and import amounts to 7.47% and 7.28%, respectively.

Table 7: SHARE OF THE ICT SECTOR IN EXPORT AND IMPORT

PLN billion	2011	2012	2013	2014
Export	558,7	603,4	647,9	693,5
of which ICT	34,5	37,3	39,6	51,8
Percentage share	6,18%	6,18%	6,11%	7,47%
Import	623,4	648,1	656,1	704,6
of which ICT	42,9	44,4	45,9	51,3
Percentage share	6,88%	6,85%	7,00%	7,28%

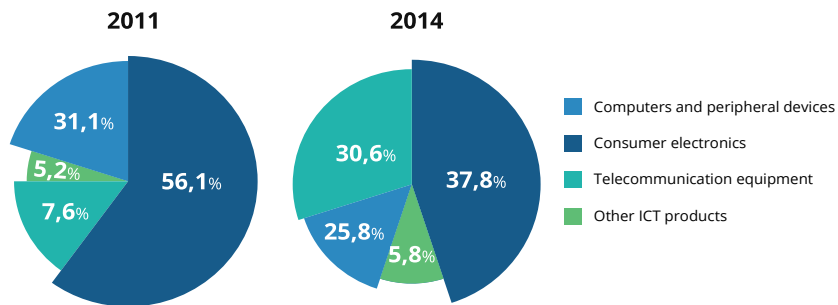
Source: Own study based on the publication of the Central Statistical Office: "Information society in Poland. Results of statistical surveys in the years 2011–2015."

The value of import also increased in the analysed period of 2011-2014. Total import grew by PLN 81.2 billion, which accounts for 13% compared to the beginning of the period. The import of the ICT sector increased by PLN 8.4 billion, i.e. by 19.6%. Similarly to export, the import of the ICT sector also grew faster, by 6 pp.

However, the two indicators did not grow evenly in individual segments of the ICT sector. Differences are recorded in the changes of export and import structure which took place between 2011 and 2014.

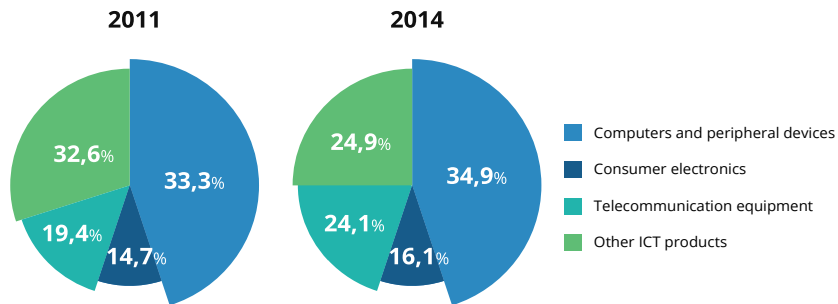
The changes in the export structure show that in the analysed years, the highest growth rate was recorded in case of exports of telecommunication equipment. The share of this product category in total exports increased by 23 pp. The expansion of this category reduced the share of computers and peripheral devices and consumer electronics by 5.3 pp and 18.3 pp, respectively.

STRUCTURE OF THE ICT SECTOR'S EXPORTS IN 2011 AND 2014



Source: Information society in Poland. Results of statistical surveys in the years 2011-2015, Central Statistical Office.

STRUCTURE OF THE ICT SECTOR'S IMPORTS IN 2011 AND 2014



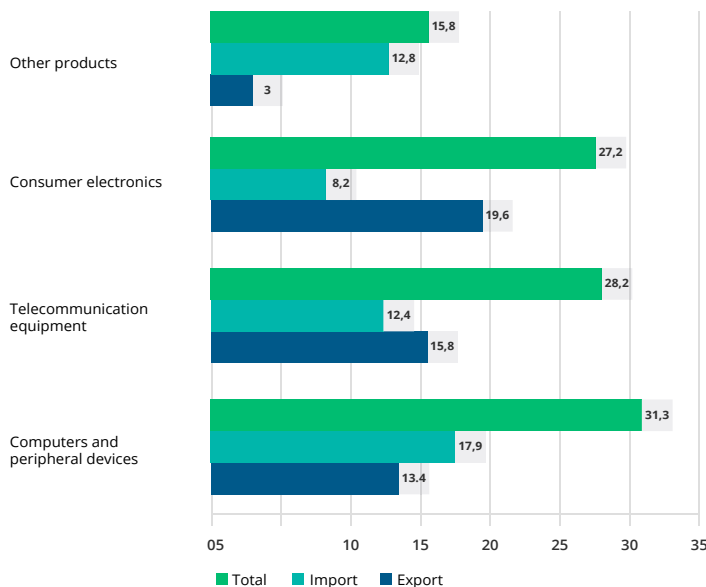
Source: Information society in Poland. Results of statistical surveys in the years 2011–2015, Central Statistical Office.

In the years 2011–2014, telecommunication equipment recorded the highest increase in its percentage share in imports. The data confirm that the segment is very strong, which is reflected also in the data

on exports. Other product categories grew only slightly (by 1.4-1.6 pp). All positive changes in the import structure happened at the expense of the reduction in the share of other ICT products (–7.7 pp).

Telecommunications remain the main segment of the ICT sector, generating the highest turnover in foreign trade.

EXPORTS AND IMPORTS OF INDIVIDUAL SEGMENTS OF THE ICT SECTOR IN 2014



Source: Information society in Poland. Results of statistical surveys in the years 2011-2015, Central Statistical Office. Data in PLN billion.

The above changes give but a fragment of the full picture of the foreign trade of the ICT sector. It needs to be complemented with the presentation of absolute values describing individual segments of the sector.

The segments with a positive foreign trade balance include those offering consumer electronics and telecommunication equipment. Their turnover balance is PLN 11.4 billion and PLN 3.4 bil-

lion respectively. It should be noted that in recent years the enterprises selling telecommunication equipment abroad recorded the highest export growth compared to other segments. Computers and peripheral devices remain the segment with the highest turnover in goods. However, it should be noted that the segment is subject to intensive competition from producers manufacturing the products in the areas characterised by significant cost advantages, e.g. Asian producers. The

segment owes its leading position primarily to high import value amounting to PLN 17.9 billion. The segment is the main importer in the ICT sector.

PRODUCTIVITY OF THE ICT SECTOR

The indicator of value added of production describes the growth of the value of goods and services as a result of a specific production process or service creation. The indicator is related to innovation, technological advancement, place in the value supply chain, brand strength and competitiveness of manufactured goods and services. At the time of increasing competition, those aspects are particularly important for the Polish ICT sector. Competition based on low costs (e.g. relatively lower personnel costs) may prove insufficient in the coming years. The value added of production of Polish enterprises from the ICT sector increased by 9.97% in the years 2010-2014, growing on average by 5.46% annually. It should be noted that the average of annual increases is strongly overstated due to above-average growth in 2010 which amounted to 17.4%.

A strong growth rate of the indicator in the years 2009-2010 was due to low values recorded in 2009 as a result of the financial crisis.

Compared to the countries which set forth the highest standard on the European market, i.e. the United Kingdom and Germany, the growth of productivity of the Polish ICT sector in the years 2010-2014 was significantly lower. In the analysed period, the surplus of value added growth rate over the production growth rate amounted to 8.83 pp for the United

Despite lower personnel costs, Polish enterprises are characterised by a lower productivity than the leaders in the sector. This means that investments in innovative solutions and R&D must be increased.

Table 8: VALUE ADDED OF THE ICT SECTOR

COUNTRY/YEAR	2008	2009	2010	2011	2012	2013	2014
Great Britain	103269	...	89239	89239 ^e	89239 ^e	89239 ^e	114945
Germany	91538	91540	90491	97941	98807	103209	110058
France	...	67516	70434	71571 ^e	72709	72128 ^e	71546
Italy	48684	46488	48997	49175	48749	45553	45396
Spain	...	...	33800	33194	31707	30565	29702
Norway	...	...	9828	10327	10327	11326	11176
POLAND	...	8617	10112	10877	10730	10521	11119
Denmark	...	...	9677	9850	10026 ^e	10204 ^e	10386 ^e
Austria	8235	7931	8091	8794	8746	9112	9306 ^e
Portugal	5471	5345	5508	5145	4909	4781 ^e	4656 ^e
Slovakia	2659	2152	2880	2868	3136	3321 ^e	3518 ^e
Greece	5607	4999 ^e	4391 ^e	3783	3463	3157	2837
Bulgaria	1584	...	...	...	1680	1766 ^e	1853
Slovenia	1114	1118 ^e	1122 ^e	1126	1120	1128	1168
Finland	...	8099	8645	9228 ^e	9850 ^e	...	...

Source: Own study based on Eurostat; Legend: "e" – own estimation, "..." – no data available; Values expressed in EUR million. Value added at factor cost.

Kingdom, 4.62 pp for Germany and 3.27 pp for Poland.

During the analysed period, Poland recorded a satisfactory growth of the value added generated in the ICT sector. The value added and its dynamics do not allow to forecast that Poland will fully use its potential and will generate a growth rate enabling it to become a leader in the international arena, but will develop at

an organic rate recorded by the majority of the European economies. Productivity must be further stimulated and Polish enterprises must be educated on key factors stimulating the productivity. The support actions carried out by the government and the EU institutions should be targeted at education and support specific activities which increase competitiveness. They include the aforementioned innovation, cost reduction, internationalisation

Table 9: SHARE OF THE VALUE ADDED IN TURNOVER

COUNTRY/YEAR	2008	2009	2010	2011	2012	2013	2014
Great Britain	...	...	41%	39%	37%	36%	45%
Norway	...	...	39%	40%	40%	41%	41%
Denmark	...	...	38%	39%	39%	40%	41%
Bulgaria	37%	...	...	...	41%	...	41%
Italy	37%	38%	39%	40%	40%	39%	39%
France	...	35%	35%	34%	34%	34%	37%
Portugal	32%	33%	35%	35%	35%	36%	37%
Spain	...	...	37%	38%	38%	38%	36%
Germany	35%	36%	33%	34%	34%	35%	36%
Slovenia	31%	31%	32%	33%	34%	33%	34%
Austria	33%	33%	33%	33%	32%	33%	33%
Greece	...	...	...	36%	34%	34%	31%
POLAND	...	34%	31%	32%	30%	29%	29%
Slovakia	23%	19%	24%	24%	26%	27%	28%
Finland	...	18%	19%	20%	21%	...	...

Source: Own study based on Eurostat; Legend: "e" – own estimation, "p" – projection, "..." – no data available; Values expressed in %, denoting the share of added value at factor cost in the turnover of the ICT sector.

or promotion. Support in the area of education should cover human resources development or cooperation with science.

Polish enterprises from the ICT sector are characterised by moderate productivity. Dynamic development in the highly competitive international environment is possible thanks to implementation of significantly improved or innovative solutions. The situation is reflected in the data on

The relatively lower productivity of the Polish ICT sector is manifested through the size of turnover per employee, which is lower by almost a half than in the German economy. This situation points to the need of further stimulation of the sector.

Investments from the government and enterprises in innovation should be the drivers of further increase of productivity.

Table 10: TURNOVER PER PERSON EMPLOYED IN THE ICT SECTOR IN THE SELECTED COUNTRIES

COUNTRY/YEAR	2008	2009	2010	2011	2012	2013	2014
Germany	3591	3576	3796	3812	4061	3947	3931
Italy	2833	2598	2938	2805	2647	2678	2856
Slovakia	2353	2041	2384	2257	2561	2635 ^e	2712 ^e
POLAND	...	1364	1799	1819	1930	1952	2189

Source: Own study based on Eurostat; Legend: "e" – own estimation, "..." – no data available; Values expressed in EUR thousands per person (FTE)

the share of the value added in turnover. More complex products that are significantly better than the existing competitive solutions usually have a higher added value. In terms of value added in turnover, Poland ranks 13th among the analysed markets, behind such countries as Bulgaria, Portugal or Greece. Within the analysed period, the share of value added in turnover varied from 34% to 29%, showing a downward trend. This situation has a negative impact on competitiveness of Polish enterprises and Poland's situation in the international arena.

Turnover per person presents the sales per one person employed. The indicator is thus independent of the size of the sector in a given country and illustrates the productivity of persons employed. The said indicator is very low in the Polish ICT sector, in comparison to both the sector leader, Germany, and to countries with

similar characteristics, such as Slovakia. However, a positive development is an above-average growth rate of this indicator for the Polish ICT sector. In the years 2008-2014, it grew annually at an average rate of 10.48%.

According to the data of the Central Statistical Office, the profitability of the ICT sector's sales is higher than the profitability of enterprises from production and service sector in total. In 2014, the profitability of the ICT sector amounted to approximately 6.4%, while the profitability of services and production in total amounted to approximately 4.7%. The profitability is the highest in the telecommunications segment and the lowest in production and wholesale of the ICT sector.

EMPLOYMENT IN THE ICT SECTOR

Poland is the 6th country in Europe in terms of employment in the ICT sector. In 2014, it amounted to 315,094 FTE. The figure accounts for approximately 5% of total employment in the sector for 28 countries of the European Union. At the same time, Poland records one of the highest employment growth rates. The parameter points to both a significant pro-development activity of Polish enterprises and the high interest of foreign entities in locating their processes in Poland. This is due largely to low personnel costs in Poland, combined with a relatively high availability of qualified labour force. The employment growth rate in the analysed period amounted to 4.76% on average. In the years 2010-2014, it totalled 20.13%. The figure gives Poland the second and the third place, respectively, among the analysed countries. The countries that compete with Poland in terms of growth rate include mainly Latvia and Romania where the employment growth rate in the years 2010-2014 amounted to 53.18% and 26.58% respectively. Germany and Bulgaria also recorded a high growth rate amounting to 19.99% and 16.59%, respectively.

The Polish economy is characterised by a high growth rate of employment in the ICT sector. Foreign investment, creation of services centres (SSC and BPO), and cost advantage contribute strongly to further growth of employment in the Polish ICT sector. It allows to predict that employment in the Polish ICT sector will exceed that in Italy and Spain, if the growth rate is maintained or increased.

Expenditure on salaries are a particularly

Poland accounts for approximately 5% of total employment generated by the ICT sector in the European Union. Employment in the Polish sector grows dynamically as a result of investment by foreign entities and development of domestic companies. However, it is accompanied by talent drain.

Table 11: NUMBER OF PERSONS EMPLOYED

COUNTRY/YEAR	2008	2009	2010	2011	2012	2013	2014
Germany	950892	924649	925909	988750	990293	1045494	1111034
Italy	...	...	397314	400581	404190	390638	396706
Spain	...	...	397314	400581	404190	390638	396706
POLAND	...	249756	262303	272415	284559	295483	315094
Romania	145160	135120	132749	141548	147549	157356	168036
Austria	94333	93509	93058	96106	100111	102380	104090 ^e
Portugal	73982	76173	76206	79290	80428	82133 ^e	83874 ^e
Norway	72474	72776	73871	75335	76693	77603	79723
Bulgaria	59324	64130	64406	66951 ^e	69495	72292 ^e	75089
Slovakia	55759	48476	58983	62830	61547	63560 ^e	65638 ^e
Greece	...	...	...	58125	59152	52916	57337
Latvia	18814	17280	17316	18431	21448	23305	26524
Slovenia	...	...	...	22153	22605	23379	23458

Source: Own study based on Eurostat; Legend: "e" – own estimation, "..." – no data available; Values expressed in full time equivalents

important and direct instrument of impact of the ICT sector on the economic situation and the labour market. Salaries are the sum of funds transferred by the sector directly to persons employed, and thus indirectly to the economy in the form of private consumption. The salaries in Polish enterprises from the ICT sector are low compared to other European countries. In 2014, Polish companies paid EUR 1,043 million to their employees. The figure marks an increase by 27.9% compared to 2010. The countries which recorded a higher growth rate of salaries included Bulgaria (51.7%), Slovakia (39.6%)

Table 12: GROWTH RATE OF EMPLOYMENT

COUNTRY/YEAR	'09/'08	'10/'09	'11/'10	'12/'11	'13/'12	'14/'13	'14/'10	ŚREDNI CAGR ⁴
Germany	-2,76%	0,14%	6,79%	0,16%	5,57%	6,27%	19,99%	2,69%
Italy	0,67%	-2,94%	-3,29%	0,07%	-1,44%	-2,34%	-6,84%	-1,54%
Spain	...	...	0,82%	0,90%	-3,35%	1,55%	-0,15%	-0,02%
POLAND	...	5,02%	3,86%	4,46%	3,84%	6,64%	20,13%	4,76%
Romania	-6,93%	-1,74%	6,63%	4,24%	6,65%	6,79%	26,58%	2,61%
Austria	-0,87%	-0,48%	3,28%	4,17%	2,27%	1,67%	11,85%	1,67%
Portugal	2,69%	0,04%	4,05%	1,44%	2,12%	2,12%	10,06%	2,12%
Norway	0,42%	1,50%	1,98%	1,80%	1,19%	2,73%	7,92%	1,60%
Bulgaria	8,10%	0,43%	3,95%	3,80%	4,02%	3,87%	16,59%	4,03%
Slovakia	-13,06%	21,67%	6,52%	-2,04%	3,27%	3,27%	11,28%	3,27%
Greece	...	...	...	1,77%	-10,54%	8,35%	...	-0,14%
Latvia	-8,15%	0,21%	6,44%	16,37%	8,66%	13,81%	53,18%	6,22%
Slovenia	...	...	...	2,04%	3,42%	0,34%	...	1,93%

Source: Own study based on Eurostat; Legend: "..." – no data available; Values expressed in %.

and Germany (29%). There is a considerable disproportion between the leaders and Poland in terms of total salaries paid by the sector. The salaries in Poland account for 7.24% of total salaries in the German ICT sector, 8.06% of the British sector or 11.1% of the French one.

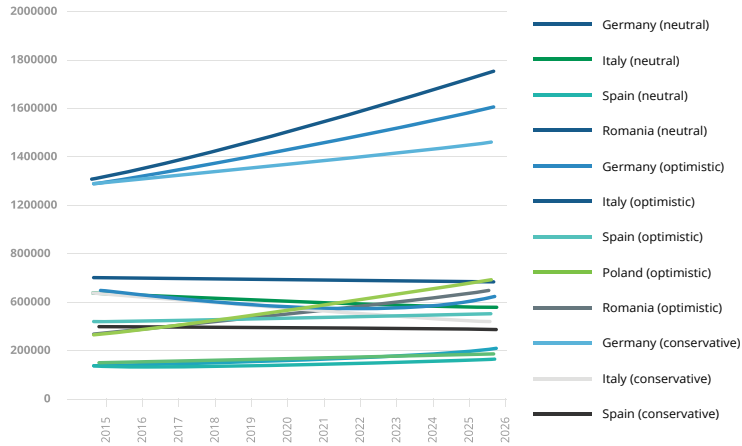
Apart from providing important information about the amount of money flowing from the sector to the economy via persons employed, the total salaries in the sector also constitute a basis for estimating the average level of salaries in the sector. In Poland, it amounted to EUR 1.043 in 2014. It is a very low figure, and in the

group of the analysed countries the lower value was recorded only in Bulgaria. The average salary in Germany amounted to EUR 4,048 and in Norway to EUR 6,048.

The analysis of salaries and expenditure on salaries in the ICT sector reveals that the level of salaries in Poland is significantly lower than in other countries. On the one hand, this situation gives an important competitive advantage to Poland, since it leads to reduction of the costs of enterprises from the ICT sector. But on the other hand, it means that the amount of money transferred by the sector to the economy in the form of salaries is consid-

Poland still attracts foreign investors with access to qualified personnel and lower salaries than in the Western countries. However, the difference is gradually reduced and will result in a decrease of Poland's competitiveness in this area.

FORECAST OF EMPLOYMENT IN THE ICT SECTOR



Source: Own study (forecast) based on Eurostat. Values expressed in full time equivalents.

Table 14: REMUNERATION TO EMPLOYMENT RATIO IN THE ICT SECTOR

COUNTRY/YEAR	2011	2012	2013	2014
Norway	5827	5724	6314	6084
Germany	3913	4013	4111	4084
Austria	3735	3642	3720	3775
Spain	3321	2755	2781	2744
Italy	2366	2440	2424	2439
Slovenia	1920	1884	1871	1891
Portugal	1930	1879	1876	1873
Greece	2234	2056	2070	1798
Slovakia	1305	1392	1444	1497
POLAND	992	992	1019	1043
Bulgaria	782	830	888	951

Source: Own study based on Eurostat; Legend: "e" – own estimation, "..." – no data available; Values expressed in EUR.

Table 13: SALARIES IN THE ICT SECTOR

COUNTRY/YEAR	2008	2009	2010	2011	2012	2013	2014
Germany	42546	41786	42219	46430	47687	51582	54446
Great Britain	45311	...	38779	41313*	41313*	48915	48915
France	...	30352	31289	32447*	33606	34553*	35501
Italy	15997	16597	16592	16654	17182	16830	16535
Spain	...	...	13262	15966	13365	13038	13061
Denmark	...	...	5751	5835	5921*	6008*	6097*
Norway	...	...	4962	5268*	5268*	5880	5820
Austria	3926	3882	3897	4308	4375	4570	4715*
Finland	...	4978	4832	4691*	4554*	4420*	4291*
POLAND	...	2619	3082	3244	3388	3614	3943
Portugal	1681	1761	1800	1836	1814	1849*	1885*
Greece	1801	1720*	1639*	1558	1549	1314	1237
Slovakia	790	760	845	984	1028	1101*	1179*
Bulgaria	...	502	565*	628*	692	770*	857*
Slovenia	501	504*	50*	511	511	525	532

Source: Own study based on Eurostat; Legend: "e" – own estimation, "..." – no data available; Values expressed in EUR million.

In the long term, the ongoing changes should be balanced with an increase in investment in the sector. Investments, in particular in innovative technology, are necessary to stimulate the development of the Polish ICT sector.

erably smaller. Poland has obtained significant benefits from its cost advantage thanks to attracting foreign investment. It should be noted, however, that at the time of increasing competition, also as a result of globalisation, cost competition may prove insufficient to keep or to strengthen the position of Poland in the international arena.

The level of employment in the Polish ICT sector results also from a relatively high labour productivity. The indicator of value added per person employed in Poland is one of the higher in the European Union. It constitutes a strong incentive for the companies to increase employment.

INVESTMENT AND INNOVATION OF THE ICT SECTOR

Investments determine the transformations and development of the sectors. The inflow of capital in the form of investment is often a necessary condition for improving the manufacturing processes and, in consequence, creating new innovative products and developing domestic companies. A growth of investment on the part of both the enterprises and the state is extremely important for the international position of the Polish ICT sector. In 2014, Polish enterprises invested EUR 1,490,571,000. The figure represents only 13.45% of total investment made by German companies in the same period. Taking into account the number of persons employed in the ICT sector, the situation of Poland looks even more optimistic. The value of investment per person amounted to EUR 46,500, which constitutes 43% of the figure on the German market.

Table 15: VALUE OF INVESTMENT

COUNTRY/YEAR	2008	2009	2010	2011	2012	2013	2014
Germany	10727661	10106402	10541251	13018795	10620034	10622386	11083929
Italy	7310879	6386448	5437978	5481417	4889661	4607852	4843519
POLAND	...	1480108	1670038	1781356	1370382	1446773	1490571
Norway	...	...	1183398	1254211 ^e	1325025 ^e	1395839	1286466
Slovakia	766633	449413	530829	474348	332219	279164 ^e	234581 ^e

Source: Own study based on Eurostat; Legend: "e" – own estimation, "..." – no data available; Values expressed in EUR thousand.

Table 16: INVESTMENT PER PERSON EMPLOYED

COUNTRY/YEAR	2008	2009	2010	2011	2012	2013	2014
Norway	...	...	138,9 ₀	131,37 ^e	123,83 ^e	116,3 ₀	107,8 ₀
Germany	9970	88,2 ₀	101,4 ₀	144,20	126,30	117,4 ₀	101,9 ₀
Italy	...	1480108	1670038	1781356	1370382	1446773	1490571
POLAND	...	40,7₀	47,00	49,10	36,70	39,60	46,50
Slovakia	115,5 ₀	65,8 ₀	78,60	64,10	46,90	38,83 ^e	32,15 ^e

Source: Own study based on Eurostat; Legend: "e" – own estimation, "..." – no data available; Values expressed in EUR thousands per person (FTE).

One of the conditions to stimulate investment activity of Polish enterprises is development of a transparent and stable legal system regulating activities in individual areas of the ICT sector and ensuring better safety of investment.

Table 17: INVESTMENT RATE IN THE ICT SECTOR

COUNTRY/YEAR	2008	2009	2010	2011	2012	2013	2014
POLAND	...	137,5	109,5	135,1	110,7	103,2	166,3
Germany	118,0	106,7	107,6	142,1	135,7	110,7	88,60
Italy	105,5	101,6	88,10	100,7	92,40	80,60	77,80
Norway	...	...	103,9	89,93 ^e	75,97 ^e	62,00	58,80
Slovakia	460,6	268,4	218,3	167,2	109,2	76,85 ^e	

Source: Own study based on Eurostat; Legend: "e" – own estimation, "..." – no data available; Values expressed in EUR thousands per person (FTE).

According to the data of the Central Statistical Office, investment expenditure in the ICT sector are not evenly distributed between its constituent segments. Investment in the segment of services prevail, since they account for 94.77% of all investment expenditure of the sector.

The reason for reluctance of Polish enterprises to invest are numerous and vary in regions, segments and enterprises. In general, one important factor stemming from the analysis of macroeconomic data may be identified. The Polish ICT sector is characterised by low effectiveness of investment. From among the selected countries presented above, Poland has the worst investment to value added rate. The rate show how investments indirectly influence the generation of value added in the sector. The lower the rate, the higher the effectiveness of the sector in translating investment into value added.

R&D investment plays a key role in inno-

vative sectors. Obtaining a competitive advantage requires offering innovative solutions. In order to explore the issue, R&D expenditure of the ICT sector is presented below.

According to the data of the Central Statistical Office, investment in R&D expenditure in 2014 amounted to PLN 1.5 billion. The figure marks a growth of PLN 553 million compared to the beginning of the analysed period, i.e. 2011. It represents an increase by 56.8%. The lion's share of the growth is attributed to the services segment, which in 2014 accounted for 93.13% of investment in R&D. The services segment is not only the dominant part of the ICT sector, but also recorded a higher investment growth rate. In the years 2011-2014, the growth rate of investment in R&D in the services segment amount to 59.07%, while in the production segment to 31.62%.

In the years 2011-2014, the ICT sector re-

corded an increase in the share in total R&D expenditure of the production and services sector by 1.2 pp. The share grew at a stable rate in the analysed period, except for 2012 when a slight decline by 0.1 pp was recorded. It should be noted that the share of the production segment of the ICT sector in total expenditure of the production sector was gradually falling (-1.6 pp). The services sector increased its share by 4.1 pp from 16.5% to 20.6%.

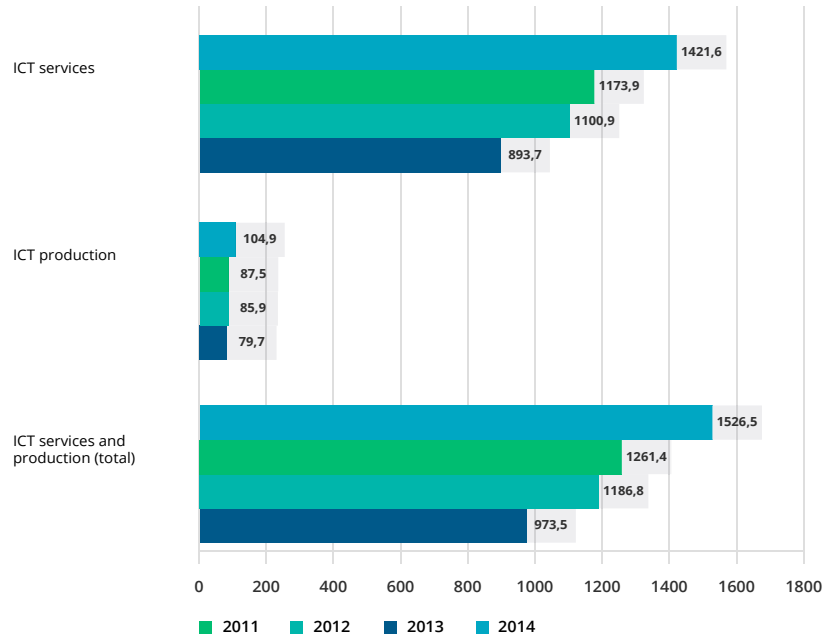
The purpose of investment in R&D is to generate specific benefits for Polish enterprises in the form of their increased innovation. The notion of innovation is not homogenous and several types of innovation may be identified. They concern various areas of activity of enterprises. They include product, process, organisational and marketing innovation. Below you will find the statistics on individual innovation groups in the Polish enterprises from the ICT sector.

PRODUCT INNOVATION is the market introduction of products or services that are substantially redesigned compared to the currently available solutions. The improvement may concern both the characteristics and the applications of products/services.

PROCESS INNOVATION is innovation implemented directly to the process and not the product itself. It may be e.g. production process or distribution process innovation.

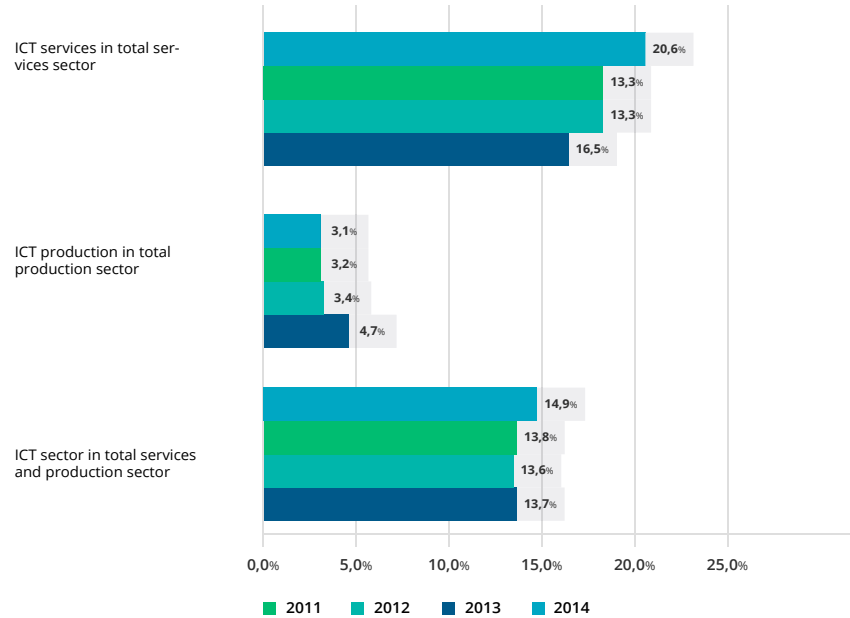
In all segments of the ICT sector, enterprises with product innovations have a higher share than those implementing process innovations. It should be noted,

R&D EXPENDITURE OF THE ICT SECTOR



Source: Information society in Poland. Results of statistical surveys in the years 2011–2015, Central Statistical Office. Data in PLN million.

R&D EXPENDITURE OF THE ICT SECTOR AS A SHARE OF TOTAL R&D EXPENDITURE



Source: Information society in Poland. Results of statistical surveys in the years 2011–2015, Central Statistical Office. Data in %.

The Polish ICT sector is characterised by significantly higher innovativeness than other sectors of Polish economy. This strengthens its perception as a good field for investment.

Table 18: PRODUCT AND PROCESS INNOVATION IN THE ICT SECTOR

SEGMENT	2011	2012	2013
Total	14,8%	9,5%	10,9%
ICT services and production (total)	24,9%	19,5%	14,7%
ICT production	31,5%	27,5%	18,1%
Services	24,1%	18,5%	14,3%

Source: Information society in Poland. Results of statistical surveys in the years 2011-2015, Central Statistical Office. Data in %.

that in general the Polish ICT sector is characterised by significantly higher innovativeness than other sectors. From among all enterprises in the economy, 14.8% have process and product innovations, while the figure for the ICT sector stands at 24.9%.

ORGANISATIONAL INNOVATION is the implementation of a new method of enterprise organisation. The method should generate additional benefits to the organisation. It may include such areas as knowledge management, human resources management, relations with the environment, workplace organisation or procedures.

MARKETING INNOVATION concerns the area of marketing concept and strategy. It consists in implementing a new version of such strategy that has not been earlier

Table 19: ORGANISATIONAL AND MARKETING INNOVATION IN THE ICT SECTOR

SEGMENT	Organisational innovation	Marketing innovation
Total	9%	7,8%
ICT services and production (total)	18,2%	15,1%
ICT production	17,8%	11,6%
Services	18,3%	15,5%

Source: Information society in Poland. Results of statistical surveys in the years 2011-2015, Central Statistical Office. Data in %.

used in an enterprise. Marketing innovation may concern the methods of product promotion, price policy, design, etc.

The group of innovative enterprises is dominated by enterprises implementing organisational innovation, though the difference is not significant. It amounts to 3.1 pp in the ICT sector, while in the economy in total it is 1.2 pp. Contrary to product and process innovation, the ICT services sector has a leading position in organisational and marketing innovation. This concerns in particular marketing innovation.

The share of new or significantly improved products in total sales is a very important measure of innovation. It demonstrates the rate of creation and implementation of innovation at the company. The ICT sector is again characterised by a significantly higher share of such products in

Table 20: REVENUES FROM SALES OF NEW OR SIGNIFICANTLY IMPROVED PRODUCTS

SEGMENT	Total	Products new to a market	Products new to an enterprise
Total	6,4%	2,9%	3,6%
ICT services and production (total)	8,5%	2,9%	5,5%
ICT production	7%	2,6%	4,4%
Services			

Source: Information society in Poland. Results of statistical surveys in the years 2011-2015, Central Statistical Office. Data in % (compared to sales total). Data for 2014. Refers to products placed on the market in the years 2012-2014.

turnover than enterprises in the economy in total. Therefore, the ICT sector should be deemed innovative. This conclusion is of particular importance, since numerous experts believe that innovation will be one of key sources of competitive advantage in the coming years. Due to its innovative nature, the ICT sector can thus become one of the dynamically developing drivers of the economy.

In terms of the entire economy, enterprises on average generate 6.4% sales from new or significantly improved products. In the ICT sector, the share of such products amounts to 8.5%. It is particularly high in the services segment, where it totals 8.9%.

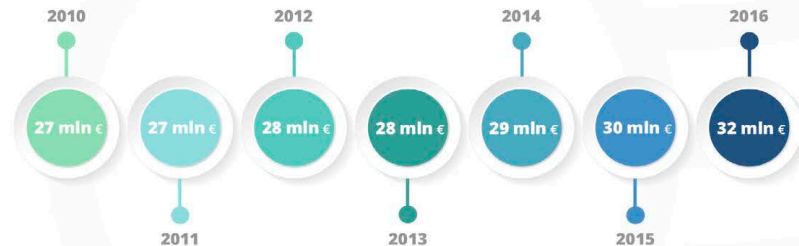
TURNOVER OF ICT SECTORS - POLAND -

DATA IN MLN EURO



PRODUCTION VALUE OF ICT SECTORS - POLAND -

DATA IN MLN EURO



ICT SECTOR SHARE OF EMPLOYMENT - POLAND -



ICT SECTOR SHARE IN POLISH INTERNATIONAL TRADE - 2015 -

- 2015 -



FORECAST OF POLISH ICT SECTOR PRODUCTION

DATA IN MLN EURO



NUMBER OF PERSONS EMPLOYED IN ICT SECTOR

- 2014

POLAND
315 094

GERMANY
1 111 034

ITALY
564 933

SPAIN
396 706

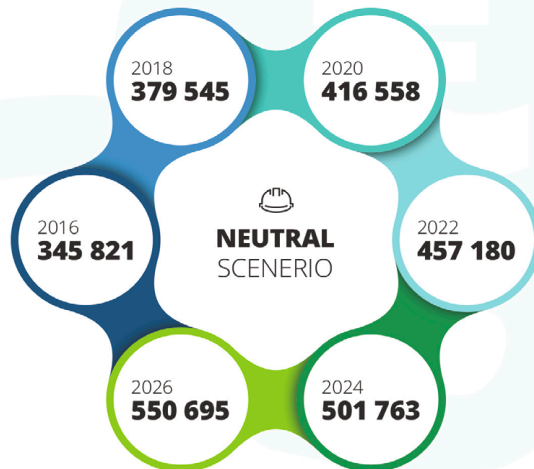
ROMANIA
168 036

NORWAY
79 723

DATA IN FULL-TIME EQUIVALENTS

FORECAST OF POLISH ICT SECTOR EMPLOYMENT

DATA IN FULL-TIME EQUIVALENTS



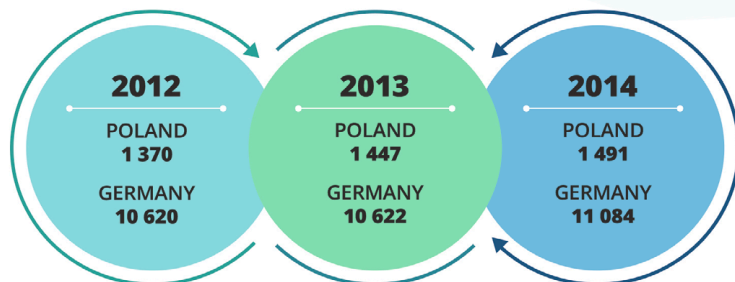
AVERAGE SALARY IN ICT SECTOR

- 2014 -



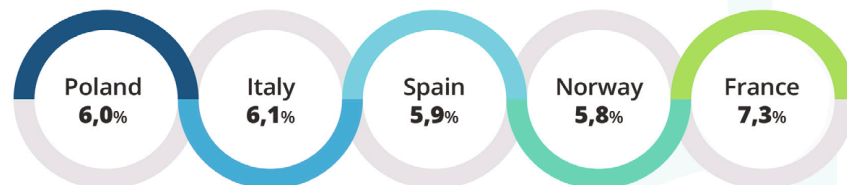
INVESTMENT VALUE IN ICT SECTOR

DATA IN MLN EURO.



ICT SECTOR SHARE OF GDP

- 2017 -



notes



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