# Chapter F Education and ICT

*Information and communication technology is of course a matter of interest for students these days – most of them have never experienced life without the internet, thus they cannot imagine their lives to be offline[1].*

*Nevertheless, adequate knowledge or education in the ICT area, does not solely concern the young generation. Every day or occasional contact with ICT in our work life and leisure time, creates pressure on nearly everyone to be able to acquire computer and digital skills. Working with computers or the internet, no longer belongs to the world of highly educated and enthusiastic individuals, but to most of us, as it has become a routine part of everyday lives.*

*The field of ICT development requires a sufficient structure of specialists, whose knowledge and skills may contribute to innovative solutions. Expert knowledge in the field of ICT may be attained by studying within the formal education system or within further (non-formal) education or self-study, or alternatively by learning from experience.*

## F.1 ICT at schools

*It has been a long time since computers at schools were solely located in computer classrooms or teachers' offices. Increasingly, there are language classrooms or scientific classrooms available at schools, which are equipped with multimedia and digital technologies. Whereas in the past, pupils/students used to present their papers only verbally, due to computer development in schools, they may enhance their papers visually and interactively, by means of various media and presentation programmes. Presentations are also a common means of involving students in lessons, and serve as visual support for teachers' lectures.*

- **Internet access** in Czech schools is almost guaranteed. Internet speed differs along with school degrees. Whereas a fifth (20%) of nursery schools is provided with internet speed higher than 30Mb/s, among secondary and higher professional schools this speed is provided by more than 54%.
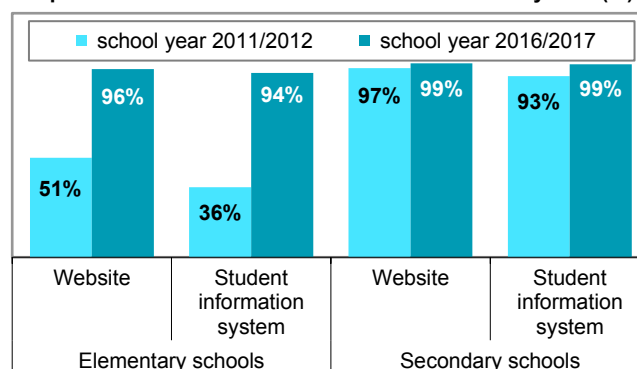


**Figure F1 Schools in the Czech Republic with at least 31 Mbit/s internet; 2016/2017 (%)***
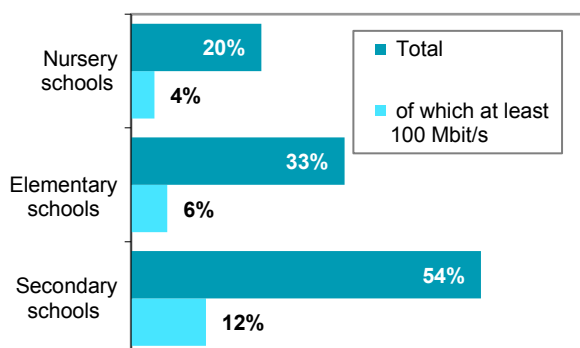
* as a percentage of all schools of a given type

*Source: Czech School Inspection, 2018*



**Figure F2 Elementary and secondary schools in the Czech Republic with a website and Student information system (%)***

* as a percentage of all schools of a given type

*Source: Czech School Inspection, 2018*

- In the 2016/2017 school year, **websites** were nearly available at all secondary and higher professional schools (99%). With respect to elementary schools, the number of them with their own website has nearly doubled in the past five years, i.e. from 51% in the 2011/2012 school year to 96% in the 2016/2017.

- In the 2016/2017 school year, a majority of schools in the Czech Republic had a **student information system** – 95% of elementary schools and 99% of secondary schools. In comparison, in the 2011/2012 school year, 93% of secondary schools had these systems, however, solely 36% at elementary schools.

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[1] According to the results of the OECD Programme for International Student Assessment (PISA), already in 2012, on average, for OECD countries where data was available, less than 0.5% of 15 year-olds reported never having accessed the internet.

- The availability of information technology at schools has not changed much over the past years in the Czech Republic. In the 2017/2018 school year, there were, for instance, on average, **25 computers per 100 students** at Czech secondary schools, compared to 24 computers the year before. Nowadays, the absolute majority of these computers are connected to the internet.

- At the same time, the number of **portable computers** has been increasing, too. In 2017, for instance, 3.2 laptops were used per 100 pupils at elementary schools – 2nd stage, compared to 2.6 laptops in 2015. Even the highest **number of tablets** in 2017 was recorded with the pupils of elementary schools – 2nd stage, nearly 4 tablets per 100 pupils, i.e. nearly three times as many as two years ago.

**Figure F3 Number of laptops with internet access per 100 students in the Czech Republic**
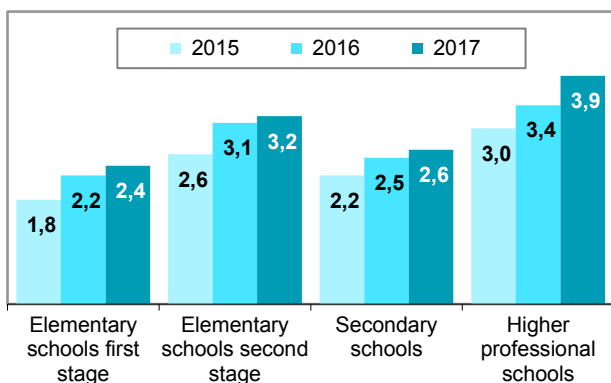


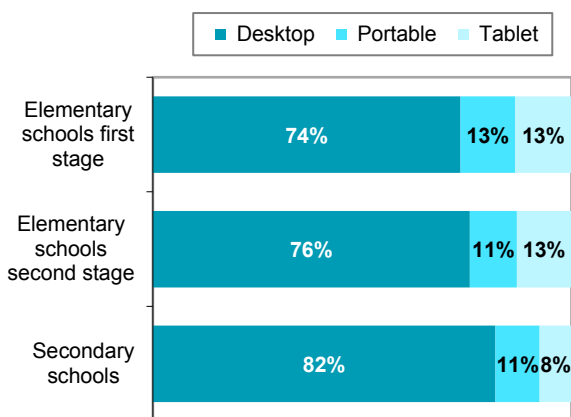*Source: Ministry of Education, Youth and Sports of the Czech republic, 2018*

**Figure F4 Number of tablets per 100 students in the Czech Republic**
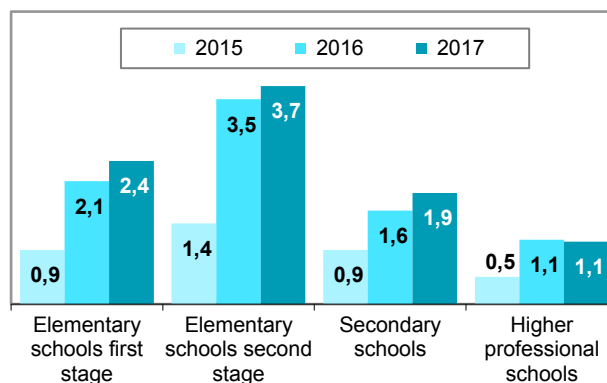


*Source: Ministry of Education, Youth and Sports of the Czech republic, 2018*

- **In absolute numbers** – desktop, portable ones or tablets – available to pupils/students of elementary schools and secondary schools, in the Czech Republic, in 2017, reached a total of 262 thousand. Three quarters of them (200 thousand) still consisted of desktop computers. In elementary schools, their share was approx. 10% lower (70%), than in secondary schools (80%). In both cases, the number of tablets and laptops in elementary schools reached 21 thousand.

**Figure F5 Computers available to students in Czech schools by type of device; 2017 (%)**



*Source: Ministry of Education, Youth and Sports of the Czech Republic, 2018*

**Figure F6 Computers available to students in Czech schools by the age of devices; 2017 (%)**
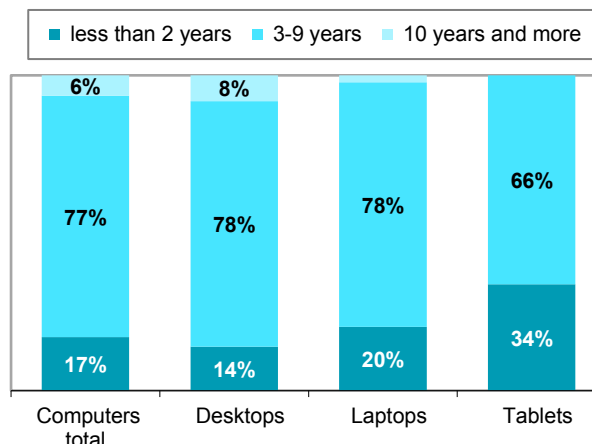


*Source: Ministry of Education, Youth and Sports of the Czech Republic, 2018*

- The **age of computers**, available to pupils/students of Czech elementary and secondary schools, is most frequently around 3 to 9 years. As mentioned above, the students of all types of schools are most frequently provided with desktop computers, which are also of the oldest service age. Only 14% (28 thousand) of them are of a service age of up to 2 years. The relatively "youngest" device (service age of up to 2 years), at elementary and secondary schools, in the Czech Republic, are tablets (34% of all tablets). The rest of the tablets were purchased 3 to 9 years ago for study purposes.

## F.2 Access of 15-year-old pupils to ICT

*The internet permeates every aspect of the economy and society, and is also becoming an essential element of children's lives. However, it carries a spectrum of risks, to which children are more vulnerable than adults. While access to information via the internet may bring considerable benefits for children's education, it also exposes them to online risks, such as access to inappropriate content, harmful interactions with other children or adults, and exposure to aggressive marketing practices. Children online may also be put at risk though the computers they use, especially by inadvertently disseminating their own personal data. Addressing risks faced by children online is becoming a policy priority for an increasing number of governments.*

- In 2015, the international survey PISA (OECD), was conducted at schools[2], focusing, besides other things, on whether 15-year-old pupils in schools have **internet access**, and whether they use this opportunity. In 2015, Czech pupils took seventh place in **EU ranking** – 78% of 15-year-olds had internet access in school and used it. The EU28 average was 71%.

- PISA assessment, carried out on 15-year-old pupils in the Czech Republic, also implies that nearly all (97%) of them used the internet at home. In schools, it is 78% of them – once again data for the year 2015. Desktop computers are available, and used, by the same number of pupils at home and at school (66%). Laptops used by 15-year-old pupils are significantly more often used at home (76%), than at schools (18%). The same applies for the use of tablets (at home used by 50%, at schools 13%).

**Figure F7 15 years old students in EU countries with the internet access at school; 2015 (%)***
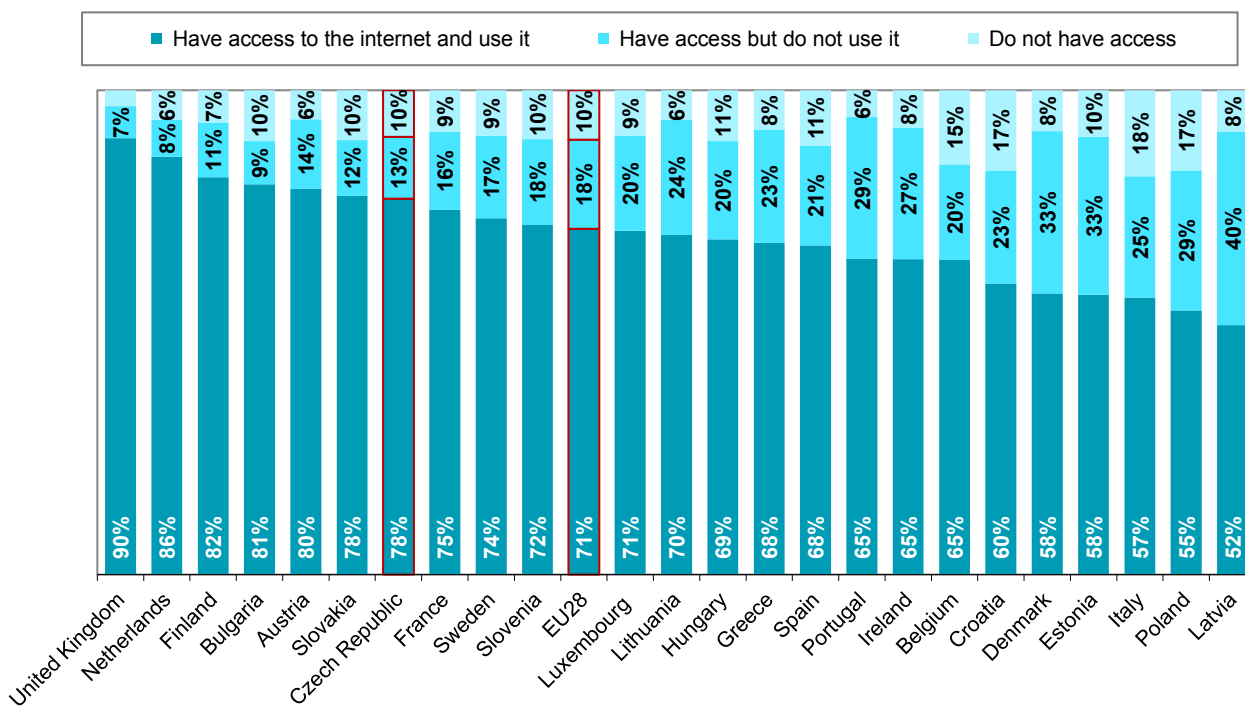


* as a percentage of all 15 years old students in a given country

*Source: OECD 2015, survey PISA*

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[2] In 2015 over half a million students, representing 28 million of 15-year-olds in 72 countries and economies, took the internationally agreed two-hour test. Students were assessed in science, mathematics, reading, collaborative problem solving, and financial literacy.
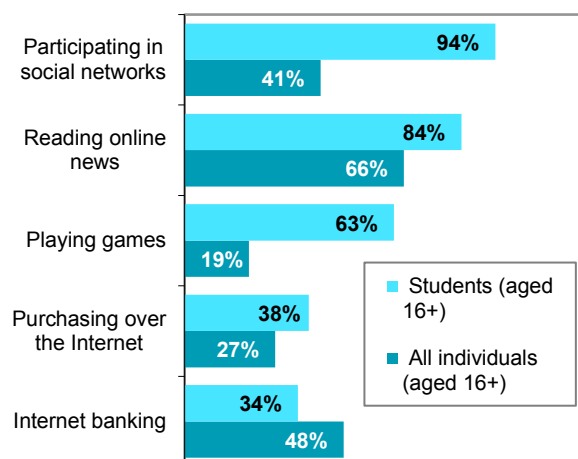
# F.3 Internet use by students aged 16+

*Nowadays, probably hardly anyone can imagine a life without the internet. Millennials, also known as Generation Y (born in 1985–2000) grew up in an era of great development of information and communication technologies, which significantly affects their lifestyles. They use the internet to communicate with each other, meet friends, to shop, or to educate themselves. The school system plays an important role in providing all children and students with the skills needed to actively participate in an increasingly digital life and world of work.*

- In the years 2015 to 2017, nearly all **students over the age of 16** (99.5%), in the Czech Republic, used the internet. In the same period of time, nearly 80% of students used **mobile internet[3]**.

- On average, from 2015 to 2017, the most frequent activity of students, with respect to internet usage, was to monitor events on social networks (94%), a further frequent activity is to read the news (84%), or play online games (63%).

- If we focus on the internet usage by students, with respect to **educational activities**, we can see that between 2015 and 2017, 39% of them used online **educational resources**, and 31% of students communicated with their lecturers, or other students, by means of **educational portals**. Nearly 7% of students attended an **online course**.

- In international comparison, the position of Czech students, in 2017, with respect to the usage of educational resources over the internet, is the tenth, i.e. significantly **above the European average**. However, in regard to the communication with lecturers, or other students, over the internet, we take fourteenth place of the European scale, and we are exactly on the EU28 average.

- It may not come as a surprise that **students' (16+) activity over the internet** is more common than the activity of adult **individuals (16+) in total**. The most significant difference lies in the subject of **participation in social networks** (94% of students and 41% of individuals), and in **online game playing** (63% of students; 19% of individuals in total). The only area, where individuals outperformed students, was the usage of **internet banking** (34% of students, 48% of individuals in total).
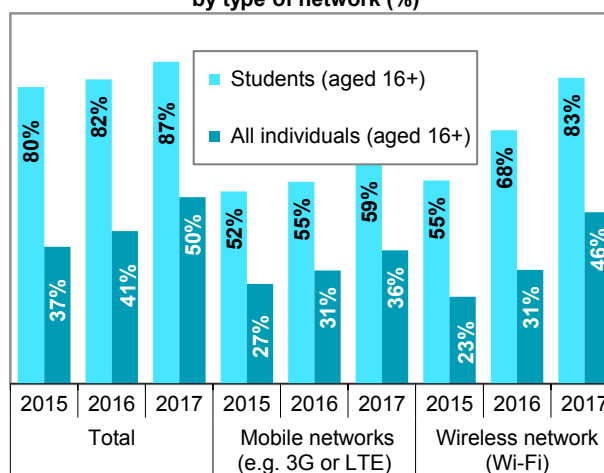


**Figure F8 Students and individuals in the Czech Republic aged 16+ using the internet for selected activities; 2015–2017 (%)***

\* as a percentage of all students aged 16+

*Source: Czech Statistical Office 2018, ICT use survey in households*



**Figure F9 Students and individuals in the Czech Republic using internet on mobile phone by type of network (%)***

\* as a percentage of all students and individuals aged 16+

*Source: Czech Statistical Office 2018, ICT use survey in households*

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[3] The data is based on the Sample Survey on the ICT Use in Households and by Individuals, which has been carried out annually by the Czech Statistical Office since 2002. The survey is carried out using the Computer Assisted Personal Interviewing (CAPI) method on the sample of about 10 000 individuals aged 16+.

## F.4 Digital skills

*Not only access to the internet and access to other ICTs, but primarily the motivation and ability of individuals to efficiently use the applications and services offered, through these technologies (digital skills), is currently considered as one of the key factors of economic, social, and political development of society. The ability to work with digital technologies belongs among eight key skills, which are absolutely indispensable for know-how-based society[4]. At the same time, safe navigation through the internet is equally important.*

*With the intensive use of ICT at work, individuals are required to make use of new skills along three lines. Firstly, the production of ICT products and services – software, web pages, e-commerce, cloud, big data, etc. – requires ICT specialist skills for the programming and development of applications, as well as for managing networks. Secondly, workers across an increasing range of occupations need to acquire generic ICT skills in order to be able to use such technologies in their daily work – to access information online, use software, etc. Finally, the use of ICT is changing, the way work is carried out, and raising the demand for ICT complementary skills, e.g. the capability to communicate on social networks, to brand products on e-commerce platforms or capability to find, evaluate and create information in different media and for different contexts (media and information literacy).*

*While the majority of people in the Czech Republic now have access to the internet, the digital divide based on lack of skills to use the internet efficiently limits not just people's job prospects, but its implications extend to all areas of well-being. In people's daily lives, this inequality in digital skills manifests itself in the form of different abilities to use the internet in a variety of ways. All time-saving opportunities, new ways to access information and social networking depend on people's ability to take advantage of the various possibilities that internet provided. As internet access rates are very high in all EU countries, differences in ability to use the internet are a key motor of inequalities.*
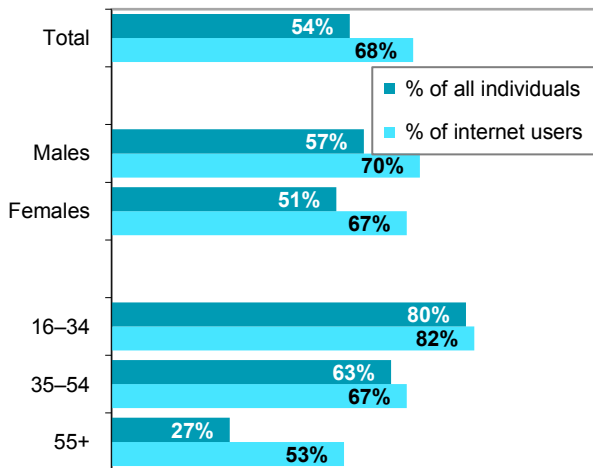
- In the Czech Republic, three fifths of persons over the age of 16 (60%) stated, in 2016, to have **copied** or transferred files or folders throughout their computer, in the past 12 months. A quarter of individuals worked with a graphic **photo-editing programme**, and 4% of them **did the programming**. These selected computer skills are mainly the interests of the young generation and men's (programming in particular). The aforementioned skills are also more frequently exhibited by students and people with a higher degree of education.

- The Czech Statistical Office also inquired on the number of inhabitants, of the Czech Republic, using the common **office computer programmes**. Most individuals aged 16+ stated to have been using **word processing software** (e.g. MS Word) – in 2017, there was nearly a half of them (54%). In the same year, more than a third (41%) of them used **spread sheet software** (e.g. MS Excel), and a quarter of them (25%) stated to have been using **presentation software** (e.g. MS PowerPoint). All these office programmes are **more frequently used by men than women**. With increasing **age**, the percentage of people using the given software is decreasing, however, with an increasing level of **education**, the percentage of such people is increasing.

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[4] The 2006 European Reference Framework of Key Competences for lifelong learning defined eight key competences that were in 2018 updated, and includes also digital competence. Digital competence involves the confident, critical, and responsible use of digital technologies for learning and engagement with them at work, and for participation in society. It includes information and data literacy, communication and collaboration, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), and problem solving. For more information see:
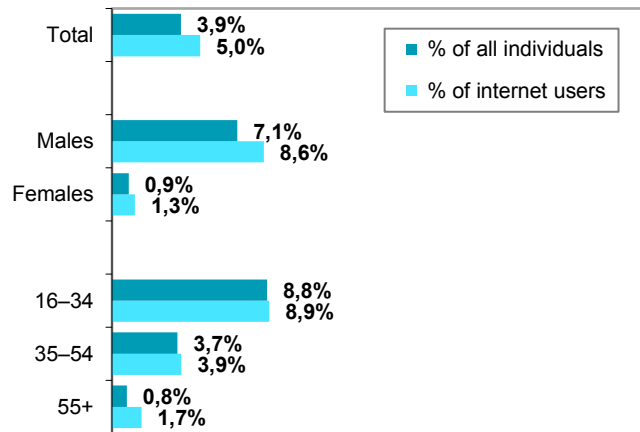https://ec.europa.eu/education/sites/education/files/annex-recommendation-key-competences-lifelong-learning.pdf

**Figure F10 Word processing software use in the Czech Republic; 2017(%)**



*Source: Czech Statistical Office 2018,
ICT use survey in households*

**Figure F11 Use of programming by individuals in the Czech Republic; 2017 (%)**



*Source: Czech Statistical Office 2018,
ICT use survey in households*

- **In international comparison**, the percentage of Czech individuals using **spread sheet software**, found themselves approximately in the middle position, slightly **above the EU28 average**. If solely assessing the advanced skills of using the spread sheet software (e.g. calculations usage, graph creation, filter usage, and so on), the Czechs would be placed below the EU28 average.

**Figure F12 Individuals aged 16–74 in EU countries who used spreadsheet software*; 2017 (%)\*\***
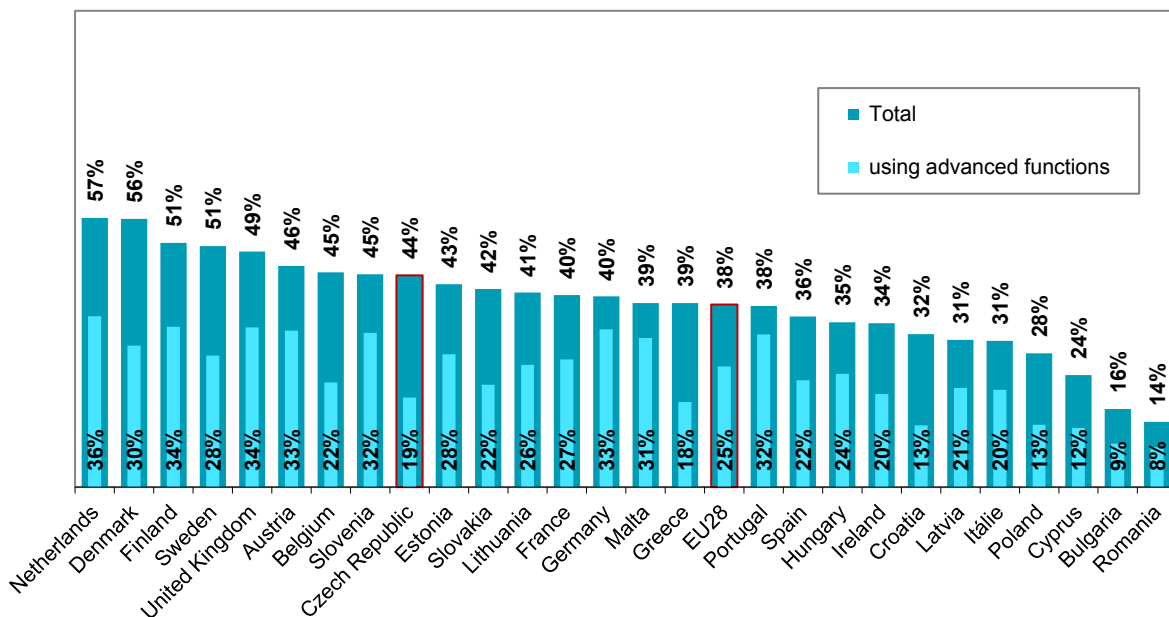


\* e.g.. MS Excel or OpenOffice Calc
\*\* as a percentage of all individuals aged 16 to 74 in a given country

*Source: Eurostat 2018*

## F.5 Students and graduates in ICT field of education

*When choosing a university to study at, the future of the ICT field, and the opportunities it provides, are acknowledged by a large number of students. Apart from motivating earnings potential, which belongs to the higher ones within the national economy, applicants are often tempted by the possibility of home office, flexible working hours, custom-made work, and other advantages.*

- In 2016, over 17 thousand students at Czech universities studied within the **ICT fields of education,** which is 5.5% of the total number of students[5]. Nearly a fifth (15.7%) of the total number of ICT field studies was formed by **women** a quarter (25%) of all these students had **foreign citizenship**.

**Figure F13 University students
of ICT field of education in the Czech Republic**
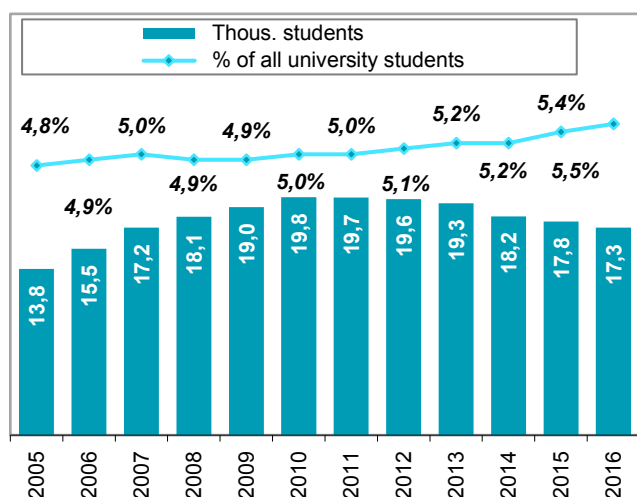


Source: CZSO calculation based on MEYS database, 2018

**Figure F14 University students of ICT field of
education in the Czech Republic by sex (%)**
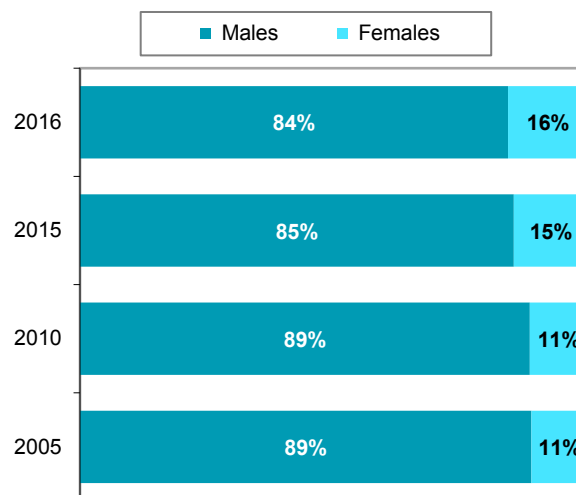


Source: CZSO calculation based on MEYS database, 2018

- The highest share of university students of ICT was found in **bachelor degree programmes** (68%), more than a quarter (27%) in master programmes, and 5% in doctoral studies.

- Compared to other **EU28 countries**, in 2015, the Czech Republic's 20–29 age group was formed by an extraordinarily higher number of ICT university students (1.4%; EU28 average was 1.2%). The highest share of ICT students, within the aforementioned group, was reported by universities in Finland, Ireland, and Greece; the lowest share by those in France and Portugal.

- In 2016, nearly 3 500 university students **graduated from the ICT field**. They represent 4.5% of all graduates from bachelor and master programmes. 85% of all ICT graduates were men.

- The highest share of ICT graduates, among university graduates (bachelor and master degree programmes), was found in Ireland and Finland, the lowest one in Belgium and in Portugal. The Czech Republic is found approximately in the mid-position.

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[5] Numbers of ICT students and graduates are based on the International Classification of Education (ISCED-F 2013), broad field code 06 Information and Communication Technologies (ICT) that involves detailed defined fields of education as follows: Computer use (0611); Database and network design and administration (0612); Software and applications development and analysis (0613); ICT not elsewhere classified (0619); and Inter-disciplinary programmes and qualifications involving ICT (0688). Education at universities presented in this chapter for the Czech Republic belongs to the tertiary level of education and includes a bachelor (ISCED level 6), master (ISCED level 7), and doctoral (ISCED level 8) study programmes of all public and private universities.

# F.6 ICT professionals

*ICT has already been the cause of significant changes to both methods and patterns of production. Policy-makers and researchers are therefore interested in tracking employment developments for ICT professionals, which influence a country's comparative advantage in the development, installation, and servicing of ICT.*

- In 2016, nearly **72 thousand ICT specialists** worked in the Czech Republic[6]. Approximately two thirds of them were analysts, software, and computer application developers. A third was formed by specialists in the field of databases and computer networks.

- Only a tenth of ICT specialists, in 2016, were **women**. A half of ICT specialists, in 2016, had a master's or doctoral degree; looking at the age group, the surpassing group was 30–39 (28%), followed by the age 40–49 group (18%).

- In 2016, the average **gross monthly earnings of ICT specialists[7]** exceeded 53,000 CZK and formed 183% of the average Czech wages. On average, men working in the ICT field earned nearly 10,000 CZK more than women. It may not come as a surprise, that higher earnings are found with ICT professionals in the private sector (receiving wages), than ICT professionals in the public sector (receiving salaries), and the earnings of ICT professionals grow along with their highest attained education. The highest average wages are earned by "middle aged" ICT professionals, i.e. 35–44 years of age.

- With respect to selected ICT professions, the highest income exceeding 61 thousand CZK is earned by **professionals in the area of data security**. In 2016, over 58 thousand CZK of gross wage was earned by system analysts or software developers. The relatively lowest earnings in the ICT field were found with system administrators and network administrators, or database designers and administrators (less than 50 thousand CZK).

- With respect to the income of ICT professionals in selected industries (in accordance with CZ-NACE classification), in 2016, the highest income was earned by ICT professionals engaged in the field of **Financial and insurance activities** (over 64 thousand CZK), or within the sector **Information and communication activities** sector (nearly 58 thousand CZK). At the end of the scale, there were ICT professionals involved in the Public administration sector, whose income nearly amounted to 37 thousand CZK, in 2016.

**Figure F15 ICT specialists in the Czech Republic**
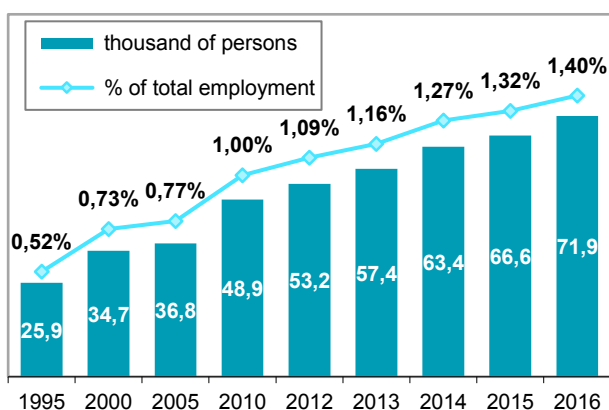


*Source: CZSO, Labour Force Survey, 2018*

**Figure F16 Earnings of men and women ICT specialists in the Czech Republic**
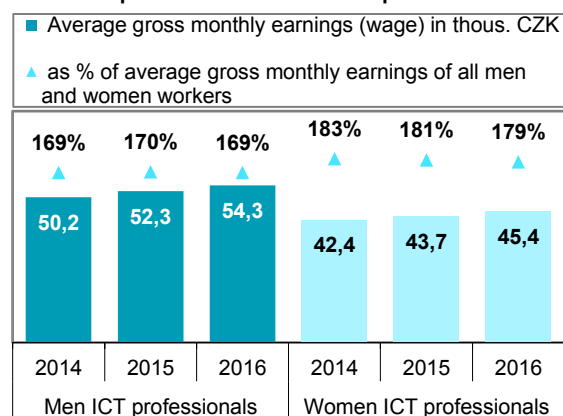


*Source: CZSO, Structural Earnings Statistics, 2018*

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[6] The data on the numbers of ICT professionals come from the Labour Force Sample Survey (LFSS) of the CZSO and presents the average annual data for the given year.

[7] Data on wages of the ICT professionals come from the structural employee wage statistics which is generated by merging of databases of the sample survey of the Information System on Average Earnings of the Ministry of Labour and Social Affairs, which covers the wage sphere, and from the database of the administrative data source of the Salary Information System of the Ministry of Finance, which exhaustively covers the salary sphere.