RETHINKING COMPETENCIES OF THE EUROPEAN INFORMATION-COMMUNICATION SECTOR’S WORKFORCE IN THE CONTEXT OF INDUSTRY 4.0: The case of Slovenia

Preispitivanje kompetencija radne snage u okviru evropskog informaciono-komunikacionog sektora u kontekstu industrije 4.0: slučaj Slovenije

ABSTRACT: The ICT sector is one of the most important economic sectors in the world and the driving force behind the industry 4.0. On this basis, the paper highlights the significant ways in which industry 4.0 transforms requirements regarding essential competencies of contemporary European ICT sector’s workforce. Stemming from this the author argues that competencies of the workforce in the ICT sector are gradually shifting from strictly technical towards hybrid (i.e. combination of technical and soft). The latter is associated with the fact that industry 4.0 is not only based on technology and creativity of people applying technology, but in addition also on increasing intertwining of ICT sector with other socio-economic sectors, which results in changes of competencies of its workforce. In order to verify the thesis, the case study of Slovenian ICT companies (interviews with representatives) was implemented.

KEY WORDS: information-communication service sub-sector, competencies, industry 4.0, workforce

APSTRAKT: Sektor informaciono-komunikacionih tehnologija (IKT) jedan je od najvažnijih ekonomskih sektora u svetu i pokretačka snaga industrije 4.0. Na osnovu toga, rad ističe značajne načine na koje industrija 4.0 transformiše zahteve u pogledu osnovnih kompetencija radne snage savremenog evropskog IKT sektora. U skladu sa tim autor tvrdi, da kompetencije radne snage u IKT sektoru postepeno prolaze sa strogo tehničkih na hibridne (kombinacija tehničkih in mekih). Poslednje je povezano sa činjenicom da se industrija 4.0 ne zasniva samo na tehnologiji in kreativnosti ljudi koji primenjuje tehnologiju, več in na povečanju isprepletenosti

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The field of information and communication technologies (ICT) began to develop rapidly in the second half of the last century, leading to changes in the narrower technological fields (e.g. digitalization, processing, transmission and generation of information), as well as in various segments of everyday life of individuals and the wider society. Nowadays during the fourth industrial revolution (Scwab, 2017) or industry 4.0, as some call it, we are witnessing exponential changes in people’s lifestyles and communication. Most analysts, who study modern society from an economic, cultural and sociological point of view, emphasize the extremely high importance of ICT manufacturing and development companies in the current era. This is not surprising, since these companies, directly and indirectly, affect all sectors of the national economy, while determining which regions will economically prosper, stagnate or decline (Wheeler et al., 2000; Acs, de Groot and Nijkamp eds., 2002; Florida, 2004; 2007; Johansson, Karlsson and Stough eds., 2006; Lenarčič, 2006).

According to a study recently conducted by Mas et al. (2018), the size of the global ICT sector has increased in the period 1995 to 2014 threefold; this indicates that it is one of the fastest-growing sectors in the world. The latter is understandable because this sector is the most powerful tool in the process of modernizing, increasing the productivity and competitiveness of companies in economic and non-economic activities. Presented situation is mainly the result of two mutually ongoing processes; on the one hand, the cost of collecting, storing and processing data is greatly reduced by ICT, and on the other hand, the power of computer processors is rapidly increasing, which contributes to the speed and accuracy of the various tasks².

As demonstrated by several international and national documents and strategies that place great emphasis on digital convergence³, the links between

² In this regard, it is worth mentioning three laws associated to ICT that explain the process of modern society’s computerization. Namely, Moore’s Law states that every eighteen months technological development doubles the number of logical elementary operations of a microprocessor; the result is an almost linear increase in the speed and power of computers. Gilder’s law claims that network capabilities grow three times faster than the power of computers, while Metcalfe’s law declares that network usability is exponential with the number of users. In short, as computers and networks become more powerful, they provide a variety of services, and consequently, they are used in different social segments, resulting in an increased level of computerization.

³ Digital convergence relates to merging the functionality of devices using the same platforms and reducing boundaries between different industries. There are many examples of such integration, but most prominent are probably Microsoft’s expansion from IT to the entertainment industry (Microsoft Azure Media Services) and Apple’s expansion from
the ICT sector and other socio-economic sectors will continue to strengthen. According to what has been said so far, ICT sector is expected to become even more important, with an increasing impact on production and economy, and last but not least, on the changing requirements for its workforce’s vocational training and required skills. For this reason, governmental policies in the field of employment and education must respond appropriately to the development and potential of the ICT sector, thereby achieving positive effects on the economy and improving the country's macroeconomic indicators.

Initially, it is important to emphasize that the information communication sector is divided into manufacturing (ICT manufacturing companies) and services (ICT wholesale, telecommunications, programming, and ICT repair and maintenance) companies. Based on this, this paper highlights the significant ways in which industry 4.0 transforms requirements regarding essential skills of ICT service sub-sector’s workforce. Namely; we hypothesize that skills of the workforce in the ICT service sub-sector are gradually shifting from strictly technical towards hybrid (i.e. combination of technical and soft) skills. The latter is associated with the fact that industry 4.0 is not based solely on technology and creativity of people applying technology, but on increasing intertwining of the ICT sector with other socio-economic sectors, which results in changes of competencies and skills of its workforce. With the purpose to verify the hypothesis a case study among Slovenian ICT companies and research institution dealing with ICT was implemented. We were interested in: (1) how important are soft-skills among ICT workforce, (2) which soft-skills are the most important and (3) how companies ensure certain soft-skills if they lack such a skill.

2. Information-communication sector in the European Union and Slovenia

With the publication *Europe and Global Information Society* (Bangeman, 1994), the European Union made it clear that it was aware of the importance of ICTs in achieving competitiveness and economic growth. In this context, it has started to encourage the informatization of member states and candidate countries. One of the key documents or strategies related to the informatization of society produced by the European Union is the 1999 *eEurope Initiative*, which contained the *eEurope 2002 Action Plan*, followed by the *eEurope 2005 Plan*, whose main objective was to achieve a shift towards knowledge-based economy.

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4 Detailed division of ICT sector in manufacturing and service sub-sectors according to the statistical classification of economic activities in the European Community (NACE Rev.2), which is used uniformly within all the Member States, can be found at the [https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07–015-EN.PDF](https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07–015-EN.PDF)


using ICT. This initiative was followed by the i2010 – *European Information Society for Growth and Employment*⁷, whose priorities were mainly focused on the development of an open and competitive e-economy. Thus, in 2010 following the economic crisis, the *EU 2020 Strategy*⁸ was adopted with the key objective of building a smart, sustainable and inclusive economy. The strategy consists of seven initiatives, of which the *Digital Agenda for Europe*⁹ is particularly relevant in the context of this paper. Namely; it highlighted weaknesses in the European ICT sector, particularly the fragmentation and small size of digital markets that are closed within individual European Union member states. To solve this, the European Union upgraded its agenda in 2015 to the *Digital Single Market Strategy for Europe*¹⁰, which outlined measures to make more effective use of ICT in the business opportunities provided by these technologies. The creation of a single European digital market is expected to bring several advantages and opportunities to the European economy and society.

The European Commission is also promoting research and innovation in the ICT sector. Recently, it has been financing innovative public-private partnerships and research programs under research and innovation programme *Horizon 2020* that covers many ICT related topics such as sustainable use of natural resources, development of safe and efficient mobility, development of health services, cyber security, the effects of ICT to the wider society, etc. Namely; *Horizon 2020*, from 2018 to 2020, foresees the highest budget (1.7 billion EUR) for the ICT sector to “digitize and transform European industries and services”¹¹. In line with the *ADigital Single Market Strategy for Europe*¹², this area focuses on a combination of ICT (5G, high-performance computers, artificial intelligence, robotics, big data, internet of things, etc.) and innovation in other technological fields.

Effects of above-mentioned strategies and incentives are undoubtedly reflected in the development and growth of the European ICT sector, for example, study implemented by Mas et al. (2018) shows that in 2015 European Union ICT sector represented 3.9% of the EU value added, 2.5% of total employment, 18.6% R&D personnel and 20.6% of researchers in the EU, respectively. And from 1995 until 2015, this sector multiplied its value added in real terms by a factor of 3.5, while the total economy did so by 1.4.

Meanwhile, the authors of the document *Digital Slovenia 2020 – Strategy for the Development of the Information Society until 2020*¹³ (published in 2016) argue that Slovenia has been steadily declining concerning the level of development of the information society for a decade and a half. According to the *Digital Economy*

⁷ https://publications.europa.eu/en/publication-detail/-/publication/4bafb6d8-1f35-4993-b0cf-6b6f34d8c81/language-en


¹³ https://www.gov.si/assets/ministrstva/MJU/DI/7df0f756bc/Strategija-razvoja-ID.pdf
Slovenia was ranked on the 17th and in 2018 on the 15th place among the 28 EU countries in 2017. Furthermore, the report states that Slovenia has made significant progress in the use of Internet services, and digital public services, and remains above the EU average in integrating digital technology, but in terms of connectivity is below the EU average. According to the Digital Slovenia 2020, the current situation regarding the level of general informatization is a result of poor investment in development and awareness of the importance of ICT for the development of economy, state and society at large.

Despite the presented situation in the field of general informatization, the Slovenian ICT sector is slowly growing. Namely, according to Zupan (2014), there were 5,676 companies in the ICT sector in 2012, and similar to the international level majority (96%) of it consisted of service subsector. Data obtained by the Statistical Office of the Republic of Slovenia\(^{15}\) show that between 2005 and 2016, the share of enterprises in the ICT service subsector increased by 188%. Within this sector, the share of enterprises in computer programming, consulting and other related activities increased by 230%. Additionally, according to the latest data available by the Statistical office of the Republic of Slovenia\(^{16}\), in 2017 the number of enterprises in the ICT sector in Slovenia increased on annual level by 6%, i.e. 8,125 enterprises, which represented 5.7% of all enterprises active predominantly in market activities. Meanwhile, in the manufacturing ICT sector, which represented 3% of all enterprises in the ICT sector, the number of enterprises decreased on annual level by 1%. A closer look at the activities of the ICT servicesubsector shows that 75% of the enterprises were active in the computer programming, consultancy and related activities (J62); in comparison with 2016, the number of these enterprises increased by 7%. Furthermore, the number of enterprises in activities wholesale of information and communication equipment (G46.5) and data processing, hosting web portals and related activities (J63.1) increased by 4% and the number of enterprises in activity telecommunications (J61) decreased by 3%.

2.1. State of the art on the information-communication sector’s workforce

In line with the increase in the number of enterprises in the European ICT sector, the number of employees is increasing. As noted by Eurostat\(^{17}\), the share of ICT professionals in all EU countries has grown from 2.8% in 2007 to 3.7% in 2017. In the same period, the proportion of individuals employed as ICT professionals increased by 36.1%, which is about ten times more than the growth of all employees. The data also reveals that in 2017, the highest share of

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15 [https://www.stat.si/StatWeb/News/Index/7527](https://www.stat.si/StatWeb/News/Index/7527)


ICT professionals was in Finland (6.8%), followed by Sweden (6.6%), relatively high shares were also in Estonia (5.6%), United Kingdom (5.1%), Luxembourg (5%) and Netherlands (5%). The countries with the lowest shares of employed ICT professionals among all employees were Bulgaria (2.3%), Cyprus and Latvia (2.2%), Portugal (1.6%) and Greece (1.6%). Slovenia is slightly above the EU average (3.7%) with a 3.8% share of employed ICT professionals.

According to data obtained by the Statistical office of the Republic of Slovenia\textsuperscript{18}, from 2011 to 2016 the total number of employees in activities of the Slovenian ICT service sub-sector increased from 9,519 to 11,369. Compared to the previous year, in 2016 the number of employees increased by 4.7% in computer programming, consulting and other related activities (J62), and by 6.6% in data processing, hosting and related activities, web portals (J63.1). On the other hand, the share of employees increased the most in software publishing (J58.2), i.e. by 17.4%.

In the framework of employment and education in the ICT sector, it is important to bear in mind that the main influx of EU workforce are graduates of the university and higher education and in some cases vocational education. According to data obtained by the Eurostat\textsuperscript{19} in 2017, 62.3% of all ICT professionals in the EU countries had completed tertiary education. With 65% share is Slovenia slightly above the average. However, the exceptions are Portugal (49.6%) and Italy (34.1%), where the share is below 50%. The countries with the highest share of ICT professionals in tertiary education in 2017 were Lithuania and Ireland (83.4%), Cyprus (81.6%) and Spain (80.7%). Additionally, the share of ICT professionals with tertiary education levels increased by 7.5% between 2007 and 2017. Over that period, this share increased by more than 20% in Slovakia, Austria, Lithuania, Hungary, Malta, and the Czech Republic. Nevertheless, in Belgium it decreased by 0.8%, in Germany by 0.2% and in Cyprus by 4.3%. The highest share of non-tertiary education (e.g. vocational training) is held by ICT professionals in Italy (65.9%), Portugal (50.4%) and Germany (49.8%).

At this point, it is necessary to mention the trend towards a decline in ICT graduates across EU member states, while the needs of industry significantly increase (Gareis et al., 2014; Pažur Aničić and Arbanas, 2015; Triangle and Zibell, 2016). Although the gap between the requirements for (digital) transformation of the economy on the one hand, and actual skills and knowledge of the workforce on the other hand is quite present in the professional literature, the estimates of its size are vague. However, Gareis et al. (2014) produced the most likely forecast of vacancies in the EU ICT sector for the period 2012–2020. Their model predicts that the ICT workforce in Europe will grow from 7.4 million in 2012 to 7.9 million in 2020, of which 5.9 million will be ICT practitioners and 2 million ICT management level employees. The excess demandor shortage (calculated as the number of open posts) amounts to 913,000 in 2020. This figure can best be described as ‘demand potential’ or ‘job potential’ for ICT jobs. It should be

\textsuperscript{18} https://www.stat.si/StatWeb/News/Index/8231

\textsuperscript{19} https://ec.europa.eu/eurostat/statistics-explained/index.php/ICT_specialists_in_employment#Number_of_ICT_specialists
seen as a (theoretical) figure describing the demand potential for new ICT jobs which could theoretically be created additionally in Europe due to an e-skills demand. This is likely to occur especially in the years closer to 2020, when the labour market would be able to absorb 630,000 potential additional jobs, which could be created in ICT practitioner occupations and around 283,000 at ICT management level.

3. Information-communication sector’s workforce skills in the context of industry 4.0

ICTs became an important part of individuals’ daily lives (computers, smartphones, smartwatches, etc.), as well as an integral part of various industrial products (cars, medical instruments and appliances, manufacturing devices, household appliances, bicycles, etc.) that they use. Such intertwining of technologies and tools for everyday activities implies interconnection of the ICT sector with other manufacturing and service sectors. This transition is so compelling that it is being called the fourth industrial revolution or industry 4.0. As observed by Motyl et al. (2017), in the framework of the industry 4.0 several changes must be expected for the industrial world such as the introduction of novel business opportunities and models, and novel service-based, real-time enabled cyber-physical systems platforms with the rise of new social infrastructure for the workplaces. At this point, we should highlight that this industry concerns the strict integration of human, especially on their creativity applying technology. “With the emergence of organizations in Industry 4.0, “connected people” or “professionals 4.0” appear, who are distinguished by being more efficient, more flexible, faster and, consequently, more competitive, thanks to the total connectivity among machines, systems, and people” (Cerzo-Navarez et al., 2017: 488). Such conditions require new responsibilities and skills of the workforce, therefore continuous training and individual appraisals are necessary to efficiently operate. To put it differently; the tasks of ICT professionals in the context of the industry 4.0 are less routine and demand continuous knowledge and skills development.

3.1. Diversity of skills in information-communication sector

Along with the increasing importance of ICTs in contemporary society, a new category of skills called digital skills has emerged. On a general level, digital skills can be defined as a range of abilities that enable people to create and share digital content, communicate, collaborate, and solve problems in all areas of their lives. In this context, OECD proposed a distinction between three categories of ICT skills, namely; ICT specialists – have the ability to develop, operate and maintain ICT systems, advanced users – competent users of advanced, and often sector-specific, software tools and basic users – competent

20 https://www.oecd.org/sti/ieconomy/37620123.pdf
users of generic tools needed for the information society, e-government and working life. The first category of presented competencies covers individuals who supply the tools, while the second and third categories cover those who use them. Recently, it was recognized that the interconnection of the ICT sector with other manufacturing and services sectors implies a greater demand for new skills. Namely; according to OECD\textsuperscript{21} this kind of demand is emerging in the areas of programming, application development and network management skills, generic ICT skills for professional purposes and complementary ICT skills to perform new ICT related tasks such as information processing, problem solving and communication. Furthermore, it is assumed that workforce in contemporary (information) society needs different types of skills, such as technical and professional (including ICT professionals who are the heart of innovation and support for digital infrastructure), and complementary ICT or soft-skills, such as leadership and communication skills that expand market opportunities. As noted by Johnson (2015) in a comprehensive literature review that addresses the non-technological (soft) skills of ICT professionals, such skills contribute to the individual's success as well as the success of the company in which he/she is employed. According to the author's findings, the most important among the soft-skills of ICT professionals are critical thinking, problem solving, project-management, and teamwork, as well as skills related to decision making, creative thinking, desire for continuous learning, etc.

Gallaher et al. (2011) offer crucial observation related to this area; they stem from two common and already mentioned broad categories of ICT professionals' skills distinction: technical and non-technical or soft-skills. At the general level, technical skills include knowledge and competencies related to hardware, systems, and software, while non-technical or soft skills often refer to cognitive and social skills, as well as to behavioral aspects of ICT professionals, which means that they are not related directly to ICT expertise or use of specific equipment and tools. However, Gallaher et al. (ibid.) in their study introduce a detailed division of both types of skills into subcategories, which are further presented.

\textit{Technical skills} are those directly relevant to the ICT profession. Within this broad area, three distinct sets of skills emerge: (1) foundational skills lay the basis for anyone gaining entrance to IT jobs, these skills equip an individual to become an ICT professional, it is common for entry-level IT professionals to learn these skills in ICT-related educational programs rather than on-the-job.; (2) operational skills require a depth of knowledge in specific technology products. They often relate to hardware and software provider products and are not typically viewed as critical to retaining inhouse and are not generally sought in new hires, in part because they are widely available and are not firm-specific. However, they are important to the development of (3) essential skills, which are indispensable for ICT staff to develop business solutions aligned with organizational objectives and are essential at all levels and on both sides of the vendor/client relationship.

\textsuperscript{21} https://www.oecd.org/els/emp/Skills-for-a-Digital-World.pdf
According to Gallagher et al. (ibid.) three non-technical skills categories include those skills that give ICT professionals the ability to understand, develop and deliver effective solutions to the organization. This broader area is also divided into three distinct sets namely: (1) project management skills which include skills for planning, organizing, leading, and controlling activities, and staff involved with projects; (2) problem/opportunity skills mean understanding the mission or business of the organization, industry, and functional process levels and thus are individuals who possess them able to apply technology effectively. This knowledge is typically learned as part of one's training in a profession, be it business, medicine, science, government, or others; and the last (3) category are relationship skills, which involve skills in managing relationships with both non-technical personnel in ICT-related activities of organizations and those of technical experts or providers who are delivering services.

Further will paper focus on the soft or non-technical (Gallaher et al., 2011) skills in the context of the industry 4.0. What follows is the case study of Slovenian ICT companies, where we were primarily interested which soft-skills are important for ICT professionals and how companies ensure them. The survey was carried out as a part of research project Forecasting the need for key competences, knowledge, and skills for reference professions in the information and communication technology sector. The case study encompasses semi-structured interviews that took place between July and September 2018. In the sample fifteen Slovenian companies belonging to ICT service sub-sector were included, among which were four micro (1–9 employees), eight small (10–49 employees), one medium (50–250 employees) and two large. The survey was carried out among the managers (micro and medium companies) and human resource staff (large companies). All interviews were implemented with prior personal consent and recorded, transcribed and anonymized.

As initially explained, the ICT sector is divided into manufacturing and service sub-sectors, and the latter represents a major part of the Slovenian ICT sector, therefore, the research focused on companies who belong to it. According to the latest available data obtained by Statistical office of the Republic of Slovenia (2019), in 2017 more than half (56%) of individuals employed in the ICT sector were in activity computer programming, consultancy and related activities (J62), therefore, the sample included the great majority (13) of the companies belonging to this economic activity.

3.2. The case study of Slovenian information-communication service sub-sector

To cope with challenges related to the ICT service sub-sector and processes of industry 4.0 ICT professionals need new skills. Interviews with representatives of companies and research institutions confirm that besides technical skills, soft or non-technical skills are becoming increasingly important in the Slovenian ICT service sub-sector. As authors of the Digital Europe And The EC’s Skills
Strategy\textsuperscript{23} emphasize, in addition to pure technical digital skills, the industry needs to rely on soft-skills and skills relevant for business growth.

Soft-skills are becoming more and more important in recruitment, more so than education itself – whether you have completed a computer college or any other – of course, we will focus more on these areas, we will have more candidates from technical schools in recruitment, but these skills are very important for our candidates. If we see that this is not the case, he will not be able to work for us. (Interviewee 9)

We asked interviewees which key soft-skills they are looking for when they recruit employers, and the most frequently mentioned are presented in the table 1.

<table>
<thead>
<tr>
<th>Ability to mentor or transfer knowledge</th>
<th>Project management</th>
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<tbody>
<tr>
<td>Growth mindset</td>
<td>Time management</td>
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<tr>
<td>Proactivity</td>
<td>Stress management</td>
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<tr>
<td>Agility</td>
<td>Burn-out prevention</td>
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<tr>
<td>Flexibility</td>
<td>Teamwork (e.g. agile groups)</td>
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<tr>
<td>Creative thinking</td>
<td>Communication skills</td>
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<tr>
<td>Empathy or emotional intelligence</td>
<td>Presentation skills</td>
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<tr>
<td>Ability to see the bigger picture</td>
<td>Critical thinking and problem solving</td>
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As table 1 shows, the most important soft-skills among ICT professionals refer to a growth mindset, proactivity, communication, and teamwork.

Fast-growing businesses like ICT service sub-sector has a constant need for new staff. According to the narratives of interviewees, on the ICT labor market, there is a lack of workforce with required soft-skills.

You have to either steal a person to someone, to another company, offer him a better salary, or you have to make a man. This can be easy if you get a student who knows at least something small and brings him up. The training of such staff is from half a year to one year, that works in a team, to make him the way you want him to be, so you can sell his product. (Interviewee 11)

Companies are dealing with this problem in different ways, some of them recruit from colleges by engaging students through summer schools, courses, promoting internships, etc.

/.../ has a very well-established strategy to bring students to their academies already, so before you start working for them, you have a two or three-month academy – they pull students out of college, we’ll have to start doing this too. (Interviewee 3)

Newly recruited staff is then internally trained and expected to monitor changes and continuing education in different fields.

Our approach is to recruit, not quite always, but relatively junior staff, and then educate them. We are not doing this to fill some top positions, we are raising them. (Interviewee 1)

Staffing problems are also resolved by continuous learning and education activities within companies. Employees are expected to be ready to keep up with new developments, acquire new knowledge, be agile and keep up-to-date of technological and other changes.

This continuous development paradigm is such a buzz word and says that you are constantly in the phase of improving your work. (Interviewee 13)

Continuous learning and training are closely linked with the ability to mentor or to transfer knowledge to others. However, according to the narrative of interviewees this important skill is somehow not self-evident among ICT professionals.

/.../ one thing that is not taken for granted by software developers is mentorship – a willingness to transfer knowledge, to have some ability to present knowledge, mentoring, giving feedback. (Interviewee 3)

With penetration of ICTs into different social spheres and working areas, there is a growing need for a “somewhere in-between” professionals, who possess combination of skills and knowledge from the area of ICT and other field (e.g. healthcare / medicine, banking, car industry, law, management etc.) and can integrate them.

I think some of the mixes here are/will be the most popular ones or they always are. That is, one developer combined with some domain, which he knows, is pleased with, whether it is medicine, mechanical engineering, law, economics, management, this is what today is a top individual. (Interviewee 3)

Otherwise analysts is ... you must have good communication skills there, you have to know the problem well, the problems can be technical, but they can be purely legal. Some law that you have to support is pure legal text and you must have knowledge from social sciences as well. Sometimes it would be nice if you are also something of a lawyer /.../. At the same time, you have to know how to turn it into pure technique, i.e. these are universal persons. (Interviewee 11)

In this context, our interlocutors highlighted the importance of individuals who possess domain-specific knowledge, which is now becoming crucial and incredibly valuable in the ICT software industry.

We call it domain knowledge. /.../ It’s not enough to know how to code, but you must understand the broader system. (Interviewee 4)

Besides knowledge of the field that company is primarily working on, the most desirable characteristic is the knowledge of law and marketing.

In ICT is always half of the domain knowledge /.../ e.g. you must master the standards, /.../ the differences in different jurisdictions – data storage policies. (Interviewee 13)
A big trend is the combination of marketing and ICT. Marketing is becoming an ICT. In marketing is very little of what marketing used to be ... it used to be events, brochures, gifts, things like that, but now it's marketing cookies, Facebook and online stuff. (Interviewee 1)

The most common way to gain missing knowledge is an investment in external training and to enable employees, for example, participation at different national and international conferences and seminars.

Which is more domain knowledge and are certain standards that we need to know, /.../, for example, we send new employees to education on IHE standards in healthcare. (Interviewee 13)

External training is common in the development of non-technical or soft-skills, which are estimated to become increasingly important, and at the same time, they are lacking.

Another field, which cannot be obtained online, and we invest in hiring various local trainers /.../ are soft-skills. Project management, agile project management, that kind of things. Then soft in terms of self-control, time management, stress management. (Interviewee 1)

In ICT companies, teamwork and collaboration represent synergistic action, which is important in creating new solutions in the field. Therefore, companies often focus on connecting employees through team buildings, team meeting activities and the like.

We put a lot of effort into how a person will fit into the team. I can say that this is of crucial importance. (Interviewee 11)

We are very attached to teamwork, it is very difficult to act as an individual. The ability to work as a team and to be able to turn team diversity into strengths /.../ this also encourages new solutions when people talk... one says something, other adds something. They are not competing, but co-creating, upgrading. /.../ that you know how to lead a team, that you know how to communicate, that you know how to work with a client, that you recognize some of the needs of the team, or that of the client, /.../.

In terms of skills, however, empathy is paramount. It is important to communicate with others. (Interviewee 6)

4. Conclusions

As our case study shows, there is a noticeable demand in non-technical or soft-skills of ICT professionals in Slovenian ICT service sub-sector. Although the main limitation of this study is the relatively small research sample, other empirical studies (e.g. Ahmed et al., 2012; Matturro, 2013; Pažur Aničić and Arbanas, 2015) revealed similar findings, namely that requirements for competencies of ICT professionals have changed in such a way that a combination of technical and
soft is needed. To put it differently, among ICT professionals soft-skills became significant as technical. Furthermore, ICT professionals are increasingly expected to specialize in two or more related and mutually supported domains (i.e. domain knowledge). Since there is a lack of workforce with required soft-skills, companies use their ad hoc solutions to gain or to educate them. Therefore, an interdisciplinary approach to education policies to ensure adequate competencies (i.e. hybrid) for ICT professionals and thus meet the labor market needs is an important future challenge.

References


Mas, Matilde; Fernández de Guevara, Juan; Robledo, Juan; Cardona Melissande et al. 2018. The 2018 PREDICT Key Facts Report. An Analysis of ICT R&D in the EU and Beyond; JRC Technical Reports. Available at: https://ec.europa.eu/jrc/sites/jrcsh/files/jrc111895.pdf

Motyl, Barbara; Baronio, Gabriele; Uberti, Stefano; Speranza, Domenico; Filippi, Stefano. 2017. How will change the future engineers’ skills in the Industry 4.0 framework? A questionnaire survey. Procedia Manufacturing, Vol. 11: 1501–1509.


