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## D7.1. Rezultati kvalitativne analize o budućim potrebama za e-kompetencijama

### Introduction

According to statistics, ICT workforce in Europe in 2012 included 7.4 million workers, which is 3.4% of the European workforce employed in almost all industries of the economy [1]. Since 2010, there was a significant growth in the size of ICT workforce in its minimum definition, with the average growth rate of 4.3% per year until 2011. Another survey suggested that there were 255 000 unfilled vacancies in EU from which 72 000 for “ICT management and business architecture” skills and about 183 000 for “Core ICT practitioners” and “Other ICT technicians” [2]. The major inflows into the ICT workforce come from ICT graduates, so it would be to expect that the number of ICT graduates follows the positive trend of needs for ICT practitioners in the labor market. Quite opposite, after a continuous increase in the number of ICT graduates, the number went down since 2006 [1] in most of the EU countries. The number of ICT graduates in the EU increased from 71 000 per year in 2000 to 127 000 in 2006, and then decreased to 114 000 by 2009 [3]. Another trend that is inconsistent with the positive predictions about the needs in the ICT workforce is the negative trends in youth employability in this sector, stressing the fact that there is a mismatch between the programs that higher education institutions offer and the needs of labor market. Current situation shows a significant level of activity in most of the Member states regarding the tailored education and training of ICT practitioners according to the needs of labor market, career support and lifelong learning of ICT practitioners, as well as the e-skills competence framework and job matching for ICT practitioners [1], but the predictions of growth in the ICT labor market stress out the need for more skilled ICT professionals in the upcoming period, which implies the more flexible education of ICT professionals that will equip them with the right skills and thus prepare them for dynamic labor market [4]–[7]. This paper provides an overview of current ICT graduates’ employment and future trends, from the perspective of competencies requirements, amended with the analysis of e-competencies (from European e-Competence Framework 3.0) and generic competencies (from Tuning project) present in the actual job advertisements (ads) in the ICT domain.

## Graduate Employment and Key Competencies

### Labor Market and Graduate Employment

Since 2010, the graduate labor market supply and demand has risen as an important issue, so there have been some researches conducted from different institutes and research groups on this topic [8],[9]. All of them explore the importance of generic and transferable skills in employment of graduates, the importance of work experience, the mismatch between obtained skills by graduates and the expected skills by future employers. McKinsey report from 2013 indicates different perception about competencies acquired by graduates, stressing that about 1/3 of both, employers and youths, consider that youths are adequately prepared for the entry-level position by their previous education, while almost 3/4 of education providers consider their graduates well prepared for the labor market [9]. Even more, only 42% of graduates from eight countries included in this survey believe that their post-secondary studies improved their employment opportunities and 33% of employers believe it is the skill gap that causes the problem of youth unemployment. The main gap is recognized in skills such as problem solving and analysis, work ethics and hands-on experience. Of the special interest is the employment potential of ICT graduates. As stated in *Towards a job-rich recovery* [3], ICT practitioners are one of the very few categories on the labor market with the growth of around 3% even in the time of current economic crisis. The predictions about future trends in ICT professional jobs and demand in Europe from 2012 to 2020 presents three different scenarios [1]. In all three cases, the demand potential exceeds the predictions about the number of ICT graduates.

### Key Competencies for Employment

European Commission has defined eight key competencies that would be necessary for lifelong learning and success in the changing world of work [10] which include communication in the mother tongue and foreign languages, mathematical competence and basic competencies in science and technology, digital competence, learning to learn, social and civic competencies, sense of initiative and entrepreneurship, cultural awareness and expression. Within Tuning project from 2010, a list of generic competencies was extended to the number of 31 key competencies applicable to any educational program [11]. A comprehensive analytic report from 2010 [12] provides an insights into the needs and perceptions of graduate recruiters, stressing that skills such as teamwork, sector-specific skills, adaptability to new situations, communication skills, computer literacy, first-class ability in reading/writing and analytical and problem-solving skills were highlighted as the most important by employers in the moment of survey implementation and for 5 years in the future. Shortage of applicants with the right skills has been recognized as the most important challenge that employers' face in filling the vacancies. Newest publications from OECD [13] stress out the high level of education and skills as crucial for the future growth and employment as well. The specificities that characterize the ICT sector are evident in the work done on the development of the ICT related skills and competencies for professionals. Already in 2003, one of the most popular frameworks for matching the skills of ICT workforce and requirements of the employers, The Skills Framework for the Information Age - SFIA, was introduced (<http://www.sfia-online.org/>). In the latest years, The European Competence Framework [14] was introduced, which provides a reference of 40 competencies required by ICT positions in all industrial sectors and is aligned with the strategic initiatives at EU level, and supported by the European ICT Professional Profiles. The mentioned publications show that the key generic competencies, as well as the specific ones in the field of ICT profession, have risen as an important issue.

## Methodology

To explore the current situation on the labor market regarding the competencies required in ICT jobs, the qualitative analysis was performed based on the ads announced at the online portal MojPosao (<http://www.moj-posao.net/>), in the category "ICT & telecommunications". The analysis was conducted on the dataset of 50 randomly chosen job advertisements. The purpose of this study was to observe the appearance of certain e-competencies, as defined in European e-Competence Framework 3.0, and generic competencies, as defined in Tuning project, in job ads. The job ads are mainly structured in two parts – first is the job description which contains the main tasks and responsibilities for a certain job position and the second are conditions that applicants have to fulfill, such as required qualifications and skills. The second part usually consists of two subparts, the required qualifications and the additional qualifications that can give certain priority in the selection process to candidates which possess them. Within this research, the goal was to observe the appearance of e-competencies, as well as generic competence in the actual job ads. Except those two categories, one additional was observed – the appearance of specific competencies such as knowledge of some certain business domain, specific programs etc. This last category was the most complex to observe since there is no limited set of specific competencies that could appear in the job ads and thus it was not possible to use some existing categorization for further analysis. Each job advertisement was observed by the author and the indicator data was used for further quantitative analysis. That means that only the appearance of each competence in a certain job ad was marked and not the frequency in appearance of certain competence.

## Results

Figure 1. shows presence of 40 defined competencies from e-CF in the 50 observed job ads. From the theoretically perspective, competence required from the highest number of ICT profiles are *Problem Management*, followed by *Component Integration* and 4 other competences required from more than 1/5 of ICT profiles: *Application Development*, *Risk Management*, *Business Change Management* and *Information Security Management*. ICT professionals searching for a job on the labor market are mostly required to have the *Application Development* competencies which are necessary for more than 1/3 of the available jobs ( $M=0.340$ ), followed by *Testing* ( $M=0.280$ ), *Application Design* ( $M=0.240$ ) and *Component Integration* ( $M=0.240$ ).

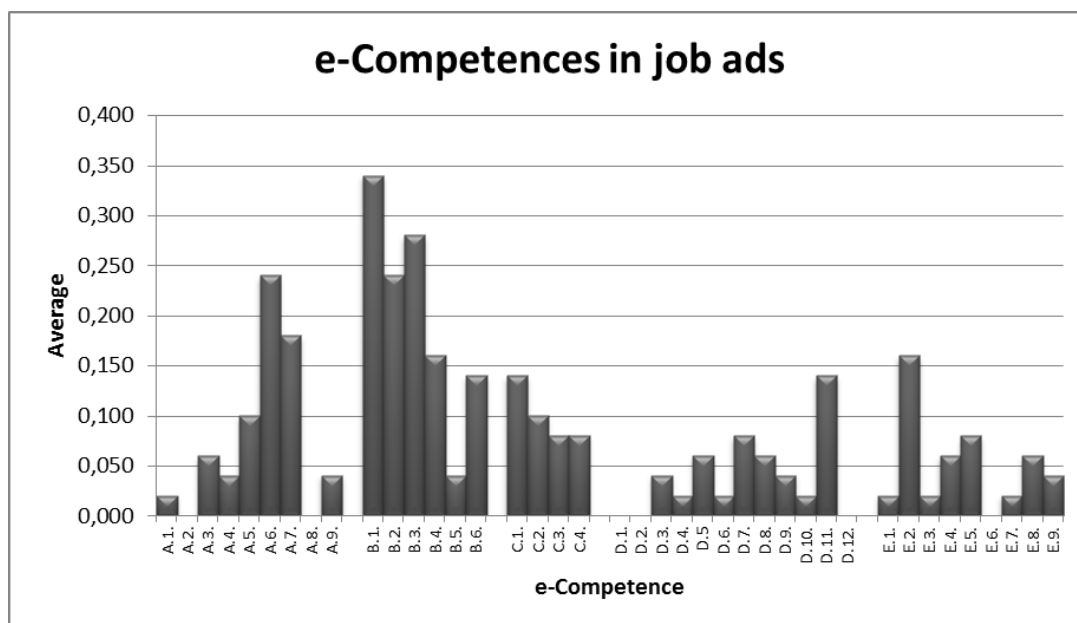


Figure 1. Comparison of required competencies in ICT Professional Profiles and ICT job vacancies

Legend:

- |   |  |  |
|---|--|--|
| A.1. IS and Business Strategy Alignment | B.6. System Engineering                        | D.9. Personnel Development                 |
| A.2. Service Level Management           | C.1. User Support                              | D.10. Information and Knowledge Management |
| A.3. Business Plan Development          | C.2. Change Support                            | D.11. Needs Identification                 |
| A.4. Product/ Service Planning          | C.3. Service Delivery                          | D.12. Digital Marketing                    |
| A.5. Architecture Design                | C.4. Problem Management                        | E.1. Forecast Development                  |
| A.6. Application Design                 | D.1. Information Security Strategy Development | E.2. Project and Portfolio Management      |
| A.7. Technology Trend Monitoring        | D.2. ICT Quality Strategy Development          | E.3. Risk Management                       |
| A.8. Sustainable Development            | D.3. Education and Training Provision          | E.4. Relationship Management               |
| A.9. Innovating                         | D.4. Purchasing                                | E.5. Process Improvement                   |
| B.1. Application Development            | D.5. Sales Proposal Development                | E.6. ICT Quality Management                |
| B.2. Component Integration              | D.6. Channel Management                        | E.7. Business Change Management            |
| B.3. Testing                            | D.7. Sales Management                          | E.8. Information Security Management       |
| B.4. Solution Deployment                | D.8. Contract Management                       | E.9. IS Governance                         |
| B.5. Documentation Production           |  |  |

From the list of generic competencies, the most required ones are: the *Ability to communicate in foreign language* (M=0.78), *Teamwork skills* (M=0.66) and *Interpersonal and interaction (communication) skills* (M=0.68). Figure 2. presents the comparison of the appearance of e-competencies and generic competencies in job ads. It can be perceived that one job advertisement contains almost twice more generic competencies (M=6.24) than e-competencies (M=3.22). Generally, the appearance of e-competencies in job ads could be read mostly from the job description, while the generic competencies appear in the “obligatory conditions” part of ads and are more clearly defined. Specific competencies are not included in the graph because the analysis of those was quite more unstructured. In 90% of ads, requirements related to specific competencies appear, but some of those could be in fact concerned as the generic competence named “*Knowledge and understanding of the subject area and understanding of the profession*”. The question that arises here is the distinction of generic and specific competencies, which could be quite hard to elaborate, regarding the dynamic nature of the ICT field. Except the knowledge of certain technologies, some of the other specific

competencies seen by employers as an advantage, but not the obligation, are the knowledge about the certain business domain or possession of some industrial certificates.

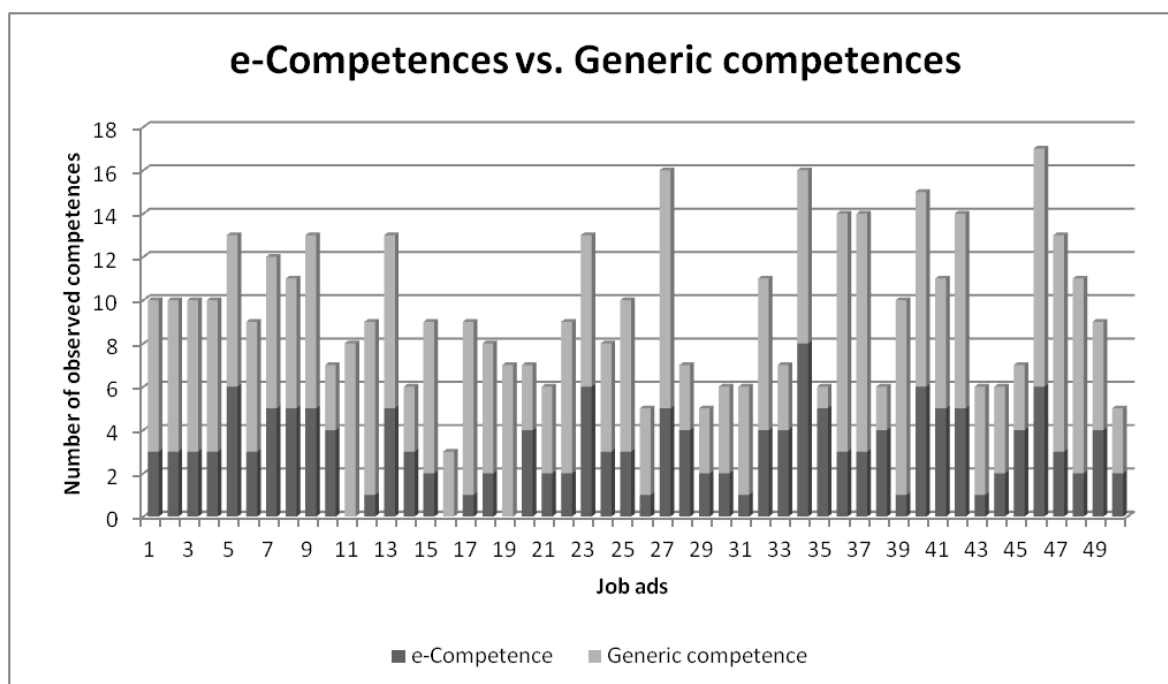


Figure 2. Appearance of e-Competencies and generic competencies in job ads (see Appendix for complete list of e-competencies and generic competencies)

## Discussion

This research study provides an insight into the real labor market and the implications of theoretical findings in practice. Generally, some conclusions can be done. Firstly, it can be said that theoretical frameworks such as e-CF are not recognized by employers and thus cannot represent the connection between learning outcomes of higher education graduates and the needs of labor market. Secondly, generic competencies are recognized as very important prerequisite from the view of potential employers, since they are required in all of the observed job ads. The main limitation of this research is in the relatively small research sample, but still appropriate for the analysis of qualitative data. In line with the trends on the labor market and the complete set of skills required from ICT graduated, the innovation in education and training programs at all levels is faced by challenges. This trend is evident mostly in design and delivery of educational programs that are more open and relevant to the needs of the labor market and society in general, but as well in promoting lifelong learning and partnership with the world of work within formal education [17]. ICT studies curricula should provide students with both technical and non-technical skills [15], [16]. Employers, who believe that the technical and non-technical skills are equally important, are seeking a team of professionals in the field of information systems that possess both types of skills. The importance of linking higher education institutions and employers in the ICT field has been recognized by many authors who particularly emphasized the need for mutual cooperation in curriculum design [18]–[24]. Aligning learning outcomes in higher education with the needs of the labor market is also a relevant topic of numerous researches and projects at

national and international level in the recent years [11], [25]–[29]. The identified need for the connection with employers in the curriculum design and delivery has led to the innovative teaching methods such as *work-ready learning activities* [30]–[32], *experience-based learning* [23], *practice-based learning* [33] *cooperative education programs* [19], etc., that are increasingly finding their place in formal education.

## Conclusion and Future Work

According to the presented forecasts about future demand potential for ICT workers and ICT graduates, some general policy recommendations have been proposed. Except on the strategic national level strategies and initiatives which should foster and strength ICT professionalism, the biggest emphasis is on the adaptation of education and training of ICT professionals, which consider new learning methods and innovation in curriculum design and delivery. The adaptation includes as well the improvements in the process of matching new graduates with industry requirements, better communication with employment agencies and the recruitment industry, establishment of career support and lifelong services. In the European Higher Education Area, certain efforts have been done in the latest years on the development and implementation of European qualification framework and national qualification frameworks which should lead to the better recognition of competencies at all levels of educational system. In the future, a certain work should be done on the creation of the ICT professional's education system that works for all stakeholders and contribute to better employment of ICT professionals, based on the innovation in curriculum design and delivery and new learning methods.

## Appendix

### List of e-competencies

- A.1. *IS and Business Strategy Alignment,*
- A.2. *Service Level Management,*
- A.3. *Business Plan Development,*
- A.4. *Product/Service Planning,*
- A.5. *Architecture Design,*
- A.6. *Application Design,*
- A.7. *Technology Trend Monitoring,*
- A.8. *Sustainable Development,*
- A.9. *Innovating,*
- B.1. *Application Development,*
- B.2. *Component Integration,*
- B.3. *Testing,*
- B.4. *Solution Deployment,*
- B.5. *Documentation Production,*
- B.6. *System Engineering,*
- C.1. *User Support,*
- C.2. *Change Support,*
- C.3. *Service Delivery,*
- C.4. *Problem Management,*
- D.1. *Information Security Strategy Development,*
- D.2. *ICT Quality Strategy Development,*
- D.3. *Education and Training Provision, D.4. Purchasing,*
- D.5. *Sales Proposal Development,*
- D.6. *Channel Management,*
- D.7. *Sales Management,*
- D.8. *Contract Management,*
- D.9. *Personnel Development,*
- D.10. *Information and Knowledge Management,*
- D.11. *Needs Identification,*
- D.12. *Digital Marketing,*
- E.1. *Forecast Development,*
- E.2. *Project and Portfolio Management,*
- E.3. *Risk Management,*
- E.4. *Relationship Management,*
- E.5. *Process Improvement,*
- E.6. *ICT Quality Management,*
- E.7. *Business Change Management,*
- E.8. *Information Security Management,*
- E.9. *IS Governance*



## List of generic competencies

- 1) *Ability to communicate in a second language,*
- 2) *Capacity to learn and stay up-to-date with learning,*
- 3) *Ability to communicate both orally and through the written word in first language,*
- 4) *Ability to be critical and self-critical,*
- 5) *Ability to plan and manage time,*
- 6) *Ability to show awareness of equal opportunities and gender issues,*
- 7) *Capacity to generate new ideas (creativity),*
- 8) *Ability to search for, process and analyze information from a variety of sources,*
- 9) *Commitment to safety,*
- 10) *Ability to identify, pose and resolve problems,*
- 11) *Ability to apply knowledge in practical situations,*
- 12) *Ability to make reasoned decisions, 13) Ability to undertake research at an appropriate level,*
- 14) *Ability to work in a team,*
- 15) *Knowledge and understanding of the subject area and understanding of the profession,*
- 16) *Ability to work in an international context,*
- 17) *Ability to act on the basis of ethical reasoning,*
- 18) *Ability to communicate with non-experts of one's field,*
- 19) *Ability for abstract thinking, analysis and synthesis,*
- 20) *Spirit of enterprise, ability to take initiative,*
- 21) *Interpersonal and interaction skills,*
- 22) *Ability to design and manage projects,*
- 23) *Ability to act with social responsibility and civic awareness,*
- 24) *Determination and perseverance in the tasks given and responsibilities taken,*
- 25) *Appreciation of and respect for diversity and multiculturalism,*
- 26) *Ability to work autonomously,*
- 27) *Skills in the use of information and communications technologies,*
- 28) *Commitment to the conservation of the environment,*
- 29) *Ability to adapt to and act in new situations,*
- 30) *Ability to evaluate and maintain the quality of work produced,*
- 31) *Ability to motivate people and move toward common goals*



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