

ICT SECTOR SKILLS NEEDS ANALYSIS IN VOJVODINA

IN A VET MULTILEVEL GOVERNANCE PERSPECTIVE

**VET GOVERNANCE
IN SERBIA**

Report prepared by Kosovka Ognjenović and Vladimir Vasić, in collaboration with the ETF and the Vojvodina ICT Cluster.

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PREFACE

The Information and communication technology (ICT) sector has the capacity to drive innovation in business and the public sector. In its economic strategy, Serbia has prioritised ICT and the overall digitalisation of the economy and public services. Achieving this requires understanding its impact on future skills demand and making swift and resolute changes in lifelong education and training provision, including efficient partnerships with businesses, to address emerging skills shortages.

Understanding skills needs requires a continuous flow of information between businesses, public authorities and education and training providers. Organising this at territorial and sectoral levels, within a national framework, can help bridge the gap between skills demand and supply. How the national, territorial and sectoral levels interact has an impact on the quality of skills assessment and development.

To explore this further, the Vojvodina ICT Cluster and the Serbian Ministry of Education, Science and Technological Development launched a skills needs assessment and an analysis of institutional cooperation in the ICT sector in Vojvodina in June 2016.

The two-part analysis was completed and presented in Novi Sad, Serbia, in April 2017. The European Training Foundation (ETF) helped to design the methodology with two aims in mind:

- to obtain comparable data on skills needs by using a questionnaire for employers and employees modelled on existing international examples; and,
- to examine the interaction between the national, regional and sectoral levels in skills development through an analysis of institutional cooperation.

This report presents the ICT sector skills needs assessment. The analysis of institutional cooperation and coordination is presented in a separate report.

Learning takes place in educational institutions, in training centres, in workplaces and on digital platforms. Enterprises know about skills needs and skills shortages; they recruit and train their employees, provide coaching and on-the-job learning; they develop business strategies to maximise competitive advantage building also on the human capital of their employees. Territories may specialise economically via cross-sectoral collaboration and innovation; enterprises may cluster together based on proximity, inter-dependence, or complementarity in product and service innovation.

Ascertaining skills needs at territorial level may be a way of kick-starting dialogue and alliances between actors in education, business and economic development. Areas of cooperation can include work-based learning for smoother school-to-work transition; adjustments and flexibility for relevant and good quality skills development; and the involvement of enterprise staff in teaching and assessment in schools, among other issues. In the way it cooperates with the region's public authorities and education providers, the Vojvodina ICT Cluster is an instructive example of supply and demand side interaction in making the best of the region's ICT growth potential.

Good quality lifelong learning provision contributes to competitiveness and employment, and skills development needs to be embedded in regional and local development strategies. Multilevel governance offers a framework and approach to develop and manage the multi-actor and inter-institutional cooperation that good quality vocational education and training (VET) and skills require. Labour market assessment, occupational classification and standards, qualifications and assessment standards call upon the knowledge and practical experience of many different actors. Agreement on what role and responsibilities to assign to which stakeholder at which level is key to a good quality VET system.

The Serbian authorities and business stakeholders in VET together with the ETF are translating these findings into action for effective and good quality skill development in ICT and other leading sectors in the country.

Siria Taurelli, VET Governance Strategic Project Leader, ETF
Cristina Mereuta, Labour Market and Employment Specialist, ETF

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Thanks are due to the representatives, managers and employees of the 40 companies operating in the ICT sector of the Autonomous Province of Vojvodina, who were interviewed during the data collection process in November 2016, as well as to the participants in the three focus group discussions held in Novi Sad and Belgrade in December 2016.

The preliminary results of this report were discussed at the stakeholder workshop held in Novi Sad on 26 April 2017. Participants' feedback was integrated into the final report.

EXECUTIVE SUMMARY

Objectives and key findings

This analysis reports on the skills needs assessment conducted in the information and communication technologies (ICT) sector in the Autonomous Province of Vojvodina. The main research objective was to identify the qualifications and skills required by the sector and to assess the potential gap between the skills available in the workforce and those demanded by the sector, leading to relevant suggestions for updating the education and training provision.

Two methodological approaches were utilised in carrying out the research. The first was to conduct a survey on a sample of 40 ICT companies, targeting both employers and employees. Secondly, the survey results were further complemented by the relevant stakeholders' views on the identification of skills needs, derived from the outcomes of three focus groups. The reliability of the statistical inferences based on the survey data was confirmed by a high response rate of 95.2% of the selected companies.

The research signalled that **the ICT sector is growing faster than the capacities of the educational and training institutions can respond to the demand for qualifications**. Of the ICT companies surveyed, 85% experienced difficulties in filling job vacancies, due either to the insufficient supply of qualified job candidates or the lack of applicable knowledge. ICT professionals are the major occupational group in the ICT sector. Six ICT occupations demanded by the sector were identified: developers, digital media specialists, ICT consultants, project managers, test specialists and system administrators. Other professional profiles are also required in the ICT sector workforce ('other employees' hereinafter), including managers and marketing, sales and human resource specialists.

ICT sector employers prefer to have a workforce with higher education qualifications. ICT professionals also fill job vacancies in other economic sectors, which additionally widens the existing gap. A gap of 76.1% is estimated within the current demand for ICT professionals with tertiary education qualifications in the ICT sector. **The demand for secondary and post-secondary VET qualifications is also increasing.** A gap of 23.8% is expected to be registered in 2017. This opens up possibilities to expand the demand to include those who gain (post)-secondary VET qualifications, both within and outside formal educational institutions.

The gap in professional (technical) and foreign language skills was more pronounced among newly recruited staff in 2016. The gap in professional (technical) skills in relation to job descriptions led the ranking reported by ICT professionals (48.5%), whereas a lack of English-language skills emerged as the most important for other employees (47.7%). ICT professionals reported foreign language and communication skills gaps as the second and third ranked deficits, whereas other employees additionally considered their professional (technical) skills to be insufficient. These findings are in line with the time needed to meet the requirements of jobs in the ICT sector, estimated at between three to six months on average in the case of ICT professionals, or up to a year for other employees. These findings imply that some inevitable changes in educational programmes are needed (e.g. revised curricula with more focus on practical skills and an enhancement of the support available before and during the transition from school to employment, with more intensive coaching/training in relation to employees' first work experience).

In-company coaching and on the job learning are the most common types of training in the ICT sector. Companies are increasingly focusing their attention on the participation of ICT professionals in continuing training. The objective of providing training ranked highly in the ICT sector, with a particular emphasis on specialised training. Nearly 95% of ICT companies provided their employees with training, whereas almost 70% of all employees participated in continuing training in 2016. Three ICT

professional profiles were identified as those who accrued greater benefits from participation in specialised training, namely, developers, digital media specialists and ICT consultants. If offered the chance to participate in continuing training, ICT professionals and other employees would choose professional (technical) instruction, and courses to improve foreign language, managerial and time management skills, while employers would add training in communication to this list.

The level of cooperation between the ICT sector and educational institutions largely depends on the qualifications the sector currently needs – it is demand-led. This cooperation is perceived by the companies as part of the strategy to recruit new staff more than as an opportunity to provide internship and/or apprenticeship opportunities to graduates. A relatively small proportion of the ICT companies maintained cooperative links with secondary education institutions (around 25%), whereas this cooperation was more evident in relation to higher education institutions (65%). Moreover, about half of the ICT companies expressed relative satisfaction with the qualifications offered by higher education, whereas this share was significantly lower when VET qualifications were considered (20%).

The insufficient skills supply encourages companies to look for alternative ways of feeding the rising demand in the ICT sector. Informal education, post-secondary VET and self-learning were identified as the three most likely choices for overcoming skills mismatches and ICT qualifications shortages. Approximately half of the ICT companies shared the opinion that the information on skills needs that comes from the ICT sector influences the supply of educational and training programmes. Approximately 45% of ICT companies considered communication with educational and training institutions at the local level as the most effective form of communication, whereas other links were perceived as less effective. These findings are in line with the conclusion that the ICT sector still needs to establish more effective forms of cooperation with relevant stakeholders at different levels, especially with providers of initial and continuing education and training.

Suggestions and policy recommendations

Public policies created to improve the match between skills and jobs should be more sensitive to the needs of the ICT sector. The outcomes of the skills identification and anticipation process should be reliable at both the sectoral and regional levels. An adequate education policy reaction would be to increase the number of places meeting ICT professional requirements at the universities and, as a long-term measure, to modernise VET provision through the introduction of new educational profiles that boost ICT qualifications. Labour market policies should be focused on the skills matching process and on providing continuing training that would feed the demand for skills in the short term. ICT clusters as knowledge hubs can contribute to achieving a better match between skills and jobs through strengthening cooperation between educational institutions and companies and other stakeholders in the region.

Educational policies should be focused on both the practical dimension and on modernising educational programmes in order to support the growth of skilled jobs in the ICT sector. The qualifications system should be continuously renewed. Modernisation of the education system requires improving the capacities (technical and human) of the educational and training institutions, and providing a more intensive programme of career guidance and counselling. Local partnerships and incentives are important for stimulating the collaboration between the educational and training institutions, and ICT companies and their associations. The relevant practical knowledge of graduates at both the secondary and higher education levels can be improved through expanding work experience and internship and/or apprenticeship opportunities, but also through developing an entrepreneurial mindset. This can be realised through the joint efforts of companies and their associations on the one hand, and the educational institutions and the government on the other.

Maintaining an adequate level of skills is a lifelong process. Companies should be more closely involved in the process of skills creation. Not all companies are affected in the same way by skills shortages. The effects of skills shortages on large companies should encourage the creation

of more opportunities for employees to participate in continuing training, whereas small companies need to invest more effort in retaining ICT professionals with adequate skills. Moreover, small companies would further benefit from the support to be gained through joining clusters and associations of ICT companies.

Companies should provide continuous learning opportunities and stimulating working conditions to promote the professional development of their employees. Companies' resources are mainly concentrated in the improvement of ICT professional skills through focusing on the provision of specialised training. Additionally, companies should focus more on the skills of other employees in order to improve their efficiency. More opportunities for specialised training that supplements the supply of ICT qualifications should be created outside the companies, through governmental and other incentives.

More focus needs to be placed on strengthening informal and non-formal opportunities for learning. Both employers and employees would benefit from establishing a system of certification and validation of previous learning. The recognition of skills acquired in informal and non-formal contexts could enable the better matching of skills and jobs. The possession of certificates is particularly important for companies and their employees, and is demand-led. The validation of previous learning, once it is established, should have positive effects on companies' recruitment policies.

The problem of qualifications and skills shortages occurs at the local level, but it can be targeted from at least two perspectives: through the adaptation of educational policies which are mainly in the remit of national-level authorities; and by conducting continuing training, employment and other incentives that can be proposed at the regional level and supported by local and provincial authorities (e.g. through local action plans for employment or other activities to stimulate priority sectors and regional development). Establishing effective mechanisms for building cooperation and partnerships between relevant stakeholders is an imperative for a more effective matching of the skills in the workforce with the needs of the ICT sector. Having functional institutional settings is a prerequisite for better cooperation between the ICT sector and the government at all levels. The ICT sector should use all available communication channels to address the skills issue. Mutual understanding is an additional prerequisite for mitigating skills shortage problems.

The table below presents a quantitative summary of the key findings.

KEY FINDINGS OF THE ICT SECTOR SKILLS NEEDS ANALYSIS

Indicator	Result (%)
Demand side	
Share of companies reporting difficulties in filling job vacancies in 2016	85.0
Obstacles/difficulties with workforce and recruitment	
Insufficient supply of ICT professionals	67.5
ICT professionals without work experience	50.0
Share of developers who left the company, as % of total employees	54.5
Share of developers hired, as % of total employees	53.6
Changes in the number of employees by education	
Tertiary-educated employees hired in the last 12 months	78.6
Currently missing professional profiles, tertiary level	76.1
VET secondary employees hired in the last 12 months	4.1
Currently missing professional profiles, VET level	18.7
Occupational gap of developers with higher education (share)	42.9
Recruitment through private employment agencies	65.0
Supply side	
Employees' skill gap assessment	
Professional skills – ICT (other) employees	48.5 (31.6)
Foreign languages – ICT (other) employees	33.3 (47.4)
Time required to meet the ICT sector job needs	3–6 months
Recommendation to enhance practical training – ICT (other) employees	81.8 (89.5)
Recommendation to enhance practical training – employers	72.5
Usefulness of formal qualifications for getting a job – ICT (other) employees	72.7 (47.4)
Participation in continuing training in 2016 – ICT (other) employees	69.7 (68.4)
Matching supply to demand	
Share of ICT professionals in continuing training in 2016, as % of total trainees	86.2
Share of developers in specialised training in 2016, as % of total trainees	58.9
Impact evaluation of training	42.1
Employers' intention to provide professional training	92.5
Employers' intention to provide courses in foreign languages	42.5
Employers' intention to provide training in communication skills	42.5
Share of ICT companies which support the validation and certification of skills	55.0
Companies' cooperation with educational institutions	
Vocational secondary schools (share of companies)	25.0
Universities and faculties (share of companies)	65.0
Most desirable characteristics of future employees	
Positive attitude and ambition	75.0
Existing skills and knowledge	47.5
Educational profiles of future employees, apart from university education	
Informal education	47.5
Post-secondary VET education	40.0
Share of ICT companies that consider information on skills needs affects the provision of training	56.4
Share of ICT companies that communicate with educational and training institutions at the local level	45.0

INTRODUCTION

The ICT sector¹ in Serbia is recognised in national priority policies not only as a fast-growing sector but also as a driver of change². In spite of the fact that the national policy framework has lately been improved through the introduction of a new strategy for the development of information technology³, and a proposal for its implementation⁴, the factors perceived to affect the business climate still do not provide strong evidence of significant changes or improvement. Given the stronger regional development of the ICT sector, the Autonomous Province of Vojvodina went one step further in adopting the Smart Specialisation Programme in innovation and research in 2015 (Government of the Autonomous Province of Vojvodina, 2015). The national-level Smart Specialisation document is still in the drafting process. Compared with other countries – based on experts' assessment of the environment for innovation and business growth – according to the *Global Information Technology Report 2016*, Serbia ranks 103rd out of 139 countries, whereas the overall country rank is 75 (Baller et al., 2016, p. 167). This overall score has improved by two places in comparison to 2015, but it is hard to conclude whether this represents a real improvement because the number of countries was larger then (i.e. 143).

The continued growth of the ICT sector over the last decade has resulted in an increasing demand for skills and qualifications. However, the sector's growth has exceeded the educational and training institutions' capacities to respond to this demand, as exhibited by the insufficient supply of highly skilled job applicants. This situation requires a coordinated set of actions by the relevant stakeholders to prevent the sector approaching the limits of its growth. In particular, the ICT sector has shown resilience during the prolonged recession and exhibited a great potential for further job creation. The real question is whether the employment of individuals who do not have adequate qualifications and skills, as required by the sector, could slow down its growth? This analysis considers a skills needs assessment in the ICT sector of the Vojvodina region, and provides some specific policy recommendations.

Some basic statistics show that the ICT sector has a large export potential. The exports of ICT services as a proportion of the total services exports of Serbia in 2015 was 36.7%, as shown in the World Bank's World Development Indicators database⁵. The European Union (EU) is the leading world exporter of telecommunications, computer and information services, with a share of 55% in the total exports of services, while the remaining European countries' share of this market is 3.8% (World Trade Organisation, 2016, p. 123). Serbia's exports were valued at USD 601.7 million in 2015, meaning that they form 0.2% of the European total or 0.1% of the world's exports of those services. Serbian exports of telecommunications and computer and information services have exhibited a strong growth from 2010 onwards. European exports increased by 6% over the 2010–15 period, while, for instance, Serbian exports almost doubled.

According to the 2015 Vojvodina ICT Cluster's report, the number of active ICT companies in Serbia exceeded 2 000 in that year, and a significant number of these companies were established in the Autonomous Province of Vojvodina (Vojvodina ICT Cluster, 2015, p. 36). The share of employees in

¹ According to the OECD definition adopted by the European Commission, the ICT sector includes the following two groups of subsectors (NACE Rev. 2): ICT manufacturing (261–264, 268) and ICT services (465, 582, 61–62, 631, 951). For more details, see European Commission (2016).

² Government of the Republic of Serbia, *Program ekonomskih reformi za period od 2017–2019*, 2017

³ Government of the Republic of Serbia, *Strategija razvoja industrije informacionih tehnologija za period od 2017–2020*, 2016

⁴ Government of the Republic of Serbia, *Predlog prioriternih ciljeva i aktivnosti svih organa državne uprave i službi Vlade za unapređenje IT sektora u Srbiji*, 2016

⁵ See <http://wdi.worldbank.org>

the ICT sector was approximately 2.5% of the total number of those formally employed⁶. However, the current occupational and skills profile of the workforce is not as high as it should be given the efforts directed towards the improvement of innovation-led competitiveness. For instance, the share of knowledge-intensive jobs was 29.1% in 2014, while in the leading world economies this figure approaches half of the labour market (Baller et al., 2016, p. 176).

The main assumption which was tested and confirmed in this study is that ICT companies in the Autonomous Province of Vojvodina have substantial difficulties in filling job vacancies due to the insufficient supply of skilled candidates. This can be further illustrated by official figures regarding the number of higher education graduates in Serbia in 2016. According to the Serbian Statistical Office's report, in that year a total of 2 564 students graduated from both state and private universities and higher education institutions in the ICT field (Statistical Office of the Republic of Serbia, 2017, p. 61). ICT graduates made up 5.1% of the total number of graduates in Serbia⁷. The distribution of graduates from universities and higher education schools was 1 472 and 1 092, respectively. The share of those who graduated from educational institutions in Vojvodina was relatively low in comparison to the total number of graduates – 37.8% for university graduates and barely 13.8% for higher education graduates in 2016. According to Eurostat data for 2015, ICT professionals with higher education in the EU-28 make up more than half of the employed ICT professionals. Hence, apparently, there are additional possibilities for the engagement of other ICT educational profiles in the Serbian economy.

Some other specific findings of this study show that the ICT sector prefers to employ candidates with higher education qualifications, but also that the demand for secondary and post-secondary VET qualifications is following an increasing trend. Companies are faced with several challenges when recruiting new employees. One is related to the shortage of graduates with preferred qualifications and another is related to the practical knowledge of those who apply for ICT jobs. In both cases, companies need to invest additional time in preparing new starters to take up their jobs⁸. Companies are thus focusing particular attention on providing specialised training courses, mainly directed at ICT professionals⁹. These training programmes are expected to narrow the gap perceived in the technical skills of employees. In relation to qualifications, cooperation between the ICT sector and higher education institutions is much more common than between potential ICT employers and VET institutions. Involvement and communication with local partners regarding skills issues are considered highly effective by companies, but they do not perceive their input as having a significant impact on policies related to skills creation.

This report is divided into a number of chapters. Chapter 1 explains the research methodology and provides a preliminary analysis of the statistical reliability of the findings obtained by investigating the main objectives of the study. The analysis combines quantitative and qualitative research methods. The essential parts of the analysis are given in chapters 2–4, including the findings in relation to the characteristics of demand and supply in the workforce, as well as the process of matching the skills and qualifications needed by the ICT sector to those available in the labour market. The final chapter presents the key findings and conclusions of the report and provides some specific policy recommendations.

⁶ For more details about the ICT sector in Serbia visit the Chamber of Commerce Association of Electronic Communications and Information Society: www.pks.rs/PrivredaSrbije.aspx?id=10

⁷ No such data are available at the level of VET education.

⁸ This is in line with the international comparison, presented in the *Global Information Technology Report 2016*, which gives a relatively low estimate of the overall quality of the Serbian education system of 3.1, whereas the quality of mathematics and science education is somewhat more highly rated, as expressed by an estimate of 4.1, on a scale from 1 to 7 (Baller et al., 2016, p. 176).

⁹ Expectations of the employers concerning skills needs in Serbia show that ICT specialists and, in particular, developers need to possess a high level of professional (technical) skills – in 95.6% of cases (National Employment Service, 2016, p. 24).

1. RESEARCH METHODOLOGY AND DATA COLLECTION PROCESS

1.1 Research methods and instruments

Two research methods were designed and three research instruments were developed as part of the research methodology and applied during the data collection process. The research methods used were the survey, designed for the quantitative part of the research methodology, and the focus groups, developed for conducting the qualitative part of the empirical research. The survey was implemented on two samples of units of observation. The first subset consisted of ICT companies from Vojvodina, represented by their owners or managers, whereas the second subset of sample units included employees of the same companies. The sample of employees was further divided into a subsample of those who belong to the group of ICT professionals, and a subsample of all other occupational profiles at the companies (i.e. other employees).

The survey tools used for data collection included two questionnaires. Different questionnaires were created for each group of target respondents (employers and employees) (see Annex 1). The process of survey tools development was carried out in two phases. In the first stage a draft questionnaire was created. This questionnaire was then tested in a small number of companies. This phase was important for several reasons. It helped to answer a number of questions: how comprehensive is the coverage of the questionnaire; are there any questions the respondents hesitate to answer; how much time is needed to fill in the questionnaire; and what is the expected survey response rate? The modified questionnaires were then presented at a workshop held in October 2016. The key stakeholders and beneficiaries of the project were invited to the workshop, together with the representatives of the ICT companies. The Vojvodina ICT Cluster took an active role in the organisation of this workshop. The participants contributed to the discussion and provided useful comments on the proposed research methodology. The questionnaires were further fine-tuned and the final versions recommended for implementation in the data collection process. The survey was conducted in the last two weeks of November 2016. Before the survey started, the Vojvodina ICT Cluster sent invitations to the selected companies asking for their support in this research venture. The selected companies were then contacted individually by the interviewers and the visits for conducting separate interviews were scheduled.

For the qualitative part of the data collection process an appropriate tool was developed and implemented in the focus groups approach. The main topics for discussion were defined partly based on the results of the survey. Three focus groups were organised in December 2016, with two held in Novi Sad and one in Belgrade. Thirty representatives of relevant institutions and ICT companies participated in the focus group discussions, reflecting the views of the public sector, the private sector, social partners, and the educational and training institutions. The set of questions for discussion was prepared based on the level of the debate conducted (see Annex 1). For the focus groups held in Novi Sad, the questions were selected to address the issues that were locally relevant, for example companies in the area, and decisions at the provincial level, whereas the discussion in Belgrade's focus group was more related to national-level policies and processes.

The annexes include the tools developed and used during the process of data collection for both the survey of the companies and their employees and the focus groups. The preliminary analysis of the survey methodology implemented is further elaborated in the next section (see also Annex 2).

1.2 Preliminary analysis

Response statistics

Based on a power sample calculation, the sample size was 42 ICT companies (see Figure A2.1 in Annex 2). After field research by two experts, the response sample size was reduced to 40 ICT companies, that is, a response rate of 95.2%. Based on this, the power of the test is an excellent 89% (which is higher than the recommended 80%) (see Figure A2.2 in Annex 2).

Check of representativity

To check representativity (or test for non-response bias), we compared the first half of the sampled companies (for interviews conducted in the first half of the interview period) with the second half of sampled companies (for interviews held in the second half of interview period). Here, we assumed that the opinions of the second half of the companies were representative of those of the non-response companies.

We used general data on ICT companies to test for non-response bias. Chi-square tests yielded no statistically significant differences between the first half of the sampled companies and the second half, suggesting that non-response bias was not a problem.

Data entry

In the survey there are three types of data: single response, multiple responses and string lists. The statistical data were analysed with IBM SPSS Statistics (version 24) software, which required data entry in the dataset format. For the questionnaire for ICT companies, 32 separate datasets had to be created. The names of these datasets can be found in Zone A2.1 (Annex 2).

Coding procedures

The values of all the questions which were coded as categorical variables are properly described. See Zone A2.2 (Annex 2) for examples of the first questions relating to general data in the surveys of ICT companies.

Data cleaning

Before providing statistical analyses, data cleaning was essential to check the dataset for errors and to spot any mistakes made during data entering. Thus, for example, the screening process included identifying variables that scored out of range (i.e. those that were not within the range of possible scores).

Categorical variables were checked with the frequencies procedure, each category of variables being described by value and label. Then, using frequency tables for each categorical variable, we could detect if we had entered any non-defined values (i.e. errors). In Zone A2.3 (Annex 2), several categorical variables from the questionnaire are displayed. We checked all the categorical variables and detected no errors in data entry.

Continuous variables were easily checked using the descriptive procedure, and the minimum and maximum values for each variable were analysed to check whether they were possible. If a marginal value was possible, then there was no error in the screening variable.

Data analysis procedures

In this report, we primarily used two statistical analyses – frequencies analysis and crosstabs analysis. It is important to note that numbers are presented to one decimal place. Because of this, some totals may not add up to 100% or 1.0, if the relative frequency is summarised (i.e. in terms of marginal percentages).

Overall critical reflections about data quality (reliability and validity)

Reliability

When we have several questions relating to similar things, it is a good idea to check the reliability (i.e. internal consistency) of this group of questions. One of the most commonly used indicators of internal consistency is Cronbach's alpha coefficient. A good result is indicated if the Cronbach's alpha coefficient of a group of questions is greater than 0.6. Cronbach's alpha values are, however, quite sensitive to the number of questions. With a small number of questions (e.g. less than five) it is common to find quite low Cronbach values (e.g. 0.5). In this case, it may be more appropriate to report the mean inter-item correlation for the items.

For example, in the tables below we show the internal consistency of a group of questions analysing the difficulties companies face in filling vacancies. We see that the alpha is above 0.6, and the inter-item correlation is above 0.5, which indicate strong correlation between questions.

TABLE 1.1 RELIABILITY STATISTICS

Cronbach's alpha	Cronbach's alpha based on standardised items	Number of items
0.894	0.892	6

TABLE 1.2 SUMMARY ITEM STATISTICS

	Mean	Minimum	Maximum	Range	Maximum/minimum	Variance	Number of items
Inter-item correlation	0.580	0.316	1.000	0.684	3.162	0.036	6

Validity

Validity can be checked in two ways. Indeed, prior to data collection, the survey instrument was pre-tested for content validity in two stages. In the first stage, three experts were asked to critique the questionnaire for ambiguity, clarity and the appropriateness of the questions. Based on the feedback received from these experts, the instrument was modified to enhance its clarity.

In the second stage, the survey instrument was checked with two ICT companies (the pilot study of this research). The final survey incorporated feedback received from these companies, which again enhanced its clarity. This process yielded a survey that was judged to exhibit high content validity.

Any difficulties encountered during implementation, including the possibility of biased results

We found no possibility of biased results during the implementation. First, the non-response percentage was less than five (4.8%), plus we also checked the representativity of the realised sample. Also, the surveys were carried out by direct, face-to-face interviews and implemented by two qualified national experts, to eliminate the risk of mistakes or false answers.

2. DEMAND SIDE – ICT COMPANIES DEMAND FOR HUMAN RESOURCES

2.1 Business operations

This skills needs analysis was based on a representative sample of 40 companies operating in the ICT sector in Vojvodina. The companies' most prevalent model of business operation was related to the development of own products and/or services, with outsourcing as the next most frequent option, while the presence of other business models was negligible. The share of those three business models in comparison to the total number of companies was measured as follows: 62.5%, 55% and 10%, respectively (Table A3.1 in Annex 3). This implies that more than one quarter of the sampled companies chose more than two models in running their businesses, most probably complementing own product development with outsourcing services¹⁰.

There is no doubt that the ICT sector is expanding (**TABLE 2.1**). Out of all the ICT companies surveyed, 70% experienced an increasing demand for their products and services in 2016, but also 82.5% expected this trend to continue during 2017.

TABLE 2.1 COMPANIES' ASSESSMENT OF THE DEMAND FOR PRODUCTS AND SERVICES (%)

Period	Increase	No changes	Decrease	Total
In last 12 months	70.0	27.5	2.5	100.0
In next 12 months	82.5	15.0	2.5	100.0

When the previous year's experience is compared to expectations, it is encouraging to see that all the companies that had experienced increased activity expected this to continue, in addition to the 12.5% whose activities stagnated in 2016. Thus, this sector will further contribute to the increase in labour demand.

2.2 Assessment of occupation and skills needs

2.2.1 Major obstacles in filling job vacancies

ICT companies have a problem in ensuring that their workforce has adequate skills. This was highlighted by two-thirds of the sampled companies. Furthermore, 85% of them had experienced some difficulties in filling job vacancies in 2016 (Table A4.1 in Annex 4).

The factors that ICT companies perceived as major obstacles differed across the occupational groups (**TABLE 2.2**). For the purpose of this analysis, seven occupational groups were created. However, the companies were most interested in enumerating the obstacles that cause difficulties in filling job vacancies for ICT specialist positions. ICT companies perceived the insufficient supply of qualified job candidates and a lack of work experience in prospective employees as the two most significant obstacles. The shortage of experienced staff was also seen as an important barrier to filling managerial positions, as well as marketing and sales specialist roles. The offered wages could also be problem in attracting ICT specialists, especially for small companies. It seems that hiring administrative and other support staff does not cause many problems for ICT companies.

¹⁰ Most of the ICT sector companies in Serbia opt for outsourcing, seeing in it the chance to be part of the global market and discovering the potential for acquiring various new (but also old) technologies (Vojvodina ICT Cluster, 2015).

These findings can be further confirmed by the statements of focus group participants.

‘Competition is growing permanently, but there are no people.’

‘There are not enough ICT professionals with adequate education and work experience.’

According to a common view this situation has arisen because the ICT sector is growing faster than the education system can respond to the increasing demand for qualifications.

TABLE 2.2 OBSTACLES THAT CAUSE DIFFICULTIES IN FILLING VACANCIES, BY OCCUPATIONAL GROUP

Obstacles	Managers	ICT specialists	Marketing specialists	Sales specialists	Human resource specialists	Administration	Others	Total
	% of the total of 40 companies							
Insufficient supply of qualified candidates who possess adequate skills	15.0	67.5	10.0	15.0	5.0	7.5	10.0	40
Candidates do not have work experience	17.5	50.0	17.5	17.5	7.5	7.5	7.5	40
Candidates do not have positive attitudes towards learning, working hard and career development	5.0	12.5	7.5	2.5	0.0	2.5	2.5	40
Candidates do not like occasional/short-term jobs	2.5	10.0	5.0	2.5	2.5	2.5	0.0	40
Wages are not attractive enough to attract qualified candidates	0.0	20.0	7.5	2.5	2.5	2.5	0.0	40
Don't know	10.0	2.5	2.5	5.0	7.5	5.0	2.5	40
There are no difficulties in filling vacancies for this type of profession	10.0	5.0	10.0	7.5	10.0	22.5	20.0	40

The supply of short-term jobs as well as the propensity to learn and excel do not form a major obstacle in filling job vacancies for almost all positions within the companies, except perhaps for certain profiles of ICT specialists. This finding could be supported by significantly higher fluctuation rates among ICT specialists than all other staff members. Even if this survey does not provide an estimate of tenure for ICT specialists, according to the experience of the private sector representatives in the focus groups, young ICT specialists usually change jobs several times during their early careers. This conclusion can be supported by the following quotations.

‘The money you are investing in newcomers is a risk for the company, because they can go to another employer.’

‘In the first three years they change two to three employers.’

These attitudes represent a one-sided view and were not confirmed by the representatives of the ICT-sector employees. However, the participants from the education sector were more inclined to believe that companies have high expectations from young interns and that new graduates in general lack sufficient competence at the beginning of their careers. Mentorship and coaching programmes are thus required within companies, especially when young people are facing their first work experience.

2.2.2 Inflow and outflow of employees

Changes in the number of employees do not fully support the conclusions about the fluctuation in employees on a yearly basis. However, it is obvious that ICT specialists hold the most important positions in the companies. While 67.5% of ICT companies hired such specialists in 2016, this trend will also follow a rapid growth in 2017, as more than three-quarters of the companies expected to hire new staff in the coming year (Table A4.2 in Annex 4). A specific feature of the sampled companies is that a significant number of them – more than two-thirds – represent micro and small business entities, which do not have a diversified organisational and managerial structure. This is why, for certain occupational groups the ‘no response’ option appears as an answer to particular questions in the questionnaire. In comparison to the previous year, some positive developments were related to the expected hiring of managers and marketing specialists, while smaller changes were foreseen for sales specialists, human resource specialists and administrators, and numbers of other workers were anticipated to remain at almost the same level. No considerable reduction of the workforce was expected to occur in 2017 (Table A4.3 in Annex 4).

Among ICT specialists, those who most frequently left the companies during 2016 had the following profiles: developers, digital media specialists, project managers, ICT consultants, test specialists and system administrators (**TABLE 2.3**). The non-ICT specialists are made up of other occupations and general managers, who lead and support the core business. Within ICT occupations there is almost no change in terms of those who were most frequently hired; in non-ICT occupations, marketing and human resource specialists were most frequently hired¹¹.

In total, in 2016 almost twice as many number people were hired than left the companies, which aligns this sector among those employers with positive net employment rates.

The experience of the experts and the private sector representatives who participated in the focus group discussions indicated that formal education, even if preferred, is not a prerequisite to finding a job in ICT companies. This can be further confirmed by **FIGURE 2.1**, which depicts the distribution by educational attainment of those who obtained employment in the ICT sector in 2016 (over 78% were tertiary educated). On the other hand, the majority of employees who left ICT companies in 2016 had tertiary (76%) or vocational secondary education (16.8%). Of course, those employees who left the surveyed companies most probably found employment in other companies in the same sector or left the country.

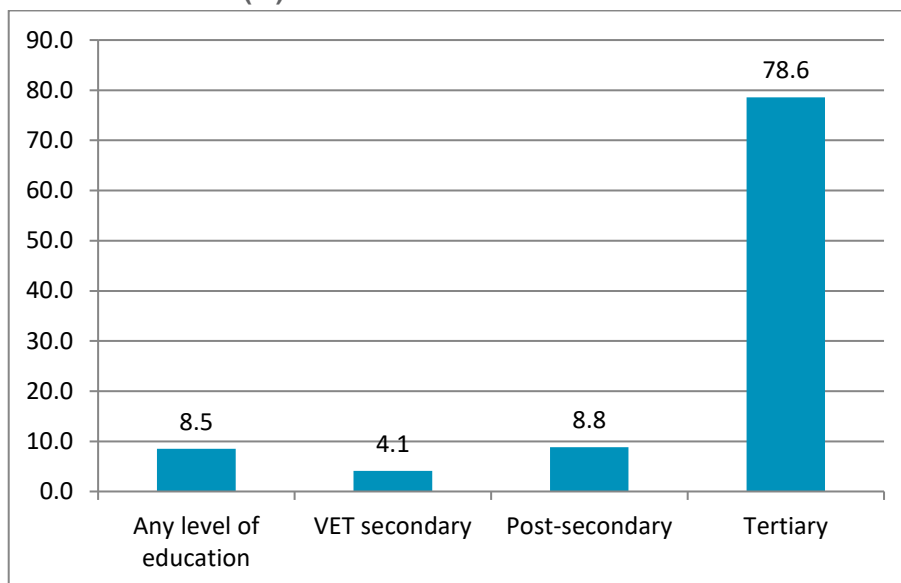
¹¹ Serbia has not yet adopted the National Qualifications Framework (NQF). For the purpose of the implementation of the ICT sector skills needs survey two international standards of qualifications are used. These are the European Union e-Competence Framework – e-CF (CEN ICT Skills Workshop, 2012) and the nationally adopted International Standard Classification of Occupations – ISCO 08 (Government of the Republic of Serbia, 2010).

TABLE 2.3 INFLOW AND OUTFLOW OF EMPLOYEES BY PROFESSIONAL TITLE, DURING THE LAST 12 MONTHS

Profile title	Left the company		Hired by the company		Net change	
	No. of employees	%	No. of employees	%	No. of employees	%
Account Manager	3	1.2	6	1.3	3	1.4
Administration	2	0.8	1	0.2	-1	-0.5
Agricultural Specialist	1	0.4	4	0.9	3	1.4
Chief Information Officer	1	0.4	0	0.0	-1	-0.5
Database Administrator	1	0.4	2	0.4	1	0.5
Developer	136	54.4	251	53.6	115	52.8
Digital Media Specialist	28	11.2	42	9.0	14	6.4
Electrical Engineer	0	0.0	2	0.4	2	0.9
GIS Expert	1	0.4	5	1.1	4	1.8
Human Resource Manager	6	2.4	5	1.1	-1	-0.5
ICT Consultant	15	6.0	30	6.4	15	6.9
ICT Operations Manager	0	0.0	1	0.2	1	0.5
ICT Service Manager	0	0.0	1	0.2	1	0.5
Service Manager	2	0.8	2	0.4	0	0.0
Network Specialist	0	0.0	2	0.4	2	0.9
Manager	9	3.6	0	0.0	-9	-4.1
Marketing Specialist	2	0.8	5	1.1	3	1.4
Other	18	7.2	1	0.2	-17	-7.8
Project Manager	10	4.0	34	7.3	24	11.0
Sales Manager	0	0.0	2	0.4	2	0.9
Sales Specialist	1	0.4	3	0.6	2	0.9
Service Desk Agent	0	0.0	1	0.2	1	0.5
Support Specialist	1	0.4	4	0.9	3	1.4
Systems Administrator	6	2.4	27	5.8	21	9.6
Test Specialist	7	2.8	37	7.9	30	13.8
Total	250	100.0	468	100.0	218	100.0

When educational levels are compared to professional titles the survey results reveal that in order to find employment in the ICT sector as developers, digital media specialists, project managers, ICT consultants, system administrators or test specialists, candidates need to have tertiary education. The same can be observed in the reverse process, looking at those who leave companies (i.e. they tend to be more highly qualified), which confirms the existence of high fluctuation rates among ICT professionals with a high level of confidence (Tables A3.4 and A3.5 in Annex 4).

FIGURE 2.1 DISTRIBUTION OF EMPLOYEES WHO ENTERED ICT COMPANIES IN 2016, BY EDUCATION (%)



2.2.3 Assessment of occupational gaps

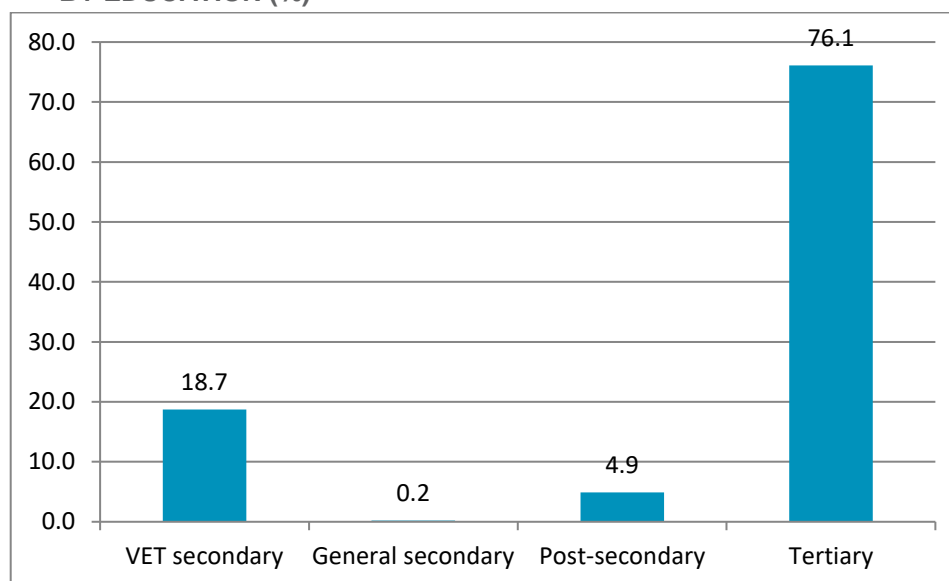
The majority of ICT companies identified developers as the occupation currently in shortest supply (Table A4.6 in Annex 4). Developers with tertiary education comprise 42.9% of the total occupational gap, while developers from all other educational profiles make up 3.7% of the gap, including 1% with a preferred VET secondary school level background. Three additional ICT professional profiles – system administrators, test specialists and project managers – are identified as having a share of 6.7% each, and ICT consultants make up 4.4% of the total gap. In respect of non-ICT occupations, marketing and sales specialists, as well as all other non-ICT occupations, appear with a share of 2%, 0.7% and 13.5%, respectively. VET at secondary school level can be an alternative for filling the gap in marketing and sales specialists – 0.7% and 0.5% of the companies identified shortages regarding these two occupations.

Thus, currently missing professional profiles are mainly related to higher education (**FIGURE 2.2**). According to the ICT companies, the most in-demand employees are those with tertiary education – 76.1% of the these businesses would employ graduates, while 18.7% were interested in those from a VET secondary school background. In terms of professional profiles, all other educational levels were seen as less attractive.

2.2.4 Identifying skill gaps and recruitment strategies

A lack of the professional (technical) skills required for the job was the most important gap that ICT companies identified for the vast majority of occupational groups, with the exception of marketing specialists, managers and other workers (Table A4.7 in Annex 4). Out of the total number of companies surveyed, 45% estimated that there was a skills gap in this area related to ICT specialists. In addition, 40% of the companies were also concerned by the lack of communication skills in this occupational group. About a quarter of the companies perceived the ability to work with clients and to control stress and emotional instability, as well as having the ambition to learn and excel, as insufficiently developed personal characteristics in ICT specialists, and thus areas that require further strengthening. Besides the ability to control stress induced by difficult situations at work, mostly related to issues such as project deadlines, which is perceived as insufficiently developed for almost all occupations, 15% of the companies considered managers to have a skills gap in relation to organising and managing a team. Insufficient knowledge of foreign languages was seen as a characteristic of marketing (10%) and sales staff (7.5%), while it was perceived that human resource specialists and all other workers should improve their communication skills.

FIGURE 2.2 DISTRIBUTION OF CURRENTLY MISSING PROFESSIONAL PROFILES, BY EDUCATION (%)



The reasons why ICT specialists suffer from skill gaps were principally related to a lack of time due to their continuing duties and project deadlines, as well as market requirements, but were also connected to changes in professional requirements occurring alongside evolving technological landscapes (Table A4.8 in Annex 4). This could be additionally explained by employees leaving or changing jobs, together with a slow recruitment procedure due to the lack of new entrants into the labour market. ICT companies considered market requirements responsible for skills gaps related to managers and sales specialists. In addition to these two occupational groups, marketing specialists were also identified as lacking work-related skills due to changes in professional requirements. ICT companies have not generally experienced skills-related difficulties with administrative and other workers.

ICT companies use the services of private employment agencies (including Infostud) and announcements of job vacancies on companies' web pages as the main means of recruiting new members of staff (TABLE 2.4). Word of mouth and collaboration with educational institutions are the second two most important sources of recruitment, whereas 'head hunting' and collaboration with the National Employment Service (NES) are less frequently utilised strategies. When there is high demand for ICT specialists, the unemployed register cannot provide a useful service to the private sector because the supply of graduates is too low to cover this demand, except where companies have specific requirements in terms of retraining individuals from various professional, preferably technical, backgrounds.

TABLE 2.4 SOURCES FOR THE RECRUITMENT OF EMPLOYEES

Sources of recruitment	% of the total of 40 companies
NES services of job matching	12.5
Private employment agencies, Infostud, etc.	65.0
Announcement on the company's website	60.0
Collaboration with secondary vocational schools and universities	42.5
Recruiting employees from other companies	22.5
Word of mouth	55.0
Other sources	20.0

3. SUPPLY SIDE – ICT SECTOR EMPLOYEES' SELF-ASSESSMENT OF SKILLS AND CONTINUING TRAINING PROCESS AT WORK

3.1 Educational background of employees

The ICT sector has the potential to create a considerable number of job vacancies, not only in ICT occupations but also in non-ICT roles. Within the companies a sample of employees in both ICT and non-ICT occupations was selected based on the recommendations of employers¹². They filled in the part of the questionnaire for employees during the same visit to the company. In total, 52 employees participated in the survey. ICT specialists represented a larger share of the employees – more than three-fifths of the respondents.

TABLE 3.1 EDUCATIONAL STRUCTURE OF EMPLOYEES (%)

Level of education	ICT professionals	Other employees
University	48.5	78.9
Post-secondary VET	18.2	10.5
Secondary VET	24.2	5.3
Secondary general	9.1	5.3
Total	100.0	100.0

The structure of employees by educational level is reported in **TABLE 3.1**. The majority of respondents were university graduates. However, the employees' educational profile differed depending on which group they belonged to. Among ICT specialists, almost half had a tertiary education background, while nearly one quarter had graduated from VET secondary schools, and the remaining respondents had completed post-secondary vocational and secondary general education¹³. On the other hand, non-ICT specialists with higher education are represented with a significantly higher share of 78.9%, while those with a VET secondary school background comprised 5.3% of the employees in other occupational groups.

3.2 Assessment of skills gaps from the perspective of ICT-sector demand

3.2.1 Current skills gaps

Both groups of employees attended additional training after graduation from either secondary school or university in significant numbers. As shown in **TABLE 3.2**, the share of non-ICT specialists who attended additional training was significantly higher than those with ICT professional profiles. It is also worth mentioning that one third of ICT professionals did not attend additional training, while only 5.3% of the other employees had never attended additional training after graduation.

The reasons ICT specialists participate in additional training after graduation less often than other employees may be because candidates with these professional profiles have better access to jobs, or

¹² The sample of companies was selected based on the statistical methodology of sampling, while the employees represent the most common occupational profiles in the companies (see Chapter 2).

¹³ The educational structure of those employed in the ICT sector probably slightly differs from the situation as reported in Table 3.1. The educational structure based on a sample of employees underestimates the share of those with university education, most probably because a significant number of those employed in ICT-based positions declared themselves as university students.

they may start working for companies during the final years of their studies – firstly as students (as recipients of scholarships or in internships), and then as employees.

TABLE 3.2 EMPLOYEES' PARTICIPATION IN ADDITIONAL TRAINING PROGRAMMES AFTER GRADUATION (%)

Response	ICT professionals	Other employees
Yes	63.6	89.5
No	33.3	5.3
No response	3.0	5.3
Total	100.0	100.0

ICT and non-ICT specialists participated in different additional training programmes (Table A4.9 in Annex 4). However, it can be seen that both groups of professionals recognised the need to learn foreign languages, with courses in English, at various levels, preferred among foreign language courses. Most ICT specialists' positions in the companies require a professional knowledge of English. In addition, ICT specialists needed training in programming languages and Scrum in order to improve their professional (technical) skills, while for the same reason non-ICT specialists attended courses in accounting, sales and project management. Non-ICT specialists also undertook training designed to improve their soft skills, including courses in negotiation, team management and time management, whereas ICT specialists were given training to improve their communication skills.

When skills gaps were self-assessed and ranked by employees, there was almost no difference in additional training needs among ICT and non-ICT specialists (**TABLE 3.3**). ICT professionals perceived professional (technical) skills and knowledge of foreign languages as areas that needed to be improved further, while these were also the most important requirements for non-ICT specialists, but in a different order of appearance – a lack of language skills was here perceived as a more serious problem than gaps in technical abilities. Communication skills should be further improved, with ICT specialists seeing this as more urgent, and managerial expertise should be strengthened, along with the ability to work with clients. Both groups of employees need to master the skills that would reduce stress at work.

TABLE 3.3 EMPLOYEES' SKILL GAP ASSESSMENT (% OF THE TOTAL NUMBER OF EMPLOYEES)

Skills	ICT professionals	Other employees
Professional (technical) skills according to the job description	48.5	31.6
Knowledge of foreign languages	33.3	47.4
Possession of professional ethics	6.1	0.0
Managerial skills	21.2	5.3
Communication skills	30.3	15.8
Ability to work with clients	21.2	10.5
Ability to identify and to solve problems	12.1	10.5
Ability to work with team spirit	21.2	5.3
Ability to compete	9.1	15.8
Ability to control stress and emotional instability	21.2	21.1
Other specific (technical) skills	6.1	5.3
There is no lack of skills	9.1	0.0

3.2.2 Satisfaction with skills acquired in educational institutions

In general, the non-ICT specialists were less satisfied with the skills and competences acquired during formal education at university than ICT specialists. More than half of the non-ICT specialists were somewhat dissatisfied or indifferent about acquired skills. This is probably because they found these qualifications to be less applicable to their current work in the ICT sector. Among the ICT specialists, a smaller number were somewhat dissatisfied, but more of them were indifferent, whereas the share of those who were somewhat and very satisfied was considerably higher – 52.1% of ICT specialists compared to 43.8% of other workers (**TABLE 3.4**). Employers' attitudes concerning the skills and competences acquired in higher education institutions were more in line with the estimates provided by the ICT specialists with a university education. About half of the employers were somewhat or very satisfied with the skills of tertiary educated individuals. Differences in attitudes were significantly greater when the skills acquired at the secondary level of education are observed. The varying levels of satisfaction with the skills acquired in secondary schools among employers and employees is probably due to the significant no response rate of the former (see section 4.2.1).

TABLE 3.4 SATISFACTION OF EMPLOYEES WITH THE SKILLS AND COMPETENCES ACQUIRED DURING FORMAL EDUCATION (%)

Satisfaction	ICT professionals		Other employees	
	Secondary schools	Universities/faculties	Secondary schools	Universities/faculties
Somewhat dissatisfied	6.7	4.3	0.0	31.3
Neither satisfied nor dissatisfied	60.0	43.5	33.3	25.0
Somewhat satisfied	20.0	39.1	33.3	37.5
Very satisfied	13.3	13.0	33.3	6.3
Total	100.0	100.0	100.0	100.0

The majority of employees who responded to the survey were tertiary-level graduates, as reported in Table 3.1. When rating the skills and competences acquired in secondary schools, 60% of ICT specialists answered that they were neither satisfied nor dissatisfied, while more of them were somewhat or very satisfied than dissatisfied. On the other hand, non-ICT specialists were generally indifferent regarding, or to some extent satisfied with, the qualifications provided by secondary education. No one was dissatisfied with the skills and competences delivered by secondary schools.

3.2.3 Utilisation of skills and the need for changes in education

Most ICT specialists needed an average of three to six months to meet the requirements of their jobs in the ICT sector; however, one fifth of those questioned assessed that their skills were applicable at work immediately after graduation. These results are in line with the views of the employers and other participants in the focus groups, who estimated the time needed to integrate newcomers into the organisation as up to six months. Many ICT companies provide university students with scholarships and/or internships, and these open various possibilities for the engagement of young people in companies' projects and help in the recruitment of new employees. This was illustrated by the fact that 12.1% of the respondents had worked for a company during their studies.

When the experience of non-ICT specialists is observed, it can be seen that only two-fifths of them perceived a period of six months as needed to meet the requirements of the job, while there was also a greater proportion of such employees – 26.3% of non-ICT staff compared to 9.1% of ICT specialists – who considered 12 months or more as the time needed to adapt to organisational duties (**TABLE 3.5**).

TABLE 3.5 TIME REQUIRED BY EMPLOYEES TO MEET ICT SECTOR JOB NEEDS (%)

Required time	ICT professionals	Other employees
Immediately after graduation	21.2	15.8
3 months	27.3	36.8
6 months	27.3	5.3
9 months	3.0	5.3
12 months	6.1	15.8
More than one year	3.0	10.5
I worked for this or another company while I was a student	12.1	5.3
No response	0.0	5.3
Total	100.0	100.0

Both groups of employees in the ICT sector would recommend that the educational institutions strengthen the practical dimension of their courses, at both secondary and higher levels, as reported in **TABLE 3.6**. The second and third ranked needs for change, related to the previous one, concern the necessity to redefine educational programmes in line with technological changes and to open them up to new methods of teaching. Joint projects between companies and educational institutions would help in filling the skills gaps that occur due to the lack of practical knowledge. These are mainly the same recommendations for changes in education as were suggested by the representatives of ICT companies (see section 4.2.1). Besides the already mentioned proposals, both groups of employees would add to the list more courses in foreign languages (preferably professional English). Between a quarter and one third of all employees considered that the education system should provide graduates with such qualifications as would be immediately applicable at work. This conclusion is in line with their experience regarding the time needed to acquire the practical knowledge required for their jobs.

TABLE 3.6 EMPLOYEES' RECOMMENDATIONS FOR CHANGES IN THE VOCATIONAL EDUCATION AND HIGHER EDUCATION INSTITUTIONS (% OF THE TOTAL NUMBER OF EMPLOYEES)

Recommended changes	ICT professionals	Other employees
Readiness to review and change curricula in order to align them with technological change	51.5	73.7
Openness to new methodologies of teaching	48.5	68.4
Focus on practical training, organisation of practice, internships at the company, etc.	81.8	89.5
Joint projects between companies and education institutions	39.4	63.2
Define and update educational profiles in line with labour market needs	18.2	57.9
Involve the representatives of the social partners in planning and developing the educational profiles	12.1	26.3
Create the skills and competences that will be applicable in the company without the need for more time spent on training	24.2	31.6
Introduce additional foreign language courses (professional language)	30.3	36.8
Provide career guidance services to future graduates	9.1	26.3
Harmonise the training programmes with international standards in order to improve the supply of ICT professionals	6.1	31.6
Other	3.0	5.3

Matching workers' qualifications to their jobs in the ICT sector reveals the differences in the experiences of the two groups of employees (Table A4.10 in Annex 4). A higher percentage of ICT specialists than other workers held the view that the qualifications acquired during formal education were helpful in finding a job in the ICT sector – 72.7% compared to 47.4%. This can be further confirmed by the fact that the same number of non-ICT specialists perceived their formal qualifications as of no help in securing their current job. When asked to assess the importance of certain specific skills in finding a job in the ICT sector, similar shares of employees confirmed that the practical knowledge they demonstrated during the probationary period was more important than a proof of graduation. In addition, they found their qualifications, both formal and some specific ones, helpful in performing their current jobs in the sector. In terms of employment opportunities in the ICT sector, 81.8% of ICT specialists would advise young people to choose an occupation related to the ICT profession, while only 47.4% of non-ICT specialists would advocate taking such a path.

Young people can seek information on the effective ways of finding a job and developing a career in the ICT sector using several sources. The first of these is the career planning provided as part of the career guidance process in schools, but this is not always the most effective way to gather information on occupational choices. The participants of the focus groups were of the opinion that in spite of the fact that schools are obliged to actively support career guidance, this practice is not sufficiently developed in schools. This conclusion may be drawn from their expressed opinions.

'Career guidance should start at preschool age.'

'Every secondary school is obliged to have a team for career guidance, but this is not the case.'

'Children do not know what a certain ICT occupation means.'

'Young people are not informed. They only sporadically know what the occupations of the future are.'

According to the experience of the Belgrade University Centre for Career Development, when university students are canvassed, they are rarely undecided concerning whether or not to choose ICT occupations.

Based on the previous elaboration, there is no doubt that young people choose ICT occupations based on the available information. However, it is likely that they make their decisions regarding future professional choices in the ICT sector, primarily based not on the information they collect in schools, but through various informal channels. For example:

'Young people are informed through the Internet, personal contacts and using other informal channels... someone is talking ... it can be heard ... see website, etc.'

'There are social networks, the NGO sector.'

Or, additionally, they may make decisions in the light of the information that is disseminated through the ICT sector by various means, as can be concluded based on the following quotations from focus group participants.

‘The ICT community is well organised. They share information through Meetup. The small IT Academy of Vojvodina ICT Cluster is a good example of a summer school for primary school pupils.’

‘Every year our company organises an ICT festival.’

‘Large ICT companies have their own student centres.’

The focus group participants agreed that young people are interested in easy ways to find a job after graduation, and especially in how much can they earn by choosing ICT-based occupations. Obviously the ICT sector can meet their expectations.

3.3 Implementation of continuing training

3.3.1 Assessment of training needs

In many ICT companies, employees have opportunities for continuous improvement of their skills through various training programmes, organised either within or outside the firms. As illustrated by **TABLE 3.7**, nearly 70% of both groups of employees participated in various programmes of continuing training during 2016. Thus, it was confirmed by both employers and employees that ICT companies are active in providing training services.

TABLE 3.7 PARTICIPATION OF EMPLOYEES IN CONTINUING TRAINING IN THE LAST 12 MONTHS (%)

Participated	ICT professionals	Other employees
Yes	69.7	68.4
No	30.3	31.6
Total	100.0	100.0

Many ICT companies use various ways to provide their employees with training opportunities. Sometimes, the companies pre-allocate a specific budget within the project funding that is dedicated to covering the expenses of training. One of the companies that participated in the focus group in Novi Sad provided a good example whereby ICT specialists who work in the department for outsourcing services provision have a team budget that may be used to supply training of their choice. Based on that particular case, one may conclude that employees who work on more profitable or strategic projects within companies have better chances of receiving the desired training.

Comparing the reported findings about the types of training companies most often provide to their employees (see section 4.1.1), it can be noticed that there are many similarities in the respondents' answers. However, the results obtained in a sub-sample of employees may be biased or incomplete because they represent only the individual views of those who attended the training. In that sense, the findings obtained by questioning the companies' representatives are much more reliable for training needs analysis in the ICT sector. In spite of this, the comparison of the training needs assessment provided by both groups of the respondents is important because their views complement each other.

A common finding was that ICT specialists have more opportunities to participate in specialised training than the other employees (Table A4.11 in Annex 4). As previously emphasised, a common pattern can be confirmed when particular professional profiles are matched with the training attended. Among ICT professionals, developers, digital media specialists, project managers, system administrators and test specialists more often attended training courses than other ICT professionals. Likewise, the types of training they participated in related to programming languages, databases and Scrum. On the other hand, only workers in administration and human resource managers among non-ICT specialists listed training that they participated in during 2016. These were seminars in business

development and courses in tax consulting, as well as training in a specialised IBM programme. However, these results are not a representative indicator of the training needs of a broader group of non-ICT specialists employed in the ICT sector.

When soft skills training needs are assessed by ICT sector employees, it can be seen that non-ICT professionals more often attended these types of courses than ICT professionals (Table A4.12 in Annex 4). Consequently, other employees (non-ICT professionals) expressed a larger potential gap in the soft skills they perceived as necessary for the fulfilment of assignments in the ICT sector. Training in this area was seen to improve communication skills, professional knowledge of foreign languages, and competence in account management and sales, as well as team management. On the other hand, among ICT specialists, only developers and project managers responded to the question on soft skills training undertaken during 2016. Those who responded attended foreign language courses, and contact management, time management and professional development training to improve communication and other skills.

Few employees in ICT companies participated in other types of training. ICT specialists, mostly digital media specialists and database administrators, attended in-company training sessions, conferences and seminars. Conversely, employees with different profiles, including human resource specialists, managers, marketing specialists and administrative staff, participated in training regarding personal development, the introduction of standards and conferences (Table A4.12 in Annex 4). These findings are only indicative, due to the small number of responses, and do not reliably confirm the training needs of employees in the ICT sector.

3.3.2 Professional development and evaluation of the impact of training

As perceived by ICT specialists, the most significant impact on professional development was made by in-company coaching and on the job learning – more than half of the respondents recognised this type of support as the most important for contributing to professional development in the work environment (**TABLE 3.8**). Likewise, more than two-fifths of ICT specialists held the view that their companies encouraged the professional development of employees by offering continuing training or allowing employees to work flexible hours while attending these or similar training courses. Contributing to the costs of training was a less common type of support, as well as providing individual incentives for active engagement in forums or networks that promote the exchange of professional experience. On the other hand, non-ICT specialists considered the possibility of attending continuing training, the cost-sharing of training expenses and in-company coaching as the three most common forms of professional development for employees.

The ICT specialists generally did not perceive the evaluation of the impact of training on the efficient fulfilment of assignments as important. Indeed, only 36.4% of the respondents from this group of admitted its practice. In the group of other employees, however, more than half of the respondents indicated that the impact of training on performing tasks in the workplace was evaluated following participation in training. Also, a considerable number of the respondents in both groups of employees – nearly one third – hesitated to answer this question (**TABLE 3.9**).

TABLE 3.8 PROMOTION OF PROFESSIONAL DEVELOPMENT OF EMPLOYEES (%)

Professional development	ICT professionals	Other employees
Company offers continuing training programmes	42.4	57.9
Cost-sharing of training expenses	33.3	47.4
In-company coaching and on the job learning	51.5	47.4
Flexible working time arrangements to follow further education or training/finalise university studies	42.4	26.3
Allocate time to engage in online expert communities/ experience exchange networks in the ICT sector	15.2	26.3
Other	6.1	0.0

TABLE 3.9 IMPACT EVALUATION OF TRAINING ON EMPLOYEES' PERFORMANCE (%)

Impact evaluation	ICT professionals	Other employees
Yes	36.4	57.9
No	18.2	5.3
Rarely	9.1	5.3
Do not remember	3.0	0.0
No response	33.3	31.6
Total	100.0	100.0

It is very likely that ICT specialists are more inclined to believe that impact evaluation of training on employees' performance is not conducted frequently because most of the courses they attend take place in the company.

3.3.3 Assessment of training gaps

Training gaps are estimated from the perspective of the needs of the present job. ICT specialists are more likely to be 'very satisfied' with the supply of continuing training in the companies than their counterparts in other roles – 27.3% of ICT specialists compared to 23.1% of other employees. However, the number of respondents who were 'somewhat satisfied' is larger in the group of non-ICT specialists than among the ICT professionals. There was also a considerable number of ICT specialists who were either indifferent or not very satisfied with the current offer of training – nearly one third. Unlike ICT specialists, the other employees were not dissatisfied with the opportunities afforded to participate in additional training, although 15.4% of them were indifferent (**TABLE 3.10**).

TABLE 3.10 EMPLOYEES' SATISFACTION WITH THE CURRENT LEVEL OF CONTINUING TRAINING (%)

Satisfaction	ICT professionals	Other employees
Very dissatisfied	4.5	0.0
Somewhat dissatisfied	4.5	0.0
Neither satisfied nor dissatisfied	22.7	15.4
Somewhat satisfied	40.9	61.5
Very satisfied	27.3	23.1
Total	100.0	100.0

As **TABLE 3.11** depicts, most ICT specialists would choose to participate in professional (vocational) training and foreign language courses. The other kinds of training that would narrow the existing gap in soft skills includes developing employees' competences in time management, managerial skills, and

information technology use, as well as professional development training to improve communication skills. The ICT specialists were less interested in these areas of training.

TABLE 3.11 IDENTIFICATION OF EMPLOYEES' TRAINING GAPS (%)

Type of training	ICT professionals			Other employees		
	Yes	No	Total	Yes	No	Total
Professional (vocational) training	90.9	9.1	100.0	78.9	21.1	100.0
Foreign languages (professional language)	51.5	48.5	100.0	57.9	42.1	100.0
Professional ethics	9.1	90.9	100.0	36.8	63.2	100.0
Managerial skills	36.4	63.6	100.0	73.7	26.3	100.0
Team building and team work	21.2	78.8	100.0	31.6	68.4	100.0
Leadership skills	24.2	75.8	100.0	31.6	68.4	100.0
Communication skills	30.3	69.7	100.0	47.4	52.6	100.0
Client servicing skills	27.3	72.7	100.0	36.8	63.2	100.0
Problem solving	24.2	75.8	100.0	36.8	63.2	100.0
Motivation skills	21.2	78.8	100.0	31.6	68.4	100.0
Time management	42.4	57.6	100.0	73.7	26.3	100.0
Information technology use	33.3	66.7	100.0	36.8	63.2	100.0

The other employees had a much more diverse list of training priorities than the primary group of workers in the ICT sector. If given the chance they would choose professional (vocational) training as well as coaching to boost their managerial and time management skills and their professional knowledge of foreign languages (preferably English). They were less interested in developing motivation, team building and team work, and leadership skills. The general impression is that all the employees perceived specialised training as more useful for performing their roles in the fast-growing ICT sector, and in that respect they agreed with the employers (see section 4.1.1). When other types of training were observed, the employers' perceptions were seen as slightly different to those of the employees. They considered the skills gaps of ICT specialists larger than those of other employees in their companies. In particular, they emphasised the importance of professional development for their staff, through further boosting their communication and managerial skills, team-working abilities and problem-solving skills.

4. MATCHING SUPPLY TO DEMAND

4.1 Continuing training of ICT workforce – needs and gaps

4.1.1 Companies' views on occupational needs for training and training topics

Continuing training was spread widely through almost all the sampled companies. Out of the total number of ICT companies, 95% had organised or supported in other ways some type of training for their employees in 2016 (Table A4.14 in Annex 4). However, when employees were divided by professional profiles it was noticed that a larger percentage of ICT professionals participated in continuing training than the other employees (Table A4.15 in Annex 4). Namely, in 2016, out of the total number of participants in training programmes, the share of ICT professionals exceeded 86%, while non-ICT professionals and other employees were represented by figures of 13.7% and 0.1%, respectively. There were three ICT professional profiles that appeared to need the most training – developers, digital media specialists and ICT consultants – with these groups accounting for 80.6% of the total number of trainees. Among non-ICT professionals, managers, and human resource, marketing and sales specialists required more training than other employees.

When the type of training was examined, it could be seen that the priorities were directed towards ICT professionals, with particular attention paid to the role of developer. This was illustrated by the number of developers present in both specialised and other training courses, making up 58.9% and 37.5%, respectively, of the total number of participants (**TABLE 4.1**). The four ICT professional profiles that took part in specialised training most frequently after developers were ICT consultants (10.3%), test specialists (9.7%), project managers (9.6%) and systems administrators (9.5%). With regard to the professionals' needs for soft skills training, here ICT specialists were less frequently represented, with the exception of project managers who made up more than a quarter of the total number of participants. The survey finding which showed that the share of call agents who attended soft skills training approached almost half of the participants is probably related to the experience of one particular company in the sample, and so does not represent a general trend in occupational needs for soft skills training. Besides the already mentioned ICT professionals who attended other training courses, managers were the second largest occupational group that participated in various training courses not classified under the first two types of training.

Among the ICT professional profiles who attended specialised training, developers usually required further training in programming languages and Scrum, whereas ICT consultants mostly received tuition in programming languages. There were also three additional profile groups – project managers, systems administrators and test specialists – that attended training in Scrum (Table A4.16 in Annex 4).

The ICT companies identified a large number of different soft skills training programmes for their employees, but most of them did not include a meaningful share of participants (Table A4.17 in Annex 4). However, it is worth noting that the companies recognised the need for training to improve employees' competences in communication, project management, negotiation and sales skills.

Other training provision was most likely comprised of in-company courses covering such areas as the introduction of standards, mentoring, sharing knowledge, and internal presentations of professionals at senior levels within the company. Developers, digital media specialists and managers are the three occupational groups that most frequently participated in these types of training (Table A4.18 in Annex 4).

TABLE 4.1 PROFESSIONALS TRAINED IN THE COMPANY, BY TYPE OF TRAINING (%)

Profile title	Specialised training	Soft skills	Other training
Account Manager	0.0	4.3	0.0
Administration	0.0	0.6	0.0
Call Agents	0.0	46.2	0.0
Database Administrator	0.2	0.9	0.0
Developer	58.9	5.8	37.5
Digital Media Specialist	0.7	0.3	34.7
Enterprise Architect	0.1	0.3	0.0
Human Resource Specialist	0.0	0.6	0.0
ICT Consultant	10.3	5.8	0.0
ICT Service Manager	0.0	0.3	0.0
Manager	0.4	1.5	26.4
Marketing Specialist	0.1	1.5	1.4
Network Specialist	0.4	0.0	0.0
Project Manager	9.6	22.2	0.0
Sales Manager	0.0	0.3	0.0
Sales Specialist	0.0	6.5	0.0
Support Agent	0.0	0.3	0.0
Systems Administrator	9.5	0.0	0.0
Team Leader	0.0	1.2	0.0
Test Specialist	9.7	0.9	0.0
Other	0.0	0.3	0.0
Total	100.0	100.0	100.0

The survey findings regarding occupational needs for training were in line with previously elaborated results showing that ICT companies perceive a considerable gap in professional (technical) skills for a significant number of professional profiles. Comparing the three types of training, ICT companies give priority to specialised courses, which are attended by a significantly higher number of employees than the other two.

Satisfaction with supply of training and training providers

Several ways to determine skills gaps within ICT companies were recognised by the survey participants. The methods which companies use most frequently are client feedback, assessment of market requirements and internal activities implemented by specialised departments, which all result in an inventory of the skills already present in the company and those needed to respond to business requirements (**TABLE 4.2**).

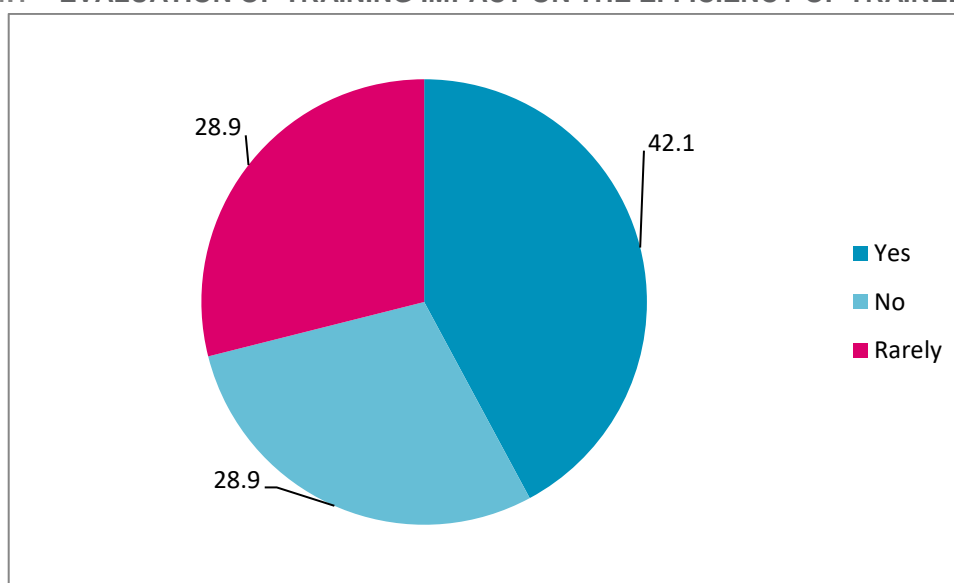
These findings were additionally confirmed by the responses which showed that the companies do not ignore the importance of the process of determining insufficient skills. This was illustrated by the fact that 95% of the companies rejected the assumption that there was a lack of time for this. Thus, it can be seen that the process of determining skills gaps is taken seriously by ICT companies.

TABLE 4.2 HOW THE PROCESS OF DETERMINING INSUFFICIENT SKILLS IS ORGANISED IN THE COMPANY (%)

Response	We make an inventory of skills present and match it with business requirements	We follow market requirements	We follow client feedback	We do not have time for this	Other
Yes	45.0	60.0	75.0	0.0	10.0
No	50.0	32.5	20.0	95.0	0.0
Do not know	0.0	2.5	0.0	0.0	0.0
No response	5.0	5.0	5.0	5.0	90.0
Total	100.0	100.0	100.0	100.0	100.0

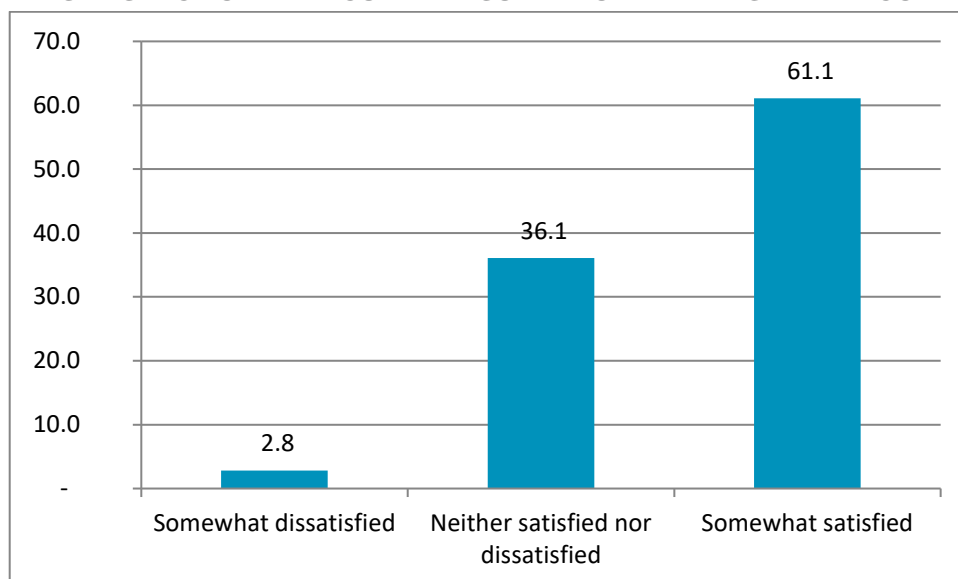
When the companies provide training to their employees this does not necessarily mean that they will evaluate its impact on how efficiently assignments are fulfilled. Only two-fifths of the companies do this on a regular basis, while the same percentages do not evaluate the impact of training at all or do so very rarely (**FIGURE 4.1**).

FIGURE 4.1 EVALUATION OF TRAINING IMPACT ON THE EFFICIENCY OF TRAINEES (%)



The ICT companies surveyed were not highly satisfied with the supply of training, either organised at the company level or provided by educational and training institutions outside the company. Only three-fifths of the companies were somewhat satisfied with the supply of training, whereas more than a third of them were indifferent (**FIGURE 4.2**). The low level of satisfaction with the current supply of training may be a product of the low quality of training providers (for instance, an insufficient number of experienced trainers) or a result of training programmes that do not meet companies' needs.

FIGURE 4.2 SATISFACTION WITH CURRENT SUPPLY OF TRAINING AT THE COMPANY (%)



The providers of additional training are mostly the companies themselves – in 75% of cases – followed by private educational and training institutions – in 42.5% of cases (Table A4.19 in Annex 4). State educational and training institutions are less popular providers. Only 7.5% of the companies had experience of using these sources of training. There were also the other providers (the ICT Cluster Academy and manufacturers of equipment). Based on the survey findings, it is hard to speculate on whether money was the main reason why the companies did not use the services of training providers more often, but it is obvious that they used their own resources on most occasions. Larger companies with a diversified organisational structure were characteristically more experienced in the recruitment of new employees and more generous in providing their staff with training.

Intention to train

The survey findings concerning the potential planning of training for employees are depicted in **TABLE 4.3**. This was assessed on the basis of the answers the companies gave when asked if they planned to organise/provide various types of training programmes during the next 12 months. As can be seen, many ICT companies were interested in conducting continuing professional training, in addition to providing courses on foreign languages and coaching to improve communication skills (including assertive communication courses) or team work. Some soft skills training intended to improve employees' level of professional ethics, their client servicing skills or motivation were considered by the companies to be less important. These forecasts do not significantly differ from the training which ICT companies already provide to their employees.

The reasons why companies do not provide training for their employees when the need exists cannot be concluded with a high degree of confidence from the responses provided by the ICT companies surveyed. It may be surmised that the most likely reason is that specialised training is expensive. There are also other possible reasons such as tight schedules due to project deadlines or lack of information on high-quality training provision. An equally important reason may lie in the absence of positive effects following previous training, leading companies to decide to orient their training methods towards online courses or in-company coaching (when time management may be perceived as at a premium).

TABLE 4.3 PLANNING TO HOLD OR PAY FOR EMPLOYEES' TRAINING IN THE NEXT 12 MONTHS (%)

Type of training	Yes	No	Total
Professional training	92.5	7.5	100.0
Foreign languages	42.5	57.5	100.0
Professional ethics	7.5	92.5	100.0
Managerial skills	32.5	67.5	100.0
Team building and team work	37.5	62.5	100.0
Leadership skills	30.0	70.0	100.0
Communication skills	42.5	57.5	100.0
Client servicing skills	22.5	77.5	100.0
Problem solving	30.0	70.0	100.0
Motivation skills	25.0	75.0	100.0
Time management	27.5	72.5	100.0
Information technology use	30.0	70.0	100.0
Other	5.0	95.0	100.0

In addition, the survey did not provide a great deal of valuable information about training gaps as assessed by the representatives of ICT companies. However, from the previous analysis it can be expected that ICT professionals need more additional training than other employees in the company. At least two different stages can be identified when employees express a greater need for training. The first occurs at the beginning of employees' careers and this need is mostly met through the mentoring of more experienced colleagues; while the second is related to some specific requirements of the companies' clients or equipment producers which call for an adaptation in the performance of particular roles. This conclusion may be taken as general, but it was also confirmed by the professional views of the focus groups participants. The experience shared by the group members was that the companies usually adopted a model whereby training courses are purchased for a small number of professionals, who then share the acquired knowledge with others. The reason that companies practise in-company coaching is related to the cost of course fees, while professional certification is demand-led, as illustrated by the following quotations.

'The specialised trainings for developers are too expensive.'

'If a client asks for it, then you need to be certified.'

In order to reconcile the mismatch between the supply and demand of qualifications, the City Government of Novi Sad invests in training courses relating to the sought after occupations. Training needs are discussed on a yearly basis with the key stakeholders – members of the local councils for employment, which, among others, include the NES and private companies' representatives – and conclusions are incorporated into the annual action plans for employment¹⁴. The training programmes for jobs in high demand which are expected to be filled by ICT specialists are usually courses in popular programming languages (Java, C#, PHP), and have an intake not exceeding a few dozen trainees¹⁵. Governmental support for training is constrained by the available resources. However, the

¹⁴ See 'Action Plan for Employment for 2016 of the City of Novi Sad' (2016).

¹⁵ In the first quarter of 2017, 40 unemployed selected from the NES register attended the courses in C#, PHP within the active labour market policies' programme created for the trainings for the occupations in demand, while in 2015, 50 candidates attended similar courses (information taken from: <http://privredans.com/nezaposlenim-novosadjanima-dodeljeni-sertifikati-iz-programiranja/>; accessed April 2017).

allocated resources for training are continually increasing¹⁶. These courses provide a good basis of knowledge that should be further upgraded in the workplace.

Recognition of skill certificates and validation of previous learning

ICT companies do not share a common view concerning the recognition of training certificates issued by various providers of continuing education. With regard to ICT professionals, more than three-fifths of the companies would recognise the certificates issued by different providers or companies, while they were more reluctant to provide answers in the case of other specialists (**TABLE 4.4**). In general, the companies equated the acquisition of training certificates with the possession of professional certificates needed by employees due to job requirements. These certificates (or standards) are usually issued by accredited certification bodies and are internationally recognised.

TABLE 4.4 RECOGNITION OF TRAINING CERTIFICATES ISSUED BY OTHER COMPANIES (%)

Recognised training certificates	ICT specialists	Other specialists
Yes	62.5	50.0
No	12.5	10.0
Rarely	12.5	12.5
Do not know	12.5	10.0
No response	0.0	17.5
Total	100.0	100.0

In the absence of a formal system for the validation of previous learning¹⁷, the market is the main evaluator of workers' skills. This is a common view which the ICT companies shared and was further illustrated by 55% of the companies surveyed supporting the validation and certification of skills acquired in both informal and non-formal contexts (**TABLE 4.5**). The ICT companies did not care where employees acquired their skills. The most important criterion for the companies was that employees should possess usable, adaptable skills. However, in ensuring access to training for their employees, the companies themselves contributed to the creation of these skills.

TABLE 4.5 VALIDATION AND CERTIFICATION OF SKILLS ACQUIRED IN INFORMAL AND NON-FORMAL CONTEXTS

Validation and certification	%
Yes	55.0
No	27.5
Do not know	15.0
No response	2.5
Total	100.0

Common attitudes shared by the private sector representatives and one section of the public sector participants in the focus groups can be further illustrated by the following quotations.

¹⁶ This information is shared by a representative of the City Government of Novi Sad, Sector for the Economy, who participated in the focus group held in Novi Sad in December 2016. For additional information about the resources allocated for the additional trainings of the unemployed for 2017, see also: www.novisad.rs/grad-novi-sad-povetshao-sredstva-za-aktivnu-politiku-zaposhljavanja (accessed April 2017).

¹⁷ A public debate on the document 'The Concept of Previous Learning' will be held soon. This is a methodological document that will serve for the preparation of further directives and other documents based on which the system of the previous learning will be established (information shared by a focus group participant from the Institute for Improvement of Education, in Belgrade in December 2016).

‘The companies have their own systems of recognition.’

‘The duration of a certificate is limited; in my company each of the 15 employees has two certificates.’

‘Equipment producers insist that the employees are trained for the usage of equipment or that they already know how to use it.’

Based on previous elaboration it can be concluded that both the companies and their employees would benefit from the recognition of previous learning and certification of skills. In particular, it would be useful in smaller companies, say, because an objective authority would then confirm that certain skills and competences had already been validated in accordance with official standards. The benefits would be at least twofold. Companies would find it easier to fill skills gaps, on the one hand, while, on the other, potential job candidates would have better access to continuing education, and the possibility of changing occupations, for example, not by re-entering the process of formal education, but instead through a route that would ensure a better match between prospective employees’ skills and current job vacancies. It should be emphasised that it is not only the possessors of skills who should be subject to validation, but also the providers of training and certificates.

4.1.2 Employees’ participation in the planning of human resources development

Employees of ICT companies, in particular those employed in ICT professionals’ positions, confirm, with a high degree of confidence, the occurrence of regular discussions with senior staff members and managers regarding the skills needed to respond to job requirements. The survey findings reported in **TABLE 4.6** indicate that more ICT professionals believe that such discussion concerns only high skill levels – almost a quarter of employees – than other members of staff, who share the same view in just 5.3% of cases. However, both groups of respondents do agree that the discussions about professional development mostly involve employees of all educational levels in the companies.

TABLE 4.6 DISCUSSION ABOUT SKILLS DEVELOPMENT BETWEEN THE EMPLOYEES AND COMPANY MANAGEMENT (% OF THE TOTAL NUMBER OF EMPLOYEES)

What does it concern?	ICT professionals	Other employees
It concerns only high skill levels	24.2	5.3
It concerns all skill levels	66.7	94.7
Other	12.1	5.3

These findings are not surprising taking into account the fact that those with ICT professional profiles attend training courses more often than the other employees. Moreover, continuing learning within companies is driven by participation in projects. This is why employees attending soft skills training are underrepresented in the total number of trainees.

If there is any reason why employees are less likely to take an active part in planning skills development, according to the survey findings this is not because they are not interested, but more likely reflects a lack of opportunities. ICT companies struggle with a shortage of qualified job candidates and project deadlines.

4.2. Institutional and sectoral cooperation to improve matching

4.2.1 The role of educational institutions in creating a supply of qualifications

The extent of cooperation between educational institutions and ICT companies is less satisfactory than might be expected. Only one quarter of the companies surveyed maintained a degree of cooperation with secondary schools, whereas this was more commonly achieved in the case of higher education institutions, as reported by 65% of the companies (Table A4.20 in Annex 4). This is the

reason that 47.5% of the companies refrained from giving an opinion on the extent to which they were satisfied with the skills and competences acquired in secondary schools (**TABLE 4.7**). In general, one fifth of them were somewhat satisfied with the skills and competences this educational level can provide. In spite of the fact that ICT companies have more knowledge about the supply of higher education qualifications, they did not rate them more highly. About two-fifths of the companies were moderately satisfied with these qualifications, while almost the same number (37.5%) were neither satisfied nor dissatisfied. The share of those who were very satisfied is negligible.

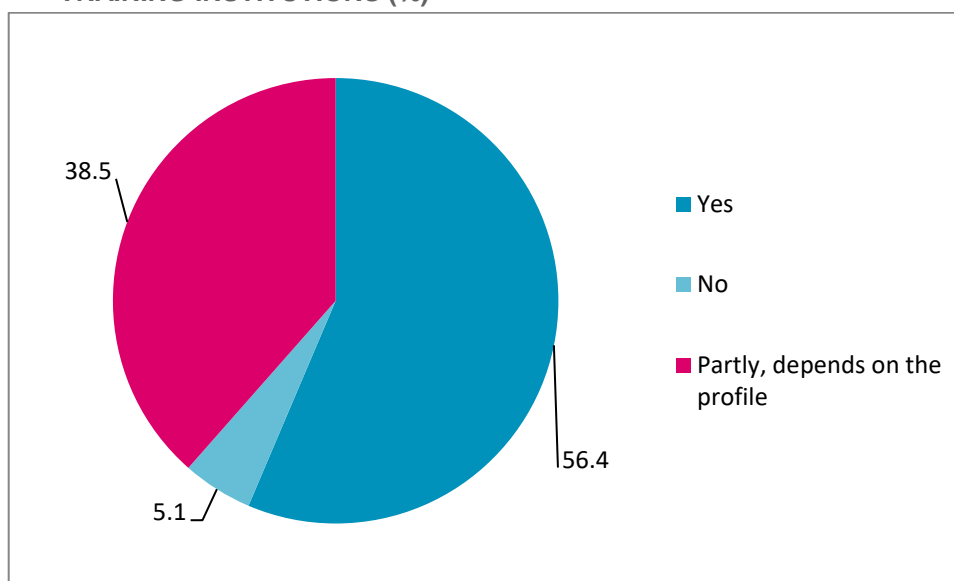
TABLE 4.7 LEVEL OF SATISFACTION WITH THE SKILLS AND COMPETENCES ACQUIRED DURING FORMAL EDUCATION (%)

Satisfaction	Secondary schools	Universities/faculties
Very dissatisfied	5.0	5.0
Somewhat dissatisfied	7.5	5.0
Neither satisfied nor dissatisfied	17.5	37.5
Somewhat satisfied	20.0	40.0
Very satisfied	2.5	10.0
No response	47.5	2.5
Total	100.0	100.0

The answers of the companies reported in Table 4.7 are in line with the assessment of the extent to which the skills and competences acquired during formal education are useful to the companies, and this will be further elaborated. In general, the answers reflect the level of ICT companies' satisfaction with the practical, but not overall, knowledge acquired during formal education, and this was further complemented by the views of the focus group participants.

Only 5.1% of the companies were not familiar with the qualifications offered by the educational and training institutions; 38.5% knew about the qualifications for particular professional profiles; and all other companies were conversant with the qualifications offered (**FIGURE 4.3**).

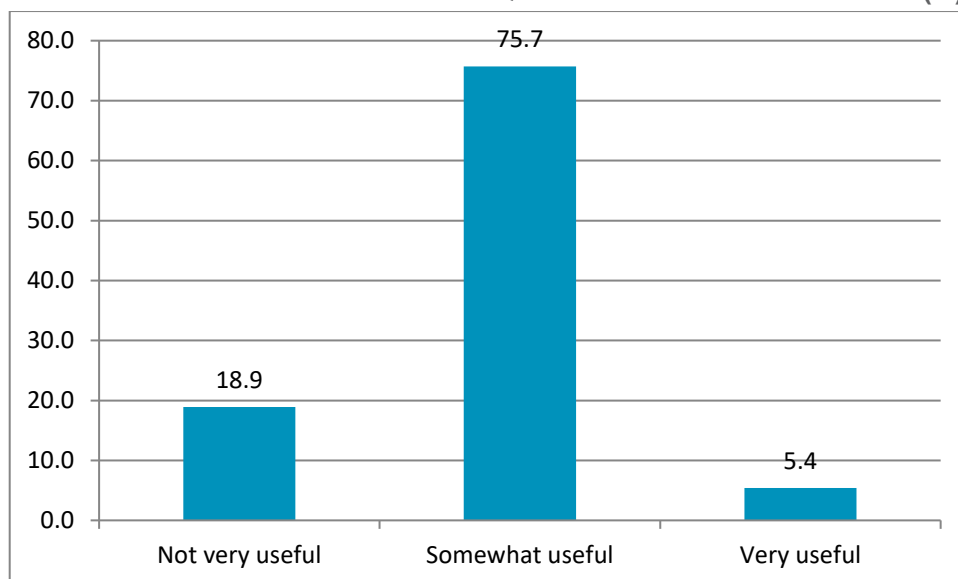
FIGURE 4.3 KNOWING THE QUALIFICATIONS OFFERED BY THE EDUCATIONAL AND TRAINING INSTITUTIONS (%)



The extent to which the qualifications were deemed useful to the companies is depicted in **FIGURE 4.4**. The general opinion was that the qualifications acquired during both the formal education at secondary schools and universities and the informal training programmes are somewhat useful –

75.7% of ICT companies held this view. They were judged very useful by just 5.4% of the companies, while the remaining 18.9% of the companies considered them as not very useful.

FIGURE 4.4 ASSESSMENT OF THE LEVEL OF QUALIFICATIONS' USEFULNESS (%)



The focus groups participants shared the view that educational institutions furnish graduates with general qualifications, and that the skills and competences needed for a particular job can be further acquired at work. The private sector makes a clear difference between the knowledge that is acquired at university and that which is attained in the vocational secondary schools, favouring the former. This can be illustrated by the following quotations.

'The shorter the training time of the job candidates for work is, the better the education.'

'The job candidates with higher education bring general knowledge, but they pick up things quickly.'

'Vocational secondary school students lack the knowledge of maths.'

'The training of newcomers/job candidates in a company takes between three and six months.'

At the same time, the educational institutions' representatives shared the following opinions.

'Due to the length of the educational process, the job candidates will not possess fresh qualifications when they finish their education.'

'The missing qualifications they will acquire at the companies.'

All the participants agreed that a possible solution for current issues lies in ensuring that the plans for enrolment in secondary schools and higher education institutions should be closely related to the labour market and especially to ICT sector skills needs. They were all of the opinion that it is necessary to strengthen cooperation between the companies and the educational institutions, with the involvement of other key stakeholders at all levels, and to ensure the creation of flexible educational programmes which would mitigate the rigidity of the existing education system. Here are a selection of quotations that illustrate their views.

‘Educational institutions should not independently create educational profiles.’

‘The plans for enrolment should follow the requirements of the economy.’

‘Changes of curricula take too much time; this is why there are no updated educational programmes.’

‘Students are overloaded with things they do not need for a job ... they quit the faculties ... they are pushed into entrepreneurship.’

‘With obsolete curricula, teachers lose authority over children.’

The material previously elaborated in this section is based on the survey findings (reported in Table 4.8) and represents the respondents’ views regarding the cooperation between individual companies and schools and/or faculties at the local level. However, when the establishment of cooperation between companies and educational institutions was observed at higher administrative levels, the representatives of the ministry in charge of education highlighted this cooperation, detailing the process of creating standards for qualifications in the vocational secondary schools. They emphasised that the accepted model is well developed and that it involves the private sector companies which will require these qualifications, on the one hand, and the educational institutions entrusted to create a system for students to acquire such accreditation, on the other. But what they perceive as less developed is the level of cooperation among companies and higher education institutions, with the exception of particular faculties that have close connections with a number of companies. Thus, a similar model should be adopted to ensure that higher education institutions react more quickly to market requirements. Furthermore, based on this model, higher education institutions would provide useful practical knowledge for students and create an adaptable system of learning. From this discussion it is obvious that the process of creating the systems that will supply qualifications should not be observed from one side only.

How these national processes may be reflected at the local level can be explained through the creation of standards for ICT qualifications at the secondary-school level. In the usual practice new educational profiles are introduced through experimental classes in a number of chosen schools. After the first generation of enrolled students graduate, these programmes undergo an evaluation process. If they are accepted by the ministry in charge of education all other schools may apply for these new educational profiles by submitting a request for verification. Their requests will be approved if they fulfil all the technical standards required, including provision of the appropriate teaching staff, learning areas and equipment as prescribed in the Regulations on educational profiles. However, the process for the introduction of new educational profiles is proving too lengthy, either because the status of experimental classes sometimes prolongs the procedure for an additional educational cycle or because of the absence of an evaluation of the previous educational cycle. In addition, if the standards for these qualifications are not defined, the ministry hesitates in announcing competitions and schools have lower chances for introduction of new educational profiles. According to the Council for VET and Adult Education, the assessment of the introduction of new educational profiles provides a good indication of the direction that the modernisation of secondary education is taking, as illustrated by the more than two-fifths of students who enrol in these new educational profiles every year. It can be concluded that the processes which follow changes to educational programmes are comprehensive (sometimes repeating) and burdened with numerous administrative procedures that further reinforce the rigidity of the education system.

It is uncertain when the multi-year process of creating the National Qualifications Framework (NQF) will end, in the sense that it leads to a basic standard which will be further upgraded¹⁸. This mostly depends on the agility of decision makers and the awareness of all the actors involved in this process of the influence

¹⁸ For the proposal of previously developed qualifications for the vocational secondary education and training, see Institute for the Improvement of Education (2013).

the introduced standards may have on the supply of qualifications (and acquired knowledge). An evaluation of the previous process would be an indication of its overall efficacy. The duties of the newly established permanent team for the development of the Serbian NQF are to position the NQF in relation to the European Qualifications Framework¹⁹. The timeframe for the termination of this activity is closely related to the process of Serbia's integration into the European Union.

Job requirements and satisfaction with the supply of qualifications

In addition to their formal educational background, companies also perceived as very important and desirable that future employees demonstrate a positive attitude towards the job and possess personal ambition (75%), as well as skills and knowledge (47.5%), which they have already acquired regardless of the educational and training institutions they attended (**TABLE 4.8**). It is also worth mentioning that the companies connected existing skills and competences with the practical knowledge that potential job candidates could apply to performing their jobs. Because only 7.5% of the companies voiced the opinion that previous experience is important in the recruitment of new employees, it seems that it is not only work experience that matters but also applicable knowledge earned while attending educational courses or pursuing vocational programmes within companies. Having good recommendations would seem to help candidates to obtain a job in only one fifth of the companies.

TABLE 4.8 ASSESSMENT OF THE CHARACTERISTICS OF FUTURE EMPLOYEES ACCORDING TO JOB REQUIREMENTS (%)

Rating	Positive attitude and ambition	Formal qualifications	Existing skills and knowledge	Experience	Good recommendations	Other
Not important	0.0	10.0	2.5	12.5	5.0	0.0
Somewhat important	0.0	40.0	5.0	37.5	27.5	0.0
Important	20.0	40.0	40.0	37.5	42.5	0.0
Very important	75.0	5.0	47.5	7.5	20.0	2.5
No response	5.0	5.0	5.0	5.0	5.0	97.5
Total	100.0	100.0	100.0	100.0	100.0	100.0

The need for changes in education from the ICT sector development perspective

There were a number of changes that the surveyed companies expected the vocational and higher education institutions to consider in order to create an adequate supply of qualifications that would satisfy qualitative and quantitative standards, as illustrated in **TABLE 4.9**. Among the more important of the recommended changes in educational programmes were: directing more focus on practical training; being open to new and innovative methods of teaching; strengthening cooperation with the corporate sector through joint projects and work experience; and following labour market requirements when proposing educational profiles that would offer usable, adaptable skills. The involvement of a broader audience in educational policies planning, career guidance and the harmonisation of educational programmes with international standards were seen as less important, largely because, according to the respondents' experience, these practices already exist but are ineffective. These conclusions are in line with the general views of the focus group participants, but they do not fully support the experience of the national institutions in charge of the implementation of educational policies, as mentioned above.

¹⁹ Information taken from: www.mpn.gov.rs/prosveta/noks/ (accessed March 2017).

TABLE 4.9 RECOMMENDATIONS FOR CHANGES IN THE VOCATIONAL AND HIGHER EDUCATION INSTITUTIONS

Recommended changes	% of the total of 40 companies
Readiness to review and change curricula in order to align them with technological change	72.5
Openness to new methodologies of teaching	50.0
Focus on practical training, the organisation of practice, internships in companies, etc.	72.5
Joint projects between companies and education institutions	50.0
Define and update educational profiles in line with labour market needs	45.0
Involve the representatives of the social partners	22.5
Create the skills that will be applicable in the company without more time being spent	32.5
Introduce additional foreign language courses (professional language)	22.5
Provide career guidance services to future graduates	12.5
Harmonise the training programmes with the international standards	12.5
Other	10.0
Nothing	2.5

The ICT sector is an open, fast-growing sector whose business operations spread internationally. The insufficient supply of educated professionals could induce the development of some alternative ways of feeding the growing demand for qualifications. When the companies were asked to nominate the educational profiles, aside from a university education, they would prefer, they opted for informal education, post-secondary VET and self-taught individuals as the three most desirable options (TABLE 4.10). They assessed vocational and general secondary education as the area that in most cases failed to provide students with the qualifications required by ICT companies. It was felt that jobseekers who have graduated from secondary level education should be able to further upgrade their qualifications through continuing training programmes. This was also the opinion of the majority of focus group participants. However, a difference of opinion emerged regarding whose responsibility this would be – the educational and training institutions or the companies.

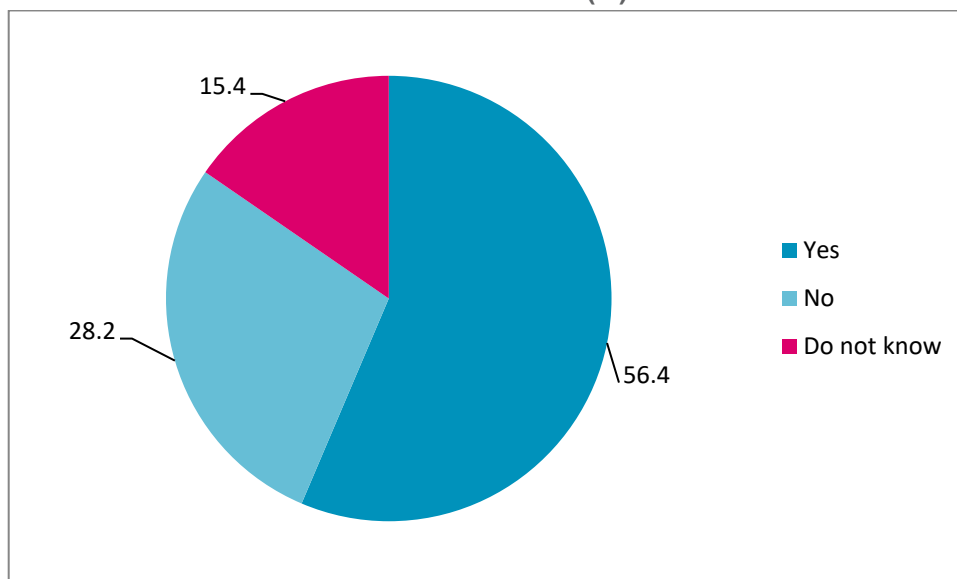
TABLE 4.10 EDUCATIONAL PROFILES OF FUTURE EMPLOYEES, APART FROM UNIVERSITY EDUCATION

Educational profiles of future employees	% of the total of 40 companies
Post-secondary VET education	40.0
VET secondary education	15.0
General secondary education	2.5
Informal education	47.5
Self-taught individuals	37.5
Others	2.5

4.2.2 Multi-sectoral cooperation in the supply of education and training

Only around half of the companies in the sample covered by the employer survey thought that the information on skills needs that comes from the ICT sector affects the supply of educational and training programmes. It is interesting to note that almost one third of the companies did not hold this view (FIGURE 4.5). It is very likely that these companies did not have a chance to participate in or initiate communication about sectoral skills shortages.

FIGURE 4.5 DOES THE INFORMATION ABOUT IN-DEMAND SKILLS COMPLEMENT THE OFFER OF ADDITIONAL TRAINING? (%)



When the previous conclusions are compared with the survey findings reported in **TABLE 4.11**, one may conclude that the cooperation regarding the exchange of information on the supply and demand requirements in the ICT sector strongly depends on the level of communication established. This communication was more pronounced between ICT companies and the educational and training institutions at the local level, but only 45% of the surveyed companies had informed local providers of educational services about their skills needs. In addition, 27.5% of the ICT companies surveyed believed that communication was even less effective between the ICT sector and local educational and training authorities. Only one company from the sample had been involved in the exchange of information on the ICT sector skills needs with the educational and training authorities at the provincial and/or national level.

TABLE 4.11 LEVEL OF COMMUNICATION AMONG ICT SECTOR AND OTHER PARTICIPANTS IN THE PROCESS OF ENSURING ADEQUATE SKILLS

Communications	% of the total of 40 companies
Communication between the ICT companies and education/training institutions locally	45.0
Communication between the ICT sector and the education/training authorities at the local level	27.5
Communication between the ICT sector and the education/training authorities at the provincial level	2.5
Communication between the sector and the education/training authorities at the national level	2.5
Other	2.5

4.2.3 Development of mechanisms of coordination

One quarter of the ICT companies believe that the main reason why the information on skills needs has not contributed to a potential offer of additional training is because there is at present no effective functional mechanism to enable this to happen (**TABLE 4.12**). Information exchange functions to a certain extent, but when it comes to turning ideas into reality the pace of change is slow (there are institutional obstacles or issues related to the capacities of educational and training institutions, for example). The current situation requires a mechanism of cooperation that would yield much faster

results. ICT companies do not have time to wait for three to four years for educational programmes to give results. The fast-growing ICT sector needs solutions that will ensure an adequate supply of qualifications, both in terms of quantity and quality.

TABLE 4.12 THE REASONS WHY THE INFORMATION ON SKILLS NEEDS IS NOT UTILISED

Reasons	% of the total of 40 companies
There is no mechanism that functions at present	25.0
Other	10.0

The focus groups participants identified several ways in which cooperation among educational and training institutions, on the one hand, and individual companies and their associations, on the other, might contribute to an increase in the supply of qualifications. They perceived the establishment of the Sectoral Council for ICT as the realisation of a formal partnership between those who manage the system for learning and acquiring qualifications and those who assess the needs for qualifications. These two parties should mutually determine what criteria the qualifications must meet. This form of coordination may be realised through the monitoring of sectoral needs and their impact on the creation of educational policies. The focus group participants were of the opinion that the process of creating qualifications for the ICT sector should be complemented by an appropriate mechanism of information sharing, and that this is the element that is currently missing. According to the participants, the formal communication channels between the educational and/or training institutions and the companies are well established at the local level. However, those forms of communication are primarily seen in the institutional and organisational cooperation which occurs through the application of programmes of in-company (vocational) practice or individual scholarships, which contributes to raising the quality of the supply of qualifications. An exception is the Faculty of Technical Sciences of the University of Novi Sad, which creates the human resources required by the ICT sector, but also establishes companies and contributes to the sector's growth.

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This analysis examines the rising demand for skills and qualifications in the ICT sector, through research conducted from the perspective of both employers and employees. The main findings and conclusions are mainly derived from the results of the survey conducted with a sample of 40 ICT companies operating in the Autonomous Province of Vojvodina. In addition, these findings were complemented by the views of relevant stakeholders on skills needs identification that were obtained as focus groups outcomes. The reliability of the statistical inference based on the survey data was preliminarily confirmed by a high response rate of 95.2% among the selected companies. However, when individual data on employees are analysed more caution is needed because the inference based on the answers provided by a small number of the respondents cannot be derived with a high degree of confidence. Potential issues were resolved by asking both employers and employees to answer the same questions, so that the employees' answers related to skills gaps or training needs assessments were complementary to the overall assessment provided at the company level.

The ICT sector in Serbia, and especially in Vojvodina, is growing faster than the educational and training institutions capacities can respond to the demand for qualifications. The survey findings clearly indicate that in 2016 ICT companies had difficulties in finding a workforce with adequate skills. Among the 85% of companies that experienced difficulties in filling job vacancies, this was identified as a result of either an **insufficient supply of qualified job candidates** or a **lack of applicable knowledge**. ICT professionals are the major occupational group in the ICT sector. In particular, the ICT occupations in high demand are developers, digital media specialists, ICT consultants, project managers, test specialists and system administrators. There are other professional profiles that also generate ICT sector workforce demand, including the positions of managers and marketing, sales and human resource specialists.

As stated, the continuous growth of the ICT sector over the previous decade has resulted in an increasing demand for skills and qualifications which exceeds the capacities of educational and training institutions. This situation requires a coordinated set of actions by the relevant stakeholders to urgently respond to the sector's needs. The real question is whether the acceptance of employees who do not have adequate qualifications and skills, as required by the sector, could slow down its growth. This analysis provides some specific recommendations for mitigating the skills shortage problems caused by both inadequate practical knowledge and the insufficient supply of a qualified workforce.

The engagement of ICT professionals is characterised by a high fluctuation rate. In 2016 67.5% of the ICT companies hired ICT specialists, while 77.5% expected to be recruiting new employees in 2017. **ICT companies prefer their workforce to have higher education qualifications.** Individuals with higher education composed 78.6% (76%) of the total hiring (leaving) in 2016. But companies still express gaps in satisfying the current demand for employees with this level of education. In most cases ICT companies identified developers as the occupation they currently lack. Those professionals with tertiary education make up 42.9% of the total occupational gap. At the same time, ICT companies employed 12.9% of secondary and post-secondary VET graduates in 2016, while there is still an estimated demand of 23.8% that is expected to be filled in 2017. Those graduates filled both ICT and non ICT-related job vacancies at the companies surveyed. **The ICT companies recruiting new staff in 2016 identified a gap in both professional (technical) and foreign language skills.** The job matching services of private employment agencies and announcements of job vacancies on companies' web pages were the most commonly reported strategies for new staff recruitment.

The newly recruited employees in the ICT sector included those who had attended continuing training after graduation – 63.6% of ICT professionals and 89.5% of other employees. However, the training they received was not necessarily related to the jobs they obtained at the companies. **The employees identified a gap between the skills needed by companies and the skills they acquired by attending courses at the educational and training institutions.** The gap in professional (technical) skills in relation to a job's requirements leads the ranking of the responses reported by ICT professionals (48.5%), whereas a lack of foreign language (preferably English) proficiency tops the responses of other employees (47.7%). In addition, ICT professionals reported foreign language and communication skills as the second and third-ranked skills gap, while other employees considered professional (technical) skills as particularly lacking. Most ICT professionals (54.6%) required an average of three-to-six months to adapt to the needs of jobs in the ICT sector, whereas other employees sometimes took up to a year to fully assimilate their role (one quarter of the respondents).

Public policies created to improve the match between skills and jobs should be more sensitive to ICT sector needs. The information on what occupations are in demand and what skills are needed for particular jobs in this sector should be available and used as evidence in coordinating public policies at different administrative levels. In that respect, further improvements to the current system of skills identification and anticipation are necessary. The outcomes of the survey in terms of skills anticipation should be reliable at the sectoral and regional levels. The monitoring and anticipation of skills needs should enable the educational and training institutions to respond more quickly to ICT sector skills needs. An adequate education policy reaction would be to increase the number of places for ICT professional profiles at the universities and, as a long-term measure, to modernise VET provision through the introduction of new educational profiles that boost ICT qualifications. Labour market policies should be focused on promoting the skills matching process and delivering continuing training that will feed the demand for skills in the short term. Also, ICT clusters, in their role as knowledge hubs, can contribute to better matching between skills and jobs through strengthening the links between the educational institutions and companies and other stakeholders.

Both employers and employees shared the same view on the top priority for change in the education system, ranking first out of four proposals strengthening the practical dimension of educational provision. More than four-fifths of the employees and two-thirds of the employers made this suggestion. The remaining three proposals are the revision of educational programmes in accordance with technological change; an openness to innovative methods of teaching; and the establishment of joint projects between companies and educational institutions that would narrow the skills gaps which occur due to the lack of practical knowledge on the part of the graduates.

All the recommendations for changes to the educational system are made with the purpose of providing an efficient response to ICT sector skills needs. Educational policies should be focused on both the practical dimension and modernising the educational programmes on offer in order to support the growth of skilled jobs in the ICT sector. The qualification system should be updated. Modernisation of the education system requires improving the capacities of the educational and training institutions. Local partnerships and incentives are important for stimulating the collaboration between the educational and training institutions and ICT companies and their associations. The practical knowledge of graduates at both the secondary and higher education levels can be improved through expanding work experience and apprenticeship and/or internship opportunities. This can be realised through the joint efforts of the companies and their associations on the one hand, and the educational institutions and the government on the other. Also, career guidance and counselling services should be expanded in schools and made more relevant to the actual demand in the labour market, taking future occupational perspectives into account.

Nearly 95% of ICT companies provided training to employees, while almost 70% of all employees participated in additional training in 2016. **ICT professionals identified in-company coaching and**

on-the-job learning as one of the most popular ways to support professional development, together with the training offered by the companies and flexible working hours, whereas other employees identified participation in continuing training, cost-sharing and in-company coaching as effective means for promoting professional development in the companies. A considerably higher share of the non-ICT professionals (84.6%) were somewhat or very satisfied with the training possibilities on offer at the companies compared to ICT professionals (68.2%) or employers (61.1%). If given the choice of participating in additional training, **ICT professionals and other employees would chose professional (technical) training, and courses that would improve foreign language, managerial and time management skills, while the employers would add communication skills training to this list.**

Maintaining an adequate level of skills is a lifelong process. Moreover, by providing opportunities for improving the skills of their employees, companies create intangible resources. Companies should be more closely involved in the process of skills creation. Not all companies are affected in the same way by skills shortages. The effects of skills shortages on large companies should result in more opportunities for employees to participate in continuing training, whereas small companies need to invest more effort in retaining ICT professionals with adequate skills. In that respect, small companies would particularly benefit from the support they could obtain through membership of clusters and associations of ICT companies.

When determining the extent and nature of skills shortages, companies follow client feedback and market requirements, as well as making inventories of their current skills profile to match against business needs. **ICT companies give priority to specialised training. These courses are attended by a much higher number of employees than those that foster transferable, mostly soft skills, or other training.** In support of this finding, it is worth noting that, in 2016, out of the total number of trainees, the share of ICT professionals exceeded 86%, while the figure for non-ICT professionals was 14%. Among ICT professionals, three occupational profiles have benefited the most from attending specialised training: developers, digital media specialists and ICT consultants – 80.6% of the total number of trainees. The soft skills training delivered during 2016 was mostly intended to improve communication skills, as well as project management, negotiation and sales competences. A significant share of the ICT companies (55%) would support the validation and certification of skills acquired in informal and non-formal contexts in order to increase the supply of qualifications. In terms of both the expected number of companies that would provide training and identified training needs, **the companies' training intentions for 2017, as compared to 2016, were not significantly different, implying a constant need for the improvement of employees' skills.**

Companies should provide continuous learning opportunities and stimulating working conditions to promote the professional development of their employees. The resources of the companies surveyed were mainly concentrated on the improvement of ICT professionals' skills through focusing on specialised training. However, companies should also focus on the skills of other employees in order to improve their efficiency. More opportunities for specialised training to supplement the supply of ICT qualifications should be created outside the companies through government incentives.

A relatively small proportion of the ICT companies (25%) maintained links with secondary education institutions, whereas cooperative relationships with the higher education sector were more common, as reported by 65% of the companies. About half of the ICT companies stated that they were somewhat or very satisfied with the qualifications offered by higher education, while this share was significantly lower when VET qualifications were considered (one fifth). In general, 56.4% of the companies were familiar with the qualifications offered by the educational and training institutions. The companies perceived a positive attitude towards work and existing skills and knowledge as important and desirable characteristics in job applicants. The insufficient supply of higher educated professionals encouraged employers to look at a number of alternative sources in terms of feeding the

rising demand for qualifications in the ICT sector. **Informal education, post-secondary VET and self-taught individuals were identified as the three most likely sources for overcoming skills mismatches and ICT qualifications shortages.**

More focus needs to be placed on strengthening informal and non-formal opportunities for learning. Both employers and employees would benefit from establishing a system of certification and validation of previous learning. The recognition of skills acquired in informal and non-formal contexts should enable a better matching of skills and jobs. However, from the perspective of the ICT sector, which needs a highly skilled workforce, the validation of previous learning is desirable but not necessary, while the possession of certificates is seen as more important for the companies and their employees and is demand-led. It is expected that the validation of previous learning, once it is established, will have some positive effects on the companies' recruitment policies, whereas it would help employees make the transition from one job to another in the sector.

Approximately half of the ICT companies believed that the information on skills needs that comes from the ICT sector affects the supply of educational and training programmes. However, a quarter of the ICT companies considered that **the main reason why information on skills needs does not contribute to a potential supply of additional training is because, at present, there is no functioning, effective mechanism in place to enable this to happen.** In addition, 45% of the companies surveyed regarded communication between ICT companies and educational and/or training institutions at the local level as particularly effective, while other types of communication were perceived as less valuable.

The problem of qualifications and skills shortages occurs at the local level. However, this problem can be observed from at least two perspectives. Educational policies are made at the national level, whereas conducting continuing training relates to the incentives proposed at the local level and can be supported by the local and provincial authorities. Establishing efficient mechanisms of cooperation and partnerships between relevant stakeholders is an imperative for the improved matching of workforce skills and ICT sector needs. Having a functional institutional setting is a prerequisite for effective cooperation between the ICT sector and the government at all levels. The ICT sector should use all available communication channels to address the skills issue. Mutual understanding is an additional prerequisite for mitigating the problem of skills shortages.

ANNEXES

Annex 1. Methodology

Instruments for ICT sector skills assessment in Vojvodina Questionnaire for employers

(region, municipality)

Information presented in this questionnaire is strictly confidential.

Date of interview: /_/_/_/_/_/_/_/

Name of interviewer: _____

Representative of the business entity: _____

(name, surname)

Function:

☐ Owner ☐ Director ☐ HR Manager ☐ Other _____

Contact telephone/e-mail: _____

A. General data

A.1. Full name of the business entity			
A.2. Register code of the business entity	/ / / / / / / / / /		
A.3. Registration date	/ / / / / / / / / /		
A.4. Juridical address			
A.5. Telephone/fax/e-mail			
A.6. Organisational type	<input type="checkbox"/> Limited liability company	<input type="checkbox"/> Stock company	<input type="checkbox"/> Other
A.7. Ownership	<input type="checkbox"/> Private	<input type="checkbox"/> Public	<input type="checkbox"/> Other
A.8. Origin of capital	<input type="checkbox"/> Domestic	<input type="checkbox"/> Foreign	<input type="checkbox"/> Mixed <input type="checkbox"/> Unknown (no label)
A.9. Type of core business activity (NACE Rev. 2)	Code (mark)	Business activity	
	2610	Manufacture of electronic components and boards	
	2620	Manufacture of computers and peripheral equipment	
	2630	Manufacture of communication equipment	
	2640	Manufacture of consumer electronics	
	2680	Manufacture of magnetic and optical media	
	4651	Wholesale of computers, computer peripheral equipment and software	
	4652	Wholesale of electronic and telecommunications equipment and parts	
	5820	Software publishing	
	61	Telecommunications	
	62	Computer programming, consultancy and related activities	
	631	Data processing, hosting and related activities; web portals	
	951	Repair of computers and communication equipment	
	Other [please specify]		
A.10. Business model	<input type="checkbox"/> Development of own product	<input type="checkbox"/> Outsourcing	<input type="checkbox"/> Other
A.11. Size by number of employees	<input type="checkbox"/> Micro (up to 9 employees)	<input type="checkbox"/> Small (10–49)	<input type="checkbox"/> Medium (50–249) <input type="checkbox"/> Large (250 plus)

A.12. How would you rate the demand for your products/services?

	In the last 12 months	In the next 12 months
Increases	1	1
No changes	2	2
Decreases	3	3

B. Self-assessment of the skills of those currently employed

B.1. Does your company have problems with ensuring adequate skills of employees?

Yes	No
1	2

B.2. Has your company experienced difficulties in filling vacancies in the last 12 months?

Yes	No
1	2

B.3. According to your experience what are the obstacles which cause difficulties in filling vacancies for each of the following occupational groups? *[Multiple answers are allowed]*

Difficulties in filling vacancies	Managers	ICT specialists	Marketing specialists	Sales specialists	HR specialists	Administration	Other
Insufficient supply of qualified candidates who poses adequate skills	1	1	1	1	1	1	1
Candidates do not have work experience	2	2	2	2	2	2	2
Candidates do not possess positive attitudes towards learning, working hard and career development	3	3	3	3	3	3	3
Candidates do not favour occasional/short-term jobs	4	4	4	4	4	4	4
Wages are not high enough to attract qualified candidates	5	5	5	5	5	5	5
Do not know	6	6	6	6	6	6	6
There are no difficulties in filling vacancies for this type of profession	7	7	7	7	7	7	7

B.4. In the last 12 months did your company experience changes in the number of employees? *[Please tick ONE answer for each occupational group]*

Occupations	Increased	No. of specialists	Remained unchanged	No. of specialists	Reduced	No. of specialists	Do not know
1. Managers	1		2		3		4
2. ICT specialists	1		2		3		4
3. Marketing specialists	1		2		3		4
4. Sales specialists	1		2		3		4
5. Human resource specialists	1		2		3		4
6. Administration	1		2		3		4
7. Other	1		2		3		4

B.5. What are your expectations regarding the changes in the number of employees in the next 12 months? *[Please tick ONE answer for each occupational group]*

Occupations	Increase	No. of specialists	Remain unchanged	No. of specialists	Reduce	No. of specialists	Do not know
1. Managers	1		2		3		4
2. ICT specialists	1		2		3		4
3. Marketing specialists	1		2		3		4
4. Sales specialists	1		2		3		4
5. Human resource specialists	1		2		3		4
6. Administration	1		2		3		4
7. Other	1		2		3		4

B.6. Could you please list the professionals (up to 10) who have left your company in the last 12 months? *[Please insert occupations/professional profiles from the list]*

List occupations <i>[Job title]</i>	Level of education (tertiary-5, post-secondary-4, general secondary-3, VET secondary-2, any level of education-1) <i>[Please insert code]</i>	No. of specialists

B.7. Could you please list the professionals (up to 10) that your company has hired in the last 12 months? *[Please insert occupations/professional profiles from the list]*

List occupations <i>[Job title]</i>	Level of education (tertiary-5, post-secondary-4, general secondary-3, VET secondary-2, any level of education-1) <i>[Please insert code]</i>	No. of specialists

B.8. Please list the professionals (up to 10) which your company currently lacks. *[Please insert occupations/professional profiles from the list]*

List occupations <i>[Job title]</i>	Level of education (tertiary-5, post-secondary-4, general secondary-3, VET secondary-2, any level of education-1) <i>[Please insert code]</i>	No. of specialists

B.9. Indicate the sources for the recruitment of professionals used by your company. *[Multiple answers are allowed]*

NES job matching services	1
Private employment agencies, Infostud, etc.	2
Announcement on the company's website	3
Collaboration with secondary vocational schools and universities	4
Recruiting employees from other companies	5
Word of mouth	6
Other sources <i>[please specify]</i> _____	7

B.10. Which skills are the most important for your employees to fulfil their assignments but are currently insufficient? [Multiple answers are allowed]

Skills	Managers	ICT specialists	Marketing specialists	Sales specialists	HR specialists	Administration	Other
Professional (technical) skills, according to the job description	1	1	1	1	1	1	1
Knowledge of foreign languages	2	2	2	2	2	2	2
Possession of professional ethics	3	3	3	3	3	3	3
Skills in organising and managing a team	4	4	4	4	4	4	4
Communication skills	5	5	5	5	5	5	5
Ability to work with clients	6	6	6	6	6	6	6
Ability to identify and to solve problems	7	7	7	7	7	7	7
Ability to work with team spirit	8	8	8	8	8	8	8
Ability to control stress and emotional instability	9	9	9	9	9	9	9
Passion for new knowledge	10	10	10	10	10	10	10
Ambition to learn and excel	11	11	11	11	11	11	11
Translating clients' needs into action plans	12	12	12	12	12	12	12
Other specific technical skills [please enumerate]							
	13	13	13	13	13	13	13
	14	14	14	14	14	14	14
There is no lack of skills [fill by interviewer]	15	15	15	15	15	15	15

B.11. In your opinion, what are the reasons that cause the lack of skills, observed by the occupational groups? [Multiple answers are allowed]

Reason	Managers	ICT specialists	Marketing specialists	Sales specialists	HR specialists	Administration	Other
High fluctuation of employees	1	1	1	1	1	1	1
Market requirements	2	2	2	2	2	2	2
Competition pressure	3	3	3	3	3	3	3
Lack of newly employed	4	4	4	4	4	4	4
Technological change	5	5	5	5	5	5	5
Changes in professional requirements	6	6	6	6	6	6	6
No possibility to organise in-company training	7	7	7	7	7	7	7
No financial resources for off-site training	8	8	8	8	8	8	8
Lack of quality of training providers	9	9	9	9	9	9	9
Lack of skilled teachers/trainers	10	10	10	10	10	10	10
Lack of time due to project deadlines	11	11	11	11	11	11	11
Other causes [please specify]							
	12	12	12	12	12	12	12
	13	13	13	13	13	13	13
There are no problems [fill by interviewer]	14	14	14	14	14	14	14

B.12. Does your company collaborate with secondary vocational schools and universities (in terms of hiring graduates, providing work experience, scholarships, internships, and so on)?

	Secondary schools	Universities/faculties
Yes	1	1
No	2	2
Do not know	3	3

B.13. To what extent are you satisfied with the skills and competences acquired during the process of formal education?

	Secondary schools	Universities/faculties
Very satisfied	5	5
Somewhat satisfied	4	4
Neither satisfied nor dissatisfied	3	3
Somewhat dissatisfied	2	2
Very dissatisfied	1	1

B.14. Do you know the qualifications offered by the national education and training system?

Yes	No	Partly, depends on the profile
1	2	3

B.15. If you know them, how do you assess them?

Very useful	6
Somewhat useful	5
Not very useful	4
Not at all useful	3
Not applicable to the job	2
Useless	1

B.16. When recruiting new employees, how would you rank the following characteristics?

[Please answer each row]

	Very important	Important	Somewhat important	Not important
Positive attitude and ambition	4	3	2	1
Formal qualifications	4	3	2	1
Existing skills and knowledge	4	3	2	1
Experience	4	3	2	1
Good recommendations	4	3	2	1
Other <i>[please specify]</i>	4	3	2	1

B.17. In your opinion, what changes are necessary in the vocational education and higher education institutions in order for the skills and competences of the graduates to meet the job requirements of your company? [Multiple answers are allowed]

Readiness to review and change curricula in order to align them with technological change	1
Openness to new methodologies of teaching	2
Focus on practical training, organisation of practice, internships at the company, etc.	3
Joint projects between companies and education institutions	4
Define and update educational profiles in line with labour market needs	5
Involve the representatives of the social partners (employers, trade unions, public employment service, other public and non-public relevant actors) in planning and developing the educational profiles	6
Create the skills and competences that will be applicable in the company without more time being spent on additional trainings	7
Introduce additional foreign language courses (professional language)	8
Provide career guidance services to future graduates	9
Harmonise the training programmes with international standards in order to improve the supply of ICT and other professionals	10
Other [please specify] _____	11
_____	12
Do not know [fill by interviewer]	13
Nothing [fill by interviewer]	14

B.18. Given the dynamics of the ICT sector in the next years, what do you see as the main education profile of your future employees (apart from higher/university educated)?

Post-secondary VET education	1
VET secondary education	2
General secondary education	3
Informal education	4
Self-taught individuals	5
Others [please specify] _____	6
Do not know	7

C. Assessment of the continuing training process of employees

C.1. Does your company practise continuing training and development of employees in order to meet the job requirements? [If the answer is NO or DO NOT KNOW go to question C.8]

Yes	No	Do not know
1	2	3

C.2. If YES, please indicate what specialists (up to 10) were trained at your company in the last 12 months. *[Please insert occupations/professional profiles from the list]*

List occupations <i>[Job title]</i>	No. of specialists

C.3. Please specify the most common training topics by specialists trained (up to 10). *[Please insert occupations and training topics from the list]*

List occupations <i>[Job title]</i>	Specialised training		Soft skills training		Other	
	Topics	No. of specialists	Topics	No. of specialists	Topics	No. of specialists

C.4. How is the process of determining insufficient skills organised in your company?

	Yes	No	Do not know
We make an inventory of the skills present and match it with business requirements	1	2	3
We follow market requirements	1	2	3
We follow client feedback	1	2	3
We do not have time for this	1	2	3
Other <i>[please specify]</i> _____	1	2	3

C.5. Does your company evaluate the impact of training on the efficiency of employees who attended?

Yes	No	Rarely	Do not know
1	2	3	4

C.6. To what extent are you satisfied with the current level of training available for your employees?

Very satisfied	5
Somewhat satisfied	4
Neither satisfied nor dissatisfied	3
Somewhat dissatisfied	2
Very dissatisfied	1

C.7. Who are the providers of training for your company? [Multiple answers are allowed]

Your company	1
ICT Cluster Academy	2
National Employment Service	3
State educational or training institutions	4
Private educational or training institutions	5
The manufacturer of equipment	6
Other [please specify] _____	7
Do not know	8

C.8. Does your company recognise training certificates issued by other competing companies? [Please answer each row]

Specialists	Yes	No	Rarely	Do not know
ICT specialists	1	2	3	4
Other specialists	1	2	3	4

C.9. Does your company plan to hold or pay for training for your employees in the next 12 months? [Please answer each row] [If your company plans to organise training, after this question go to C.12]

Type of training	Yes	No
Professional (vocational) training	1	2
Foreign languages (professional language)	1	2
Professional ethics	1	2
Managerial skills	1	2
Team building and team work	1	2
Leadership skills	1	2
Communication skills	1	2
Client servicing skills	1	2
Problem solving	1	2
Motivation skills	1	2
Time management	1	2
Information technology use	1	2
Other [please specify]		
_____	1	2
_____	1	2

C.10. Why does your company not organise training for employees – what are the main reasons? *[Multiple answers are allowed]*

Workforce has all necessary skills	1
Insufficient offer of training services	2
Offered training does not meet our business needs	3
Lack of financial resources	4
High quality training is too expensive	5
We have no time for training	6
Lengthy training courses	7
Great distance to places where training is organised	8
Lack of motivation of employees	9
Quality of training offered is unsatisfactory	10
Lack of information on training offer	11
Proposed date, time is inconvenient for training	12
We have no technical basis for organising training	14
Previous training did not meet expectations and has not had the desired effect	15
Other <i>[please specify]</i>	
	16
	17
Do not know	18

C.11. Please specify what are your companies' training needs that are not currently organised for/provided to employees. *[Only companies that do not provide training] [Please insert occupations/professional profiles and training topics from the lists]*

List occupations <i>[Job title]</i>	Training topics	Number of specialists requiring trainings

C.12. In order to increase the level of competences of employees, do you take into consideration the validation and certification of skills acquired in informal and non-formal contexts as an alternative to continuing training?

Note: validation and certification of skills acquired in a non-formal setting that may increase the level of competences of employees (i.e. skills and qualifications acquired by professional training or work experience but not formally recognised).

Yes	1
No	2
Do not know	3

D. Education and business cooperation

D.1. Is information on skills needs feeding the education training supply in the ICT sector?

Yes	No	Do not know
1	2	3

D.2. If YES, through *[Multiple answers are allowed]*

Communication between the ICT companies and education/training institutions locally	1
Communication between the ICT sector and the education/training authorities at local level	2
Communication between the ICT sector and the education/training authorities at provincial level	3
Communication between the sector and the education/training authorities at national level	4
Other <i>[please specify]</i> _____	5

D.3. If NO, why? *[Multiple answers are allowed]*

There is no mechanism that functions at present	1
Other <i>[please specify]</i> _____	2

Instruments for ICT sector skills assessment in Vojvodina

Questionnaire for employees

(region, municipality)

Information presented in this questionnaire is strictly confidential.

Date of interview: /_/_/_/_/_/_/_/_/

Name of interviewer: _____

Business entity: _____

Name of employee: _____

Function/Job title: _____

Contact telephone/e-mail: _____

A. Education of employees

A.1. What is your level of education?

University	1
Post-secondary	2
Secondary VET	3
Secondary general	4

A.2. Have you followed additional/further training programmes after graduation?

Yes	1
No	2

A.3. If YES, which type of training and in which fields/topics? *[Please also enumerate types of training not necessarily related to your employment in the ICT sector]*

B. Self-assessment of the skills of employees from an employment perspective

B.1. Which skills are most important for your job but are currently missing? *[Multiple answers are allowed]*

Skills	
Professional (technical) skills according to the job description	1
Knowledge of foreign languages	2
Possession of professional ethics	3
Managerial skills	4
Communication skills	5
Ability to work with clients	6
Ability to identify and solve problems	7
Ability to work with team spirit	8
Ability to compete	9
Ability to control stress and emotional instability	10
Other specific (technical) skills <i>[please enumerate]</i>	11
	12
	13
There is no lack of skills <i>[fill by interviewer]</i>	14

B.2. Depending on your level of education, to what extent are you satisfied with the skills and competences acquired during the process of formal education?

	Secondary schools	Universities/faculties
Very satisfied	5	5
Somewhat satisfied	4	4
Neither satisfied nor dissatisfied	3	3
Somewhat dissatisfied	2	2
Very dissatisfied	1	1

B.3. How much time did you need in order to meet the ICT sector job requirements (in terms of skills) after graduation?

Immediately after graduation	1
3 months	2
6 months	3
9 months	4
12 months	5
More than one year	6
I worked for this or another company while I was a student	7

B.4. In your opinion, what changes are necessary in secondary vocational and higher education institutions in order for the skills and competences of the graduates to meet the job requirements? *[Divide answers depending on the level of respondent's education]*
[Multiple answers are allowed]

Readiness to review and change curricula in order to align them with technological change	1
Openness to new methodologies of teaching	2
Focus on practical training, organisation of practice, internships at the company, etc.	3
Joint projects between companies and education institutions	4
Define and update educational profiles in line with labour market needs	5
Involve the representatives of the social partners (employers, trade unions, public employment service, other public and non-public relevant actors) in planning and developing the educational profiles	6
Create the skills and competences that will be applicable in the company without more time being spent on additional training	7
Introduce additional foreign language courses (professional language)	8
Provide career guidance services to future graduates	9
Harmonise the training programmes with international standards in order to improve the supply of ICT and other professionals	10
Other <i>[please specify]</i> _____	11
_____	12
Do not know <i>[fill by interviewer]</i>	13
Nothing <i>[fill by interviewer]</i>	14

B.5. With reference to the skills demanded by your company *[Please answer each row]*

	Yes	No	Do not know
Has your qualification awarded by the national education and training system helped in finding your job?	1	2	3
Did your qualification and education level matter when you were recruited, or did the employer assess mere specific skills and competences?	1	2	3
Is your qualification currently helping you in performing your job?	1	2	3
Would you advise other people to achieve the same or similar qualification, to meet labour market demand?	1	2	3
Other <i>[please specify]</i> _____	1	2	3

C. Assessment of the continuing vocational training process of employees

C.1. Have you participated in continuing training in the last 12 months? *[If NO go to C.6]*

Yes	No
1	2

C.2. If YES, what were the topics of the training courses? *[Please insert training topics from the list]*

List occupations <i>[Job title]</i>	Specialised trainings	Soft skills trainings	Other

C.3. How does your company promote your professional development? *[Multiple answers are allowed]*

Company offers continuing training programmes	1
Cost-sharing of training expenses	2
In-company coaching and on the job learning	3
Flexible working-time arrangements to follow further education or training/finalise university studies	4
Allocates time to engage in online expert communities/experience exchange networks in the ICT sector	5
Other <i>[please specify]</i> _____	6

C.4. Has your company evaluated the impact of training on your efficiency in the fulfilment of assignments?

Yes	No	Rarely	Do not remember
1	2	3	4

C.5. Are you satisfied with the current level of continuing training opportunities?

Very satisfied	5
Somewhat satisfied	4
Neither satisfied nor dissatisfied	3
Somewhat dissatisfied	2
Very dissatisfied	1

C.6. If you were given the opportunity, what types of training would you like to participate in?
[Please answer each row]

Type of trainings	Yes	No
Professional (vocational) training	1	2
Foreign languages (professional language)	1	2
Professional ethics	1	2
Managerial skills	1	2
Team building and team work	1	2
Leadership skills	1	2
Communication skills	1	2
Client servicing skills	1	2
Problem solving	1	2
Motivation skills	1	2
Time management	1	2
Information technology use	1	2
Other <i>[please specify]</i>		
_____	1	2
_____	1	2

D. Education and business cooperation

D.1. Are skills needs and skills development discussed between the employees and company management?

Yes	1
No	2
Do not know	3

D.2. If YES, what does it cover? *[Multiple answers are allowed]*

It concerns only high skill levels	1
It concerns all skill levels	2
Other <i>[please specify]</i> _____	3

D.3. If NO, why not? *[Multiple answers are allowed]*

Employees do not see an interest in that	1
Employers do not see an interest in that	2
Other <i>[please specify]</i> _____	3

Topics for the focus group discussions

Introductory part

1. Introduction by focus group moderator – brief description of the purpose of the meeting and an explanation of the method by which the discussion will be conducted
2. Invite the participants to introduce themselves and the companies/organisations/institutions they are representing

Focus groups held in Novi Sad (the public and private sector in the Autonomous Province of Vojvodina, social partners, educational institutions and others)

1. How would you estimate the potentials of the ICT sector in the Autonomous Province of Vojvodina in terms of innovation-driven competitiveness and employment growth?
2. What are the most important skills and competences for the ICT sector/your company and how do you see the role of educational and/or training institutions in ensuring the supply of adequate skills?
3. Could you indicate if the existing qualifications of secondary and higher technical and vocational education are appropriate to the needs? What is missing?
4. Do you support the existing institutes of vocational practice / internships / scholarships? Is there any institutional obstacle for the implementation of this type of vocational in practice?
5. What are the main obstacles for the ICT sector/your company to finding and retaining employees with adequate skills and competences? What are your main suggestions for improvement?
6. In your opinion, to what extent do educational and/or training institutions establish formal communication channels with enterprises/clusters/chambers to obtain information on skills needs, at the local, provincial and national levels? What are your suggestions for improvement?
7. How would you estimate the present role of companies, employees and educational/training institutions in the process of ensuring continuing training? How can this improve?
8. Is the validation and certification of skills acquired in informal and non-formal contexts an important step in increasing the level of employees' competences? What role do you see for the employers/the VET schools and higher education institutions/the employment services/the Ministry of Education, Science and Technological Development in developing validation and certification?
9. How do young people become informed about the effective possibilities for finding a job and developing a career in the ICT sector in the Autonomous Province of Vojvodina/Serbia? Do they choose the sector based on available information?
10. Is there anything else you think is important for the topic but has not been previously mentioned?

Focus group held in Belgrade (Ministry of Education, Science and Technological Development, Ministry of Labour, educational institutions, employers' associations, ICT sector, and other social partners)

1. In your opinion what are currently the greatest challenges for the education system in Serbia? How should the challenges/unsolved problems be dealt with?
2. How do you see the role of educational and/or training institutions in ensuring the supply of adequate qualifications, especially regarding the ICT sector, which is the most dynamic sector in Serbia in relation to the global market?

3. Could you indicate if the existing qualifications of secondary and higher technical and vocational education are appropriate to the needs of the ICT sector? What is missing?
4. Regarding the previous topic, what is your opinion on how the educational and/or training institutions can help the sector in the most effective way?
5. According to your opinion, to what extent do educational and/or training institutions establish formal communication channels with enterprises/clusters/chambers/and other associations of employers to obtain information on skills needs, at the local, provincial and national levels? What are your suggestions for improvement?
6. Could you indicate if there are problems in establishing a mechanism for coordination among the main actors (mentioned in the previous topic) in terms of the process and its approaches that should lead to the improvement of qualifications? Is the approach to the process unique/should it be? What are the main obstacles and suggestions for improvement?
7. Is the validation and certification of skills acquired in informal and non-formal contexts an important step for increasing the level of competences of employees? What role do you see for the employers/the VET schools and higher education institutions/the employment services/the Ministry of Education, Science and Technological Development, in developing this validation and certification?
8. How do young people become informed about the effective possibilities of finding a job and developing a career in the ICT sector in Serbia? Do they choose the sector based on available information?
9. Is there anything else you may think is important for the topic but has not been previously mentioned?

Annex 2. Preliminary analysis

FIGURE A2.1 TOTAL SAMPLE SIZE CALCULATION

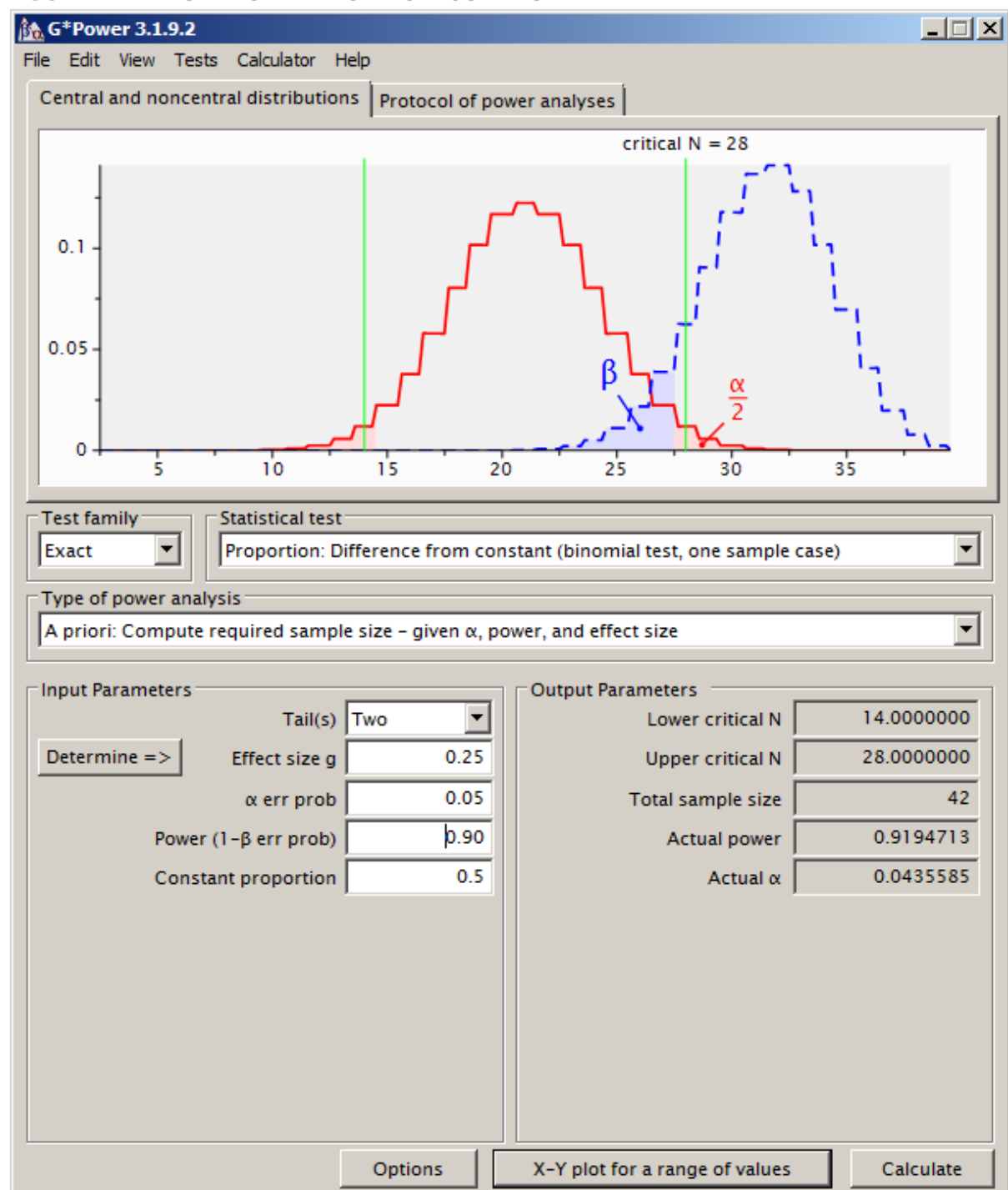
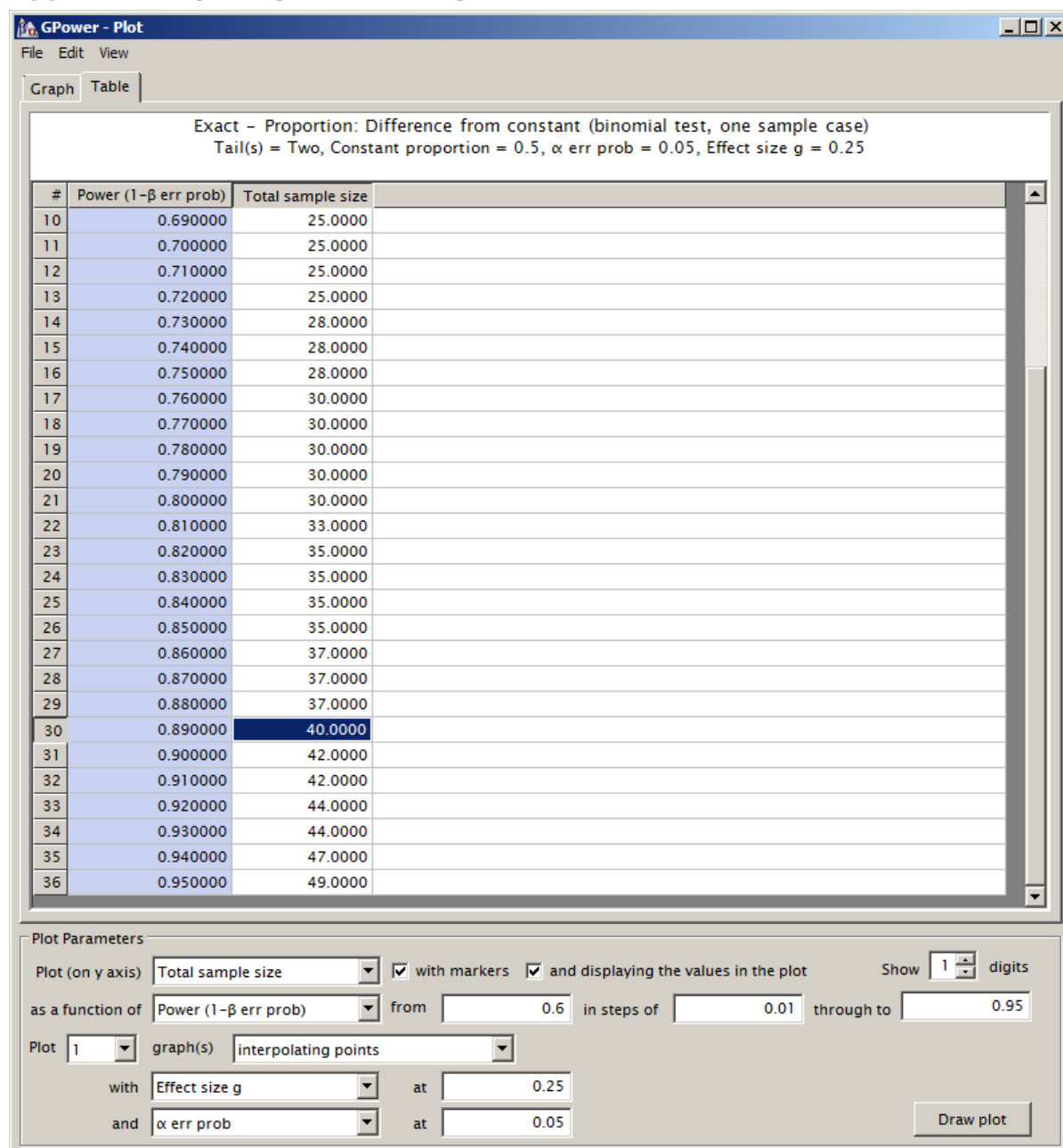


FIGURE A2.2 POWER OF AVAILABLE SAMPLE



Zone A2.1 Names of datasets for data from field research

- 01 Single Responses.sav
- 02 A10 Multiple Responses.sav
- 03 B3 Multiple Responses.sav
- 04 B9 Multiple Responses.sav
- 05 B10 Multiple Responses.sav
- 06 B11 Multiple Responses.sav
- 07 B17 Multiple Responses.sav
- 08 B18 Multiple Responses.sav
- 09 C7 Multiple Responses.sav
- 10 C10 Multiple Responses.sav
- 11 D2 D3 Multiple Responses.sav
- 12 B6 String Lists.sav
- 13 B7 String Lists.sav
- 14 B8 String Lists.sav
- 15 C2 String Lists.sav
- 16 C3 String Lists.sav
- 17 C11 String Lists.sav
- 18 ICT Experts A3 String Lists.sav
- 19 ICT Experts C2 String Lists.sav
- 20 Other Experts A3 String Lists.sav
- 21 Other Experts C2 String Lists.sav
- 22 ICT Experts Single Responses.sav
- 23 Other Experts Single Responses.sav
- 24 ICT Experts B1 Multiple Responses.sav
- 25 ICT Experts B4 Multiple Responses.sav
- 26 ICT Experts C3 Multiple Responses.sav
- 27 ICT Experts D2 Multiple Responses.sav
- 28 ICT Experts D3 Multiple Responses.sav
- 29 Other Experts B1 Multiple Responses.sav
- 30 Other Experts B4 Multiple Responses.sav
- 31 Other Experts C3 Multiple Responses.sav
- 32 Other Experts D2 Multiple Responses.sav

Zone A2.2 Codebook of first few questions from questionnaire

A6		
		Value
Standard attributes	Label	Organisational type
Valid values	1	Limited liability company
	2	Stock company
	3	Other
A7		
		Value
Standard attributes	Label	Ownership
Valid values	1	Private
	2	Public
	3	Other
A8		
		Value
Standard attributes	Label	Origin of capital
Valid values	1	Domestic
	2	Foreign
	3	Mixed
	4	Unknown
A10		
		Value
Standard attributes	Label	Business model
Valid values	1	Development of own product
	2	Outsourcing
	3	Other
A11		
		Value
Standard attributes	Label	Size by number of employees
Valid values	1	Micro
	2	Small
	3	Medium
	4	Large
A12a		
		Value
Standard attributes	Label	In last 12 months
Valid values	1	Increases
	2	No changes
	3	Decreases

A12b		
		Value
Standard attributes	Label	In next 12 months
Valid values	1	Increases
	2	No changes
	3	Decreases

Zone A2.3 Frequency tables for data cleaning

A8 Origin of capital					
		Frequency	Percent	Valid percent	Cumulative percent
Valid	1 Domestic	32	80.0	80.0	80.0
	2 Foreign	1	2.5	2.5	82.5
	3 Mixed	7	17.5	17.5	100.0
	Total	40	100.0	100.0	

A11 Size by number of employees					
		Frequency	Percent	Valid percent	Cumulative percent
Valid	1 Micro	14	35.0	35.0	35.0
	2 Small	15	37.5	37.5	72.5
	3 Medium	8	20.0	20.0	92.5
	4 Large	3	7.5	7.5	100.0
	Total	40	100.0	100.0	

A12a In last 12 months					
		Frequency	Percent	Valid percent	Cumulative percent
Valid	1 Increases	28	70.0	70.0	70.0
	2 No changes	11	27.5	27.5	97.5
	3 Decreases	1	2.5	2.5	100.0
	Total	40	100.0	100.0	

Annex 3. General information about the sample of ICT companies in Vojvodina

TABLE A3.1 GENERAL DATA ABOUT THE SAMPLE OF ENTERPRISES

Enterprise	%	
Organisational type		
Limited liability company	95.0	
Other	5.0	
Total	100.0	
Ownership		
Private	100.0	
Public	0.0	
Total	100.0	
Origin of capital		
Domestic	80.0	
Foreign	2.5	
Mixed	17.5	
Total	100.0	
Size		
Micro	35.0	
Small	37.5	
Medium	20.0	
Large	7.5	
Total	100.0	
Business model	No. of companies	% of the total
Development of own product	25	62.5
Outsourcing	22	55.0
Other	4	10.0
Total number of enterprises	40	

Annex 4. Data based on the sample of ICT companies and employees

TABLE A4.1 COMPANIES' ATTITUDES ABOUT THE DIFFICULTIES CAUSED BY INADEQUATE SUPPLY OF SKILLS (%)

Experiences	Yes	No	Total
Problems with ensuring adequate skills of employees	65.0	35.0	100.0
Difficulties in filling vacancies in the last 12 months	85.0	15.0	100.0

TABLE A4.2 CHANGES IN THE NUMBER OF EMPLOYEES IN THE LAST 12 MONTHS (%)

Changes	Managers	ICT specialists	Marketing specialists	Sales specialists	HR specialists	Administration	Others
Increased	27.5	67.5	22.5	25.0	20.0	17.5	17.5
Remained unchanged	25.0	17.5	12.5	7.5	12.5	27.5	20.0
Reduced	5.0	5.0	2.5	0.0	0.0	2.5	7.5
Do not know	0.0	2.5	0.0	0.0	0.0	0.0	0.0
No response	42.5	7.5	62.5	67.5	67.5	52.5	55.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE A4.3 EXPECTED CHANGES IN THE NUMBER OF EMPLOYEES IN THE NEXT 12 MONTHS (%)

Changes	Managers	ICT specialists	Marketing specialists	Sales specialists	HR specialists	Administration	Others
Increase	32.5	77.5	35.0	27.5	22.5	22.5	17.5
Remain unchanged	22.5	10.0	12.5	17.5	20.0	30.0	22.5
Reduce	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Do not know	0.0	10.0	0.0	0.0	0.0	0.0	0.0
No response	45.0	2.5	52.5	55.0	57.5	47.5	60.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE A4.4 DISTRIBUTION OF EMPLOYEES WHO LEFT THE COMPANY IN THE LAST 12 MONTHS, BY EDUCATIONAL ATTAINMENT (%)

Profile title	Level of education					Total
	Any level of education	VET secondary	General secondary	Post-secondary	Tertiary	
Account Manager	0.0	1.2	0.0	0.0	0.0	1.2
Administration	0.0	0.8	0.0	0.0	0.0	0.8
Agricultural Specialist	0.0	0.0	0.0	0.0	0.4	0.4
Chief Information Officer	0.0	0.0	0.0	0.4	0.0	0.4
Database Administrator	0.0	0.0	0.0	0.0	0.4	0.4
Developer	0.0	0.0	2.0	2.4	50.0	54.4
Digital Media Specialist	0.0	6.8	0.0	0.0	4.4	11.2
GIS Expert	0.0	0.0	0.0	0.0	0.4	0.4
Human Resource Manager	0.0	0.0	0.0	0.0	2.4	2.4
ICT Consultant	0.0	0.0	0.0	0.0	6.0	6.0
ICT Servicer	0.0	0.8	0.0	0.0	0.0	0.8
Manager	0.0	0.0	0.0	0.0	3.6	3.6
Marketing Specialist	0.0	0.0	0.0	0.4	0.4	0.8
Other	1.2	6.0	0.0	0.0	0.0	7.2
Project Manager	0.0	0.4	0.0	0.0	3.6	4.0
Sales Specialist	0.0	0.0	0.0	0.4	0.0	0.4
Support Specialist	0.0	0.0	0.0	0.4	0.0	0.4
Systems Administrator	0.0	0.0	0.0	0.0	2.4	2.4
Test Specialist	0.0	0.8	0.0	0.0	2.0	2.8
Total	1.2	16.8	2.0	4.0	76.0	100.0

TABLE A4.5 DISTRIBUTION OF EMPLOYEES WHO WERE HIRED IN THE LAST 12 MONTHS, BY EDUCATIONAL ATTAINMENT (%)

Profile title	Level of education				Total
	Any level of education	VET secondary	Post-secondary	Tertiary	
Account Manager	0.0	1.1	0.2	0.0	1.3
Administration	0.0	0.0	0.2	0.0	0.2
Agricultural Specialist	0.9	0.0	0.0	0.0	0.9
Database Administrator	0.4	0.0	0.0	0.0	0.4
Developer	4.3	0.2	6.8	42.3	53.6
Digital Media Specialist	0.0	0.0	0.4	8.5	9.0
Electrical Engineers	0.0	0.4	0.0	0.0	0.4
GIS Expert	1.1	0.0	0.0	0.0	1.1
Human Resource Manager	0.0	0.0	0.0	1.1	1.1
ICT Consultant	0.0	0.0	0.2	6.2	6.4
ICT Operations Manager	0.0	0.0	0.0	0.2	0.2
ICT Service Manager	0.0	0.0	0.0	0.2	0.2
Service Manager	0.0	0.0	0.0	0.4	0.4
Marketing Specialist	0.0	0.0	0.4	0.6	1.1
Network Specialist	0.0	0.0	0.0	0.4	0.4
Other	0.0	0.0	0.2	0.0	0.2
Project Manager	0.9	0.0	0.0	6.4	7.3
Sales Manager	0.0	0.0	0.0	0.4	0.4
Sales Specialist	0.0	0.0	0.0	0.6	0.6
Service Desk Agent	0.0	0.0	0.0	0.2	0.2
Support Specialist	0.4	0.2	0.2	0.0	0.9
Systems Administrator	0.2	0.0	0.0	5.6	5.8
Test Specialist	0.4	2.1	0.0	5.3	7.9
Total	8.5	4.1	8.8	78.6	100.0

**TABLE A4.6 DISTRIBUTION OF CURRENTLY MISSING PROFESSIONAL PROFILES,
BY EDUCATIONAL ATTAINMENT (%)**

Profile title	Level of education				Total
	VET secondary	General secondary	Post- secondary	Tertiary	
Architect Business Systems	0.0	0.0	0.0	1.0	1.0
Business Analyst	0.0	0.0	0.0	0.2	0.2
Business Information Manager	0.0	0.0	0.0	0.5	0.5
Developer	1.0	0.0	2.7	42.9	46.6
Digital Media Specialist	2.5	0.0	0.7	3.2	6.4
Enterprise Architect	0.0	0.0	0.2	0.0	0.2
GIS Expert	0.0	0.0	0.0	0.5	0.5
Human Resource Manager	0.0	0.0	0.0	0.7	0.7
ICT Consultant	0.0	0.0	0.0	4.4	4.4
ICT Service Manager	0.0	0.0	0.0	0.2	0.2
IOT (Internet of Things) Specialist	0.0	0.0	0.0	0.2	0.2
Manager	0.0	0.0	0.2	0.2	0.5
Marketing Specialist	0.7	0.0	0.0	1.2	2.0
Network Specialist	0.0	0.0	0.2	0.0	0.2
Office Administrator	0.0	0.0	0.0	0.2	0.2
Other	13.5	0.0	0.0	0.0	13.5
Project Manager	0.0	0.0	0.2	6.4	6.7
Quality Assurance Manager	0.0	0.0	0.2	0.0	0.2
Sales Manager	0.5	0.2	0.0	0.0	0.7
Sales Specialist	0.0	0.0	0.0	0.5	0.5
Support Specialist	0.0	0.0	0.2	0.0	0.2
System Architect	0.0	0.0	0.0	0.2	0.2
Systems Administrator	0.2	0.0	0.0	6.4	6.7
Systems Architect	0.0	0.0	0.0	0.2	0.2
Team Leader	0.0	0.0	0.0	0.2	0.2
Test Specialist	0.2	0.0	0.0	6.4	6.7
Total	18.7	0.2	4.9	76.1	100.0

TABLE A4.7 SKILL GAPS BY OCCUPATIONAL GROUP

Most important skills	Managers	ICT specialists	Marketing specialists	Sales specialists	HR specialists	Administration	Other	Total
	in % out of the total of 40 companies							
Professional skills according to the job description	10.0	45.0	5.0	15.0	10.0	10.0	2.5	40
Knowledge of foreign languages	5.0	17.5	10.0	7.5	2.5	2.5	2.5	40
Possession of professional ethics	2.5	15.0	2.5	2.5	5.0	5.0	2.5	40
Skills to organise and manage team	15.0	17.5	0.0	0.0	5.0	2.5	0.0	40
Communication skills	7.5	40.0	5.0	7.5	7.5	2.5	5.0	40
Ability to work with clients	7.5	25.0	2.5	10.0	2.5	0.0	2.5	40
Ability to identify and solve problems	5.0	12.5	2.5	2.5	2.5	5.0	2.5	40
Ability to work with team spirit	5.0	15.0	2.5	7.5	5.0	2.5	2.5	40
Ability to control stress and emotional instability	17.5	25.0	7.5	2.5	2.5	5.0	5.0	40
Passion for new knowledge	5.0	17.5	2.5	7.5	2.5	5.0	2.5	40
Ambition to learn and excel	10.0	25.0	5.0	0.0	5.0	2.5	2.5	40
Translating clients' needs into action plans	7.5	7.5	0.0	0.0	0.0	0.0	0.0	40
Other specific technical skills	0.0	2.5	0.0	0.0	0.0	0.0	0.0	40
There is no lack of skills	7.5	5.0	10.0	2.5	5.0	10.0	17.5	40

TABLE A4.8 REASONS CAUSING THE LACK OF SKILLS, BY OCCUPATIONAL GROUP

Reasons	Managers	ICT specialists	Marketing specialists	Sales specialists	HR specialists	Administration	Other	Total
	in % out of the total of 40 companies							
High fluctuation of employees	2.5	17.5	2.5	2.5	0.0	0.0	0.0	40
Market requirements	20.0	20.0	5.0	10.0	2.5	0.0	0.0	40
Competition pressure	2.5	2.5	0.0	0.0	2.5	0.0	0.0	40
Lack of newly employed	7.5	17.5	0.0	0.0	0.0	0.0	2.5	40
Technological change	7.5	25.0	2.5	5.0	0.0	2.5	0.0	40
Changes in professional requirements	12.5	20.0	10.0	7.5	5.0	5.0	2.5	40
No possibility to organise in-company trainings	5.0	5.0	5.0	2.5	2.5	5.0	0.0	40
No financial resources for out-of-job trainings	0.0	5.0	0.0	0.0	0.0	0.0	0.0	40
Lack of quality of training providers	10.0	15.0	0.0	2.5	5.0	0.0	0.0	40
Lack of skilled teachers / trainers	0.0	0.0	0.0	0.0	2.5	0.0	0.0	40
Lack of time due to project deadlines	12.5	30.0	7.5	5.0	2.5	5.0	2.5	40
Other causes	10.0	10.0	0.0	0.0	2.5	5.0	0.0	40
There are no problems	7.5	5.0	10.0	5.0	12.5	15.0	20.0	40

TABLE A4.9 EMPLOYEES WHO PARTICIPATED IN ADDITIONAL TRAINING PROGRAMMES AFTER GRADUATION, BY TRAINING TOPIC (% OF THE TOTAL NUMBER OF EMPLOYEES)

Training topics	ICT professionals	Other employees
Accounting course	0.0	15.8
Communication skills	3.0	0.0
Databases	3.0	0.0
Language course (preferably English)	18.2	21.1
Marketing	0.0	5.3
Microsoft technologies and certification	15.1	0.0
Negotiation	0.0	15.8
Online courses	3.0	10.6
Personal networking	0.0	5.3
Process design	0.0	5.3
Programming languages	15.2	5.3
Project management	0.0	15.8
Sales course	0.0	15.8
Scrum	6.1	0.0
Spotlight	3.0	0.0
Team management	0.0	10.5
Time management	0.0	21.1
Training in Excel	0.0	5.3
Web conference	3.0	0.0
Web design	3.0	0.0
Other	3.0	21.1

TABLE A4.10 MATCHING THE QUALIFICATIONS OF EMPLOYEES TO A JOB (%)

Qualification	ICT professionals					Other employees				
	Yes	No	Do not know	No response	Total	Yes	No	Do not know	No response	Total
Has your qualification awarded by the national education and training system helped in finding your job?	72.7	24.2	3.1	0.0	100.0	47.4	47.4	0.0	5.2	100.0
Did your qualification and education level matter when you were recruited, or did the employer assess mere specific skills and competences?	84.8	9.1	6.1	0.0	100.0	78.9	10.5	5.3	5.3	100.0
Is your qualification currently helping you in performing your job?	81.8	18.2	0.0	0.0	100.0	73.7	21.1	0.0	5.2	100.0
Would you advise other people to achieve the same or similar qualifications, to meet labour market demand?	81.8	12.1	6.1	0.0	100.0	47.4	21.1	21.1	10.4	100.0
Other	6.1	0.0	0.0	93.9	100.0	10.5	5.3	0.0	84.2	100.0

TABLE A4.11 SPECIALISED TRAINING FOR EMPLOYEES, BY PROFESSIONAL PROFILE (%)

Specialised training	ICT professionals							Other employees		
	Developer	Digital Media Specialist	IT Support	Project Manager	Systems Administrator	Test Specialist	Total	Administration	HR Manager	Total
Databases	7.7	0.0	3.8	0.0	0.0	3.8	15.4	0.0	0.0	0.0
Frameworks	0.0	3.8	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0
Microsoft technologies and certificates	3.8	0.0	0.0	0.0	7.6	0.0	11.4	0.0	0.0	0.0
Patterns	3.8	0.0	0.0	3.8	0.0	0.0	7.7	0.0	0.0	0.0
PHP web development	3.8	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0
Programming languages	11.5	3.8	3.8	3.8	0.0	3.8	26.9	0.0	0.0	0.0
Scrum	11.5	0.0	0.0	3.8	0.0	0.0	15.4	0.0	0.0	0.0
Seminar in business and tax consulting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	50.0
Specialised IBM programme	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0
SW testing	3.8	0.0	0.0	0.0	0.0	3.8	7.7	0.0	0.0	0.0
Other	3.8	0.0	0.0	0.0	3.8	0.0	7.7	0.0	0.0	0.0
Total	50.0	7.7	7.7	11.5	11.5	11.5	100.0	50.0	50.0	100.0

TABLE A4.12 SOFT SKILLS TRAININGS FOR EMPLOYEES, BY PROFESSIONAL PROFILE (%)

Soft skills trainings	ICT professionals			Other employees							
	Developer	Project Manager	Total	Economic Technician	Human Resource Manager	Manager	Marketing Specialist	Office Administrator	Office Assistant	Sales Manager	Total
Account management	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	10.0
Communication skills	20.0	0.0	20.0	10.0	0.0	10.0	10.0	0.0	0.0	10.0	40.0
Contact management	0.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Language course	10.0	0.0	10.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	10.0
Negotiation	0.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Project management	0.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reengineering and process management	0.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sales	0.0	10.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	10.0	20.0
Strategic planning	0.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Team management	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	10.0
Time management	0.0	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	10.0
Total	30.0	70.0	100	20.0	20.0	10.0	10.0	10.0	10.0	20.0	100

TABLE A4.13 OTHER TRAINING FOR EMPLOYEES, BY PROFESSIONAL PROFILE (%)

Other training	ICT professionals			Other employees				
	Database Administrator	Digital Media Specialist	Total	Human Resource Specialist	Manager	Marketing Specialist	Office Administrator	Total
In-company training	0.0	50.0	50.0	0.0	0.0	20.0	0.0	20.0
ISO standards	0.0	0.0	0.0	20.0	0.0	0.0	0.0	20.0
Successful business secretary course	0.0	0.0	0.0	0.0	0.0	0.0	20.0	20.0
Other	50.0	0.0	50.0	0.0	40.0	0.0	0.0	40.0
Total	50.0	50.0	100.0	20.0	40.0	20.0	20.0	100.0

**TABLE A4.14 PRACTICE OF CONTINUING TRAINING AND DEVELOPMENT OF EMPLOYEES
IN THE COMPANIES**

Continuing training and development of employees	%
Yes	95.0
No	2.5
Do not know	2.5
Total	100.0

TABLE A4.15 PROFESSIONALS TRAINED AT THE COMPANY IN THE LAST 12 MONTHS

Profile title	%
Account Manager	2.0
Administration	0.1
Call Agents	5.7
Database Administrator	0.5
Developer	59.2
Digital Media Specialist	16.0
Human Resource Manager	0.3
Human Resource Specialist	0.1
ICT Consultant	5.4
ICT Servicer	0.5
Manager	5.7
Marketing Specialist	0.9
Network Specialist	0.3
Other	0.1
Project Manager	0.5
Sales Manager	0.1
Sales Specialist	0.8
Support Agent	0.6
Systems Administrator	0.2
Team Leader	0.5
Test Specialist	0.5
Total	100.0

TABLE A4.16 SPECIALISED TRAININGS BY PROFESSIONAL PROFILE (%)

Profile title	Specialised training										Total
	Computer networks	Databases	Frameworks	Other	Programming languages	SAP software	Scrum	Software solutions	SW Testing	Technologies	
Database Administrator	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Developer	0.2	0.9	6.2	3.6	26.7	0.0	19.4	0.0	1.4	0.5	58.9
Digital Media Specialist	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.7
Enterprise Architect	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
ICT Consultant	0.0	0.0	0.5	0.0	6.2	0.5	1.9	1.2	0.0	0.0	10.3
Manager	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4
Marketing Specialist	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Network Specialist	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Project Manager	0.0	0.0	0.0	0.1	0.0	0.0	9.5	0.0	0.0	0.0	9.6
Systems Administrator	0.0	0.0	0.0	0.0	0.0	0.0	9.3	0.0	0.0	0.1	9.5
Test Specialist	0.0	0.0	0.0	0.0	0.4	0.0	9.3	0.0	0.0	0.0	9.7
Total	0.6	1.1	6.8	3.9	34.0	0.5	49.8	1.2	1.4	0.6	100.0

TABLE A4.17 SOFT SKILLS TRAINING BY PROFESSIONAL PROFILE (%)

Profile title	Soft skills training																Total
	Account management	Business development	Communication skills	Contact management	Customer relationship	Foreign languages	Lead generating	Marketing	Negotiation	Personal networking	Project management	Sales	Strategic planning	Team management	Time management	Other	
Account Manager	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	4.3
Administration	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
Call agents	15.4	0.0	0.0	0.0	0.0	0.0	0.0	15.4	0.0	0.0	0.0	15.4	0.0	0.0	0.0	0.0	46.2
Database Administrator	0.3	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Developer	0.0	0.0	4.3	0.6	0.0	0.3	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	5.8
Digital Media Specialist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Enterprise Architect	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Human Resource Specialist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.6
ICT Consultant	0.3	0.0	4.9	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	5.8
ICT Service Manager	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Manager	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
Marketing Specialist	0.3	0.3	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.5
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3
Project Manager	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	5.5	5.5	0.0	5.5	0.0	0.0	22.2
Sales Manager	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Sales Specialist	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	1.2	1.2	0.0	6.5
Support Agent	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Team Leader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	1.2
Test Specialist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Total	18.5	0.3	12.0	0.6	0.3	1.8	0.3	16.0	6.8	0.6	6.5	27.7	0.3	6.8	1.2	0.3	100.0

TABLE A4.18 OTHER TRAINING BY PROFESSIONAL PROFILE (%)

Profile title	Other training						Total
	ISO standards	Mentoring system	Online training	Presentations of modern technologies and methodologies	Seminar on e-commerce	Other	
Developer	26.4	5.6	4.2	1.4	0.0	0.0	37.5
Digital Media Specialist	0.0	0.0	0.0	0.0	0.0	34.7	34.7
Manager	26.4	0.0	0.0	0.0	0.0	0.0	26.4
Marketing Specialist	0.0	0.0	0.0	0.0	1.4	0.0	1.4
Total	52.8	5.6	4.2	1.4	1.4	34.7	100.0

TABLE A4.19 TRAINING PROVIDERS

Providers	% out of the total of 40 companies
Own company	75.0
ICT Cluster Academy	20.0
State educational or training institutions	7.5
Private educational or training institutions	42.5
The manufacturer of equipment	12.5
Other	15.0

TABLE A4.20 ICT COMPANIES' COOPERATION WITH SECONDARY SCHOOLS AND UNIVERSITIES (%)

Educational institution	Yes	No	Total
Secondary schools	25.0	75.0	100.0
Universities/faculties	65.0	35.0	100.0

ACRONYMS

ETF	European Training Foundation
EU	European Union
HR	Human resources
ICT	Information and communication technology
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne (Statistical classification of economic activities in the European Community)
NES	National Employment Service
NQF	National Qualifications Framework
USD	US dollar
VET	Vocational education and training

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