

**FACULTY OF MASS MEDIA COMMUNICATION**  
University of Ss. Cyril and Methodius in Trnava,

# **MEGATRENDS AND MEDIA**

# **ON THE EDGE**

**Zuzana Kvetanová  
Martin Solík**  
(eds.)

**FMK**  
Fakulta masmediálnej komunikácie  
Faculty of Mass Media Communication

Faculty of Mass Media Communication  
University of Ss. Cyril and Methodius in Trnava

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Conference Proceedings  
from the International Scientific Conference  
held online on 22<sup>nd</sup> April 2020,  
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## MEGATRENDS AND MEDIA

### On the Edge

*International Scientific Conference, 22<sup>nd</sup> April 2020*

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*Megatrends and Media* is an international scientific event organised by the Faculty of Mass Media Communication at the University of Ss. Cyril and Methodius in Trnava (FMK UCM). The conference is supported and attended by media theorists, media scholars, social scientists, media and marketing researchers, as well as media professionals from Slovakia and many other countries. Regardless of the conference's main topic that changes on yearly basis, its goal always remains the same – to present, critically discuss and disseminate current theoretical knowledge and practical experience related to media and the latest development trends in media production and consumption.

The 15<sup>th</sup> annual international conference *Megatrends and Media* (the conference's main title has been used since 2011, the event had previously been called *On Problems of Media Communication*, later *Mass Media Communication and Reality*, and then *Media, Society, Media Fiction*), took place on 22<sup>nd</sup> April 2020 and was held online due to coronavirus concerns. The main discussion session is available via <https://fmk.sk/mm20/> and also at FMK UCM's *Facebook* page: <https://sk-sk.facebook.com/FMK.UCM/>

The discussion sessions were divided into four sections as follows:

- Section 1: *Merging Reality and Fiction*
- Section 2: *Media Education, Policy and Ethics*
- Section 3: *Digital Platforms and Marketing*
- Section 4: *Media Culture, Art and Creativity*

The conference's Scientific Board and Organising and Programme Committee were proud to welcome many regular and just as many new participants, as well as esteemed foreign guests from Croatia, the Czech Republic, the Netherlands, Pakistan, Poland, Serbia and Ukraine.

**Conference website:**

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## EDUCATION AS A PREREQUISITE FOR BUSINESS DEVELOPMENT IN THE ICT SECTOR

*Ivana Bestvina Bukvić – Ivana Đurđević Babić – Maja Haršanji*

### ABSTRACT:

As development of the Information and communication technologies (ICT) influences the competitiveness of all business sectors and overall economic growth, the authors conducted a research on factors influencing the ICT sector's development. In identifying business development factors the surveyed ICT professionals emphasized the role of state activities in ensuring favorable and encouraging business environment and quality high education. The quality education is of high importance as inability to reduce shortages of skilled ICT professionals can negatively affect innovation, profitability and earnings of ICT companies. Following these findings, the research of the existing skill gaps and the relevance of the education for the ICT sector growth was conducted. The aim of the research was to evaluate success of the current education model in following ICT sector needs. In analysing the results of the survey conducted on 120 ICT professionals it was found that they believe that the education is most important activity by which the state and its institutions can influence the development of the ICT sector where most of them consider that the state should intensify education of ICT key personnel in order to stimulate the sectors growth. As well, this research revealed most important specific fields that should be taught in more extent and with involvement and coordination with the ICT professionals.

### KEY WORDS:

business environment, education, industry needs, information and communication (ICT) sector, skill gaps

## 1 Introduction

Commonly known characteristics of Information and communication (ICT) sector are rapid changes that affect the development of all other industries and the global economy.<sup>1,2,3,4</sup> By infiltrating in all business spheres the ICT gradually started to transform the industrial economy into a knowledge based economy<sup>5</sup> influencing the labor efficiency and businesses profitability. It is obvious that the advantage of the benefits provided by this development flywheel have to be used to ensure the dynamics of future economic development. In this sense, it is necessary to identify development prerequisites and needs of the ICT sector and provide a favorable and supportive business environment that will enable its further growth. Previous authors' research observed the ICT sector's growth perspectives and identified the economic key factors that are influencing its development. It was concluded that the strategic long-term perspective approach to the development of the national ICT sectors is essential. In identifying the obstacles for the Croatian ICT sector development, the inadequate number of

<sup>1</sup> CIOACĂ, S. I. et al.: Assessing the Impact of ICT Sector on Sustainable Development in the European Union: An Empirical Analysis Using Panel Data. In *Sustainability*, 2020, Vol. 12, No. 592, p. 2-15.

<sup>2</sup> DRACA, M. et al.: *The Evolving Role of ICT in the Economy: A Report by LSE Consulting for Huawei*. London : London School of Economics and Political Science, 2018, p. 4-7. [online]. [2020-05-01]. Available at: <<http://www.lse.ac.uk/business-and-consultancy/consulting/assets/documents/the-evolving-role-of-ict-in-the-economy.pdf>>.

<sup>3</sup> ROSARIO, C. et al.: The Impact of Information and Communication Technologies on Countries Economic Growth. In DA SILVA, A. L., TOMIC, D., GRILEC, A. (eds.): *Sustainability from an Economic and Social Perspective*. Varaždin : Varaždin Development and Entrepreneurship Agency, 2019, p. 414-420.

<sup>4</sup> YIE, M. S., NAM, S. J.: The Impact of ICT Sector on Economic Output and Growth. In *Informatization Policy*, 2019, Vol. 26, No. 2, p. 25-44.

<sup>5</sup> HOVE, D.: *A fit-gap analysis of the National Certificate (Vocational)—Information Technology and Computer Science curriculum against the needs of the South African ICT industry*. [Master's thesis]. Stellenbosch : Stellenbosch University, 2019, p. 98. [online]. [2020-04-26]. Available at: <[http://scholar.sun.ac.za/bitstream/handle/10019.1/105914/hove\\_national\\_2019.pdf?sequence=1&isAllowed=y](http://scholar.sun.ac.za/bitstream/handle/10019.1/105914/hove_national_2019.pdf?sequence=1&isAllowed=y)>

high-skilled employees was emphasized.<sup>6</sup> It is clear that one of the areas where continuous improvements need to be implemented is the labor market and the education of skilled work force. The public education system is the first in a line of those responsible for the development and qualification of young ICT professionals as “the current technological revolution widens the gap between education and work; as the introduction of new technologies, changes the nature of knowledge and skills required by companies.”<sup>7</sup> “This situation poses important challenges for university managers and academics as there is an urgent need to find a way that allows a better alignment between universities and business.”<sup>8</sup> However, Llorens Garcia and associates have shown that the Universities are not taking into consideration the needs of the dynamic and changing industry where the profile of the young ICT professionals after graduation, in terms of soft skills, stayed the same during the last decade. The authors argue that if Universities do not succeed to recognize the businesses needs the ICT sector could lose its competitive edge. The aim of this research was to contribute to the ongoing discussion and to identify possibilities for improvements of the education model in the ICT related study programs thus indirectly influencing better business perspectives of the ICT sector. Following, after the recent literature review the authors have set up following research questions: Is the education model following the ICT industry expectations?; Which knowledge and skills should Universities teach at a greater extent in the future?; What state activities are the ICT professionals considering as most important for the development of the ICT sector? The authors conducted a review of the recent literature and a survey on the sample of 124 ICT experts (of which 120 valid questionnaires were included in the further analysis) whose results are presented as follows. The next chapter gives a review of previous empirical studies on the existing skill gaps in the ICT industry and the relevance of the quality educational model for the ICT development. Following literature review, the research methodology and the results of the empirical study were presented. The last chapters are giving discussion on research findings, conclusion and recommendations for policy-makers, limitations of this research and recommendations for the future research.

## 2 Literature Review

Development of the information and communication technologies (ICT) is setting the newest challenges towards Universities, their teachers and students and state institutions.<sup>9</sup> They are challenged to change the ways of teaching and learning, to adopt their study programs to the latest digital trends regardless of the primary fields of study. Per example “many university or college business programs offer majors or concentrations of small business management, but few of them offer a course of information technology (IT) for small business, despite the fact

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<sup>6</sup> BESTVINA BUKVIĆ, I.: Impact of Business Environment on the Development of Regional ICT Sector: Case Eastern Croatia. In TONKOVIĆ, M., CRNKOVIĆ, B. (eds.): *7th International Scientific Symposium Economy of Eastern Croatia – Vision and Growth*. Osijek : Faculty of Economics in Osijek, 2018, p. 11-20. [online]. [2020-04-15]. Available at: <<https://www.dropbox.com/s/9mqur gla6jl8kq/GIH%202018.pdf?dl=0>>.

<sup>7</sup> HOVE, D.: *A fit-gap analysis of the National Certificate (Vocational)—Information Technology and Computer Science curriculum against the needs of the South African ICT industry*. [Master’s thesis]. Stellenbosch : Stellenbosch University, 2019, p. 98. [online]. [2020-04-26]. Available at: <[http://scholar.sun.ac.za/bitstream/handle/10019.1/105914/hove\\_national\\_2019.pdf?sequence=1&isAllowed=y](http://scholar.sun.ac.za/bitstream/handle/10019.1/105914/hove_national_2019.pdf?sequence=1&isAllowed=y)>

<sup>8</sup> LLORENS GARCIA, A. et al.: ICT skills gap in Spain: Before and after a decade of harmonizing the European Higher Education Area. In *Computer Applications in Engineering Education*, 2019, Vol. 27. No. 4, p. 934.

<sup>9</sup> DAS, K.: The Role and Impact of ICT in Improving the Quality of Education: An Overview. In *International Journal of Innovative Studies in Sociology and Humanities*, 1990, Vol. 4, No. 6, p. 98-102.

that ICT plays an important role in the management of innovative small businesses.<sup>10</sup> Consequently, integration of ICT is setting open issues in front of Universities some of those are: lack of awareness, knowledge and positive attitude of authorities, staff and policy-makers, lack of availability of adequate ICT infrastructure high operational costs and high level of obsolescence rate of ICT infrastructure and knowledge.<sup>11</sup> Furthermore it is important to harmonize state instruments and measures and to analyse the achieved results with the aim of continuous adjustments of the existing state policies, development measures and activities.<sup>12</sup> There are numerous researches analysing the existence of the skill gaps and shortages between the ICT industry (employers) expectations and the University study programs, i.e. the skills that are actually being acquired by students. At the same time, new technologies are developing the demand for new skills that are not being taught on the University, which, during time, further increases the insufficiency of qualified workforce<sup>13</sup> while the outdated programs are losing their attractiveness. Per example, the rare “strong evidences to show that the market for traditional programming languages is on its way to extinction.”<sup>14</sup> As the result, some of the young professionals after graduation face obstacles and need to upgrade their knowledge as of the misalignment of the knowledge and skills acquired on their Universities with the industry needs.<sup>15</sup> Additionally, Loyalka and associates state that the quality of the study programs and the skill gained in computer study programs considerably differ across countries. They analysed comparable study program results in China, India, Russia, and the United States and found that there were potentially higher skill gains in the United States that could be the result of the “higher quality teaching or stronger linkages between college performance and employment outcomes”<sup>16</sup> This finding is significant as it shows the comparison of the computer science skills among students coming from “four major economic and political powers that produce approximately half of the science, technology, engineering, and mathematics graduates in the world.”<sup>17</sup>

Additionally, it has to be emphasized that the ICT businesses are preferring industry certifications over academic certificates. The reasons for that are: “Firstly, industry certifications are developed by industry itself. Therefore, the certifications are considered relative and in line with industry requirements. Secondly, industry certifications are current; that is, most industry certifications expire after a period of three years, with others having an

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<sup>10</sup> WANG, S., WANG, H.: Design and Delivery of a New Course of Information Technology for Small Business. In *Journal of Information Systems Education*, 2015, Vol. 26, No. 1, p. 37.

<sup>11</sup> MIR, S. A.: ICT Integrated Higher Education: Prospects and Challenges. In *International Journal of Research in Economics and Social Sciences (IJRESS)*, 2019, Vol. 8, No. 2, p. 3.

<sup>12</sup> BESTVINA BUKVIĆ, I., ĐURĐEVIĆ BABIĆ, I.: Catching the ICT Development Trends: What are the Odds?. In BUČKOVÁ, Z., RUSŇÁKOVÁ, L., SOLÍK, M. (eds.): *Megatrends And Media – Digital Universe*. Trnava : FMK UCM in Trnava, 2019, p. 35-53.

<sup>13</sup> BRUNELLO, G., WRUUCK, P.: Skill Shortages and Skill Mismatch in Europe: A Review of the Literature. In *IZA – Journal of Labor Economics*, 2019, Vol. 8, No. 12346, p. 26.

<sup>14</sup> KOONG, K. S. et al.: A Study of the Demand for Information Technology Professionals in Selected Internet Job Portals. In *Journal of Information Systems Education*, 2020, Vol. 1, No. 1, p. 24. [online]. [2020-4-20]. Available at: <<https://aisel.aisnet.org/jise/vol13/iss1/4>>.

<sup>15</sup> AKDUR, D.: The Design of a Survey on Bridging the Gap between Software Industry Expectations and Academia. In JOZWIAK, L., STOJANOVIC, R. (eds.): *8th Mediterranean Conference on Embedded Computing (MECO)*, Budva : MECOnet Institute (Mediterranean Excellence in Computing and Ontology), 2019, p. 1. [online]. [2020-4-20]. Available at: <[https://www.researchgate.net/publication/333635133\\_The\\_Design\\_of\\_a\\_Survey\\_on\\_Bridging\\_the\\_Gap\\_between\\_Software\\_Industry\\_Expectations\\_and\\_Academia](https://www.researchgate.net/publication/333635133_The_Design_of_a_Survey_on_Bridging_the_Gap_between_Software_Industry_Expectations_and_Academia)>.

<sup>16</sup> LOYALKA, P. et al.: Computer science skills across China, India, Russia, and the United States. In *Proceedings of the National Academy of Sciences*, 2019, Vol. 116, No. 14, p. 6735.

<sup>17</sup> Ibidem, p. 6732.



expiration period as low as twelve months.,<sup>18</sup> This is forcing the ICT professionals to stay in line with the new technologies, tools, practices and concepts. For previous reasons the ICT integrated programs are usually not sufficiently widespread and are having a limited number of students. Except relative rapid obsolescence of knowledge acquired within ICT study programs there is an issue of existing differences among understanding of Universities and industry with respect to the importance of certain skill categories. In analysing this question, Aasheim and associates encountered on significant differences and mismatch in expectations and what is actually being taught between Universities and the industry. Although the ICT sector is placing more importance on “hardware concepts, operating systems, leadership skills, entrepreneurial/risk taker traits, high overall college grade point average, packaged software skills, and work experience“ on a broader level “both groups ranked the importance of these categories in the following decreasing order: interpersonal skills, personal skills, technical skills, organizational skills, experience, grade point average.“<sup>19</sup> In identifying underrepresented areas in ICT study programs on Moscow universities Platov and associates found that those are “programming, working with open software, the principles of ICT functioning.”<sup>20</sup> The survey was conducted in 2019 on 250 students of which 83% had work experience. The most important ways that the students were using to acquire digital skills were combination of university study programs (85%), self-learning (53%) and work experience (51%). They emphasized that the programming (41%), work with software on independent platform (37%) and principles of ICT (33%) were not sufficiently represented on study programs.<sup>21</sup> Of course, it has to be taken into consideration that different positions in ICT sector require different set of skills and certifications, but at this point of time, the sector is still highly volatile and not developed to the extent that the specific skills could be observed separately within the sector.<sup>22</sup>

Additional problem is relative unattractiveness of the ICT related study programs as Kaarakainen found that less than 5% of future Finnish students are planning to study or work within the ICT sector.<sup>23</sup> This is interesting information as the young are using ICT technology and keeping track with technology and digital innovations on a daily basis but it seems that they are not equally interested to work in the industry itself. For previous reasons the ICT integrated programs are usually not widespread and are having a limited number of students. Although questions risen are more complex that could seam at a first look, the authors wanted to investigate the importance of Universities in providing the skilled future employees where attitudes of the ICT professionals on education as activity by which the state and its institutions should influence the development of the ICT sector and the knowledge and skills that should be thought at a greater extent in the future, were risen. Based on these research questions, the following research statements were formed:

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<sup>18</sup> HOVE, D.: *A fit-gap analysis of the National Certificate (Vocational)—Information Technology and Computer Science curriculum against the needs of the South African ICT industry.* [Master’s thesis]. Stellenbosch : Stellenbosch University, 2019, p. 99. [online]. [2020-04-26]. Available at: <[http://scholar.sun.ac.za/bitstream/handle/10019.1/105914/hove\\_national\\_2019.pdf?sequence=1&isAllowed=y](http://scholar.sun.ac.za/bitstream/handle/10019.1/105914/hove_national_2019.pdf?sequence=1&isAllowed=y)>

<sup>19</sup> AASHEIM, C. A. et al.: Knowledge and Skill Requirements for Entry-Level Information Technology Workers: A Comparison of Industry and Academia. In *Journal of Information Systems Education*, 2009, Vol. 20, No. 3, p. 354.

<sup>20</sup> PLATOV, A. V. et al.: Gaps in educational programs in the context of global digitalization. In *Advances in Economics, Business and Management Research*, 2019, Vol. 105, No. 1, p. 728.

<sup>21</sup> Ibidem, p. 730.

<sup>22</sup> DESPLACES, D. E. et al.: What Information Technology Asks Of Business Higher Education Institutions: The Case of Rhode Island. In *Journal of Information Systems Education*, 2020, Vol. 14, No. 2, p. 195.

<sup>23</sup> KAARAKAINEN, M. T.: ICT Intentions and Digital Abilities of Future Labor Market Entrants in Finland. In *Nordic journal of working life studies*, 2019, Vol. 9, No. 2. p. 120.

- H1: The ICT experts which believe that the most important activity by which the state and its institutions can influence the development of the ICT sector is education will more probably consider that that the government should intensify education of key personnel in order to stimulate the growth of the ICT sector.
- H2: Most ICT professionals believe that the Universities should teach Development in a greater extent.

### 3 Methodology and the Results of the Research

The research was conducted in 2019 and on 124 ICT experts from which 120 valid questionnaires were included in the further analysis. The ICT experts participated in this research are mainly from Croatia (91.07 %) working in companies with different dominant ICT activities. Their answers on questions regarding their firms' dominant activity (V1), place of firms' registration (V2), approximate total revenue for the previous year (V3), firms' size (V4), number of firms' employees (V5), participants role in firm (V6), whether or not they believe that currently the most important activity by which the state and its institutions can influence the development of the ICT sector is education (V7) as well as do they think or not that the government should intensify education of key personnel in order to stimulate the growth of the ICT sector (V8) and do they think that Universities should teach at a greater extent in the future: Business apps and processes within digital workplace (V9), Development (V10), Design (V11), Gaming (V12), Cloud Development (V13), Project management (V14), Planning Basics (v15), Time management (V16), PR and social networks (V17) or some other knowledge and skills (V18) as well as their opinion whether or not a stimulating business environment should have openness of educational and scientific institutions to changes in study programs to achieve ICT sector development. (V17), were analysed for this research. More than one third of participants (36.61%) expressed that *J62.0.1 - Computer programming activities* is the dominant activity of their company and 43.75% of participants stated that their company was registered in capital city, Zagreb. Also, more than a third of participants (34.82%) claimed that their company approximately had total revenues more than 2.700.000 EUR in 2018 year. In addition, more than a third participants (36.61%) revealed that their company is a medium size company and little less than a third claimed that their company has more than 150 employees. The largest number of participant (43.75%) stated that their role in the company is team member.

62.5% of participants believe that education is currently the most important activity by which the state and its institutions can influence the development of the ICT sector. The greatest number of participants (66.96%) thinks that the government should intensify education of key personnel in order to stimulate the growth of the ICT sector. When it comes to their opinion regarding which knowledge and skills should Universities teach at a greater extent in the future, more than a half of them (54.46%) consider that it should be the *Business apps and processes within digital workplace*, majority of them (78.57%) believes that it should be the *Development*, more than a half (59.82%) that it should not be the *Design*, majority (74.11%) that it should not be the *Gaming*, more than a half (58.93%) that it should not be the *Cloud*, 54.46% of participants that it should be the *Project management*, more than a half (53.57%) that it should not be the *Planning Basics* or the *Time management* (57.14%), majority of participants indicated that it also should not be the *PR and social networks* or some other areas (99.11%). Furthermore, more than a half of participants (54.46%) consider that a stimulating business environment should have openness of educational and scientific institutions to changes in study programs to achieve ICT sector development. The Chi-square

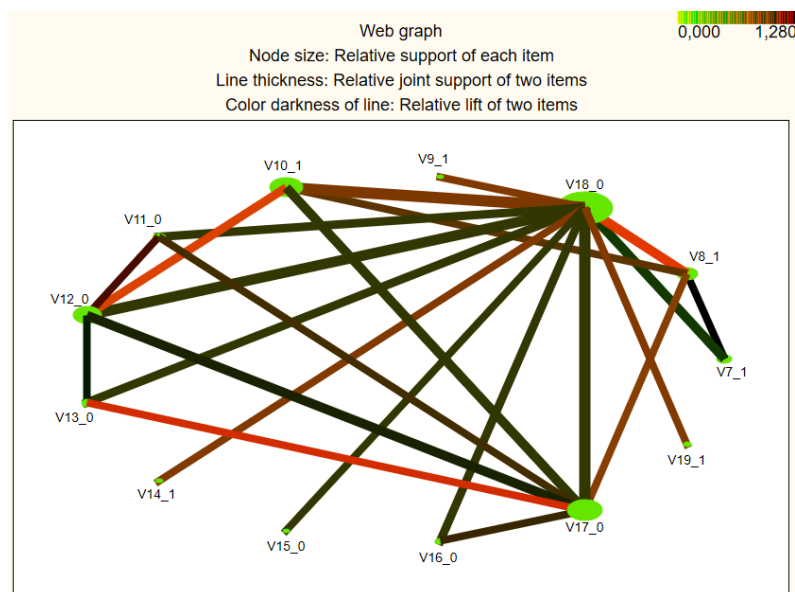
test of independence was used to discover whether or not the variable V7 is associated with any other variable. The test showed that at the level of significance 0.05 there is statistically significant association between V6 and V7 ( $\chi(4) = 13.55, p = .0089$ ) as well as variables V6 and V14 ( $\chi(1) = 7.26, p = .007$ ). Additionally, Cramer's V measure of strength showed that there is strong association between variables V6 and V7 (.35) while Phi measure revealed moderate (.25) association between variables V6 and V14. The Statistica 13 software was used to generate association rules. Altogether, 132 rules were extracted whose minimum support and confidence were not lower than 50%. Overall, 98 rules had lift value higher than 1. (see Table 1).

**Table 1: The obtained rules with sufficiently good lift values**

Body	==>	Head	Support (%)	Confidence (%)	Lift
V8_1	==>	V7_1	53.57143	80.0000	1.280000
V7_1	==>	V8_1	53.57143	85.7143	1.280000
V7_1, V18_0	==>	V8_1	52.67857	85.5072	1.276908
V8_1	==>	V7_1, V18_0	52.67857	78.6667	1.276908
V7_1	==>	V8_1, V18_0	52.67857	84.2857	1.275676
V8_1, V18_0	==>	V7_1	52.67857	79.7297	1.275676
V12_0	==>	V18_0, V11_0	54.46429	73.4940	1.228556
V11_0	==>	V18_0, V12_0	54.46429	91.0448	1.228556
V18_0, V12_0	==>	V11_0	54.46429	73.4940	1.228556
V18_0, V11_0	==>	V12_0	54.46429	91.0448	1.228556
V12_0	==>	V11_0	54.46429	73.4940	1.228556
V11_0	==>	V12_0	54.46429	91.0448	1.228556

Source: own processing

Based on the obtained lift and confidence value, the most important obtained rule stated that probability that ICT experts will consider that that the government should intensify education of key personnel in order to stimulate the growth of the ICT sector, if they believe that currently the most important activity by which the state and its institutions can influence the development of the ICT sector is education (85.00%). Although, this rule has the lift value the same as another rule, it has higher confidence than that rule. Figure 1, gives association rules with sufficiently good lift values.



**Chart 1: Association rules with sufficiently good lift values**

Source: own processing

As shown by Figure 1, the highest individual support was achieved by the nod V9\_0 (business apps and processes within digital workplace should not be taught to greater extent) while the V8\_0 (other than already stated skills or knowledge should not be taught to greater extent) and V17\_0 (PR and social networks should not be taught to greater extent) have the highest relative joint support and V7\_1 (Education is currently the most important activity by which the state and its institutions can influence the development of the ICT sector.) and V8\_1 (the government should intensify education of key personnel) the highest lift.

## 4 Discussion

The results of this research indicated that the state should be involved in a development of its ICT sector through positive development measures that was confirmed by previous authors' studies.<sup>24</sup> The novelty was found in the statement which was given by the most participants that the education is currently the most important activity by which the state and its institutions can influence the development of the ICT sector where government should intensify education of key personnel in order to stimulate the growth of the ICT sector, which confirmed the first research statement. The reason for that was found in a fact that "skill shortages and mismatch are costly to individuals, firms and society because they negatively affect earnings, productivity, innovation and productivity growth. The effects on earnings can be quite persistent."<sup>25</sup> Nevertheless the skill gaps on a labor market continuously persist.<sup>26</sup> It seems that that in shaping the new study program curriculums, Universities are not taking into full consideration the needs of the industry thus contributing to preservation of existing of

<sup>24</sup> BESTVINA BUKVIĆ, I.: Impact of Business Environment on the Development of Regional ICT Sector: Case Eastern Croatia. In TONKOVIĆ, M., CRNKOVIĆ, B. (eds.): *7th International Scientific Symposium Economy of Eastern Croatia – Vision and Growth*. Osijek : Faculty of Economics in Osijek, 2018, p. 11-20. [online]. [2020-04-15]. Available at: <<https://www.dropbox.com/s/9mqur gla6jl8kq/GIH%202018.pdf?dl=0>>.

<sup>25</sup> BRUNELLO, G., WRUUCK, P.: Skill Shortages and Skill Mismatch in Europe: A Review of the Literature. In *IZA – Journal of Labor Economics*, 2019, Vol. 8, No. 12346, p. 26.

<sup>26</sup> LLORENS GARCIA, A. et al.: ICT skills gap in Spain: Before and after a decade of harmonizing the European Higher Education Area. In *Computer Applications in Engineering Education*, 2019, Vol. 27, No. 4, p. 935-941.

mismatch between skills and industry needs.<sup>27</sup> For that reason the authors were investigating which skills and competences should be taught in a greater measure with the aim of developing recommendations for the Universities and policy-makers. The research statement which claims that most of the respondents believe that the Universities should teach Development in a greater extent is accepted as 78.57% respondents gave affirmative response to this field. It is interesting to see that majority of respondents out of ten categories selected following three: *Development, Business apps and processes within digital workplace* and surprisingly *Project management*. The importance of project management skills was emphasized in study given by Desplaces and associates<sup>28</sup> which confirmed that project management skills are significant for the ICT industry positions, where the higher compensations were connected to „higher educational levels, higher number of database administration or architecture certifications, and higher number of project management skills.“<sup>29</sup> In addition, *Development* field (especially programming Languages and Web Development) was accounted as important by Koong and associates where it was found that coding skills in contemporary languages were required by most jobs posted. Only a quarter of job posts required communication skills,<sup>30</sup> where it seems that, in line with the results of this research, soft skills overall are not so highly positioned, but the technical skills are. The soft skills that were found significant to mention were “communication, creativity, information, objective oriented, and problem solving“.<sup>31</sup>

In this research, at the other hand, majority of participants indicated that skills that should not be taught in a greater measure are the *PR and social networks* but *Gaming, Design and Cloud* that was found surprising as those are fast growing subsectors.<sup>32</sup> In conclusion, “companies spend crucial resources to train these personnel, who are not “ready” for the industry. Hence, academia must know what skills are needed to adapt the educational programs via an effective curriculum.“<sup>33</sup> The input should be given by the industry and supported by the state. In that way mutual cooperation between ICT industry, University and state institutions could be developed with an aim of support and development of the ICT sector. This collaboration would be in line with a concept of Quadruple Helix and the goals of the European Union policies.<sup>34</sup> Another reason for development of this cooperation model would be increasing the continuity of obtaining new information and knowledge from the ICT and case studies

<sup>27</sup> HOVE, D.: *A fit-gap analysis of the National Certificate (Vocational)—Information Technology and Computer Science curriculum against the needs of the South African ICT industry*. [Master’s thesis]. Stellenbosch : Stellenbosch University, 2019, p. 99. [online]. [2020-04-26]. Available at: <[http://scholar.sun.ac.za/bitstream/handle/10019.1/105914/hove\\_national\\_2019.pdf?sequence=1&isAllowed=y](http://scholar.sun.ac.za/bitstream/handle/10019.1/105914/hove_national_2019.pdf?sequence=1&isAllowed=y)>

<sup>28</sup> DESPLACES, D. E. et al.: What Information Technology Asks Of Business Higher Education Institutions: The Case of Rhode Island. In *Journal of Information Systems Education*, 2020, Vol. 14, No. 2, p. 195.

<sup>29</sup> Ibidem.

<sup>30</sup> KOONG, K. S. et al.: A Study of the Demand for Information Technology Professionals in Selected Internet Job Portals. In *Journal of Information Systems Education*, 2020, Vol. 1, No. 1, p. 24. [online]. [2020-04-20]. Available at: <<https://aisel.aisnet.org/jise/vol13/iss1/4>>.

<sup>31</sup> LLORENS GARCIA, A. et al.: ICT skills gap in Spain: Before and after a decade of harmonizing the European Higher Education Area. In *Computer Applications in Engineering Education*, 2019, Vol. 27, No. 4, p. 939.

<sup>32</sup> For more information, see: *Digital economy compas 2018*. Hamburg : Statista, 2018.

<sup>33</sup> AKDUR, D.: The Design of a Survey on Bridging the Gap between Software Industry Expectations and Academia. In JOZWIAK, L., STOJANOVIC, R. (eds.): *8th Mediterranean Conference on Embedded Computing (MECO)*, Budva : MECOnet Institute (Mediterranean Excellence in Computing and Ontology), 2019, p. 1. [online]. [2020-4-20]. Available at: <[https://www.researchgate.net/publication/333635133\\_The\\_Design\\_of\\_a\\_Survey\\_on\\_Bridging\\_the\\_Gap\\_between\\_Software\\_Industry\\_Expectations\\_and\\_Academia](https://www.researchgate.net/publication/333635133_The_Design_of_a_Survey_on_Bridging_the_Gap_between_Software_Industry_Expectations_and_Academia)>.

<sup>34</sup> *Pillars of the Digitising European Industry initiative*. 2018. [online]. [2020-4-23]. Available at: <<https://ec.europa.eu/digital-single-market/en/pillars-digitising-european-industry-initiative>>.



coming from this dynamic and rapidly changing sector<sup>35</sup> for the needs of students' education. Accordingly, the coordination with state institutions would be necessary<sup>36</sup> for the development the strategic approach in order to reach the efficiency and upgrade of productive specializations.<sup>37</sup> This model is line with the results of this research, as more than a half of participants (54.46%) consider that a stimulating business environment should have openness of the University to the industry for the purpose of conducting changes in their study programs and to consequently (indirectly through competent and qualified, skilled young ICT professionals) contribute to sector's growth. At the same time, the responsibility for developing the skills requested by the industry should not only fall on state, University and industry but on the future young professionals (students) as well.<sup>38</sup> Although the reward for acquiring the necessary and rare skills is generous, since ICT professionals have above-average salaries and good working conditions, students' interest in enrolling in these study programs is still not sufficient to meet the needs of the fast-growing sector.<sup>39</sup>

## Conclusion

Through the literature review and survey conducted with ICT professionals, it was found that there are numerous open questions regarding the best approach to education in the ICT discipline. However, it is indisputable that the quality of the ICT future professionals' education has significant impact on ICT businesses and sector performance. For that reason, as confirmed by the research results, the strategic approach to this issue would be of valuable importance. In fact, ICT professionals consider that the education is the most important activity by which the state and its institutions could influence the development of the ICT sector where education of key personnel should be intensified in order to stimulate the growth of the ICT sector. Moreover, they majority of the respondents believe that the Development, Business apps and processes within digital workplace and Project management are the disciplines which should be in a greater extent taught in the future. Although the solution for the existing skills mismatch on the ICT labor market seems clear, there are numerous obstacles and challenges on the side of Universities which could be overcome through cooperation between ICT sector, universities and the government. Some of activities should be directed towards shaping more flexible ways of university study programs development and improvement, enabling more frequent changes according to industry needs and allowing higher level of industry participation in implementation of study programs. As well, the state and industry support is needed in provision of ICT infrastructure and equipment, continuous training and upgrading of teachers knowledge and promotion of ICT discipline among future students. Limitations of the research are including the relatively small scale at which the study was conducted on and the geographic area as most of the respondents are coming from Croatia, although it has to be emphasized that most of them are working in international environment. The limitations are imposing the recommendations for improvements in future research. The future research should be conducted at a larger scale with greater geographical

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<sup>35</sup> BRUNELLO, G., WRUUCK, P.: Skill Shortages and Skill Mismatch in Europe: A Review of the Literature. In *IZA – Journal of Labor Economics*, 2019, Vol. 8, No. 12346, p. 26.

<sup>36</sup> GAROUSI, V. et al.: Closing the Gap Between Software Engineering Education and Industrial Needs. In *IEEE Software*, 2019, Vol. 37, No. 2, p. 76.

<sup>37</sup> GARCIA CALVO, A.: State-firm Coordination and Upgrading in Spain's and Korea's ICT Industries. In *New Political Economy*, 2020, Vol. 25, No. 5, p. 1.

<sup>38</sup> BRUNELLO, G., WRUUCK, P.: Skill Shortages and Skill Mismatch in Europe: A Review of the Literature. In *IZA – Journal of Labor Economics*, 2019, Vol. 8, No. 12346, p. 26.

<sup>39</sup> KAARAKAINEN, M. T.: ICT Intentions and Digital Abilities of Future Labor Market Entrants in Finland. In *Nordic journal of working life studies*, 2019, Vol. 9, No.2. p. 120.

coverage. As well, it should include more comprehensive examination including the ICT companies' managers and employees, Universities and upper level high school and university students to gain a deeper understanding of the problem of lack of skilled work force in the ICT sector and to design possible solutions.

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