UNIVERSITY OF NIŠ
FACULTY OF MECHANICAL ENGINEERING IN NIŠ

THE FIFTH INTERNATIONAL CONFERENCE
"MECHANICAL ENGINEERING IN XXI CENTURY"

- MASING 2020 -

PROCEEDINGS

Niš, December 09-10, 2020

ORGANIZERS

UNIVERSITY OF NIŠ
FACULTY OF MECHANICAL ENGINEERING IN NIŠ

with support of:
Ministry of Education, Science and Technological Development

Chairman of the International conference

Prof. Dr Nenad T. PAVLOVIĆ, Dean
Faculty of Mechanical Engineering in Niš

SCIENTIFIC COMMITTEE

Prof. **Nenad T. Pavlović**, chairman, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Ljiljana Radović**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Dragoljub Đorđević**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Peđa Milosavljević**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Boban Anđelković**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Vlastimir Nikolić**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Mića Vukić**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Miodrag Manić**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Predrag Rajković**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Goran Janevski**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Dejan Mitrović**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Goran Petrović**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Dragan B. Jovanović**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. **Živan Spasić**, University of Niš, Faculty of Mechanical Engineering, Serbia
Prof. Dr.-Ing. habil. **Manfred Zehn**, Technical University of Berlin, Faculty of Mechanical Engineering and Transport Systems, Germany
Prof. **Rosen Mitrev**, Technical University of Sofia, Faculty of Mechanical Engineering, Bulgaria
Prof. **Alpar Lošonc**, University of Novi Sad, Faculty of Technical Sciences, Serbia
Prof. **Miran Komac**, University of Ljubljana, Faculty of Social Sciences, Slovenia
Prof. **Matthew P. Cartmell**, University of Strathclyde, Department of Mechanical & Aerospace Engineering, UK
Prof. Dr.-Ing. habil. **Reinhold Kienzler**, University of Bremen, Bremen Institute for Mechanical Engineering, Germany
Prof. **Marjan Leber**, University of Maribor, Faculty of Mechanical Engineering, Slovenia
Prof. **Sanjin Troha**, University of Rijeka, Faculty of Technical Sciences, Croatia
Prof. **Miloš Nedeljković**, University of Belgrade, Faculty of Mechanical Engineering, Serbia
Prof. **Uroš Karadžić**, University of Montenegro, Faculty of Mechanical Engineering, Montenegro
Prof. **Ivan Samardžić**, University of Osijek, Faculty of Mechanical Engineering in Slavonski Brod, Croatia
Prof. **Janez Kramberger**, University of Maribor, Faculty of Mechanical Engineering, Slovenia
Prof. Dr.-Ing. habil **Lena Zentner**, Ilmenau University of Technology, Faculty of Mechanical Engineering, Germany
Dr **Nataša Markovska**, Macedonian Academy of Science and Arts, North Macedonia
Prof. **Cristian Barz**, PhD, Technical University of Cluj Napoca, North University of Baia Mare, Romania
Prof. **Milica Rančić**, Mälardalen University, Division of Applied Mathematics, School of Education, Culture and Communication, Sweden
Prof. **Tibor K. Pogány**, PhD, Dr habil, Óbuda University, Institute of Applied Mathematics Budapest, Hungary
Prof. **Radivoje Mitrović**, University of Belgrade, Faculty of Mechanical Engineering, Serbia
Prof. **Dobrica Milanović**, University of Kragujevac, Faculty of Engineering Sciences, Serbia
Prof. **Mile Savković**, University of Kragujevac, Faculty for Mechanical and Civil Engineering in Kraljevo, Serbia
Prof. **Rade Doroslovački**, University of Novi Sad, Faculty for Technical Sciences, Serbia

Prof. **Darko Knežević**, University of Banja Luka , Faculty of Mechanical Engineering, B&H
Prof. **Milija Krajišnik**, University of East Sarajevo, Faculty of Mechanical Engineering, B&H
Prof. **Nebojša Arsić**, University of Priština, Faculty of Technical Sciences in Kosovska Mitrovica, Serbia
Dr.-Ing. **Dragan Marinković**, Technical University of Berlin, Faculty of Mechanical Engineering and Transport Systems, Germany
Dr.-Ing. **Danijela Ristić-Durrant**, University of Bremen, Institute of Automation, Germany
Prof. **Dragan Djurdjanović**, The University of Texas at Austin, Walker Department of Mechanical Engineering, USA

Organizing Committee

dr **Predrag Janković**, President, University of Niš, Faculty of Mechanical Engineering, Serbia
dr **Mirjana Laković Paunović**
dr **Danijel Marković**
dr **Jelena Dinić**
dr **Miloš Kocić**
dr **Goran Vučković**
dr **Miloš Tasić**
dr **Miloš Madić**
dr **Emina Petrović**
Milica Milunović
Nikola Despenić
Milena Rajić
Nataša Zdravković
Vesna Grozdanović
Dušanka Nikolić, technical secretary

Publication:
Proceedings of The Fifth International Conference – MASING 2020

Edition:
"MECHANICAL ENGINEERING IN XXI CENTURY"
ISSN 2738-103X

Publisher:
Faculty of Mechanical Engineering in Niš
Prof. Dr Nenad T. Pavlović, Dean

Editor:
Prof. Dr Predrag Janković

Number of copies:
120

Printing:
Grafika Galeb, Niš

CIP- Каталогизација у публикацији
Народна библиотека Србије

ISBN 978-86-6055-139-1

GENERAL SPONSOR

Serbian Government

Ministry of Education, Science and Technological Development

PREFACE

Six decades of tradition, high standards in the education of generations of students, modernly equipped classrooms, professional teaching and associate staff, their references and recognizability, position the Faculty of Mechanical Engineering, University of Niš, as the leader in the field of engineering sciences and technological sciences, not only on the territory of the Republic of Serbia but also in the wider region of the Western Balkans.

The Proceedings of the 5th International Conference **MECHANICAL ENGINEERING IN XXI CENTURY** appear in the year when the Faculty of Mechanical Engineering, University of Niš, celebrates its the sixtieth anniversary. The Department of Mechanical Engineering of the Faculty of Engineering in Niš was founded on May 18, 1960, and it developed into the Faculty of Mechanical Engineering of the University of Niš in 1971. The Faculty of Mechanical Engineering grew intensely, thus becoming one of the most renowned scientific and educational institutions in the country.

The mission of the Faculty is to organize and conduct academic study programs and to develop and perform scientific and professional work in the field of engineering sciences and technology. Its vision is to be recognizable in the European and global academic environment in the areas of mechanical engineering and engineering management.

More than 90 teachers and associates, around 40 members of non-teaching staff, as well as numerous teachers and associates from other faculties and the industry, are working hard every day to accomplish the mission and vision of the Faculty.

The Faculty of Mechanical Engineering, University of Niš, is accredited in compliance with the Law on Higher Education within the scientific and educational field of engineering sciences and technology. It conducts the academic studies of the first degree – undergraduate studies, the second degree – master academic studies, and the third degree – doctoral studies, within the scientific area of mechanical engineering and engineering management.

The Faculty of Mechanical Engineering is a scientific research institution, in addition to being an educational one. There are 11 international scientific research projects within the framework of HORIZON 2020, ERASMUS, CEEPUS and DAAD programs. The participation of teachers and associates from the Faculty in these projects is of utmost importance for their educational and research work and their further career.

The 5th International Conference **MECHANICAL ENGINEERING IN XXI CENTURY** represents a forum for the presentation of latest results, basic and developmental research and application within the topics of:

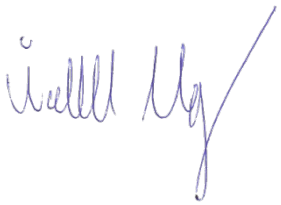
- Energetics, energy efficiency and process engineering,
- Mechanical design, development and engineering
- Mechatronics and control
- Production and information technologies
- Traffic engineering, transport, and logistics
- Theoretical and applied mechanics and mathematics
- Challenges of the engineering profession in modern industry and
- Engineering management.

The MASING 2020 Conference has attracted just over 200 participants from 14 countries, with over 80 papers. The papers present the research results within the scientific work financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, as well as the research results within international projects.

The main goal of the Conference is to bring together researchers from scientific and industrial institutions so that they can present and communicate their newest results, create personal contacts, promote research within the area of mechanical engineering, and stimulate the exchange of results and ideas within the fields encompassed by the Conference.

As Dean of the Faculty of Mechanical Engineering in Niš, I am honored to greet all participants of the Conference and wish them very successful work..

Dean of the Faculty of Mechanical Engineering,
University of Niš



Prof. dr Nenad T. Pavlović

Niš, December 2020

THE 5th INTERNATIONAL CONFERENCE
MECHANICAL ENGINEERING IN XXI CENTURY

December 9-10, 2020
Faculty of Mechanical Engineering in Niš, Serbia

ICT Study Programs in Higher Education in Serbia: Analysis of Main Trends

Dušan MOJIĆ[1], Branka MATIJEVIĆ[2]

[1] Faculty of Philosophy, University of Belgrade, Čika Ljubina 18-20, Belgrade, Serbia
[2] Institute of Social Sciences, Kraljice Natalije 45, Belgrade, Serbia
dmojic@f.bg.ac.rs, bmatijevic@idn.org.rs

***Abstract* — The paper analyzes main trends in development of ICT study programs at higher education institutions (HEIs) in Serbia. Significant increase in number and scope of these programs has been one of the most important characteristics of Serbian higher education sector in the last two decades. Such development has been the result of a complex interplay of global, national and sectorial factors. What all of these factors have in common is the market principle, which has also become one of the corner-stones of the HEIs' development strategies. Such strong environmental pressures has forced HEIs to undergo transformations that will maintain and improve their market positions. The market principle has prompted the proactive behavior of HEIs towards customers/future students. These transformation strategies to a large extent depend on the labor market trends, represented on the level of individual actors/customers by the perception of employment possibilities enabled by a specific degree. The goal of the paper is to provide general insight into the diversity of ICT study programs at HEIs in Serbia, which represents one of the key strategic responses to said market pressures.**

***Keywords*— ICT Study Programs, Higher Education Institutions, Serbia**

I. INTRODUCTION

Higher education institutions (HEIs) in Serbia has underwent radical transformations in the recent decades. These transformations has coincided with overall transformations of Serbian society from socialism to (semi-peripheral) capitalism, to a large extent caused by global economic, political, cultural and social trends. Capitalism as a world system [1] "reintegrated" former socialist societies, although at a different pace and to an unequal degree. Serbia has shared some similar characteristics in that respect, being however a rather unsuccessful example regarding the overall transition processes [2].

"Paradoxically, being rather unsuccessful in economic transition, Serbia has established a fairly free market in higher education. Institutional transformation in higher education in Serbia has been carried out through the accreditation process in the overall Bologna process implementation, followed by the full implementation of a three-cycle system (bachelor studies, MSc studies and PhD studies) and ECTS system in all study programs" [3, p. 3510].

The market principle has prompted the proactive behavior of HEIs towards customers/future students. As the main outcome of changed competitive landscape, the relationship between students and HEIs has developed into a customer–service supplier relationship. Generally, on the global level, the student–university relationship has become more marketised [4]. Students are perceived as customers, while universities' mission becomes delivering added value compared to competitors and finding effective ways of market positioning.

Students, as customers, have been mostly interested in employability when deciding which HEI to enroll. Therefore, wider labor market trends and transformations are the key determinants of these customer orientations. These transformations have been mostly influenced by the rapid development of information and communication technologies (ICT) in the last decades.

According to famous sociologist Manuel Castells these technologies include the converging set of technologies in micro-electronics, computing (machines and software), telecommunications/broadcasting, and opto-electronics. Castells adds to this list the application of information technologies in genetic engineering [5, p. 29].

This influential author emphasizes the terms "informational economy" and "informational society" to denote a specific form of economic and social organization in which "information generation, processing, and transmission become the fundamental sources of productivity and power because of new technological conditions emerging in this historical period" [5, p. 21].

How do HEI in Serbia respond to these trends and transformations? The main goal of this paper is to present main trends in development of ICT study programs in Serbian higher education.

II. THEORETICAL CONSIDERATIONS

Various theoretical approaches have been applied in explanations of the role and organization of higher education institutions [6]. Universities and faculties belong to a common category or entity – organizations. Scientific studies of organizations have experienced radical paradigm shift in the 1960s, offering theoretical frameworks for understanding relationships between organizations and their environment. This paradigm shift refers to a transition from the notion of organization as a closed system to a

comprehension of organization as an open system (influenced by various aspects of its environment).

Modern theories of organization have been main embodiments of this radical paradigm shift. The most prominent representatives of this theoretical stream are the system theories and the contingent (situational) theories of organization. The system approach had proposed that organizations are open systems, constantly interacting with their environment. The basis of this approach had been found in the Ludwig von Bertalanffy's general system theory, while its application in understanding the nature and the functioning of organizations refer to the ideas of social psychologists Katz and Kahn [7, p. 5]. According to this approach, elements of organization interact with each other, simultaneously interacting with the environment of the organization.

Contingent or situational theoretical approaches have been viewed as the most developed and the most influential in the field of organization studies in general [8, p. 133]. According to these theories, every organization adapts to each situation (defined through various factors) [9, p. 157]. There is no "one best way" of organizing and different types of organizations respond to different kinds of situations. The degree in which particular organization ensures "best match" between the characteristics of the situation and its own structural characteristics determines the success of the organization as a whole. Most important aspects of organizational environment can be broadly categorized as social, cultural, economic, technological, political, and legal [9].

III. Serbian Higher Education landscape

Last decades has brought radical and dramatic changes in all aspects of the organizations' environment. Economic globalization and the rise of the multinational companies (MNC) had influenced all the aforesaid aspects of the environment. These changes (among others) have also influenced the role, organization and strategies of higher education institutions. Different environmental challenges led some authors [10, p. 11] to a conclusion that modern universities have been "under pressure". These pressures operate on global, national, regional and local levels.

Higher education institutions in Eastern Europe have been under additional pressure in the recent decades. Transition in former socialist countries brought political, economic and overall social transformation toward the "western capitalist model" of society and its institutions. These transformations refer to formal (constitutions, laws, statutes) and informal (beliefs, values, norms) institutional changes [11, p. 231].

Universities have experienced organizational changes under these institutional circumstances or environmental pressures. Higher education institutions in Serbia have been additionally "pressured" by political conflicts (including armed conflicts), the UN sanctions, hyperinflation and overall economic and social crisis in the 1990s. Although political changes in 2000 brought some political and economic stability, environmental changes "surrounding" universities have been even more turbulent. For example, the Bologna process imposed radical institutional transformation through the accreditation process. The accreditation process is *par excellence* a process of putting institutional pressure on universities as basic units in the higher education sector [12, p. 1554].

These institutional pressures have been strengthened by inadequate state financial support for public universities and dramatically increased share of private sector in higher education. Furthermore, competition for university attendees between privately-owned and state founded universities has been taking place in a very unfavorable demographic situation primarily characterized by severe depopulation and youth emigration.

Different strategic responses have been noted among higher education institutions in Serbia [12]. These transformation strategies have been mainly based on the perception of the prospective demands of the labor market. The main strategic tool available to universities and faculties have been curricular transformations. Responding to this needs, HEI also have to adapt their organizational structures, systems and processes to various aspects of environmental changes in last decades. Our focus will be on the analysis of ICT study programs.

IV. ICT Study Programs in Serbian Higher Education institutions

Higher education in Serbia has got rich and prominent tradition in the field of informatics since 1980s within the Faculty of Electrical Engineering, Faculty of Mathematics, and Faculty of Organizational Sciences (University of Belgrade), Electronic Faculty (University of Niš), Faculty of Technical Sciences, and Faculty of Sciences (University of Novi Sad) [13, p. 183]. However, the period of blocked postsocialist transformation in the 1990s had dramatic negative impact on higher education, particularly in highly advanced technological sectors such as ICT. One of the important consequences of such situation had been the prevailing interest of prospective students for study programs in social sciences.

Nevertheless, this trend has reversed in the last years – the number of students associated with technical skills in general is rising year by year recently. As for ICT study programs, in 2018/2019 school year, 22,339 out of 249,771 students have been in this field of study (Table I). Further 45,960 students are in the technical areas (engineering, manufacturing, and construction). The share of ICT students in overall student population in Serbia is slowly but constantly increasing. Negative demographic trends in Serbia (depopulation and emigration) led to decrease in number of students from 2015 to 2018 (from 251162 to 249771). However, all categories of HEI in Serbia (state and private universities, state and private higher schools) recorded growth of number of ICT students.

TABLE I Proportion of Students Enrolled in ICT Programs in Overall Number of Students in HEI in Serbia [14], [15]

	2015/2016	**2018/2019**
Overall number of students	251,162	249,771
Number of students enrolled in ICT programs	19,285 (7.68%)	22,339 (8.94%)
State universities	10,660 (55.26%)	11,978 (53.62%)
Private universities	2,266 (11.75%)	3,369 (15.08%)
State higher schools	5,578 (28.92%)	6,026 (26.98%)
Private higher schools	781 (4.05%)	966 (4.32%)

The proportion of ICT students in state and private HEIs has slightly changed from 2015 to 2018 in favor of private universities and higher schools. In 2015 the percentage of ICT students in private HEIs in overall number of ICT students in Serbia was 15.8%, raising to 19.41% in 2018. This could be explained by the stronger orientation of private HEIs to labor market needs, unlike state universities and higher schools, which have been more inclined to development of traditional study programs (although state HEIs also had more ICT students in 2018 than in 2015).

More than 16% of all Serbian newly-enrolled students in 2018 were ICT enrollees (9,747), which is a clear indicator of interest of Serbian young people in studies related to informatics [13, p. 182]. In the period 2012-2018, an impressive growth of new students was registered in Serbian HEIs – from 5,523 in 2012 up for 76.5% in 2018, with average growth rate in the six-year period of 9.9%. Demand for experts in ICT has been so high that only 60% of enrolled students graduate, while a certain number of students get employment during studies (which is the main reason why majority of those never graduates). With or without a diploma in ICT in Serbia, significant number of ICT students find job very easily [13, p. 185].

TABLE III REGIONAL DISTRIBUTION OF ICT STUDENTS IN STATE UNIVERSITIES [14], [15]

	2015/2016	2018/2019
Overall number of students	177352	181310
Number of students enrolled in ICT programs	10660 (6.01%)	11978 (6.61%)
Belgrade Region	3800 (35.65%)	4119 (34.39%)
Vojvodina	5064 (47.50%)	5304 (44.28%)
Šumadija and Western Serbia	1258 (11.8%)	1231 (10.28%)
Southern and Eastern Serbia	990 (8.27%)	1324 (11.05%)

Regional distribution of ICT students has been (as expected) to a large degree determined by an existing distribution of (predominantly state) HEIs in Serbia (Table II). Nevertheless, although the University of Belgrade is by far the biggest university in Serbia, in relative terms, University of Novi Sad has got the largest proportion of ICT students (47.50% in 2015 and 44.28% in 2018, with Faculty of Technical Sciences and Faculty of Sciences (both located in Novi Sad) as the strongest institutional stands of ICT study programs.

TABLE IIIII REGIONAL DISTRIBUTION OF ICT STUDENTS IN PRIVATE UNIVERSITIES [14], [15]

	2015/2016	2018/2019
Overall number of students	28,203	29,174
Number of students enrolled in ICT programs	2,266 (8.34%)	3,369 (11.55%)
Belgrade Region	2,007 (88.57%)	3018 (89.58%)
Vojvodina	141 (6.22%)	232 (6.89%)
Šumadija and Western Serbia	118 (5.21%)	119 (3.53%)
Southern and Eastern Serbia	-	-

As for regional distribution of ICT students enrolled in private universities (Table III), centralization in the main university center is enormous (almost 9/10 of all ICT students in this type of HEIs attend their study programs in Belgrade). On the other hand, this is expected, since great majority of private universities have been founded (and majority of their faculties located) in the capital of Serbia.

TABLE IVV REGIONAL DISTRIBUTION OF ICT STUDENTS IN STATE HIGHER SCHOOLS [14], [15]

	2015/2016	2018/2019
Overall number of students	41,467	34,567
Number of students enrolled in ICT programs	5,578 (13.45%)	6,026 (17.43%)
Belgrade Region	2,820 (50.56%)	3,383 (56.14%)
Vojvodina	724 (12.98%)	796 (13.21%)
Šumadija and Western Serbia	1,288 (23.1%)	1,241 (20.59%)
Southern and Eastern Serbia	746 (13.37%)	606 (10.06%)

State higher schools also have got an important tradition in offering study programs in ICT. Decrease in overall number of students is here more dramatic than in state universities – 20% in just three years, but in spite of that fact, the absolute number of ICT students in fact increased 8% in this period. Belgrade located state higher schools account for majority of ICT students – 50.56% in 2015, and 56.14% in 2018. As for other Serbian regions, Šumadija and Western Serbia has relative majority of students enrolled in ICT study programs (23.1% in 2015 and 20.59% in 2018) compared to Vojvodina and Southern and Eastern Serbia (Table IV).

As for private higher schools, the relative share of ICT students is 20.47% in overall student population of this type of HEI. Vast majority of them attend study programs in Belgrade (936 of 966, or 96.89%).

Finally, an interesting topic related to ICT studies is gender distribution of students. ICT studies are still male dominated, as well as the ICT profession in general. For example, the average share of female students in ICT programs in HEI in Europe is 19%. In Serbia, to a large extent still traditional and patriarchal society [16], this share is 7% higher – 26% [13]. How can this be explained?

TABLE V GENDER DISTRIBUTION OF ICT STUDENTS IN SERBIAN HEIS [14], [15]

	2015/2016		2018/2019	
	All	Women	All	Women
Number of students enrolled in ICT programs	19,285	4,959 (25.71%)	22,339	6,283 (28.13%)
State universities	10,660	3,375 (31.66%)	11,978	4,377 (36.54%)
Private universities	2,266	377 (16.64%)	3,369	735 (21.82%)
State higher schools	5,578	1058 (18.97%)	6,026	1,101 (18.27%)
Private higher schools	781	149 (19.08)	966	170 (17.60%)

The legacy of socialism has certainly significant impact in that respect. Namely, women from Eastern Europe enrolled engineering studies significantly more often than

women in the Western Europe. The similar pattern can be identified in Serbia today regarding engineering studies, as well as ICT studies. The proportion of female students in ICT study programs in Serbian HEIs increased from 25.71% in 2015 to 28.13% in 2018 (Table V). There are considerable differences between four main types of HEIs in Serbia in that respect. State universities have more than 1/3 of female students in ICT programs (36.54% in 2018), while private universities, state higher schools and private higher schools have 21.82%, 18.27%, and 17.60%, respectively.

V. Conclusions

The impact of technology on society has been an important topic of social studies, especially during dramatic changes brought about by the early stages of modernization and industrialization. The standpoint of technological determinism was very common in these considerations [17]. Recently, the variant of social constructivism called social construction of technology (SCOT) [18] has been the dominant paradigm in studying the interrelationship of technology and society. The fundamental proposition of this theoretical approach is understanding of technology as a product of dynamic interaction of relevant social actors.

Very important social actors in this process are higher education institutions. HEIs represent key institutional actors in the process of professionalization of occupations related to ICT sector, providing theoretical knowledge and formal educational credentials for work of ICT experts [19]. HEIs in Serbia have responded to threats and opportunities from the changing environment by developing existing and introducing new study programs in ICT. Challenges posed by transformations in social, cultural, economic, technological, political, and legal aspects of the environment exist on different but interconnected levels – global, national, regional and local.

As for social aspect of the environment, Serbia can be regarded as a society of semi-peripheral capitalism [20]. In cultural terms, norms and values in Serbia have shown to be rather inconsistent and mixture of traditional, modern and postmodern elements [16]. Being a part of capitalism as a world system [1], Serbia have benefited in the recent decades from economic globalization through foreign direct investments (FDI). Multinational companies (MNCs) brought advanced ICT and increased the technological level of Serbian economy. Nevertheless, on a global scale Serbian economy has been rather uncompetitive in terms of ICT [13, p. 28]. The main reasons for that can be found predominantly in two remaining aspects of the environment – political and legal.

"Serbia is an economic growth laggard due to deficient institutions, specifically lacking rule of law and control of corruption, and due to low investment, which itself is curbed by corruption and poor rule of law" [21, p. 17]. According to these Serbian economists, Serbia has been growing 2 percentage points below its potential in recent years. Their estimate is that roughly one half of the growth gap could be explained by underperforming institutions (1 p.p.), and the other half by low investment (0.7 p.p.) and education (0.2 p.p.).

Having in mind these analysis, it is clear that HEIs function in a rather unfavorable institutional environment, but still bear a part of the responsibility for Serbian economic and overall social underdevelopment. Our analysis of the official statistical data on ICT programs in higher education in Serbia have strongly confirmed both – external threats and internal weaknesses of HEIs. Further development of quality ICT study programs would definitely be a very successful strategy to turn these weaknesses into strengths of Serbian higher education. Such transformations could also represent strong impetus for institutional transformation of Serbian economy and society.

References

[1] I. Volerstin, *Uvod u analizu svjetskog sistema*. OKF, Cetinje, 2005.

[2] M. Lazić and S. Cvejić, "Stratificational Changes in Serbian Society: A Case of Blocked Post-socialist Transformation". Faculty of Philosophy, Institute for Sociological Research, 2005.

[3] S. Mitić and D. Mojić, "Student Choice of Higher Education Institutions in a Post-transitional Country: Evidence from Serbia", *Economic Research-Ekonomska Istraživanja*, Vol. 33, No. 1, pp. 3509-3527, 2020.

[4] F.Maringe and P.Gibbs, *Marketing Higher Education: Theory and Practice*. Open University Press, Buckingham.

[5] M. Castells, *The Information Age: Economy, Society, and Culture. Volume I: The Rise of the Network Society*. Second edition, Wiley-Blackwell, Malden, MA; Oxford, 2010.

[6] A. Altmann and B. Ebersberger, "Universities in Change: As a Brief Introduction", Universities in Change: Managing Higher Education Institutions in the Age of Globalization (pp.1-6) Springer, 2013.

[7] R. W. Scott, "Reflections on a Half-Century of Organizational Sociology". *Annual Review of Sociology*, Vol. 30, pp. 1-21, 2004.

[8] K. Grinth, *The Sociology of Work: Introduction*. Third Edition. Polity Press, Cambridge, 2005.

[9] P. Sikavica, *Organizacija*. Školska knjiga, Zagreb, 2011.

[10] E. P. Berman and C. Paradeise, "Introduction: The University under Pressure". in Berman, E. P. and Paradeise, C. (eds). *The University under Pressure* (pp. 11-19). Emerald Group Publishing Limited, Bingley, UK, 2016.

[11] S. Pejovich, "The Uneven Results of Institutional Changes in Central and Eastern Europe: The Role of Culture". *Social Philosophy and Policy*, Vol. 23, No. 1, pp. 231-254, 2006.

[12] N. Janićijević, "The Reactions of Universities to Imposing a New Institutional Pattern: The Case of Higher Education in Serbia". No. 174, pp. 1550-1559, 2015.

[13] M. Matijević and M. Šolaja, *ICT in Serbia: At a Glance*. Vojvođanski IKT klaster, Novi Sad, 2020.

[14] *Highed Education (2015/2016)*, Statistical Office of the Republic of Serbia, Belgrade, 2017,

[15] *Highed Education (2018/2019)*, Statistical Office of the Republic of Serbia, Belgrade 2019,

[16] J.Pešić, *Promena vrednosnih orijentacija u postsocijalističkim društvima Srbije i Hrvatske: politički i ekonomski liberalizam.* Filozofski fakultet, Univerzitet u Beogradu, Beograd, 2017.

[17] D. Petrović, *Društvenost u doba interneta: studija komunikacione upotrebe interneta u Srbiji.* Akademska knjiga, Novi Sad, 2013.

[18] T. Pinch and W. E. Bijker. "The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other." *Social Studies of Science*, Vol. 14, No. 3, pp. 399-441, 1984.

[19] C. Turner and M. N. Hodge, "Occupations and Professions". in Jackson, J. A. (ed). *Profession and Professionalization* (pp. 17-50). Cambridge, University Press Cambridge, 1970.

[20] M. Lazić and J. Pešić, *Making and Unmaking State Centered Capitalism in Serbia*. Faculty of Philosophy, Institute for Sociological Research, Belgrade, 2012.

[21] P. Petrović, D. Brčarević and M. Gligorić, "Why is Serbia an Economic Growth Underachiever?" *Ekonomika preduzeća*, Vol. 67, No. 1-2, pp. 17-33, 2019.