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RANGIRANJE ISTRAŽIVAČA NA OSNOVU POSTIGNUTIH NAUČNIH REZULTATA (STUDIJA SLUČAJA: TEHNIČKI FAKULTET U BORU, UNIVERZITET U BEOGRADU, SRBIJA)

RANKING OF RESEARCHERS BASED ON THE ACHIEVED SCIENTIFIC RESULTS (CASE STUDY: TECHNICAL FACULTY IN BOR, UNIVERSITY OF BELGRADE, SERBIA)

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Abstract

This paper presents the ranking results of researchers at the Technical Faculty in Bor (TFB), University of Belgrade (UB), Serbia according to the achieved scientific results based on the following criteria: the number of published papers in journals with the Impact Factor (IF), the number of hetero-citations and the h-index. All relevant data were obtained from SCOPUS database for the period ending on 1st October 2018. The ranking of the most successful researchers was also carried out based on the number of published university textbooks, supplementary university textbooks and research monographs, as well as on the basis of the number of PhD mentorships. The considered ranked researchers were those who worked at the Faculty since it was founded in 1961 until 1st October 2018.

Sažetak

Ovaj rad prikazuje rezultate rangiranja istraživača Tehničkog fakulteta u Boru (TFB), Univerziteta u Beogradu (UB) Srbija, prema postignutim naučnim rezultatima na osnovu sledećih kriterijuma: broja objavljenih radova u časopisima sa faktorom uticaja (IF), broj heterocitata i h-indeksa. Svi relevantni podaci dobijeni su iz baze podataka SCOPUS za period koji se završava 1. oktobra 2018. Takođe su rangirani najuspešniji istraživači na osnovu broja objavljenih univerzitetskih udžbenika, dodatnih univerzitetskih udžbenika i istraživačkih monografija, kao i na osnovu broja doktorskih mentorstava. Razmatrani rangirani istraživači bili su oni koji su radili na Fakultetu od njegovog osnivanja 1961. do 1. oktobra 2018.

Keywords: *ranking, researchers, research papers, hetero-citations, h-index*

Ključne reči: *rangiranje, istraživači, istraživački radovi, hetero-citati, h-indeks*

JEL klasifikacija*: O30*

1. Introduction

The main activity of members in the academic community (people who work at the universities, research institutes and higher education institutions) is the scientific-research activity which involves discovering new horizons and gaining knowledge in the areas in which they are experts. The achieved scientific result, which represents the way of pushing the boundaries in regard to the previous state, has to be published and, in that way become available to the scientific community. If this does not occur, the scientific result does not exist. Publication of scientific results is the measurement of academic achievement and it represents "the meaning of scientific life" for the members of academic community. It is not a coincidence that the widespread maxim in this community is "Publish or perish" [6]. While members of the academic community publish, they exist, and when they stop, they cease to exist in it. The purpose of the scientific research can be described in three steps: do - write - publish [10].

Motivating members of the academic community is not debatable, due to the fact that their position in the institution they work in, their salary, as well as their promotion, depend on the number of publications. Personal motivation is also very important: desire to acquire new knowledge, build international reputation, and realize cooperation with researchers from other parts of the world etc. [8]. There are not many members of the academic community who are not motivated to publish and who are satisfied with the position they occupy, thus only building the reputation within the institution they work in. These people do not belong in the scientific community, but, unfortunately, there are some not so positive examples.

The practice of publishing scientific results in the academic journals is quite old and it dates back to 1665 when the first journal was published in London by the Royal Society of England, which was called Philosophical Transactions [9]. The first journal published in Serbia was the Serbian Chronicles (Serbske Letopisi) in 1824, and it can be seen as the fact that depicts the tradition of publishing academic journals and research papers in Serbia [10]. Since then, the publication of academic journals has gone thorough considerable expansion worldwide, which encouraged the systematization of this area by ranking journals addressing certain fields by the quality and making published results available to the academic community in the whole world. The ranking of scientific results and researchers as well, has become more objective in the last decades due to the modern methods: Bibliometrics, Scientometrics, Informetrics and Webometrics [5].

By the year 2000, Science Citation Index (SCI) was published by The Institute for Scientific Information (ISI) in Philadelphia in CD format, and the journals were ranked by the impact factor (IF), which has recorded a positive impact on the development of academic publishing in the world since 1995. At the beginning of 2002, Thomson Reuters launched an integrated Web platform, and Web of Science (WoS) database became widely available. Elsevier Scopus (launched in 2004) and Google Scholar (beta version launched in 2004) were developed as competitive citation indexes, which offer personal researchers' profiles with the number of citations, the h- index and the i10-index. A physicist at the University of San Diego, J. Hirsch, suggested in 2005 an introduction of the h-index, which enabled counting of the researchers' citations [3] [1]. Other launched scientific databases did not offer any notable results, which is why these mentioned above databases are of interest for the analysis of publishing research papers and "scientific life" in the world.

Based on the quality of the published papers, the ranking of the universities on the Shanghai list of top 500 universities in the world is done according to: the number of published papers in journal on SCI and SSCI lists (JCR), published papers in Nature and Science journals, and the number of Highly Cited researchers (HiCi) from 21 scientific fields [15]. Furthermore, a world list of highly cited researchers in Google Scholar database, who have the h-index >100, has been published since 2015 [9]. Portal – SCImago performs ranking of journals and countries based on the Scopus

database with the JCR indicator and the h- index. So-called Webometrics – Ranking of World Universities list is also known, and it has been published since 2004. [9]

The fact that researchers want to publish their results in the most noticeable journals with higher Impact Factor (IF) is unquestionable. The reason for this is to make them available to as many researchers in the world as possible, and to allow the chance for the paper to be cited, thus improving their references [12]. Researchers with a large number of papers in journals with IF and a large number of citations have the greatest impact on establishing not only personal reputation but the reputation of the institution in which they work.

At the initiative of The Institute of Molecular Genetics and Genetic Engineering in Belgrade, the issue of citation and publishing papers in leading world journals was introduced. This Institute was the first to compile a list of their researchers' citations, and in 1993 the daily newspapers Politika initiated the idea of creating a file on WHO IS WHO IN SERBIAN SCIENCE. This idea was supported only by the Vinča Institute of Nuclear Science and the Technical Faculty in Bor, University of Belgrade. Professor Živan Živković PhD was the editor of the Lexicon WHO IS WHO IN SCIENCE IN BOR (Živković, 1993), which included the list of citations of all doctors of science who lived and worked in Bor, which was reported in an article "People from Bor and researchers" in Politika (Politika 4th October 1994). This article, despite strong opposition to this idea, had a strong positive impact on TFB's reputation, as well as on the reputation of University of Belgrade in the country and abroad. Since that moment the reputation of TFB has started to grow at the University of Belgrade and in the world. This publication discussed the number of papers in the leading international journals with the Impact Factor and the number of citations based on data in the ISI database, when this was an unknown fact to the most of the scientific and university community in Serbia [2].

The Ministry of Science of the Republic of Serbia carried out the ranking of scientific institutions (faculties and institutes) based on the number of published papers in journals with IF (they were categorized by the value of the Impact Factor- first 30% with the highest IF value, then 30-50% with the lower value of IF, and then the remaining 50% of scientific journals). The Ministry took this number and compared it to the number of registered researchers (the researchers who worked on the Ministry's projects) and then made a list of almost 400 institutions by the decreasing ratio of TNP/NR (total number of papers/ number of researchers) for the period from 2006 to 2010. The Technical Faculty in Bor took 19th place with an impressive 4.10 ratio, which demonstrates the commitment of the researchers at TFB for publishing papers in leading scientific journals in the world [11].

Today, Technical Faculty in Bor, University of Belgrade, exists as the only faculty within the University of Belgrade located outside of Belgrade. First, there were Departments for Mining and Metallurgy, and later Inorganic Technology Department was opened, and since 2002, the Department for Engineering Management has been established as well. All study programs are accredited and teaching is conducted at all three academic levels: undergraduate studies, master and PhD studies. Technical Faculty in Bor organizes four (4) international conferences, one of which is in the EBSCO database. It publishes 4 scientific journals, with two of them in Clarivate and CSImago databases and with the Impact Factor. The Faculty has about 80 employees who conduct the teaching process and do the research. Given the fact that the Faculty has been on the Shanghai List since 2012, and that in 2015 and 2016 it was among 200-300 top universities, and in 2017 among 300-400, it has accomplished scientific results at the same, or even higher levels compared to other faculties and institutes at the University of Belgrade, even though it is not located in Belgrade [15].

The Technical Faculty in Bor, compared to other faculties, takes around the 10th place in all rankings [15], and in Webometrics, for the period from 2010 to 2015, individually takes between the 10th and 40th place among all scientific institutions in Serbia, including the universities [9].

These results indicate that there is respectable scientific research which is presented through publications and citations realized at the TFB. There are four Departments at the Technical Faculty in Bor: Mining Engineering (MiE), Metallurgical Engineering (MeE), Technological Engineering (TE) and Engineering Management (EM) which cover different fields of technical sciences. The results show that scientific and research activity differs within the departments, so the research results are different as well [14]. It should be noted that the greatest influence on the Webometric result has the Engineering Management Department's website with the number of visits that exceeds 2x105 per month.

In every scientific institution, even at the Technical Faculty in Bor, there is a clear difference between researchers. There are those who work only enough to get by, and there are those who have outstanding results and make the institution recognizable and respectable in the world. The purpose of this paper is to make a list of top 10 researchers who enhanced the development of the Technical Faculty in Bor with their scientific results, and evaluate the impact of individual Departments on the overall result of TFB as well. There is hope that these results will help motivate those "dormant" researchers at TFB to be better and accomplish more.

2. Ranking Methodology

In order to measure the results of scientific research at the Technical Faculty in Bor, existing scientific databases have been used, in which researchers' published scientific results are ranked based on the journal's Impact Factor. Publishing in national journals and conference proceedings has a local character and cannot be considered in this analysis. Only results which are published and have an impact on the researcher's reputation and the reputation of institution they work in, are considered.

The h– index [3], regardless of the criticism [4], is considered to be the objective measure of quality of researcher's scientific results because it reliably indicates what kind of impact paper has had in the scientific community. The i10- index, taken from the Google Scholar database, is highly indicative given that only 10 citation are needed for the election procedure to a higher scientific-educational title. Furthermore, the g-index [7] offers information about the quality of researcher's scientific results, however, not one database calculates it automatically, and it does not apply for the ranking of achieved scientific results.

Having in mind that the data used for the ranking of individual scientific results is available on Google Scholar (citations, h-index and i10-index) only to the researchers who have their own profile, and the data from Scopus (number of papers in journals that are on JSR list, number of hetero-citation and h- index) is available to all researchers, the author of this paper can only rely on the Scopus database, due to the fact that most researchers do not have profile on Google Scholar (only the researcher at the Engineering Management Department have GS profiles, which is the basic requirement for the visibility of researchers in the world).

Due to these facts, only the Scopus scientific database, which provides information about published papers in journals on the SCImago list, the number of hetero citations in journals with the IF on the SCImago list, and the h- index, were used for this analysis. Based on these indicators, the number of papers in leading journals with IF, the number of hetero-citations in journals with IF, as well as the h-index with hetero-citations were considered, thus providing a realistic overview of achievements accomplished by the researchers who worked or have been working at the Technical Faculty in Bor.

Taking into consideration that the Technical Faculty in Bor is an educational institution, and that it would not exist without its students, the author assessed that the important segments of scientific and educational process are the textbooks which teachers provide for the students, as well as the textbooks

which are used at other faculties in the country and abroad. Furthermore, the number of accomplished PhD candidates has a significant impact by creating a scientific basis for further growth and development realized at the Technical Faculty in Bor. The impact of the researcher can be also seen in the establishment of a school in a field which is developed through the series of PhD thesis and then passed on to new generations for further development, making TFB well known in the country and abroad by publishing in journals with the Impact Factor and being cited in leading scientific journals.

Based on the proven scientific competence, the ranking of 10 most successful researchers, who worked or have been working at the Technical Faculty in Bor in the last 60 years, was carried out on the following measurable criteria:

1. Number of published papers in journals with the Impact Factor (SCOPUS)
2. Number of hetero-citations (SCOPUS)
3. Value of the h- index based on the hetero-citations (SCOPUS).

The ranking of 10 most successful researchers at the Technical Faculty in Bor was also done based on:

- Number of published university textbooks and research monographs (TFB Archive)*
- Number of PhD mentorships (TFB Archive).

* The monograph published on the occasion of 50th anniversary of the Technical Faculty in Bor and the Reports on the Quality of Science and Research and International Cooperation at the Technical Faculty in Bor.

The ranking for the admission to the Serbian Academy of Sciences and Arts (field of technical sciences) was carried out in 2018 based on the first three criteria, and the significance of scientific results was presented in a declining sequence: h- index → number of hetero-citations → number of papers in journals with IF.

The ranking of 10 most successful researchers at the Technical Faculty in Bor was performed for each of the mentioned criteria, and the final ranking of the top 10 researchers based on the proven scientific competence was carried out according to the results obtained on the first three criteria (SCOPUS). The final results were obtained by appointing 10 points for the first position according to a particular criterion, and then in a descending order to the 10th place which was appointed with one point. This way, a list of the 10 most influential researchers was obtained, of those who marked almost sixty years of the Faculty's existence and had the impact on the position of the Technical Faculty in Bor at the University of Belgrade and scientific community in the world [15].

The ranking of 10 most successful researchers based on the number of published university textbooks and research monographs, as well as on the number of PhD mentorships that had the greatest influence on the teaching process and formation of personnel at the TFB, was also presented in this paper.

The author acknowledges the fact that each measurement of the results has its disadvantages due to the frauds some researchers commit in order to enhance their references. Possible frauds include the following: publishing papers in predatory journals for money, plagiarism, auto-plagiarism-publishing the same results multiple times, falsification of the experimental results, false co-authorships, forced citations through reviews and publishing papers in journals in which they hold editorial position, etc. After 2000, the number of published papers with 5 or more authors has rapidly increased, and it is not possible that all co-authors participated in the research, and some of the co-authors are not in the field of the research covered by the paper. These frauds can be found in every academic institution, even at the Technical Faculty in Bor, and even though there are indications they exist their scope is yet to be determined [13].

3. Results

For the measurement of the research results at TFB within UB, researchers who are currently employed at the Faculty, as well as researchers who worked until 1st October 2018, are taken into consideration because it is believed that they had an impact on the overall quality of research at the Faculty.

The indicators of the scientific competence were measured through the number of papers published in journals with IF, the number of hetero-citations, and the h-index, which is based on the number of hetero-citations (SCOPUS database). Furthermore, the impact on the development of the teaching process and formation of the personnel was also ranked based on the number of published textbooks and number of PhD mentorships.

The first phase of ranking scientific competence based on the mentioned indicators was performed for each study program, that is, Department: Mining Engineering (MiE), Metallurgical Engineering (MeE), Technological Engineering (TE) and Engineering Management (EM), that de facto represent four different scientific fields at the Technical Faculty in Bor. The purpose of this ranking is to offer insight into the realistic state at TFB, show the level of research development at each Department, and provide a picture of WHO IS WHO IN SCIENCE AT TFB.

3.1. Mining Engineering

Table 1 shows the ranking results of researchers at the Mining Engineering Department (MiE) based on the number of published papers in journals with IF as a predominant criterion, listing as well the number of hetero-citations and the h-index for the period ending on 1st October 2018.

Table 1 *Ranking of the researchers at MiE Department by different criteria (state on 1st October 2018) (source: SCOPUS)*

No	Name	No of papers	No of hetero-citations	h-index
1.	Zoran Stević	37	63	5
2.	Vladimir Despotović	32	60	5
3.	Radoje Pantović	18	53	3
4.	Mira Cocić	15	19	2
5.	Grozdanka Bogdanović	14	288	8
6.	Zoran Marković	14	72	2
7.	Saša Stojadinović	12	73	3
8.	Nedeljko Magdalinović	11	152 +(30)* = 182	8
9.	Miodrag Žikić	11	25	2
10.	Milan Trumić	10	31	3
11.	Nenad Vušović	8	3	1
12.	Rodoljub Stanojlović	6	74	3
13.	Maja Trumić	6	15	2
14.	Jovica Sokolović	5	80	4
15.	Dejan Petrović	5	50	2
16.	Miodrag Banješević	4	7	2
17.	Zoran Štirbanović	3	3	1
18.	Vitomir Milić	2	46	2
19.	Duško Đukanović	1	0	0

( ) Number of citations according to the Scientific Citation Index until 1995*

Some of the researchers who worked at this Department, like Mladen Gajić, Predrag Nikolić, Milutin Grbović, Dragiša Tomić, Gojko Hovanec, Dragoslav Ignjatović, Vesimir Veselinović, Miodrag Zivković, Zdravko Ljubić, Miodrag Miljković, Živorad Nikolić, Ratomir Stanković, Živorad Milićević, Radomir Milanović, Ivan Budić, and Rajko Ačić, as well as some who did not work full time or had permanent employment for short period of time, were not taken into consideration because they had negligible number of papers or they were not present in the SCOPUS database.

3.2. Metallurgical Engineering

Table 2 shows the ranking results of researchers at the Metallurgical Engineering Department (MeE) based on the number of published papers in journals with IF as a predominant criterion, listing as well the number of hetero-citations and the h-index for the period ending on 1st October 2018.

Table 2 *Ranking of the researchers at MeE Department by different criteria (state on 1st October 2018) (source: SCOPUS)*

No	Name	No of papers	No of hetero-citations	h-index
1.	Dragana Živković	213	837	13
2.	Dragan Manasijević	120	317	9
3.	Nada Štrbac	54	289	7
4.	Ljubiša Balanović	41	76	4
5.	Mirjana Rajčić Vujasinović	35	73	4
6.	Velizar Stanković	30	379 + (12)* = 391	9
7.	Zvonimir Stanković	30	153 + (38)* = 191	5
8.	Aleksandra Mitovski	28	57	4
9.	Vesna Grekulović	20	17	2
10.	Saša Marjanović	19	17	2
11.	Svetlana Nestorović	18	43	4
12.	Desimir Marković	16	43	4
13.	Ivana Marković	14	31	3
14.	Svetlana Ivanov	14	17	2
15.	Srba Mladenović	14	12	2
16.	Dragoslav Gusković	13	9	2
17.	Milan Gorgijevski	12	216	5
18.	Borislav Dačić	9	116	5
19.	Leonida Stuparević	7	101	4
20.	Ljubica Ivanić	7	11	2
21.	Nikola Pacović	4	38 + (12)* = 50	3

( ) Number of citations according to the Scientific Citation Index until 1995*

Some of the researchers who worked at this Department, like Milan Blagojević, Dušanka Čikara, Miloš Vukadin, Božidar Stanokjević, Blagoje Kočovski, Mihajlo Rajčić, Damjan Cvetković, Milan Antić, Gradimir Pavlović, Nikola Colović, and Slobodan Stojadinović, as well as some who did not work full time or had permanent employment for short period of time, were not taken into consideration because they had minor number of papers or they were not present in the SCOPUS database.

3.3. Technological Engineering

Table 3 shows the ranking results of researchers at the Technological Engineering Department (TE) based on the number of published papers in journals with IF as a predominant criterion, listing as well the number of hetero-citations and the h-index for the period ending on 1st October 2018.

Table 3 *Ranking of the researchers at TE Department by different criteria (state on 1st October 2018) (source: SCOPUS)*

No	Name	No of papers	No of hetero-citations	h-index
1.	Milan Antonijević	75	1355	19
2.	Čedomir Maluckov	39	66	6
3.	Snežana Šerbula	34	348	9
4.	Ana Simonović	27	155	7
5.	Jelena Đoković	27	4	1
6.	Mile Dimitrijević	26	425	11
7.	Slađana Alagić	26	166	9
8.	Snežana Milić	22	350	9
9.	Marija Petrović Mihajlović	20	601	8
10.	Milan Radovanović	17	119	6
11.	Ana Radojević	17	162	6
12.	Tanja Kalinović	16	72	5
13.	Dejan Tanikić	12	14	2
14.	Žaklina Tasić	9	42	3
15.	Maja Nujkić	6	42	4

Researchers who worked at this Department, like Petar Ilić, Berislav Ristić, and Tomislav Vidojković have a small number of papers and they were not taken in consideration. Aleksandar Tolić, Miodrag Bogosavljević, Gradimir Pavlović and Živa Markov worked only for a short period of time or they had negligible number of papers and their results were not recorded.

3.4. Engineering Management

Table 4 shows ranking results of researchers at the Engineering Management Department (EM) based on the number of published papers in journals with IF as a predominant criterion, listing as well the number of hetero-citations and the h-index for the period ending on 1st October 2018.

Table 4 *Ranking of the researchers at EM Department by different criteria (state on 1st October 2018) (source: SCOPUS)*

No	Name	No of papers	No of hetero citations	h-index
1.	Živan Živković	168	793+ (95)* = 888	14
2.	Darko Brodić	93	67	4
3.	Ivan Mihajlović	62	229	7
4.	Đorđe Nikolić	38	136	6
5.	Dragiša Stanujkić	27	163	8
6.	Snežana Urošević	21	41	5
7.	Milovan Vuković	20	117	4
8.	Ivana Đolović	17	73	5
9.	Predrag Đorđević	17	26	3
10.	Isidora Milošević	11	59	5
11.	Marija Panić	13	19	3
12.	Dejan Bogdanović	12	39	3
13.	Milica Arsić	9	18	3
14.	Ivan Jovanović	9	14	2
15.	Aleksandra Fedajev	6	4	1
16.	Sanela Arsić	5	38	4
17.	Darko Kocev	5	11	2
18.	Danijela Voza	5	4	1
19.	Nenad Milijić	3	15	3
20.	Dejan Riznić	3	6	2
21.	Ivana Stanišev	3	1	1

( ) Number of citations according to the Scientific Citation Index until 1995*

Researchers who worked at this Department, like Radmilo Nikolić and Aca Jovanović, and English language teachers Miroslav Piljušić, Danica Radosavljević, Enisa Nikolić, and Mara Manzalović have a small number of papers and they were not taken in consideration.

4. Ranking of 10 most successful researchers at TFB based on the number of published papers

Based on the number of published papers in journals with IF, according to the SCOPUS database, for the period ending on 1st October 2018, Table 5 shows the list of 10 most successful researchers at the Technical Faculty in Bor since its establishment.

Table 5 *Top 10 researchers at TFB based on the number of published papers until 1st October 2018 (source: SCOPUS)*

No	Name	No of published papers	Department	Points
1.	Dragana Živković	213	MeE	10
2.	Živan Živković	168	EM	9
3.	Dragan Manasijević	120	MeE	8
4.	Darko Brodić	93	EM	7
5.	Milan Antonijević	75	TE	6
6.	Ivan Mihajlović	62	EM	5
7.	Nada Štrbac	54	MeE	4
8.	Ljubiša Balanović	41	MeE	3
9.	Čedomir Maluckov	39	TE	2
10.	Đorđe Nikolić	38	EM	1

5. Ranking of 10 most successful researchers at TFB based on the number of hetero-citations

Table 6 shows the ranking of 10 most cited researchers at TFB since its establishment until 1st October 2018, based on the number of hetero-citations according to the SCOPUS database.

Table 6 *Top 10 researchers at TFB based on the number of hetero-citations until 1st October 2018 (source: SCOPUS)*

No	Name	No of hetero-citations	Department	Points
1.	Milan Antonijević	1355	TE	10
2.	Živan Živković	888*	EM	9
3.	Dragana Živković	837	MeE	8
4.	Marija Petrović Mihajlović	601	TE	7
5.	Mile Dimitrijević	425	TE	6
6.	Velizar Stanković	391*	MeE	5
7.	Snežana Milić	350	TE	4
8.	Snežana Šerbula	348	TE	3
9.	Dragan Manasijević	317	TE	2
10.	Nada Štrbac	289	MeE	1

( ) Number of citations according to the Scientific Citation Index until 1995*

6. Ranking of 10 most successful researchers at TFB based on the h-index

Table 7 shows the ranking of best researchers based on the value of the h-index as a reliable indicator of the quality of published papers. In the cases where the h-index was the same, better position was appointed to the researcher with a higher number of hetero-citations.

Table 7 *Top 10 researchers at TFB based on the value of h index until 1st October 2018 (source: SCOPUS)*

No	Name	h- index	Department	Points
1.	Milan Antonijević	19	TE	10
2.	Živan Živković	14	EM	9
3.	Dragana Živković	13	MeE	8
4.	Mile Dimitrijević	11	TE	7
5.	Velizar Stanković	9 (391)*	MeE	6
6.	Snežana Milić	9 (350)	TE	5
7.	Snežana Šerbula	9 (348)	TE	4
8.	Dragan Manasijević	9 (317)	MeE	3
9.	Snežana Alagić	9 (166)	TE	2
10.	Marija Petrović Mihajlović	8 (601)	TE	1

( ) For the same value of h- index, the number of points was calculated based on the number of hetero-citations and the number of citations according to the Scientific Citation Index until 1995*

7. Ranking of 10 most successful researchers at TFB based on the criteria for the scientific competence

Scientific competence of the people in science in the academic community is measured by internationally verified criteria: the number of published papers in journals with IF, the number of hetero-citations in journals with IF and the h-index which is based on hetero citations (obtained according to data available in the SCOPUS database). These were basic criteria for accepting new members at the Serbian Academy of Sciences and Arts (technical sciences) in 2018.

Table 8 shows the results of ranking of top 10 researchers at the Technical Faculty in Bor based on the number of published papers in journals with the Impact Factor, the number of hetero-citations

and the h-index calculated according to the number of hetero-citations (SCOPUS database) for the period ending on 1st October 2018. The first position on the list, based on one of the criteria, was appointed with 10 points, second position with nine points, and the tenth position with one point. The addition of points for each of the used criteria provided the list of researchers at TF in Bor with the highest scientific competence. In the case of the same number of points, the priority was given to the researcher with higher number of the hetero-citations.

Table 8 *Top 10 researchers at TFB based on the criteria for the scientific competence (SCOPUS) for the period ending on 1st October 2018*

Name No of points Department based on three criteria
1. Živan Živković 27 EM
2. Milan Antonijević 26(1334)* TE
3 Dragana Živković 26 (837) MeE
4. Mile Dimitrijević 13 (425) TE
5. Dragan Manasijević 13 (317) MeE
6. Velizar Stanković 11 MeE
7. Snežana Milić 9 (349) TE
8. Darko Brodić 9 (67) EM
9. Marija Petrović Mihajlović 7 (592) TE
10. Snežana Šerbula 7 (343) TE

( ) In the case of the same number of points, the priority was given to the researcher with higher number of hetero-citations*

The obtained results clearly show that the three most prominent researchers at the Technical Faculty in Bor are Živan Živković, Milan Antonijević and Dragana Živković, with almost 100% more elements for scientific competence than researchers who were placed lower on the list, and compared to others, they stand out even several times more. Two of the researchers, together with their PhD students, practically established two schools for which TF in Bor is well known in the country and abroad: Živan Živković with D. Živković, D. Manasijević, N. Štrbac, I. Mihajlović and others - School for Thermal Analysis; and Milan Antonijević with M. Dimitrijević, S. Milić, M. Petrović, S. Šerbula and others – School for Corrosion Processes and Biomonitoring. The results achieved by Velizar Stanković and Darko Brodić, who developed research in their respected areas, should also be emphasized.

8. Ranking of 10 most successful researchers at TFB based on the number of published university textbooks and research monographs

The publication of a university textbook (UT), supplementary university textbook (SUT), or research monograph (RM) provides a significant contribution to the education of students, especially if they are used at other faculties in the country and abroad as well. This offers the opportunity for the development of new researchers and allows the curricula to become clear and understandable. Table 9 shows the ranking results of top 10 researchers at TFB based on the number of published UT, SUT and RM.

Table 9 *Top 10 researchers at TFB based on the number of published UT, SUT and RM for the period ending on 1st October 2018*

No	Name	No			No of UT used at other faculties		Department	Points
		UT	RM	SUT	In the country	Abroad		
1.	Živan Živković	11	5	5	2	4	EM	10
2.	Radmilo Nikolić	9	2	-	3	-	EM	9
3.	Milovan Vuković	6	3	-	2	-	EM	8
4.	Blagoje Kočovski	5	-	-	-	-	MeE	7
5.	Nenad Vušović	3	2	1	-	-	MiE	6
6.	Nedeljko Magdalinović	2	3	1	1	-	MiE	5
7.	Živorad Milićević	3	2	-	-	-	MiE	4
8.	Radoslav Ignjatović	2	3	-	-	-	MiE	3
9.	Nada Štrbac	2	2	2	-	-	MeE/EM	2
10.	Dragana Živković	2	2	2	-	-	MeE	1

** In the case of the same number of UT, the ranking was carried out based on the nuber of UT and their use at a) other faculties or b) on other study programs*
Source: Monograph on 50 years of higher education and science at TF Bor and the Reports on the Quality of Science and Research and International Cooperation at the Technical Faculty in Bor

9. Ranking of 10 most successful researchers at TFB based on the number of PhD mentorships

Considering that the defended PhD thesis is needed for the election procedure to higher scientific-educational title, the significant scientific result that the researcher at the Faculty realizes through this aspect of transferring knowledge to younger colleagues is also very important. Forming new personnel that will further develop research is significant for new generations in the country. Table 10 shows the ranking of researchers at TFB based on the number of completed PhD mentorships at the Technical Faculty in Bor, and other faculties as well.

Table 10 *Top 10 researchers at TFB based on the number of PhD mentorships*

No	Name	No of mentorships at TFB	No of mentorships at other faculties	Department	Points
1.	Živan Živković	12	5	EM	10
2.	Milan Antonijević	8	-	TE	9
3.	Nikola Pacović	5	-	MeE	8
4.	Dragana Živković	5	-	MeE	7
5.	Milovan Vuković	5	-	EM	6
6.	Nada Štrbac	4	-	MeE	5
7.	Radoslav Ignjatović	3	-	MiE	4
8.	Mile Dimitrijević	3	-	TE	3
9.	Ivan Mihajlović	3	-	EM	2
10.	Snežana Šerbula	3	-	TE	1

** In the case of the same number of mentorships, the ranking was carried out chronologically (the priority was given to the mentorships completed in the previous period due to the fact that the research conditions were more difficult)*

10. Conclusion

The ranking of scientific results achieved by the teachers – researchers at the Technical Faculty in Bor since it was founded until 1st October 2018 offers a genuine picture of the individual researcher's achievements based on the generally accepted criteria for ranking researchers in the world – SCOPUS database: the number of published papers in journals with the Impact Factor, the number of hetero-citations, and the h-index, which were all predominant criteria for appointing new members at the Serbian Academy of Sciences and Arts (technical sciences) in 2018.

Besides achieved scientific results, the following activities are also important for researchers:

- Publication of university textbooks (offers clear overview of the curriculum)
- Forming new personnel through successful PhD mentorships.

Having in mind that, for a longer period of time, publishing of scientific papers in leading scientific journals was not common at the Technical Faculty in Bor, these results can be seen as modest. The only goal for most of the teachers was to become a full professor with as little effort as possible and to take part in scientific research. The predominant activity was to participate in projects (a routine activity) that brings money, and affiliation of the Faculty with international scientific journals was uncommon.

Finally, being criticized for this publication is expected. Instead of contestation, the author is sending a message: do better and more than others (publish your own papers in leading journals, and do not allow just to be signed as co-authors) and in that way prove that you belong to the scientific elite from which you are ***currently unjustly omitted***.

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