The ranking of Iranian universities based on an improved technique

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ABSTRACT
Current competitive environment has forced higher education authorities to rank the scientific performance of their universities. The results of the university rankings have been used in strategic planning of research affairs. Focal point behind the university ranking is the methodological issues. Previous university rankings have relied on the conventional methods that are accompanied by some drawbacks. Therefore, the present study aims to evaluate Iranian universities based on the Crown indicator. The performance of fourteen Iranian universities was evaluated based on the data gathered from Essential Science Indicators (ESI) database. Results of the world university rankings do not indicate the true positions of the universities that can be attributed to the combined methods. Findings show that the older and larger sized Iranian universities, notwithstanding their enormous publications and citations, have lower research impact performance compared to relatively newer and smaller universities. Furthermore, employing a normalized mechanism [such as Citation per Publication (CPP)/ Mean Field Citation Score (FCSm)] in rankings provide better results useful for strategic decisions in universities. Using the ranking results from normalized data, using new sets of metrics, smaller and newer Iranian universities could attract larger resources, better quality faculties and students to strengthen stronger national and international collaborations.

Keywords: University ranking; Crown indicator; Research performance; Scientific assessment; Iranian universities.

INTRODUCTION

Scientific efforts have an important role in university ranking. Ranking of higher education institutes results in a competitive environment for universities to attract more financial support, as well as students and qualified researchers from within the country and worldwide (Van Raan 2005a; Moed 2005). University rankings have also influenced the decisions of policy makers in higher education, especially in the allocation of financial resources among universities and research institutes.

There are different ranking techniques with different approaches and different outcomes. Therefore, the rank of universities, nationally and worldwide, may be different in various ranking systems. Although the results of the rankings are important for universities and the authorities of research institutes, the calculations should be statistically significant (Van Raan 2005b). Considering the main purpose of all rankings, as an assessment of academic quality, Harnad (2008) discussed the validation metrics. He indicated the "research performance quality" as a standard criterion of scientometric assessments to resolve the validation issue. This criterion should take face-validity of citation into account. He ended with the question of "what is the face-valid measure of research performance quality?"

The ranking systems have always been subject to criticisms (Dill and Soo 2005; Van Raan 2005b) for various reasons such as the methodology, technique (Proulx 2009), indicators, and institutional approaches toward the results. The last reason is associated with the concern of university authorities to raise the reputation and prestige of their universities. The reputation indicators, although controversial as "social capitals", are generally used in ranking systems with different share of total score such as Times Higher Education Supplement (THES) World Rankings and Perspectivity [Polish magazine ranking] (each 50%) and U.S. News and World Report Ranking, Asia Week and Macleans (each 25%) (Federkeil 2009). Therefore, the main focus of educational managers is to enroll students, recruit faculties, and to gain revenues. Despite the growth of university rankings at the national and international levels, reception to this issue is lukewarm among higher education policymakers in the world.

Universities are subject to different ranking systems. With the launch of the first ranking in 1983, US News and World Report rankings (Lazaridis 2010), government agencies, media, funding organizations are encouraged to provide and improve ranking systems. There have been proposals for different ranking systems such as the UK Sunday Times University Guide, Guardian's Guide to Universities, the Canadian Maclean's University Rankings, the CHE University Ranking, the Asia Week's Best Universities, Shanghai Jiao Tong University (SJTU), Times Higher Education Supplement (THES-QS ranking), Leiden University Ranking and the rankings of Taiwan Higher Education and Accreditation Council (Van Raan 2005a; Pagell 2009; Leydesdorff and Shin 2011). The question is which university ranking can provide true ranking? The shift from merely relying on peer review in performance assessment have moved to the inclusion of other factors (such as, Nobel Prizes and Fields Medals, number of highly cited researchers selected by Thomson Reuters, number of articles published in *Nature* and *Science* and alumni, teacher student ratio, teaching, citations, industry income, employability, and internationalization) have changed the approaches toward the evaluation and ranking of universities.

Many studies have considered rankings and their performances, similarities, or differences (e.g. Docampo 2011). The Shanghai Jiao Tong University has been at the forefront of criticism and some researchers have posed challenging questions (Dill and Soo 2005; Zitt and Filiatreau 2006; Van Raan 2006; Buela-casal et al. 2007; Ioannidis et al. 2007; Van Raan 2005a). This includes questioning the Shanghai ranking as being "a reliable one-dimensional scale" at aggregate level (Docampo 2011). Although it is more popular than other rankings (Billaut, Bouyssou, and Vincke 2010), it has a strong bias against different fields of sciences (science and technology against arts, humanities and social sciences) in relation to the indicators such as Nobel Prizes, publication in *Nature* and *Science* (N&S) that are questioned by critics.

Notwithstanding the challenges of ranking, there is a high tendency among the world's higher education institutions to evaluate themselves using different or a combination of ranking systems. The results of rankings (league tables) are based on various methods of collecting quantitative and qualitative data. The soundness of these methods for monitoring university quality strongly depends on the indicators used. Iranian universities have been involved in global competition among higher education institutions. Accordingly, they have been rated in different ranking systems such as the QS World University Ranking, Academic Ranking of World Universities (ARWU), and THES in different years (Table 3).

Some countries initiate the launch of new ranking systems as opposed to using the existing ones. This decision is rooted in the aim and method of current rankings (Pagell 2009) and the mission of higher education institutions (Shin and Toutkoushian 2011). The method of normalization is an important issue. Little census is available on the normalization, such as citation differences among fields. Consequently, other indicators have been developed, which includes, an indicator introduced by the Centre for R&D Monitoring (ECOOM) in Leuven, Belgium (Waltman et al. 2010; 2011), Leiden Crown indicators (CPP/FCSm & MNCS), fractional counting of citations introduced by Leydesdorff and Shin (2011), Karolinska Institute in Sweden indicator (item oriented field normalized citation score average) as an alternative to Leiden Crown indicators (Rehn et al. 2007), and the latest SCImago research group indicator, SCImago Journal Rank (SJR) (SCImago 2007). Since number of publications and citations are important factors for university performance assessment, it is highlighted in the Centre for Science and Technology Studies (CWTS), Leiden University ranking (Leydesdorff and Shin 2011). The performance measurement of universities based on Crown indicators is more close to reality when considering differences between fields.

Iranian universities have been ranked under some world rankings in different years. In addition, ranking of Iranian universities and research centres project has ranked Iranian higher education institutes with a set of different indicators (Islamic World Science Citation Center 2012). However, this study proposed a different approach and aims to evaluate Iranian universities performances based on Leiden Crown indicator (CPP/FCSm), not the common classic indicators with technical and methodological problems (Proulx 2009).

METHODOLOGY

To calculate CPP/FCSm, we combined the Baseline values from the Essential Science Indicators (ESI) with individual publication data taken from Web of Science (WoS). Then a search was carried out in the Science Citation Index-expanded (SCIE), Social Science Citation Index (SSCI) and Arts & Humanities Citation Index (AHCI) in WoS using the search formula: “OG= (name of the university)” with the timespan = 2000-2010. Search results for each university were refined using all defined “Subject Areas”. It displays the various subject categories under which the articles are mapped. Scope Note SCI and SSCI, 2010 were assigned to match the various subject categories with 22 broad disciplines. This search provided universities’ publications numbers in each field. To export the records to notepad, we used the option “Save to tab delimited win”, then pasted the content to an excel sheet for further analyzes.

Values of two parameters CPP and FCSm should be defined. Since ESI works with 22 broad disciplines to provide e_i values, ($\mathbf{CPP/MCSm} = \frac{1}{n}\sum_{i=1}^{n} w_i \frac{c_i}{e_i}$) (Waltman et al. 2011) for each of these disciplines, CPP value was extracted from the ESI database (under Institutions Menu). We searched all Iranian universities by names (all universities affiliated to Ministry of Science, Research, and Technology and Ministry of Health and Medical Education) in ESI to check if they have CPP value. Retrieved records showed fourteen universities, which had CPP values. Therefore, our research population consisted of fourteen universities. We considered variations in name of a university and controlled it using two most often used names of each university. To calculate FCSm, we determined the field of each publication of a university and then based on that field we found the correct Baseline value from the baselines (average citation rates table) in the ESI. To

estimate FCSm, a weighted average was calculated to correct the differences among fields [Waltman et al. (2010) and Waltman et al. (2011) for more information]. Finally, we divided the CPP value by FCSm to rank Iranian universities based on the Crown indicator.

Of the fourteen universities, seven universities including University of Tehran (UT), University of Tabriz (TAU), University of Mazandaran (UMZ), Razi University (RAU), Buali Sina University (BASU), Shiraz University (SHU), and Shahid Beheshti University (SBU) were comprehensive universities in Iran, which offered programmes in scientific disciplines and majors. One university, Tarbiat Modares University (TMU) was the only university of graduate studies in Iran; two were universities of medical sciences including Shiraz University of Medical Sciences (SUMS) and Tehran University of Medical Sciences (TUMS). There are four universities of engineering and sciences comprising Sharif University of Technology (SUT), Isfahan University of Technology (IUT), AmirKabir University of Technology (AUT), and Iran University of Science and Technology (IUST). To perform a review of the universities, their profile is presented in Table 1.

Table 1: Profile of Studied Iranian Universities

University *	Foundation Year	Fields **	Aging: Years Established	Number of Academic Staff	Number of Students
IUST	1929	Eng. and S	82	365	10000
TUMS	1934	Med. Sci	77	>2000	>19000
UT	1934	Comp. A. P	77	1492	34691
SHU	1946	Comp. A. P	65	553	>15000
SUMS	1946	Med. Sci	65	539	> 8000
TAU	1947	Comp. A. P	64	500	>11000
AUT	1958	Comp. A. P	53	>450	3629
SBU	1959	Comp. A. P	52	575	11547
SUT	1966	Eng. and S	45	>300	10000
IUT	1971	Eng. and S	40	421	>8000
RAU	1974	Comp. A. P	37	261	>8900
BASU	1975	Comp. A. P	36	300	7000
UMZ	1979	Comp. A. P	32	176	10000
TMU	1982	Eng. and S	29	409	8000

Note*: Iran University of Science and Technology (IUST), Tehran University of Medical Sciences (TUMS), University of Tehran (UT), Shiraz University (SHU), Shiraz University of Medical Sciences (SUMS), University of Tabriz (TAU), AmirKabir University of Technology (AUT), Shahid Behesh University (SBU), Sharif University of Technology (SUT), Isfahan University of Technology (IUT), Razi University (RAU), Buali Sina University (BASU), University of Mazandaran (UMZ), Tarbiat Modares University (TMU).

Note:** Com.A.P: comprehensive academic programs, Eng. and S: engineering and sciences, Med. Sci: medical sciences.

With differences in statistical data related to the fourteen Iranian universities, we also observed differences in their research performance especially in the number of publications and citations (Table 2).

Table 2: Publications and Citations Received by Fourteen Iranian Universities

University	Absolute Numbers Size			Normalized Numbers Impact	Normalized Numbers Productivity	
	Academic Staff (AS)	Publications (Ps)	Citations (Cs)	CPP	C/AS	P/AS
AUT	540	3231	10269	3.18	19	6
BASU	300	1144	7889	6.90	26.3	3.8
IUST	365	2214	6784	3.06	18.6	6
IUT	421	2370	10840	4.57	25.7	5.6
RAU	261	1182	9654	8.17	40	4.5
SBU	575	1319	10736	8.14	18.7	2.3
SHU	553	3254	17236	5.30	31.2	6
SUMS	539	1509	4969	3.29	9.2	2.3
SUT	300	4528	19184	4.24	64	15
TAU	500	1263	6598	5.22	13.2	2.5
TMU	409	1073	9870	9.20	24.1	2.6
TUMS	2000	4201	17956	4.27	9	2.1
UMZ	176	569	3671	6.45	20.9	3.2
UT	1492	7475	30142	4.03	20.2	5

Note: The data [publications (Ps), citations (Cs), and Citation Per Publication (CPP)] extracted from Essential Science Indicators (Baselines), 28 Feb. 2011.

Of these fourteen universities, two universities (University of Tehran and Sharif University of Technology) were rated in three world university rankings. The breakdowns are shown in Table 3.

Table 3: Universities Situation based on QS, ARWU and THES Rankings (2007-2010)

QS Rankings							ARWU Rankings	THES Rankings
	Arts and Humanities	Natural Sciences	Engineering and IT	Social Sciences	Life Sciences	Overall Ranking		
UT								
2007	301=	277=	184	228=	410=	539	N/A	N/A
2008	N/A	229=	159=	N/A	N/A	401-500	N/A	N/A
2009	N/A	183=	112	N/A	298=	368=	402-501	N/A
2010	351-400	290=	178	N/A	257=	401-450	401-500	401-500
SUT								
2007	N/A	466=	244=	N/A	472=	528=	N/A	N/A
2008	N/A	N/A	165	N/A	N/A	501+	N/A	N/A
2009	N/A	N/A	145=	N/A	N/A	501-600	N/A	N/A
2010	N/A	301-350	183=	N/A	N/A	501-550	N/A	N/A

Note: University of Tehran (UT) focuses on comprehensive programs, Sharif University of Technology (SUT) in science and technology.

Five universities were not ranked in world rankings, but received scores in engineering (SHU=351-400, IUT=301-350, AUT=301-350, IUST=351-400) and life sciences (TUMS=257). Rankings which emphasized on numbers of publications and citations pushed universities towards strengthening fields (e.g. biomedical sciences where publications and citations are higher than other field such as mathematics (Leydesdorff and Shin 2011). In this case, results

are less reliable, and normalization can play a significant role. The Leiden ranking uses Crown indicators, i.e. CPP/FCSm and MNSC (Mean Normalized Citation Score) to measure research performance. They are well-known for considering the issue of normalization for differences among fields (Waltman et al. 2010). Waltman et al. (2011) inferred that there is small difference between the CPP/FCSm and the MNCS indicators in ranking countries and universities. To prove this, we conducted this study based on CPP/FCSm. It should be pointed out that the study does not consider The Leiden Ranking methodology for 2011/2012. This study also presents universities based on three different indicators: Size (numbers of citations and publications), Impact (citation per publication), and Productivity (citations or publications per faculty) (Leydesdorff and Shin 2011)

RESULTS

Performance of Iranian Universities Based on Subject Fields in WoS

There are more than 130 Iranian universities and about 29000 academic staffs covered by Ministry of Science, Research and Technology (MSRT), Iran and Ministry of Health and Medical Education (MOHME), Iran (Mohammad-Nedjad et al. 2008). Like other countries, scientific activities in Iran are different among different universities. This difference is more obvious in international publications of high-rank universities. Not all academic societies and institutes publish their research findings in internationally indexed journals. As a result, most publications from Iranian universities are not indexed in international citation databases, such as WoS and Scopus. This is the limitation of this study.

The period of 2000-2010 was considered for evaluation of this study. The performance of 14 universities in 22 subject categories of WoS with numbers of publications (Ps), citations (Cs), citations per publications (CPP), the mean of field citation score (FCSm) and the Crown indicator (CPP/FCSm) are presented in Table 4.

Table 4: Performance of Iranian Universities based on Bibliometric Indicators

University	Fields	Ps	Cs	CPP	FCSm	CPP/FCSm
TMU	Com. A. P.	1073	9870	9.2	10.22	0.9
RAU	Com. A. P	1182	9654	8.17	9.37	0.87
IUST	Eng. and S.	2214	6784	3.06	6.27	0.84
UMZ	Com. A. P	569	3671	6.45	8.8	0.73
BASU	Com. A. P	1144	7889	6.9	10.22	0.68
SBU	Com. A. P	1319	10736	8.14	12.36	0.66
SUMS	Med. Sci.	1509	4969	3.29	5.36	0.61
SHU	Com. A. P	3254	17236	5.3	8.93	0.59
SUT	Eng. and S.	4528	19184	4.24	7.25	0.58
IUT	Eng, and S.	2370	10840	4.57	8.06	0.57
TAU	Com. A. P	1263	6598	5.22	10.28	0.51
AUT	Eng. and S.	3231	10269	3.18	6.47	0.49
UT	Com. A. P	7475	30142	4.03	9.6	0.42
TUMS	Med. Sci.	4201	17956	4.27	13.7	0.31

Note: Tarbiat Modares University (TMU), Razi University (RAU), Iran University of Science and Technology (IUST), University of Mazandaran (UMZ), Buali Sina University (BASU), Shahid Beheshti University (SBU), Shiraz University of Medical Sciences (SUMS), Shiraz University (SHU), Sharif University of Technology (SUT), Isfahan University of Technology (IUT), University of Tabriz (TAU), AmirKabir University of Technology (AUT), University of Tehran (UT), Tehran University of Medical Sciences (TUMS).

Iranian Universities Ranked Based on Publications and Citations

Of the fourteen Iranian universities, the data related to date of establishment and size of universities are available. If we rank these universities based on numbers of publications and citations, we found that older universities achieved more publications (Ps) and citations (Cs) and are placed within the high-ranked universities (Figure 1).

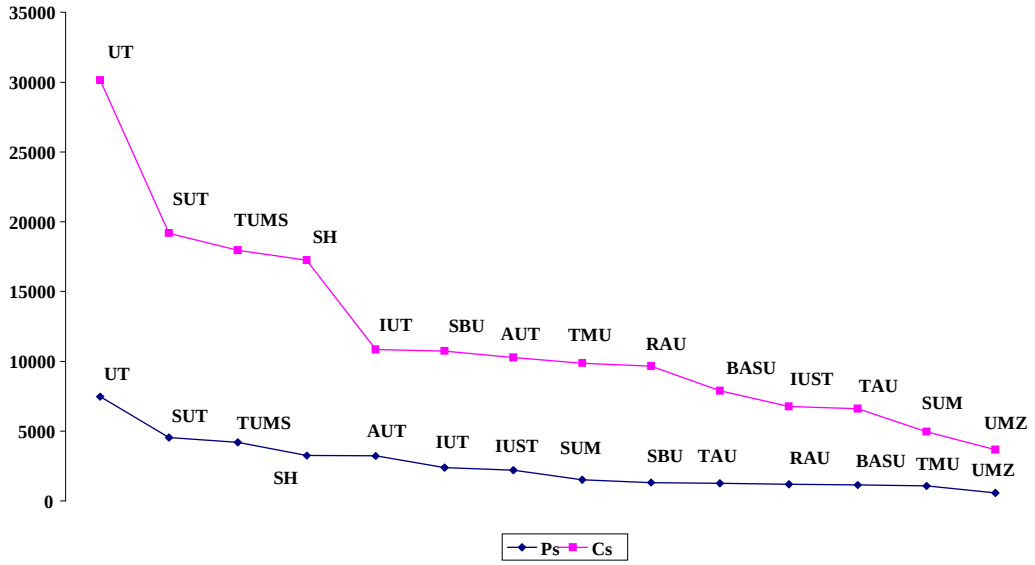

Figure 1: Ranks of Iranian Universities based on Publications (Ps) and Citations (Cs)

Note: University of Tehran (UT), Sharif University of Technology (SUT), Tehran University of Medical Sciences (TUMS), Shiraz University (SHU), AmirKabir University of Technology (AUT), Isfahan University of Technology (IUT), Iran University of Science and Technology (IUST), Shiraz University of Medical Sciences (SUMS), Shahid Beheshti University (SBU), University of Tabriz (TAU), Razi University (RAU), Buali Sina University (BASU), Tarbiat Modares University (TMU), University of Mazandaran (UMZ).

Although, the number of publications and citations as bibliometric indicators are important in citation analysis, these data do not indicate the research impact of the universities. Consequently, normalization techniques are required to achieve reliable results. Therefore, the average number of citations (including self-citations) per publication (CPP), FCSm and CPP/FCSm is calculated. Figure 2 shows the ranking position of universities according to three bibliometric indicators.

The correlation (Spearman's rho) between "C" and "CPP/FCSm" is negatively significant (ρ =-.547; $p<0.05$) and it is also true for correlation between "P" and "CPP/FCSm" (ρ =-.749; $p<0.05$). These results were expected since the total number of citations and publications do not show the research impact. But the CPP/FCSm indicator normalizes the citation rates between document types and subject areas. The correlation between average number of citations per publication (CPP) and "CPP/FCSm" indicator is statistically significant (ρ = .534; $p<0.05$). This is the indication of the average scientific impact of universities using the crown indicator that "is relatively resistant to citation scores being levered by a few highly cited papers in low-cited fields" (Rehn, et al. 2007).

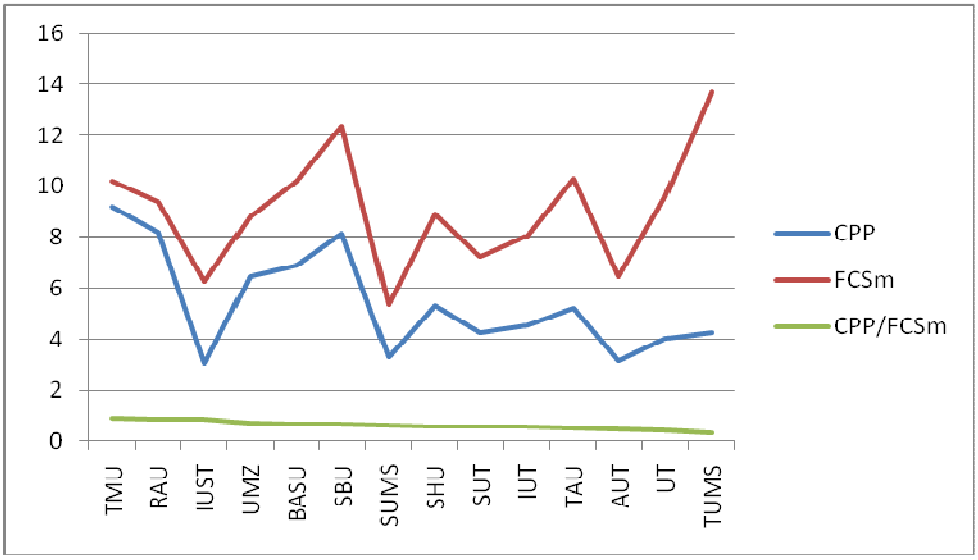

Figure 2: Ranks of Iranian Universities Based on Citation Per Publication (CPP), the Mean of Field Citation Score (FCSm) and CPP/FCSm.

Normalized Ranking of Iranian Universities

Because of the different citation habits in many fields of sciences (Van Raan 2005a), a field-specific normalization (FCSm) against international citation reference values were calculated. Citations per publications (CPP) and mean field citation score (FCSm) as the building blocks of the Crown indicator (CPP/FCSm) were compared to assess the proper performance of Iranian universities (Table 4).

As expectation, there was a high correlation between size measurements, i.e. numbers of faculty members and publications (r=0.67), numbers of faculty members and citations (r=0.65) and, numbers of publications and citations (r=0.94). Size measurements (Table 2) were negatively correlated with impact (AS and CPP r= -0.31; P and CPP r= -0.53; C and CPP r= -0.22). Furthermore, productivity indicators showed negative or weak correlation with size measurements (AS and C/AS r= -0.41; AS and P/AS r= -0.24; P and C/AS r= 0.16; P and P/AS r= 0.43; C and C/AS r= 0.27; C and P/AS r= 0.37).

Employing CPP, FCSm, and CPP/FCSm in the assessment, the smaller universities were placed in higher ranked positions (Figure 2). Three universities (UT, SUT, TUMS) which are big (in terms of size) and have been ranked in world rankings (QS, ARWU, THES) (Table 3) were placed in lower positions (Figure 2). Universities, which are small in size (numbers of publications and citations), obtained the rank of first to seventh based on the Crown indicator, CPP/FCSm, (Figure 2). According to Table 2 the scores of size indicators for citations and publications are less than median, respectively ($median_c < 10069$ and $median_p < 1861$). Of seven universities, five universities (including TMU) were comprehensive (based on programmes and disciplines), one university focuses on sciences and technology and one concentrates on medical sciences. Traditionally, we believe older universities perform better than the newly established ones. An interesting point is that the age of universities was negatively correlated with their ranks (r = - 0.95) based on PP/FCSm indicator.

Universities Performance Compared with International Impact Average

The Crown indicator evaluates the impact of universities and research institutes against international citation average. Therefore, it aims to correct citation density among fields (Waltman et al. 2011). Van Raan (2005a) describes the performance of the under evaluation units (here universities) in five scales:

- far below (indicator value < 0.5)
- below (between 0.5 and 0.8)
- around (between 0.8 and 1.2)
- above (between 1.2 and 1.5)
- far above (>1.5)

According to our findings based on CPP/FCSm indicator, the performance of all Iranian universities can be placed in three scales; far below, below, and around international average. Van Raan (2005a) also stated "the higher the aggregation level, the larger the volume of publications and the more difficult it is to have an impact significantly above the international level". It is true of Iranian universities (especially those with high number of publications). The local ranking of Iranian universities has been brought out an assessment of all universities in Iran with complete different outcomes. The results are negatively correlated with those of this study (ρ =-.58; $p<0.05$). In general, the impact of Iranian universities is below international impact average (Figure 3).

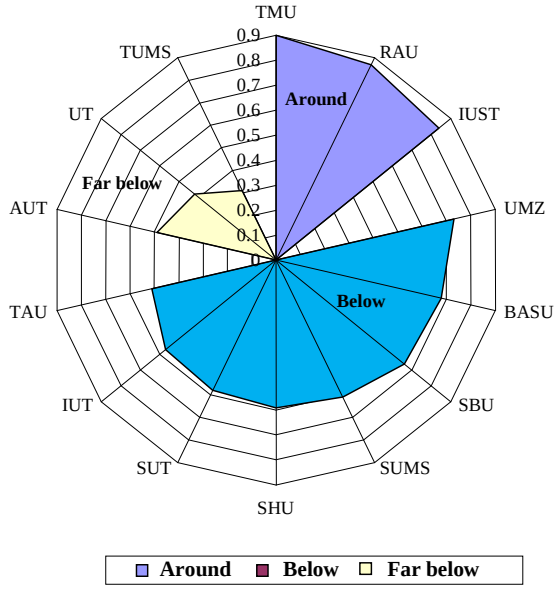

Figure 3: Universities Performance in Comparison with International Impact Average

Note:

Around: Tarbiat Modares University (TMU), Razi University (RAU), Iran University of Science and Technology (IUST).

Below: University of Mazandaran (UMZ), Buali Sina University (BASU), Shahid Beheshti University (SBU), Shiraz University of Medical Sciences (SUMS), Shiraz University (SHU), Sharif University of Technology (SUT), Isfahan University of Technology (IUT), University of Tabriz (TAU).

Far Below: AmirKabir University of Technology (AUT), University of Tehran (UT), Tehran University of Medical Sciences (TUMS).

DISCUSSIONS AND CONCLUSION

We employed CPP/FCSm indicator in our research that was the first Crown indicator of CWTS. Field normalization enables us to rank higher education institutions research impact in a competitive market within and across countries. Our finding showed the size measures (numbers of academic staff, publications, and citations) do not affect the impact (CPP). This finding is in agreement with Leydesdorff and Shin (2011), which showed correlation between size measures and impact measure is not statistically significant. The weak and negative correlation between size and productivity also substantiates the correctness of the Crown indicator (CPP/FCSm). However, the increasing rate of publications and citations do not necessarily increase impact and productivity of large universities in Iran.

Our empirical analysis based on CPP/FCSm revealed interesting facts about university ranking, because some old and large universities are at the bottom of the Iranian university league table (Table 5). Nowadays, higher education policy makers around the world, including in Iran, focus on the local and international ranking results rather than on "the international impact standard of a field". In such situation, larger universities with more per capita student, faculty, publication, and citation will receive more financial support and will be placed in top-ranked positions (third column in Table 5). Applying normalized mechanism (the Crown indicator) gave different ranking results. Therefore, for more assurance we used Spearman rank correlation test and found that this difference (between two rankings in Table 5) was statistically significant (ρ =-.58; $p<0.05$).

Table 5: Ranks of Fourteen Iranian Universities in Local and International (Crown) Rankings

Universities	Local Ranking		Crown Indicator	
	Score	Rank	Score	Rank
Tarbiat Modares University (TMU)	40.17	6	0.90	1
Razi University (RAU)	8.16	14	0.87	2
Isfahan University of Technology (IUST)	44.78	5	0.84	3
University of Mazandaran (UMZ)	12.31	12	0.73	4
Buali Sina University (BASU)	11.66	13	0.68	5
Shahid Beheshti University (SBU)	18.08	11	0.66	6
Shiraz University of Medical Sciences (SUMS)	24.58	8	0.61	7
Shiraz University (SHU)	32.38	7	0.59	8
Sharif University of Technology (SUT)	65.17	3	0.58	9
Isfahan University of Technology (IUT)	23.69	9	0.57	10
University of Tabriz (TAU)	20.86	10	0.51	11
AmirKabir University of Technology (AUT)	52.49	4	0.49	12
University of Tehran (UT)	100	1	0.42	13
Tehran University of Medical Sciences (TUMS)	65.29	2	0.31	14

ρ =-.58; $p<0.05$

In the international rankings (i.e. QS, ARWU, THES, in Table 3) with a combination of different indicators, University of Tehran (UT) as one of the oldest and largest universities in Iran is among the top 500 universities of the world. Furthermore, based on the new local ranking, *Ranking of Iranian Universities and Research Centres*, universities with larger financial support have higher citations (> median = 10069) but have less impact performance in terms of CPP. This study showed that "field normalized citation" is a good

indicator that can also be used in ranking systems. Table 5 compares the local ranking scores and the empirical ranking scores based on the Crown indicator.

Table 5 shows that the more comprehensive and smaller universities perform better than larger ones according to the Crown indicator. It can be concluded that high quality research at universities, can boost the university's ranking and also attracts more funds, better qualified students and faculties. University ranking based on the Crown indicator leads to somehow different results from other rankings. From the view point of policy making, funding and other managerial issues, it is better not to focus on a single specific ranking but consider results from different ranking systems. Higher education market has become more competitive for universities to convey and develop their brand. "No one ranking can be accepted as definitive" (Thakur 2007), in this case, metrics, methods, and awareness of them are important for administrators.

Based on the results, a total mean of $\bar{x}$ = 2524 (SD=1885) and median of Md = 10069 was achieved for the number of publications and citations, respectively. The results revealed three scales of Iranian universities namely, *around*, *below* and *far below* "the international impact standards" (Van Raan 2005b). Three universities are classified as *around scale*, i.e. Tarbiat Modares University (TMU), Razi University (RAU) and Iran University of Science and Technology (IUST). The mean obtained for these three universities ($\bar{x}$ =1490, SD=630) was far below the total mean score ($\bar{x}$=2524). Other eight universities (University of Mazandaran (UMZ), Buali Sina University (BASU), Shahid Beheshti University (SBU), Shiraz University of Medical Sciences (SUMS), Shiraz University (SHU), Sharif University of Technology (SUT), Isfahan University of Technology (IUT) and University of Tabriz (TAU) fell within the *below scale* with the mean publication of $\bar{x}$=1995 (SD=1316) and the median citation of Md = 9654, which were also below the total mean ($\bar{x}$=2524) and median (Md = 10069) scores. These findings revealed the number of publications and number of citations could not provide a true picture of university performance. A survey of Table 4 revealed the three universities, AmirKabir University of Technology (AUT), University of Tehran (UT) and Tehran University of Medical Sciences (TUMS), (with more publications and citations) were at the bottom of the league table (Table 5). The mean publication ($\bar{x}$=4969, SD=2224) and median citation (Md = 17956) of these three universities, all belonging to the *far below scale*, were well above the total mean and median scores gained.

In general, the performances of Iranian universities were below the international impact average (Figure 3). The results, while providing a clear picture of the present status of Iranian higher educational institutions, may provoke university chancellors to change, or at least modify, their views on ranking systems and thus adopt different policies. All these findings put together, highlight the prime need for research policy makers to exert changes or adjustments based on the new metric indicators.

The university rankings worldwide caused different arguments. They are based around the quality of indicators, healthy competition, data, methodology and validity of rankings (Teichler 2001). As a result the ranking systems should provide higher education policymakers with sufficient incentives to improve their performance. The outcomes of rankings might in principle be considered to be less dissuasive to attract the attention of all sectors of higher education institutions. This situation would not solve the controversial aspect of rankings, but it is a step in the right direction, especially for developing countries.

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