
Citation Impact

Assessing Progress in
Nine Countries

Dr Michael Norris

This report was prepared by Dr Michael Norris on behalf of INASP in February 2013 as part of the concluding review and documentation of the Programme for the Enhancement of Research Information (PERii).

Dr Norris in his doctoral work was concerned with identifying the citation impact of open access articles when compared to their closed counterparts. Subsequently he spent some time working on a number of wide ranging UK funded projects. Latterly he has been working at the University of Surrey in a part time bibliometric role where he has concentrated his skills on improving the understanding of the university's citation impact and advising how this might be enhanced. He may be contacted at miken237@gmail.com

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1 Introduction

Part of INASP's work is to promote, broadly, the academic excellence that is evident in the countries it supports and '...to improve access, production and use of research information and knowledge, so that countries are equipped to solve their development challenges.'¹ Assessing if such strategies have helped improve the impact of the many institutions INASP supports and their host countries is of strategic interest. Assessing excellence in research institutions is often undertaken by peer review, but this is very expensive on a national scale and citation metrics, often called bibliometrics and described as '...the analysis of data derived from publications and their citations'² can act as a proxy measure of the quality or impact of institutions through their publications. The instructions from INASP are to provide a short analysis of nine countries, at a national level, using some bibliometric techniques to assess whether their academic impact in the world, through citation metrics, is growing.

2 Methods

The nine countries indicated for study were: Bangladesh, Pakistan, Bolivia, Cuba, Nicaragua, Kenya, Malawi, Rwanda and Tanzania.

The SCImago Journal & Country Rank³ database was chosen to gather citation data; it includes country specific bibliometric indicators which have been developed from the information contained in the Scopus database. Scopus is a citation database from the journal publisher Elsevier; it indexes the contents of many thousands of journals and some conference proceedings from across the world and counts citations to the articles which appear in them. Through these citation counts, and their attendant features, indicators can be created to assess and analyze, collectively, the impact of academic institutions and their host countries.

A number of key features (metrics) were used to assess the progress the nine countries are making towards increasing their impact, these were:

Productivity – the number of publications they produced

Mean or average citation rate - the average number of citations received for publications

Citedness – the percentage of publications which are cited and the percentage which are not.

International collaboration – the number of publications written with international partners

Percentage world share – share of all the world's academic publications as indexed by Scopus

A key concept in bibliometrics is normalisation, this is where you show comparative performance where the values, in this case citations, have been 'standardised' to enable fair comparisons. For example if you took a set of documents published in physics and their citations and divided those citations by all the documents in your set you would have an average citation rate which you could

¹ INASP. About. 2013. Available at: <http://www.inasp.info/file/3d034b8bae0a3f7e1381979aedc356a9/about-inasp.html> [Accessed 22 Feb 2013].

² Bibliometric study of India's Scientific Publication outputs during 2001-10. 2012. Available at: http://www.dst.gov.in/whats_new/whats_new12/report.pdf [Accessed 22 Feb 2013].

³ SCImago Journal & Country Rank. 2013. Available at: <http://www.scimagojr.com/> [Accessed 22 Feb 2013].

use as a benchmark to compare the citation impact of other sets of comparable physics documents. An in context example of this is given immediately below.

2.1 Data selection and some definition

Two time periods, 2002-06 and 2007-11, were of particular interest. Data was downloaded from SCImago into an Excel spread sheet and some analysis was made of it. SCImago gives summaries of output at world, regional and country levels and these are useful bench marks against which the relative performance of the candidate countries can be measured. Table 1 & Table 2 show this key data.

Table 1 allows for some broad comparative measures, for example a country with average citations per document of 15 would have twice the world average ($15/7.53 = 2.0$) i.e. a normalised impact relative to the world of 2. Similar metrics can be derived for the regions, for example the broad level of citedness. Data is split to show both sets of years to allow comparative analysis for the two periods.

Table 1 World and regional data 2002-2011

Region	Years	Documents	Citations	Self-Citations	Avg Cites/Doc	Avg Self Cites/Doc.	% Self Citation	% Cited Docs	% Uncited Docs
World	2002-6	7976835	97514948	N/A	12.22	N/A	N/A	67.70	32.30
	2007-11	10624152	42596322	N/A	4.01	N/A	N/A	51.09	48.91
	All years	18600987	140111270	N/A	7.53	N/A	N/A	58.21	41.79
Africa	2002-6	45752	576435	155874	12.60	3.41	27.04	81.87	18.13
	2007-11	75685	350261	106843	4.63	1.41	30.50	60.58	39.42
	All years	121437	926696	262717	7.63	2.16	28.35	68.60	31.40
Asiatic	2002-6	1600578	16094884	8800978	10.06	5.50	54.68	72.82	27.18
	2007-11	2947301	9343593	5593749	3.17	1.90	59.87	48.87	51.13
	All years	4547879	25438477	14394727	5.59	3.17	56.59	57.30	42.70
Latin America	2002-6	232055	2551858	826030	11.00	3.56	32.37	79.76	20.24
	2007-11	399649	1400667	483466	3.50	1.21	34.52	54.91	45.09
	All years	631704	3952525	1309496	6.26	2.07	33.13	64.04	35.96

Similarly Table 2 shows the same key data but on a country level. Comparable analysis is possible and data may be further extracted from either table to facilitate further detailed analysis if necessary.

Table 2 Country data 2002-2011

Countries	Years	Documents	Cites	Self Cites	Avg Cites/Doc	Avg Self Cites/Doc.	% Self Citation	% Cited Docs	% Uncited Docs
Bangladesh	2002-6	3901	40927	7284	10.49	1.87	17.80	74.98	25.02
	2007-11	8986	24801	9014	2.76	1.00	36.35	46.33	53.67
	All years	12887	65728	16298	5.10	1.26	24.80	55.00	45.00
Pakistan	2002-6	10891	71089	20849	6.53	1.91	29.33	68.10	31.90
	2007-11	29977	77075	25479	2.57	0.85	33.06	47.28	52.72
	All years	40868	148164	46328	3.63	1.13	31.27	52.83	47.17
Bolivia	2002-6	649	9959	1104	15.35	1.70	11.09	88.44	11.56
	2007-11	1128	7286	800	6.46	0.71	10.98	68.88	31.12
	All years	1777	17245	1904	9.70	1.07	11.04	76.03	23.97
Cuba	2002-6	6304	39614	9618	6.28	1.53	24.28	59.38	40.63
	2007-11	9176	19193	4064	2.09	0.44	21.17	33.79	66.21
	All years	15480	58807	13682	3.80	0.88	23.27	44.21	55.79
Nicaragua	2002-6	233	2896	250	12.43	1.07	8.63	88.41	11.59
	2007-11	409	2159	211	5.28	0.52	9.77	66.75	33.25
	All years	642	5055	461	7.87	0.72	9.12	74.61	25.39
Kenya	2002-6	4176	65453	11602	15.67	2.78	17.73	87.05	12.95
	2007-11	6937	39978	7244	5.76	1.04	18.12	67.51	32.49
	All years	11113	105431	18846	9.49	1.70	17.88	74.85	25.15
Malawi	2002-6	780	12906	2024	16.55	2.59	15.68	91.28	8.72
	2007-11	1523	9597	1589	6.30	1.04	16.56	70.32	29.68
	All years	2303	22503	3613	9.77	1.57	16.06	77.42	22.58
Rwanda	2002-6	119	1298	119	10.91	1.00	9.17	84.87	15.13
	2007-11	488	2207	193	4.52	0.40	8.74	60.25	39.75
	All years	607	3505	312	5.77	0.51	8.90	65.07	34.93
Tanzania	2002-6	2000	30239	5167	15.12	2.58	17.09	89.20	10.80
	2007-11	3534	21641	3614	6.12	1.02	16.70	69.02	30.98
	All years	5534	51880	8781	9.37	1.59	16.93	76.31	23.69

In addition some data was drawn directly from SCImago after using its analytical features; some screenshots were taken of the results⁴. It is important to note though that the data is displayed from 1996, but the periods of interest can be clearly discerned. The data, which address the features given above, can be found in the Appendix in a series of figures. A sequential approach was taken for each of the countries, sometimes grouped to give a comparative effect where analysis would allow.

Following is a brief introduction to the key features used for analysis.

⁴ All screen shots taken from SCImago Journal & Country Rank. 2013. Available at: <http://www.scimagojr.com/> [Accessed 22 Feb 2013].

Productivity here refers to the number of documents, articles and conference proceedings in this case, that a country produces through its academic institutions. Table 3 for example shows the productivity of India, Pakistan and Bangladesh from 2002-11. Overall world output in terms of publications is steadily increasing and a rising trend should be expected if countries are intent on keeping their percentage share of it and increasing their research output.

When academics cite the work of another they are generally acknowledging or building on the work already done and such citations are seen as a measure of a publications quality or utility. When all of the citations that a country receives are counted and divided by all of the publications it produces, a *mean or average citation rate* is produced. This is a very important measure of citation impact, the higher that average the greater the research impact or influence the country is thought to have, quite apart from it being seen as a proxy measure of the quality of the work. Figure 1 is an illustration of such averages, the longer a document is available the more citations it is likely to receive, hence citation impact is less strong the more recent the analysis i.e. citations to publications from 2011 will be fewer than citations to publications in 2002 simply because the publications have been available for less time to be cited.

Citedness is a measure, usually given in percentages, of how many documents have been cited and how many have not. Again this is a very important measure, and the greater the percentage cited the greater the *mean or average citation rate* is likely to be. It follows of course that the greater the percentage cited the more of the works are thought worthy of citation. There should be awareness though of the different citing practices, and citing intensities between disciplines, the sciences are more highly cited than the humanities, with engineering subjects somewhere in between the two.

International collaboration is important; it can be measured when the authors of a publication are from different countries. It shows that the institution is capable of collaboration and that it has something to contribute. Generally publications that are the result of such collaboration are cited more frequently than publications authored solely domestically within the country.

A companion of *productivity* is *percentage world share* this expresses productivity in terms of what a country produces, by percentage, compared to the rest of the world. A stable or rising percentage share is good. As world productivity increases it is necessary to produce more just to remain at the same level or to exceed this by producing more than is required to maintain that current share. This should be done with care since it should not be at the expense of quality as measured by the *mean or average citation rate* or the level of *citedness*.

Moving to the data in Table 1 & Table 2, their headings are explained with some qualifying comments.

Region and country are defined in their title. Clearly regions are very large and some of the countries are very small, so comparisons between them should be treated with some care. The two time periods (*Years*) are those of interest and for completeness totals for them is given as well.

Documents are those indexed by Scopus and hence included in SCImago but these are limited to articles and conference proceedings but these are the principal components, of *productivity*, found in most analyses.

The remaining seven columns of both tables deal with citations. *Citations* are the raw data from which comparisons can be drawn and have been noted above. *Self-citation* is a key metric and is where the author cites their own work. Self-citation rates vary between disciplines, but are usually subject specific and the norms for rates of self-citation are generally understood by those in the subject area. Excessive self-citation can, however, be counterproductive where league tables of countries or institutions use citation metrics in their rankings, as they may be discounted to discourage attempts to inflate citation impact. The column *% Self Citation* emphasises the point, as it shows what percentage of all the citations are self-citations and illustrates the differences in citing cultures, or perhaps identifies where there are constraining factors operating, between the different territories.

Average citations per document and average self-citations per document give a normalised measure which aids comparison, especially if there are large numbers of documents and citations associated with them and of course appears above in a slightly different guise as *mean or average citation rate*. In small samples especially, care needs to be taken to observe the influence of outliers, for example a single article may be very highly cited and so skew averages or impact. As already noted *citedness* is very important and in the tables percentages are given of documents which are cited/not cited and clearly there are some notable differences in rates of citedness amongst the different countries.

3 Commentary on Results & Findings

In bibliometrics, trends and direction of data are generally more important than single values, so Increasing or decreasing trends are more useful to assess progress than single spikes in the data. The results of the analyses are given in the Appendix. Analyses follow the key features outlined above.

3.1 Pakistan and Bangladesh

In terms of document productivity, as shown in Table 3, Pakistan has increased its output at rates very similar to India, clearly India's productivity, used as a bench mark here, is ten times higher but output rates remain in step for the later five year period.

Table 3 Productivity of India, Pakistan and Bangladesh

Year	India	Pakistan	Bangladesh
2002	26,403	1,425	526
2003	30,489	1,588	702
2004	32,278	1,906	732
2005	37,811	2,669	886
2006	44,935	3,303	1,055
2007	49,456	3,953	1,392
2008	54,888	4,804	1,515
2009	61,557	5,849	1,748
2010	74,855	7,077	2,134
2011	88,437	8,294	2,197
Total	501,109	40,868	12,887

Mean citation rates and levels of citedness in Figures 1 & 2, are shown to follow that of India. Interestingly in Figure 4 Pakistan is shown to have a greater international rate of collaboration than India, and this has steadily increased and one would expect there to be an increase in mean citation impact greater than that of India, however this is not the case, possibly because of the nature of the collaboration in subject areas that are less well cited, or perhaps the journals in which Pakistan's academics publish. Generally the higher the impact factor of a journal in which you publish the more likely you are to be cited and to be cited more frequently. Figure 3 shows a steadily increasing share of the world's output.

An interesting view of Bangladesh's international collaboration is evident in Figure 4, where it is the highest; it does have, though, the third highest level of productivity of the nine countries. Table 3 shows the relative productivity between Pakistan and Bangladesh. We know that Pakistan's productivity and general level of citation impact is on a par with India and this makes Pakistan a useful benchmark with Bangladesh. Levels of overall citedness are marginally over 50% and are shown in Figure 2, this should be considered in the light of Pakistan and Bangladesh's high rate of self-citation as mentioned below. Similarly, including India, Figure 1 shows the relative mean or average citation rate, which shows Bangladesh generally having about the same rate of impact as India, although all three countries converge at 2007 onward.

Taking the Asiatic region as a whole during 2002-11 it almost doubled its productivity, between the two periods 2002-06 vs. 2007-11 and for both Bangladesh and Pakistan this was approximately two and three times respectively. Levels of mean citation rates and levels of citedness, were about average for Bangladesh but below average for Pakistan, but are sufficiently close for Pakistan in the period 2007-11 to suggest that its performance is converging to that of the region.

Individually the results for Pakistan and Bangladesh show a positive and generally upward trend which overall is good. Bangladesh is operating at a lower level of activity and whilst its international co-operation is high this is not reflected in its mean or average citation impact. Similarly Pakistan's average citation impact is the lowest of the group. The rate of self-citation, where authors cite themselves is a little high for Pakistan at 31.27%, and for Bangladesh this is 24.80%. This has to be seen in context though. The self-citation rates for China, India, Japan and the UK are 56%, 38%, 30% and 25% respectively and in terms of the first three their productivity dominates the region as a whole. Nevertheless where bibliometric analyses of countries are carried out, self-citations are often removed, and this would noticeably harm Bangladesh and Pakistan's mean or average citation impact. Provided self-citations are kept to within disciplinary expectations they can be seen and used as 'pump primers' to get work noticed, the challenge remains, however, to produce work which is cited externally because of its contribution to the research field.

Percentage of world share is shown as steadily rising for both Pakistan and Bangladesh. In fact since 2002 Pakistan has tripled its world share to 0.35% and Bangladesh has moved from 0.04% to 0.09% in the same period, both creditable performances.

Comparing at a broad level, Bangladesh's average citation impact is effectively at the Asiatic average but below that of the world. Comparing Pakistan, whose productivity is relatively high, but whose citation impact is about half that of the world and about two thirds that of the region and whose

rate of self-citation looks a little high. Data and comments around Table 5 below further discuss this issue in relationship to Cuba. For both Bangladesh and Pakistan the results are mixed and whilst there are steady increases evident this is not always consistently reflected in the measures used to assess their progress.

3.2 Bolivia, Cuba and Nicaragua

Bolivia, Cuba and Nicaragua are grouped in Central America by SCImago and are so considered together. These countries in terms of their productivity are generally small, as shown in Table 4.

Table 4 Productivity of L. America, Bolivia, Cuba & Nicaragua

Year	Latin America	Bolivia	Cuba	Nicaragua
2002	35,713	91	1,267	14
2003	40,110	120	1,032	37
2004	43,298	123	1,010	44
2005	50,254	138	1,286	50
2006	62,680	177	1,709	88
2007	66,910	208	1,746	61
2008	73,878	238	1,657	81
2009	79,745	230	1,919	85
2010	87,223	222	1,806	87
2011	91,893	230	2,048	95
Total	631,704	1,777	15,480	642

Productivity in the region has increased almost three fold between 2002 and 2011. For Bolivia this has stabilised at around 220 documents a year and for Cuba and Nicaragua this has been steadily increasing. Figures 5 and 6 show the mean or average citation rate, and rates of average citation when self-citations are removed from the three countries. It is evident from Table 2 that Cuba has the lowest citation impact overall and the highest rate of self-citation and this is very evident in Figure 5 where Cuba, shown in blue, has the lowest citation impact of the three countries. Added to this, as shown in Figure 7 the levels of citedness for Cuba are low at 44% and this would be considerably lower, it is conjectured, if the documents which Cuban academics have self-cited were removed from the number of documents and only externally cited documents were shown. It is noted though that Pakistan and Bangladesh are in similar positions to Cuba and it could be argued that their higher productivity is partly the cause of this. If the countries are ranked by their productivity then the percentage rates of self-citation almost follow exactly, with for the most productive three, having similar rankings in their level of citedness. It is evident that mean or average citation rate (Average Cites/Document in Table 5) follow this trend as well and as noted above productivity should not be at expense of quality as measured by the *mean or average citation rate* or the level of *citedness*.

Table 5 Productivity and citation rankings

	Documents	Avg Cites/Doc	% Self Citation	% Cited Docs
Rwanda	607	5.77	8.90	65.07
Nicaragua	642	7.87	9.12	74.61
Bolivia	1777	9.70	11.04	76.03
Malawi	2303	9.77	16.06	77.42
Tanzania	5534	9.37	16.93	76.31
Kenya	11113	9.49	17.88	74.85
Bangladesh	12887	5.10	24.80	55.00
Cuba	15480	3.80	23.27	44.21
Pakistan	40868	3.63	31.27	52.83

Rates of international collaboration are shown in Figure 8 and Latin America as whole has a very low rate of collaboration. This is not unusual because large countries like Brazil, which dominate the region, often have lower rates of international collaboration (29%) and in this case suggest the data is interpreted with care. Cuba again appears in blue in Figure 8 and whilst their rate is around 50-60% it is well below its fellows who are averaging about 90%. What is particularly noticeable is the drop to 40% for Cuba from 2009 onwards.

Percentage world share is limited for Nicaragua and Bolivia, and is related of course to their productivity, here Nicaragua does not register a score and for Bolivia this 0.01%. For Cuba this is 0.08% for the first period to 2006 and 0.09% to 2011 a small but notable increase where it will have had to increase its productivity to keep up with growing world productivity, notwithstanding that there are issues of productivity vs. quality.

Overall Bolivia and Nicaragua over the two time periods show steady and consistent growth with stable rates of citation and citedness albeit from relatively low rates of productivity. Cuba also exhibits a steady growth rate in its productivity, which is reflected in its world share, but it is noticeable that this is at the expense of its regional share which has fallen from a peak in 1999 of 4.47% to 2.23% in 2011. This suggests Cuba is either looking elsewhere for collaboration or regional growth is expanding faster than its own and hence has a falling share of the region's publications.

3.3 Kenya, Malawi, Rwanda and Tanzania.

Kenya, Malawi, Rwanda and Tanzania are the final grouping, from in this case Southern Africa, as defined by SCImago. South Africa dominates the region with 81,767 (67%) of the region's productivity leaving Kenya, Malawi, Rwanda and Tanzania with a further 16.10% of the share and the other remaining 23 countries in the region sharing the rest between them. The disposition of the 16.10% share is shown in Table 6.

Table 6 Productivity S. Africa, Kenya, Malawi, Rwanda & Tanzania

Year	S Africa	Kenya	Malawi	Rwanda	Tanzania
2002	5107	684	112	7	256
2003	5468	811	139	14	358
2004	5995	808	154	28	364
2005	6776	875	173	25	447
2006	7906	998	202	45	575
2007	8253	1,166	263	56	608
2008	8940	1,225	283	66	598
2009	9956	1,350	269	88	686
2010	11013	1,496	330	135	789
2011	12353	1,700	378	143	853
Total	81,767	11,113	2,303	607	5,534

Productivity in the region has increased effectively three fold since 2002 to 2011 with the exception of Rwanda, which, starting from just 7 has reached 143 publications in 2011. Comparing this to S. Africa we see a factor increase of 2.5 in productivity and for the region as a whole an increase by a factor of 1.67. Figure 9 shows a strong convergence from 2000 towards a common level of citation impact, Rwanda apart, but it is starting from a very low base, but even this converges from 2006. The mean citations per document for the region is 7.63 and for this group it is around 9 (6 for Rwanda) S. Africa's rate being 7.56 showing just how strong its influence is in the region. This mean is very close to the World mean citation impact as well, where it stands at 7.53.

Citedness has been a critical issue along with rates of self-citation in the other country groupings, in the case of these four countries there has been a high degree of consistency in these measures. This is evident in Figure 10 where strong uniformity is evident in levels of citedness and this has remained more or less consistent across the years and the two year ranges. For S. Africa its level of citedness for whole the period is 67% and for the World 58%. Self-citation rates are again remarkably steady and consistent across the countries at around 16-17% with Rwanda even less at 9%, contrasting this with S. Africa where the rate for the period is 23.30%.

International co-operation is high, not surprisingly for the four countries, and particularly their closeness after 2004 is evident in Figure 11, ranging around 75–90% with 66% for S. Africa and a regional level of a little over 50%. Where share of world publications are concerned Rwanda has just managed to register with a 0.01% share in 2010 & 11, for Malawi in the same period they have increased their share from 0.01% to 0.02% and for Tanzania this is 0.04%. For Kenya this has improved steadily from 0.05% to a 0.07% share.

This group of four countries show good consistency in the measures used. There is a steady improvement in productivity and an incremental improvement in impact and citedness as well as the World share of publications. This compares well within the region and particularly with S. Africa which dominates the region with its high productivity. Although it cannot be discerned it is suggested that such consistency may be the result of close co-operation between the countries on a regular basis particularly with S. Africa.

4 Summary and Conclusion

The nine countries may be conveniently separated into three groups. The first group are those countries in Southern Africa, excluding Rwanda, who are exhibiting steady progress by increasing their productivity, their international cooperation and their regional or world share of documents. Similarly they are increasing their citation impact whilst holding steady their self-citation rate and levels of citedness. This performance suggests these countries are benefiting from the type of interventions by INASP which seek to promote such results.

The second group are those countries who have low productivity - Bolivia, Nicaragua and Rwanda. Some progress is being made here but it is not as marked as the first group but it is still evident with levels of citation impact improving and moving in the right direction. They are also holding steady their self-citation rates and levels of citedness whilst increasing their productivity. It has to be remembered though that their productivity is low compared to the regions in which they operate and the 'sample size' presented by them can be easily distorted by outlier values and it is evident that Bolivia's productivity has almost stalled at the moment.

The final group is made up of Bangladesh, Cuba and Pakistan. These are the most productive countries but they show mixed results in terms of exhibiting uniform progress in the measures chosen to chart this. To varying degrees all three countries have shown good growth in productivity but in the other measures they fall below their peers and sometimes their regions. Of concern are their levels of average citation rates, their high rates of self-citation and the general levels of citedness. These are of course all related and affect each other. Similar individual scores can be found for the other countries, but it is the combination of several of these which are of concern. This is not helped by high self-citation rates in the Asiatic region which is dominated by high self-citing countries such as India and China. Hence controlling these for Pakistan and Bangladesh positively will help improve these scores. It is fair to note that it is far more difficult to maintain the same desirable levels in these metrics as productivity rises, especially if there are incentives to publish and the necessary controls on quality are less stringent. Additionally gaining access to high impact, predominantly USA/European based journals written in English is difficult enough without having to deal with the many issues which face these developing countries. Hence international collaboration with stronger partners can help.

Placing these immediate issues aside, and taken at a broad level, the countries examined are making a modest, but steady progress, in increasing their influence as measured by citation metrics used here. This progress conforms to the hoped for aspirations and intentions of INASP as indicated earlier.

5 Appendices

Pakistan and Bangladesh

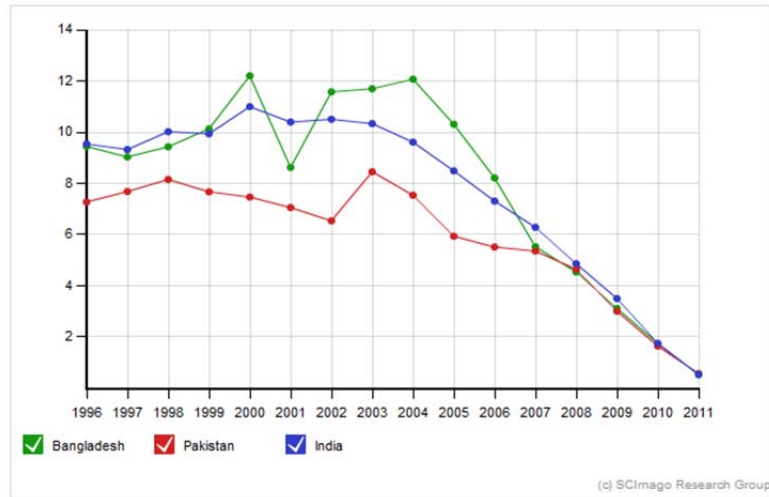


Figure 1 Average cites per document

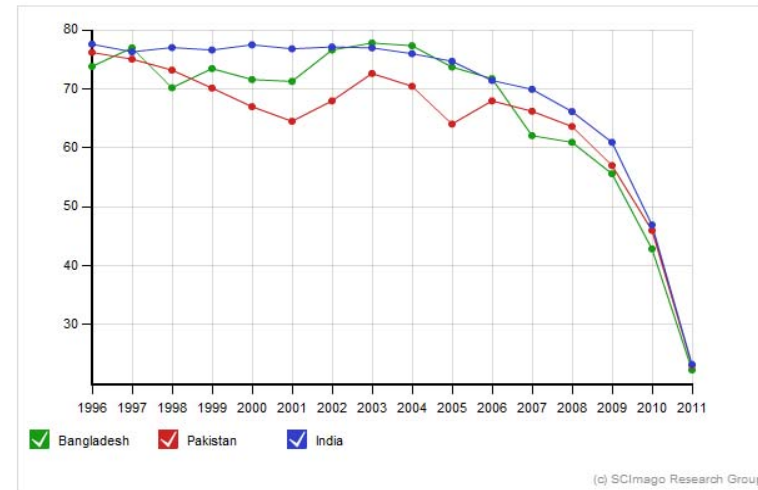


Figure 2 Rates of Citedness

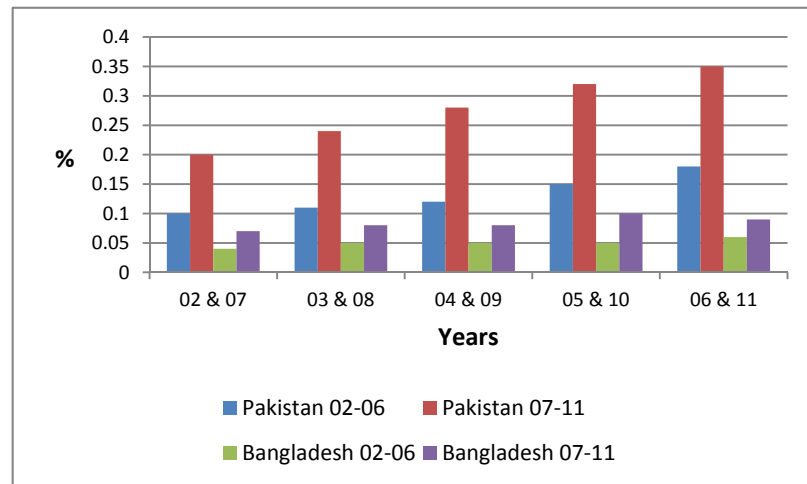


Figure 3 Percentage of world output

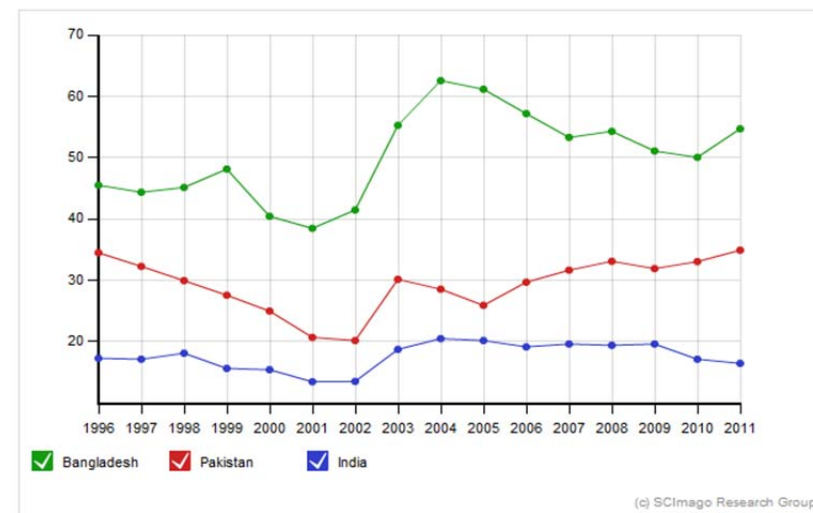


Figure 4 Rates of international collaboration

Bolivia, Cuba and Nicaragua

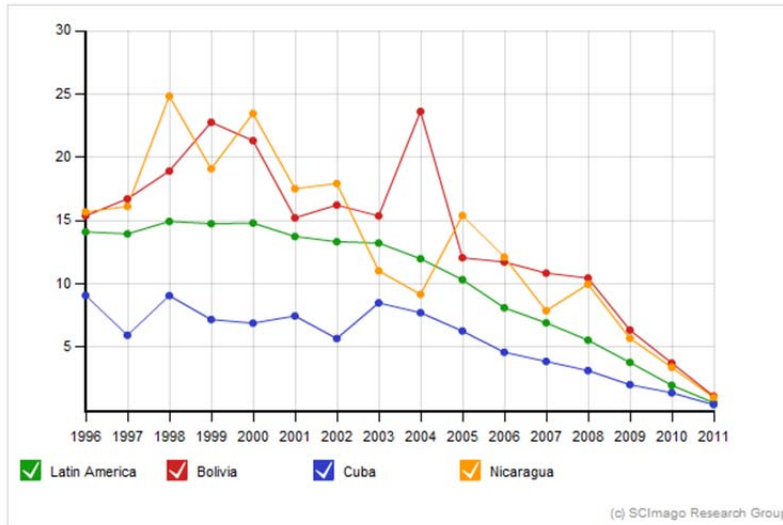


Figure 5 Average cites per document

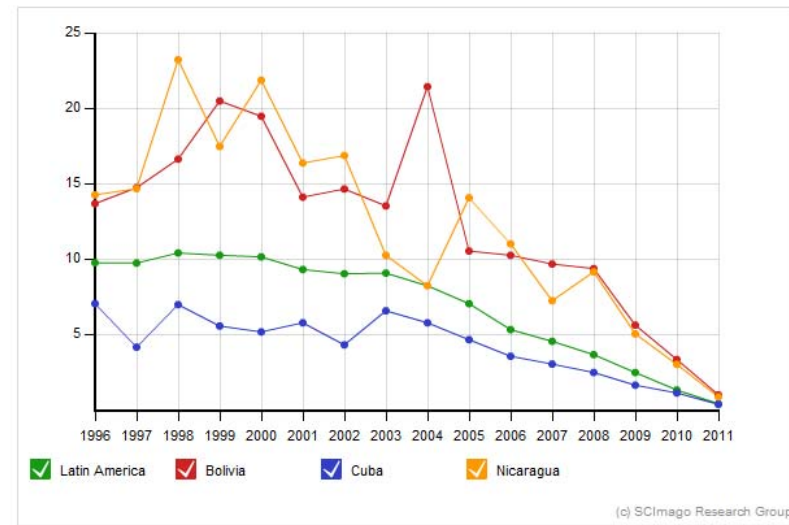


Figure 6 Average cites per document less self-citations

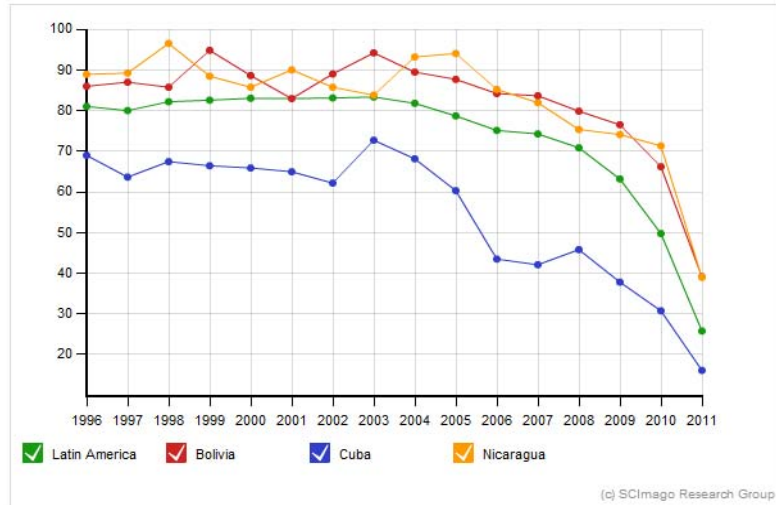


Figure 7 Rates of citedness

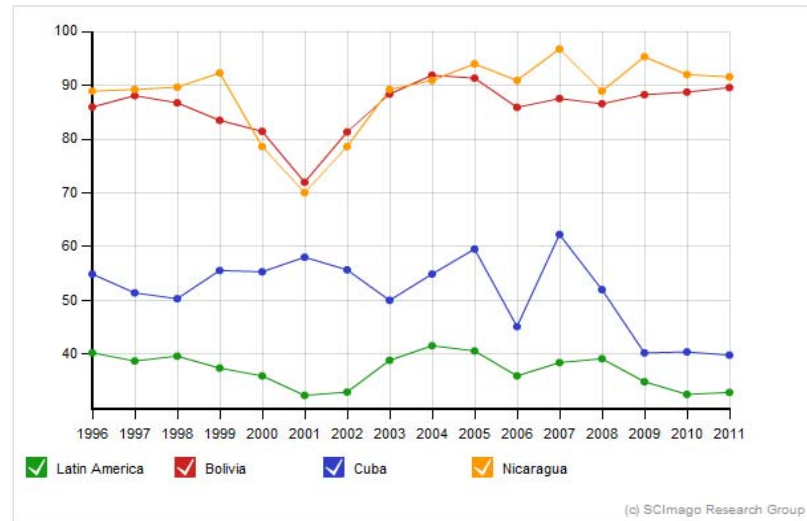


Figure 8 Rates of International collaboration

Kenya, Malawi, Rwanda and Tanzania.⁵

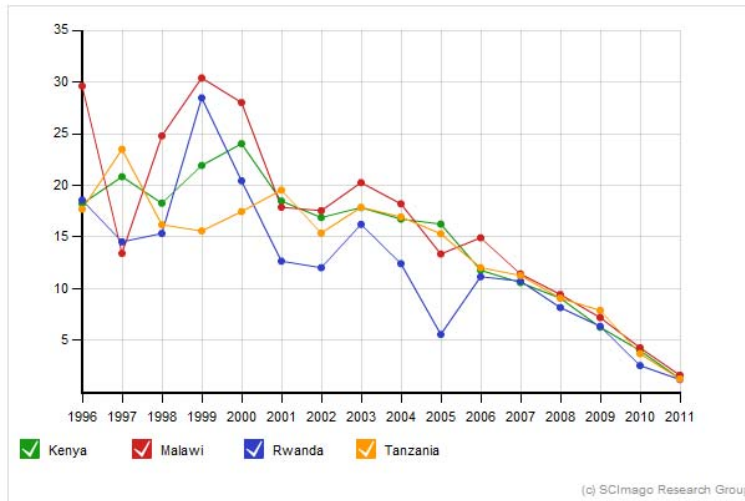


Figure 9 Average cites per document

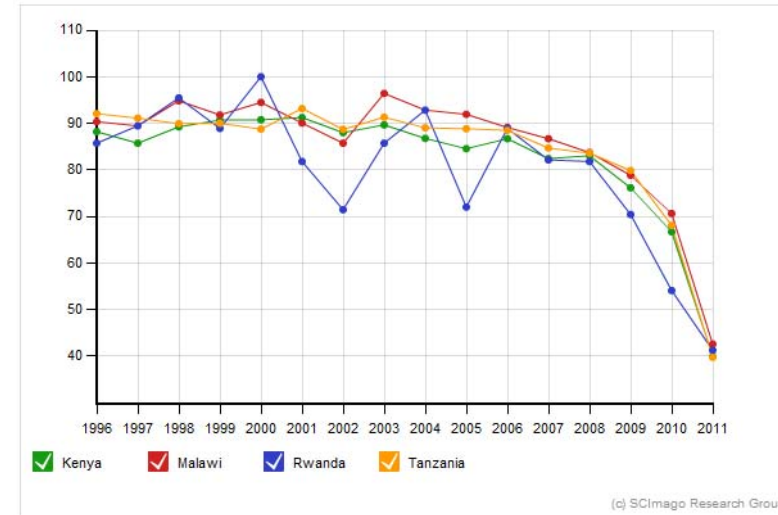


Figure 10 Rates of citedness

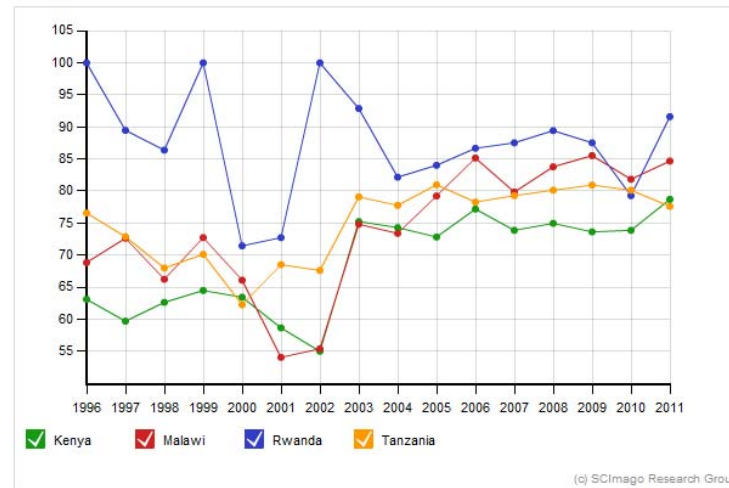


Figure 11 Rates of International co-operation

⁵ All screen shots taken from SCImago Journal & Country Rank with the exception of Figure 3. 2013. Available at: <http://www.scimagojr.com/> [Accessed 22-28 Feb 2013]