

# Global Metadata Analysis of Research Publications in Pharmaceutical Sciences

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## ABSTRACT

The aim of the present work was orienting to generate information about global research publications in Pharmaceutical sciences. Method adopted for this dry lab project was assimilation of metadata analysis, processing and interpretation. Results showed that hierarchy of countries sourcing journals (total journals-percentage global share) were in the descending order of USA>UK>Germany>Canada and France>Netherlands>China>Spain>Finland>Denmark, Egypt, Georgia, India, Israel, Japan, Sweden, Switzerland. When quality was considered (total IF of journals from a country), the order was in the descending order of USA>UK>Germany>France>Sweden>Netherlands>Canada>Italy>Spain>Switzerland>Israel>Denmark>Georgia>China>India>Finland. Total number of authors and global authors share of top 10 countries are in the desc-ending order of: USA>China>Japan>France>UK>India>Germany>Canada>Italy>Netherlands. Although journal quality was less from some countries, authors from these countries were accommodated in good impact factor journals which are sourced from other countries. More over some countries although outsourcing more journals were found to have lesser quality if impact factor was considered as a parameter for determining the quality of journals.

**Keywords:** database, Science Citation Index, impact factor, metadata.

## INTRODUCTION

Scientific productivity of an author, institution and country depends on the total output as well as the credibility of the publications. But the credibility of a manuscript and journal is measured by several factors. There are very few reports on the scientific publication statistics which are based on a country or region, quality assessment of scientific methods, citation index etc. Li *et al.* has conducted a survey of Chinese authors in North Asia region.<sup>1</sup> Unnikrishnan *et al.* has surveyed on research publications in Pharmacy schools in India based on Scopus data base.<sup>2</sup> Dinararan SK *et al.* reviewed on assessment of quality of journals.<sup>3</sup> Shailendra Kumar *et al.* demonstrated structure and functions of citation index.<sup>4</sup>

The database services support all levels of scientific and scholarly research

within academic, corporate, government or non-profit environments. The advantage of these services is that it allows a researcher to identify which articles have been cited most frequently and who cited them. It consists of a list of highly cited researchers included in academic ranking of world universities published by Shanghai Jiao Tong University and Annual Journal Citation Reports, listing the journals and their impact factor.

There are no comprehensive reports which compare institutional research potentialities of various countries in a global level, although there are some regional based or single country based research. The present work aims in bringing out the various countries research potential and categorizing into speculated geographical regional research outputs. By studying so, it could be more vivid for the apex bodies to consider

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which way to focus institutional research, so that the countries research potentialities can be augmented.

The endeavour of the present work was to aid in determining the quality of research works and resource persons from various countries based on outsourcing publications in the field of pharmaceutical sciences. Thus, the work was oriented towards conducting survey on journal publications in the area of pharmaceutical sciences, determine the share of journals from a country, find out the credibility of journals, determine country of origin where the authors are working, find out the credibility of a countries publication and find out what could be the most contributory factor in enmeshing institutional research works.

### Science direct college edition

The Science direct college edition provides smaller academic institutions with affordable access to dedicated subject packages in the physical, social and health sciences that are complemented by content from online books and pre 1995 journals. The Science Direct college edition enables to support the teaching and learning process with unparalleled breadth and depth of content, improve information quality with access to relevant peer-reviewed content, increase user support with a new and improved interface and our dedicated e-helpdesk, manage budget more effectively with transparent, flexible and predictable pricing, make evidence based decisions with industry leading and counter compliant usage reports that give you insights into user behaviour, give users a broader perspective with valuable journal content going back to 1995, online book access and pre-1995 content, maximize the investment with training and marketing programs to ensure the users get the most out of Science Direct.<sup>5,6</sup>

At present, it has become a prerequisite for a researcher or a professional to get research work published in Science Citation Index (SCI) journals with impact factor (IF), if his/ her interest is seeking placement in reputed academia or research organizations. Government universities and other world universities give credits to research publications in SCI journals from a research scholar while considering him for selection for the award of research fellowship.<sup>7-14</sup>

### MATERIALS AND METHODS: STUDY DESIGN AND DATA RESOURCES

Metadata collection and analysis were divided into 'journal oriented' and 'author oriented'. The database used to know the journals pertaining to Pharmaceutical Sciences and its allies Pharmacology, Toxicology were science direct database-college edition. Only journals were

considered and books/proceeding/patents etc. were not considered.<sup>15-21</sup> A separate search was conducted on the individual journal websites homepage, SCImago journal and country rank to know its impact factor (IF) and the origin (country) of publication (outsourcing).<sup>9</sup> Authors are aware that the origin of the publication may not be pinpointed to 100% accuracy, but the authors feel it was a reasonable effort within the limits. Readers do reserve their choice to accept or reject our efforts.

To know the author details, each journals latest publication were verified. Author details include country of affiliation and the journal in which the article were published. Data collected was segregated into separate spread sheets of journal based on alphabetic order, impact factor and origin of country. Ratio of total impact factor of authors to global author share (%) was calculated. An attempt was made to determine the contribution of selected Indian journals. Global share of authors and journals from each country was determined by equation no.1 and 2 respectively. Since the data collected is from the last issue of each journal available in 'Sci verse database-college edition' the entire author population, time line, time interval and author migration need not be considered.

Global share (%) of the author contribution of a country (C1) =  $[At/\Sigma At] \times 100$  (1)

Where At = total no. of authors from C1 and  $\Sigma At$  = Cumulative total of all authors globally.

Global share (%) of the Journal contribution of a country (C1) =  $[Jt/\Sigma Jt] \times 100$  (2)

Where Jt = total no. of Journals from C1 and  $\Sigma Jt$  = Cumulative total of all Journals globally.

Geographical based segregation of countries is as below:

1. **Asia pacific region:** China, Hong Kong, India, Japan, Korea, Mauritius, Pakistan, Philippines, Republic of Korea, Singapore, Srilanka.
2. **Australia and New Zealand**
3. **Central South America:** Argentina, Algeria, Venunzvala, Chile, Croatia, Brazil, Croatia, Colombo, Spain, Puertorico.
4. **Eastern Europe (Including Russia and CIS):** Lithuania, Croatia, Czechoslovakia, Russia.
5. **Middle east and Africa:** Bulgaria, Egypt, Tunisia, Iran, Jordan, Korea, Lebanon, Morocco, Nigeria, S. Africa, Saudi Arabia, Syria, Turkey,
6. **Western Europe including Israel:** Austria, Belgium, Cyprus. Israel, west indies, Denmark, France, Finland, Germany, Greece, Holland, Hungary, Italy, Israel, Netherlands, Norway, Poland, Portugal, Macedonia, Sweden, UK, Ireland.
7. **North America:** USA, Canada, Mexico.

Readers are requested to note that the findings of this metadata are based on only one metadata source and need not reflect either a cumulative research productivity of any country nor authors. Thus the findings may be utilised only as one among other parameters, if credibility of institutions belonging to a specific country or province is compared.

## RESULTS

Representation of authors and journal information from respective countries and logistics of journals and authors are mentioned in table no 1 and 2 respectively.

When metadata of total authors from each country was considered USA stands first with 332 corresponding authors. Total number of authors and global authors share of top 10 countries are in the descending order of: USA (332–29.380)>China (142–12.5663)>Japan (99–8.7610)>France (89–7.8761)>UK (68–6.0176)>India (64–5.6637)>Germany (59–5.2212)>Canada (55–4.8672)>Italy (47–4.1592)>Netherlands (22–1.9469). Global authors share of top 10 countries and the B/A value are displayed as a pie chart in figure 1 and 2 respectively.

Metadata of journals revealed that 18 countries are outsourcing journals in the field of pharmaceutical sciences

**Table 1: Representation of Authors and journal information from Respective Countries for the Total Number, Global Share and Ratio of Latter to Former**

Country	Global author share% (A)	Total IF of authors (B)	B/ A	Global journal share% (C)	Total IF of journals (D)	D/C
Austria	1.1504	34.149	29.6844	–	–	–
Argentina	0.7079	27.163	38.3712	–	–	–
Australia	1.2389	30.829	24.8841	–	–	–
Algeria	0.0884	3.268	36.9683	–	–	–
Brazil	2.2123	54.269	24.5305	–	–	–
Belgium	1.5044	29.248	19.4416	–	–	–
Bulgaria	0.179	5.3	29.6089	–	–	–
China + Hong Kong	12.5663	284.597	22.6476	3.2258	2.799	0.8677
Chile	8.5309	15.406	1.80590	–	–	–
Canada	4.8672	146.042	30.0053	4.8387	8.898	1.8389
Croatia	0.3539	6.121	17.2958	–	–	–
Cyprus	0.0884	2.549	28.8348	–	–	–
Czeeh Republic	0.3539	8.823	24.9307	–	–	–
Costarica	0.0884	2.508	28.3710	–	–	–
Colombia	0.0884	2.508	28.3710	–	–	–
Czechoslovakia	0.0884	2.65	29.9773	–	–	–
Denmark	0.4424	12.635	28.5601	0.8064	3.212	3.98313
Egypt	1.5044	11.044	07.3411	0.8064	(0)	0
France	7.8761	122.925	15.6073	4.8387	11.746	2.4275
Finland	0.8849	13.043	14.7395	1.6129	2.301	1.4266
Germany	5.2212	73.746	14.1243	16.1290	47.607	0.062
Georgia	0.0884	2.967	33.5633	0.8064	2.967	3.679
Greece	0.1769	21.854	123.5387	–	–	–
Holland	0.0884	3.99	45.1357	–	–	–
Hungary	0.1769	10.92	61.7299	–	–	–
India	5.6637	149.7274	26.4363	0.8064	2.683	3.3271
Italy	4.1592	148.414	35.6833	4.0322	6.714	1.6650
Iran	0.7964	19.634	24.6534	–	–	–
Israel	0.2654	5.3	19.9698	0.8064	4.046	1.2400
Ireland	0.0884	10.927	123.6085	–	–	–
Japan	8.7610	145.483	16.6057	0.8064	0	0
Jordan	0.0884	0	0	–	–	–
Korea	1.0619	33.32	31.3777	–	–	–
Kenya	0.0884	2.549	28.8348	–	–	–

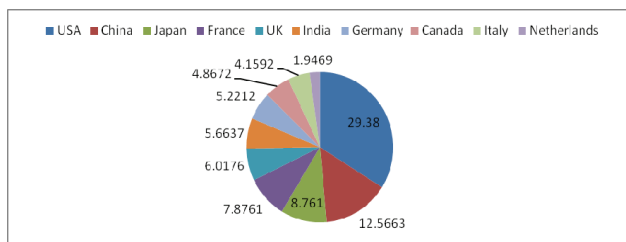
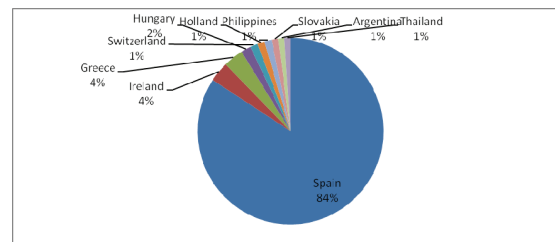
(continued)

**Table 1: Continued**

Country	Global author share% (A)	Total IF of authors (B)	B/ A	Global journal share% (C)	Total IF of journals (D)	D/C
Lebanon	0.4424	4.539	10.2599	—	—	—
Lithuania	0.0884	3.035	34.3325	—	—	—
Mexico	0.6194	10.492	16.9389	—	—	—
Malaysia	0.0884	2.301	26.0294	—	—	—
Mauritius	0.0884	0	0	—	—	—
Morocco	0.0884	0	0	—	—	—
Nether lands	1.9469	49.487	25.4184	4.0322	9.489	2.3533
Nigeria	0.2654	5.627	21.2020	—	—	—
New Zealand	8.5309	28.607	0.0041	—	—	—
Norway	8.5309	16.734	1.9615	—	—	—
Pakistan	0.2654	8.801	33.1613	—	—	—
Poland	1.5044	39.773	26.4378	—	—	—
Portugal	0.4424	10.816	24.4484	—	—	—
Philippines	0.1769	7.834	44.2849	—	—	—
Puertorico	0.1769	1.324	7.4844	—	—	—
Republic of korea	1.5929	38.199	23.9807	—	—	—
Russia	0.7079	19.467	27.4996	—	—	—
Republic of Macedonia	0.0884	2.850	32.2398	—	—	—
Spain	0.0185	55.436	2996.5405	2.4193	4.436	1.8335
Slovak republic	0.2654	10.809	40.7272	—	—	—
Sweden	0.9734	26.545	27.2770	0.8064	9.559	11.8539
South Africa	0.4424	10.722	24.2359	—	—	—
Switzer land	0.7964	37.241	46.7616	0.8064	4.269	5.2938
Singapore	0.0884	2.969	33.5859	—	—	—
Serbia	0.0884	2.549	28.8348	—	—	—
Slovenia	0.2654	0	0	—	—	—
Srilanka	0.0884	0	0	—	—	—
Saudi Arabia	8.5309	1.597	0.1872	—	—	—
Syria	0.0884	0	0	—	—	—
Slovakia	0.2654	4.275	16.1078	—	—	—
Turkey	1.7699	30.842	17.4258	—	—	—
Taiwan	0.7079	16.503	23.3126	—	—	—
Thailand	0.0884	3.268	36.9683	—	—	—
India	5.6637	149.7274	26.4363	0.8064	2.683	3.3271
Italy	4.1592	148.414	35.6833	4.0322	6.714	1.6650
Iran	0.7964	19.634	24.6534	—	—	—
Israel	0.2654	5.3	19.9698	0.8064	4.046	1.2400
Ireland	0.0884	10.927	123.6085	—	—	—
Japan	8.7610	145.483	16.6057	0.8064	0	0
Jordan	0.0884	0	0	—	—	—
Korea	1.0619	33.32	31.3777	—	—	—
Kenya	0.0884	2.549	28.8348	—	—	—
Lebanon	0.4424	4.539	10.2599	—	—	—
Lithuania	0.0884	3.035	34.3325	—	—	—
Mexico	0.6194	10.492	16.9389	—	—	—
Malaysia	0.0884	2.301	26.0294	—	—	—
Mauritius	0.0884	0	0	—	—	—
Morocco	0.0884	0	0	—	—	—
Nether lands	1.9469	49.487	25.4184	4.0322	9.489	2.3533
Nigeria	0.2654	5.627	21.2020	—	—	—

**Table 2: Geographical Region Based information of journals and Authors**

Geographical region	No. of Authors	No. of Journals outsourced
Asia pacific	335	6
Australia/ New Zealand	20	2
Central and South America	76	3
Eastern Europe including Russia and CSI	34	1
Middle east and Africa	72	2
North America	387	49
Western Europe including Israel	399	59

**Figure 1:** Global authors share of top 10 countries.**Figure 2:** Top ten countries with B/A value.

out of which USA stands first outsourcing 43 journals. Hierarchy of countries sourcing journals (total journals-percentage global share) were in the descending order of USA (43–34.6774 )>UK (22–17.7419)>Germany (20–16.1290)>Canada and France (6–4.838)>Netherlands (5–4.0322)>China (4–3.2258)>Spain (3–2.4193)>Finland (2–1.6129)>Denmark, Egypt, Georgia, India, Israel, Japan, Sweden, Switzerland (1–0.8064). When quality was considered ( total IF of journals from a country) the order was in the descending order of USA (151.385)>UK (50.438)>Germany (47.607) >France (11.746)>Sweden (9.559)>Netherlands (9.436)>Canada (8.898)>Italy (6.714)>Spain (4.436) >Switzerland (4.269)>Israel (4.046)>Denmark (3.212)>Georgia (2.967)>China (2.799)>India (2.683)>Finland (2.301). Data is illustrated in figure 3. Ironically, when the ratio of total IF of all journals from a country (D) to its global share (C) was considered (D/C), the order was found to be in the order Sweden (11.8539)>Switzerland (5.2938)>USA (4.3655)>Denmark (3.98313)>Georgia (3.679)>India (3.3271)>UK (2.8428)>France (2.4277)>Netherlands (2.3533)>Canada (1.8389)>Spain (1.8335)>Italy (1.6650)>Israel (1.240)>China (0.8677)>Germany (0.062). Based on various geographical regions author and journal contributions are mentioned in figure 4 and 5 respectively.

## DISCUSSION

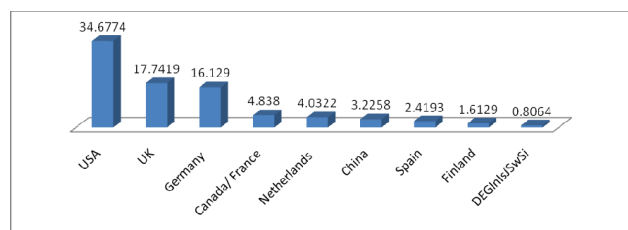
Usage of research work of researcher always pays importance and value to the author and also to the work. Work in the form of article, patents and notes in the

subject get its impact when it got cited in the literature of importance. Guidance to the future generations is by creation of the platform to share the experiences by publishing the articles in important and effective journals. If the quality of any journal is considered, the most important parameters to watch for are Impact Factor and Citation Index which may serve as efficient parameters for scientific evaluation. IF, given by Thomson Reuters necessarily need not reflect the quality of a journal since it gives an average number of citations of a journal which in turn depends on the viewers discipline, area of interest, application etc. But as long as a better device/s are recognized to value a journal, we perhaps may be struck up with IF.

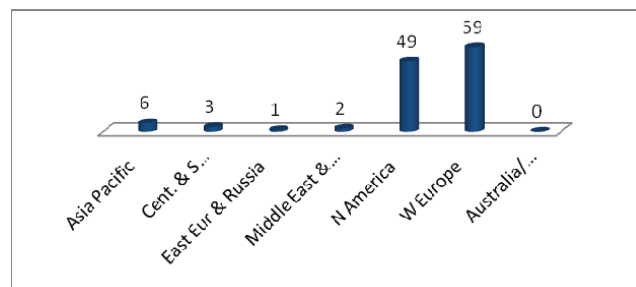
The data collected were only from journals and books/proceeding/patents etc. were not considered. In the data base, one hundred thirty four journals were provided in the field of Pharmacology, Toxicology and Pharmaceutical sciences and these were considered to determine the assessment of data. The data collected were impact factor of journal, country of origin, country of author affiliation. Further the global share and average impact factor were separately taken into account for the respective country.

It was found that some of the journals were discontinued or changed the journal title. Some others were incorporated under a parent journal. Out of all journals which are available in the science direct college edition, 'Trends in Pharmacological Sciences' was found to have the maximum impact factor, (10.927). Other top rated journals were: Current Opinion in Chemical





**Figure 3:** Hierarchy of countries sourcing journals expressed in percentage global share (DEGINISwSi = Denmark, Egypt, Georgia, India, Israel, Japan, Sweden, Switzerland).



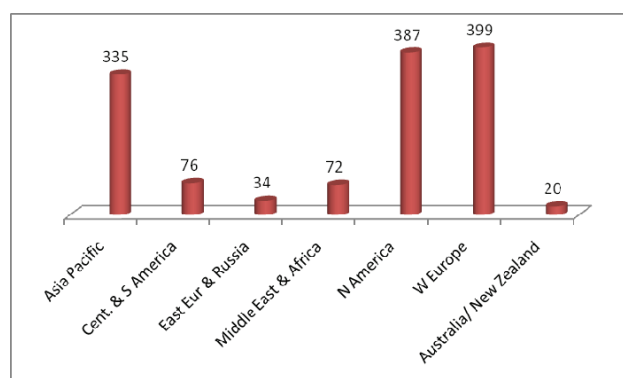
**Figure 5:** Journal contribution (values represent no.) of various geographical regions.

Biology (9.850)>Drug Resistance Updates (9.559)>Current Opinion in Pharmacology (6.856)>Drug Discovery Today: Biosilico (6.828). But we have noticed that there are other journals having higher impact factor which were excluded from this database (Sci verse database-college edition). For example a separate investigation revealed that 'Nature review drug discovery' (29.05), 'Annual reviews in pharmacology' (21.64), 'Pharmacological review' (13.069) having more impact factor but not available in the data source.<sup>22-24</sup> Further most of the journals which are popular in the Indian subcontinent are also not available.

There were some confusions while segregating territories and solved on the basis of the world map and central administration. For example, the Commonwealth of Puerto Rico (Spanish: *Estado Libre Asociado de Puerto Rico*), is an unincorporated territory of the United States, located in the north-eastern Caribbean, east of the Dominican republic and west of both the Islands and the British Virgin Islands. Thus this was honoured as a separate province which is independent.<sup>25</sup>

Hong Kong is a special administrative region of the People's Republic of China. It is situated on China's south coast and, enclosed by the Pearl River Delta and South China Sea. Thus this was incorporated into mainland China ie, People's Republic of China.<sup>26</sup>

In India, Current science enjoys the maximum impact factor (0.897). It has to be noted that many journals which is mentioned is not purely oriented in pharmaceutical



**Figure 4:** Author contribution (values represent no.) of various geographical regions.

sciences but related to health sciences. Some specific pharmacy journals like Indian J Pharm Sci, Indian Journal of Pharm Edu Res have not been included in the website, and if did so will be out of the study design. Thus, it has to be noted that a separate search is recommended on other metadata were other journals are included and may be wisely interpreted that as the journal becomes multidisciplinary, the authors as well as reader will increase in number which is a major contribution to improve the citations of a journal, which necessarily need not reflect the quality. This is perhaps because there could be more manuscripts and resource person for selection and consideration respectively. Thomson Reuters noted that research publications from India rose by 80% during the years 2000–2007.<sup>16</sup> If this growth is maintained, India is expected to be on par with G8 nations within 7–8 years and overtake them between 2015–20. But if the quality of the journals outsourced from this subcontinent is not maintained, we believe that the overall credibility of the pharmaceutical journals will be affected.

If total number of authors is more, naturally the total impact factor for this particular country also will be more. But this doesn't give the exact picture that all authors publish in high impact journals. To understand this better ratio of total impact factor of authors from a country (B) to its global author share (A) was determined (B/A). Surprisingly Spain stands first with B/A as 29996.5405 with only 21 authors and global author share and IF of this country as 0.0185 and 55.436 respectively. This is against USA whose B/A is 20.9347. Hierarchy of top 10 countries with B/A value was in the order of Spain (2996.4505)>Ireland (123.6085) Greece (123.5387)>Hungary (61.7299) Switzerland (46.7616)>Holland (45.1357)>Philippines (44.2849)>Slovakia (40.7272)>Argentina (38.3712) Thailand (36.9683). This suggests that authors from Spain are opting high quality journals.

It was fascinating to understand that authors from Western European countries substantially contributed (considering the publications) towards the research in the field of Pharmaceutical sciences. The hierarchy follows Western European>North American>Asia Pacific>Central and South America>Middle East and Africa>Eastern Europe and Russia>Australia and New Zealand.

Western European countries contributed maximum Journal publications. Continental contribution of journals were in the order Western European countries>North American>Asia Pacific>Central and South America>Middle East and Africa>Eastern Europe and Russia.

It has to be noted that both the author contribution and journal contribution are equivalent and we believe that total number of countries who are economically forward need not be a deciding factor to the research output. This is prominent if we take the country wise GDP. First six countries are in the following order of GDP: USA>China>Japan>India>Germany>UK. Although China, Japan, India belong to one regional group (Asia Pacific), research contribution is only third. Perhaps it is wise to interpret that the quality of Universities and Institutions play a major role in the number of institutional research activities. If so, it is highly recommended that the existing Universities and institutions must be upgraded in terms of advanced equipments, laboratory facilities and of course recruitment of quality resource persons. Proper utilisation of the funded investment also may be appropriately checked not only in terms of documents put also assessing the quality of the research works envisaged.

## CONCLUSION

Results showed that Hierarchy of countries sourcing journals (total journals-percentage global share) were in the descending order of USA>UK>Germany>Canada and France>Netherlands>China>Spain>Finland>Denmark, Egypt, Georgia, India, Israel, Japan, Sweden, Switzerland. When quality was considered (total IF of journals from a country) the order was in the descending order of USA>UK>Germany>France>Sweden>Netherlands>Canada>Italy>Spain>Switzerland>Israel>Denmark>Georgia>China>India>Finland. Total number of authors and global authors share of top 10 countries are in the descending order of: USA>China>Japan>France>UK>India>Germany>Canada>Italy>Netherlands. Although journal quality is less from some countries, authors from these countries are getting published in good impact factor journals which are sourced from other countries. For Indian jour-

nals it will be highly appreciable that they come under reputed databases so that the citations and viewers will increase so do the credibility of the journal as well as the authors concerned. USA is outsourcing maximum number of journals as well as authors, in the field of Pharmacology, Toxicology and Pharmaceutical sciences. Although journal quality is less from some countries, authors from these countries are getting published in good impact factor journals which are sourced from other countries. At the same time it has to be said that impact factor of a journal necessarily need not reflect the quality of the articles or even the journal itself. In Toto, it has to be concluded that to generate more institutional research works, proper investment and utilization in the research facilities at institutional level is inevitable. Perhaps the best way to improve any institution is to identify the deficiencies including resource persons and support the institution by government/other agencies funding partially or fully and monitor specifically the funding is channelized in the proper direction and quality has been improved.

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