

# Current Comments®

## Third World Research. Part 1. Where It Is Published, and How Often It Is Cited

Number 33

August 15, 1983

Last December, I presented the 1982 Annual Magnus Pyke Lecture at the US Embassy in London. The lecture is sponsored by the Science Policy Foundation, Ltd. (SPF), London. Founded in 1966, SPF is a nonprofit organization that promotes the study of science and technology as social phenomena. Under the directorship of my old friend, Maurice Goldsmith, SPF has sponsored seminars on and investigations of science management and productivity, the social and economic impact of science, the contribution of scientific knowledge to a nation's gross national product, and other topics.

I chose to devote my talk to an analysis of science in the Third World. My interest in Third World research is longstanding, and I welcomed the opportunity to study this topic in detail. In particular, I wanted to examine the level of productivity and impact of Third World research on the international scientific community. That is, I determined the number of articles published by first authors who listed an institutional address in a developing nation and the number of citations they received. We used the 1973 *Science Citation Index*® (SCI®) as a source year for the study so that we could track citations over a six-year period. We then identified the clusters of research that were most cited by Third World researchers in 1981. This gave us an idea of the current areas of research activity in the developing nations.

This study is our first comprehensive examination of the productivity, impact,

and areas of intense research activity in Third World science. We are now updating the study, using 1978 as a source year, and are expanding it to analyze all nations that published articles in journals indexed in *SCI*. We will be able to isolate any nation or group of nations and determine where their scientists published research articles, in what languages, and how many citations they received. In addition, we will provide details on the nationality and language of the citing articles. That is, the *SCI* data base enables us for the first time to uncover the international and interlingual citation patterns in the world scientific press.

The text of the first part of the lecture is reprinted on the following pages. It provides data on the number of articles authored and published in the Third World and their impact, and compares this to the productivity and impact of research in the developed nations. The second part of the lecture will be reprinted next week. It identifies the journals that published Third World research and the most-cited articles by Third World authors. It also provides maps of the clusters of research in which Third World scientists have been most active. The complete text of the lecture first appeared in *Science and Public Policy*,<sup>1</sup> a journal published by SPF. Incidentally, the offices of SPF at 36 Craven Street, London, happen to be in the house where Benjamin Franklin stayed when he was living in London in the late 1700s.<sup>2</sup>

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### REFERENCES

1. Garfield E. Mapping science in the Third World. *Sci. Publ. Policy* 10(3):112-27, 1983.
2. .... Benjamin Franklin—Philadelphia's scientist *extraordinaire*. *Current Contents* (40):5-12, 4 October 1982.

# Mapping Science in the Third World\*

## Part 1

**Dr. E. Garfield contributes importantly to the world information order debate through an analysis of Third World science employing the cluster mapping methodology developed by the Institute for Scientific Information®.**

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*This article is an edited version of the 1982 Annual Magnus Pyke Science Policy Foundation Lecture.*

I am honored to present the 1982 Annual Magnus Pyke Science Policy Foundation Lecture. It gives me an opportunity to expand on a topic that has interested me for many years—science in the developing countries. Most scientists in the West are not aware of research going on in Peru, Ghana, Singapore, or other countries collectively called the Third World. And what they do know about Third World science is dominated by the research of one or two Third World 'research superpowers'—India or Argentina, for example.

An analysis of Third World science is especially relevant today. The New Information Order is a much debated issue in international forums, such as UNESCO.<sup>1-4</sup> Third World countries have charged that news from their part of the world is underreported in the international press. And what little news of the developing countries is reported allegedly gives a biased and sensational view of the Third World—earthquakes and revolutions, eruptions and government overthrows.

Only four news agencies currently account for more than 90 percent of all foreign news transmitted around the

world.<sup>5</sup> All are in the West—Reuters, Agence France-Presse, Associated Press, and United Press International. In light of the Western monopoly on international information, Third World nations sometimes feel powerless to control and contribute to what is said about them. As a result, a New Information Order has been proposed, one in which Third World news is given increased and more balanced coverage.

This is a controversial issue, but perhaps I can demonstrate statistically why the Third World feels the way it does. The representation of Third World research in international scientific journals is a neglected aspect of the New Information Order debate. How many research articles from Third World countries are published in journals from the developed countries? And what impact does Third World research have on the international scientific community? The term 'impact' is vague without a definition. Here, impact is defined in terms of citations. I realize that this, too, is controversial.

### Citation Method

When a scientist cites a given article, he or she indicates that the article was somehow relevant to the research performed. The citing author calls attention to some useful piece of information included in that article—a method, statistic, result, or whatever. And when an article is cited many times, it can be considered to have had a significant impact on the conduct of scientific research. I do not discuss here the vast literature which supports the validity of this premise.

\*Reprinted with permission from: *Science and Public Policy* 10(3):112-27, June 1983.

If we take into account only the number of articles an entire nation's scientists authored, we get an idea of their level of productivity. But when we also consider the number of citations these articles received, we have a measure of their utility or impact. The purpose here is to document the level and impact of Third World research in the world's scientific journals. Perhaps it will serve as a point of departure for a wider discussion on the need for a New *Scientific Information Order*.

The Institute for Scientific Information® (ISI®), of which I am founder and chairman, offers a unique viewpoint on Third World science. Every year, we monitor several thousand scientific journals in our *Science Citation Index*® (*SCI*®) data base. We record bibliographic information on every item published in these journals. Last year, we processed 540,000 research articles, reviews, notes, letters, editorials, and other scientific communications. Similar data are available from our *Social Sciences Citation Index*® (*SSCI*®) data base, and the *Arts & Humanities Citation Index*™ (*A&HCI*™) data base. Here I restrict myself to *SCI*.

#### ***SCI Source Index***

We recorded the names and addresses of about 1.5 million authors; the titles, issues, and pages of 3,000 journals they published in; and about nine million references they cited. This information allows us to tabulate the number of articles written by Third World researchers that were published in the journals we covered. That is, we can identify all articles with first authors who list a Third World country as their address.

#### ***SCI Citation Index***

Our records also let us calculate the number of citations these Third World articles received. We can tell who the citing author is, and the journal, volume, page, and year of the citing article.

#### ***Third World Study***

For convenience, we used the *Encyclopedia of the Third World*<sup>6</sup> to define

which countries are considered as member states of the Third World. In 1982, the encyclopedia listed 122 developing nations. These countries met a variety of economic requirements in order to be considered developing nations. In addition, they were nonaligned with the US or USSR.

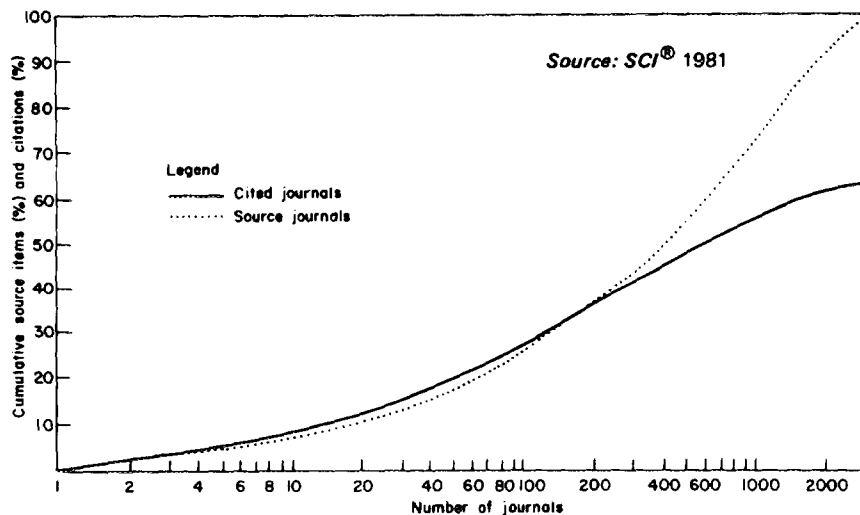
As a source year for this study, we decided to use the 1973 *SCI* data base. This gives a base year to compare the performance of Third World researchers in the future. In fact, we are now processing both the 1978 and 1981 *SCI* files to update this study. Of course, it takes an immense effort to produce and collate these data. But in a short time, we shall be able to chart the growth or decline of Third World science from 1973 to 1978 and 1981.

Also, using 1973 as a base year gives us enough time to measure the impact of Third World research on the international scientific community. That is, we can determine the number of citations these Third World articles received over a period of several years. The data are taken from six annual *SCI* files, covering 1973-1978.

There are a few important caveats. This discussion of Third World science is limited to that fraction of the international scientific press covered in the 1973 *SCI*. In 1973, it was estimated that 50,000 science journals were published worldwide.<sup>7</sup> This figure is a gross distortion, and it is safe to say that over 90 percent of these publications are of minor significance. *SCI* covered about 2,500 carefully selected journals that year.

Our studies indicate that the 'important' high-impact science journals actually amount to no more than 500 to 1,000 journals.<sup>8,9</sup> For example, the solid line in Figure 1 shows that only 80 journals are cited in 25 percent of all references processed in the 1981 *SCI*. In other words, only two percent of the 4,000 journals covered in *SCI* that year account for 25 percent of all citations. And only 700 journals account for 52 percent of all citations. Thus, a small number of journals account for the majority of citations.

Figure 1: Distribution of published items and citations among science journals.



Further evidence of the concentration of scientific literature in a small group of journals is provided by the dotted line in Figure 1, which shows that 20 percent of all 1981 articles were published in only 60 journals. And 400 journals account for 50 percent of all published articles. Again, a small group of journals predominates in the scientific literature.

I am confident that the journals ISI covers represent the major channels of international scientific communication. It should be borne in mind that we are assessing the level and impact of Third World research in international scientific journals—we do not intend to provide an inventory of Third World scientific output in every journal from every country of the world.

Table 1 shows how the articles in the 1973 *SCI* were distributed by country of publication. About 353,000 articles were indexed in *SCI* that year, and these articles received two million citations from 1973 to 1978. US journals alone published 48 percent of all *SCI* articles in 1973, and US published articles account for 60 percent of the two million citations in the 1973-1978 *SCI* files. The average article published in a US journal received about seven citations over that six-year period.

Table 1: Publishing countries represented in the 1973 *SCI*® data base. A=geographical region. B=percent of 1973 *SCI* articles. C=percent of 1973-1978 *SCI* citations. D=impact.

A	B	C	D
US	48	60	6.9
UK/Developed Commonwealth	16	16	5.5
Western Europe	15	10	3.4
USSR	6	2	1.4
Eastern Europe	3	1	1.9
Japan	3	2	2.9
Scandinavia	2	2	7.6
All Third World	2	—	.8
All Others	1	—	1.4

Table 2: Locations of authors in the 1973 *SCI*® data base. A=geographical region. B=percent of 1973 *SCI* articles. C=percent of 1973-1978 *SCI* citations. D=impact.

A	B	C	D
US	43	54	6.9
Western Europe	17	14	4.6
UK/Developed Commonwealth	16	17	5.9
USSR	7	2	1.6
All Third World	5	2	2.3
Eastern Europe	4	2	2.5
Japan	4	3	4.1
Scandinavia	3	4	7.4
All Others	2	2	5.2

If we add together the publication output of the US, the UK and developed Commonwealth countries, Western Europe, Japan, and Scandinavia, we see that these 'First World' countries ac-

count for 84 percent of 1973 articles, and 90 percent of 1973-1978 citations. Clearly, the *SCI* data base reflects the dominance of First World scientific publications. Western journals control the flow of international scientific communication almost as much as Western news agencies 'monopolize' international news. This is not a judgment, but simply a statement of fact.

Table 2 shows how the 1973 articles were distributed by *nationality* of the first author. Articles written by first authors listing a US institution as their address account for the largest portion—43 percent. These articles also account for the lion's share of citations—more than half. And if we add together articles authored in the US, UK and developed Commonwealth countries, Western Europe, Japan, and Scandinavia, they account for 83 percent of 1973 articles, and 92 percent of 1973-1978 citations. The data indicate that researchers from First World countries are the major partici-

pants in international science, at least as it is reflected in *SCI*.

### Position of India

Table 3 identifies the top 25 countries in terms of the number of articles written by their authors, and only two Third World countries appear—India and Argentina. India's rank is significant. It is considered to rank third in the world in the number of researchers, behind the US and USSR.<sup>7</sup> But it ranks eighth when we consider the number of articles its researchers authored in the international journals discussed here.

We can expect India to dominate the Third World when we rank developing countries by the number of articles their researchers authored (see Table 4). In fact, Indian researchers alone authored half the 16,000 articles from the Third World. Out of 93 Third World author countries in the 1973 *SCI* data base, authors from 30 developing countries authored 50 or more articles. These 30

**Table 3:** Top 25 countries, ranked by number of articles their authors produced. Asterisks indicate Third World countries.

Country	Articles	Citations	Impact	Cited Articles	Uncited Articles	Percent Citedness
US	151,939	1,047,854	6.9	97,852	54,087	64
UK	32,189	202,600	6.3	21,387	10,802	66
USSR	24,715	40,455	1.6	11,159	13,556	45
FRG	20,137	93,233	4.6	12,981	7156	64
France	17,707	72,912	4.1	11,069	6638	62
Japan	15,569	64,160	4.1	10,161	5408	65
Canada	15,362	86,654	5.6	10,688	4674	70
*India	7888	15,515	2.0	4568	3320	58
Australia	6985	38,342	5.5	4798	2187	69
Italy	6012	22,276	3.7	3448	2564	57
Sweden	4989	42,078	8.4	3748	1241	75
Switzerland	4483	29,078	6.5	2940	1543	66
Netherlands	4114	28,415	6.9	2971	1143	72
Czechoslovakia	3497	9859	2.8	2207	1290	63
Israel	3199	20,788	6.5	2274	925	71
Poland	2918	7072	2.4	1676	1242	57
Belgium	2675	12,532	4.7	1772	903	66
Denmark	2398	18,460	7.7	1745	653	73
GDR	2344	6401	2.7	1463	881	62
Hungary	2209	5025	2.3	1068	1141	48
Norway	1850	11,200	6.0	1292	558	70
Austria	1753	5205	3.0	1106	647	63
South Africa	1676	5182	3.1	992	684	59
Finland	1669	9467	5.7	1162	507	70
*Argentina	1526	4110	2.7	655	871	43

Source of data on articles: 1973 *SCI*<sup>®</sup>

Source of data on citations: 1973-1978 *SCI*

countries accounted for 95 percent of all Third World articles. Clearly, India is the research 'superpower' of the Third World. Argentina is a distant second, accounting for ten percent, or a fifth of India's output.

Ranking countries by the number of authored articles has its disadvantages. Small developing *and* developed countries producing high-quality science would tend not to appear. Their overall output is dwarfed by that of the large superpowers. But when we rank all countries by the *impact* of their authored articles, we see some interesting results.

### Impact of Third World Articles

Thirty countries averaged four or more citations to their authored articles from 1973 to 1978 (see Table 5). Twelve are developing countries, and they are indicated by asterisks. Three developing countries rank among the top ten in the world in impact—Liberia, Jamaica, and Thailand. However, we should note that Liberia's high impact is based on only seven authored articles. It would be difficult to derive much significance from so small a sample.

Articles authored in Liberia, Jamaica, and Thailand *together* averaged seven

**Table 4:** Third World countries whose authors produced 50 or more articles, ranked by the number of articles.

Country	Articles	Citations	Impact	Cited Articles	Uncited Articles	Percent Citedness
India	7888	15,515	2.0	4568	3320	58
Argentina	1526	4110	2.7	655	871	43
Brazil	812	2355	2.9	401	411	49
Egypt	713	1306	1.8	451	262	63
Venezuela	589	702	1.2	127	462	22
Chile	565	1228	2.2	227	338	40
Mexico	535	1652	3.1	258	277	48
Nigeria	354	866	2.4	229	125	65
Iran	196	444	2.3	107	89	55
Turkey	184	405	2.2	110	74	60
Malaysia	154	361	2.3	96	58	62
Lebanon	153	401	2.6	90	63	59
Singapore	139	305	2.2	88	51	63
Thailand	138	970	7.0	96	42	70
Uganda	132	587	4.4	93	39	70
Kenya	127	595	4.7	89	38	70
Pakistan	111	197	1.8	60	51	54
Zimbabwe	87	236	2.7	53	34	61
Ghana	79	140	1.8	44	35	56
Jamaica	77	545	7.1	63	14	82
Philippines	61	190	3.1	38	23	62
Peru	59	125	2.1	25	34	42
Tanzania	58	159	2.7	39	19	67
Sri Lanka	58	123	2.1	43	15	74
Sudan	57	161	2.8	36	21	63
Uruguay	57	121	2.1	24	33	42
Algeria	56	82	1.5	28	28	50
Colombia	54	159	2.9	35	19	65
Iraq	54	248	4.7	31	23	58
Ethiopia	50	247	4.9	40	10	80
<b>Totals</b>	<b>15,123</b>	<b>34,535</b>	<b>2.3</b>	<b>8244</b>	<b>6879</b>	<b>54</b>
<b>All Other Third World Nations</b>	<b>755</b>	<b>1630</b>	<b>2.2</b>	<b>410</b>	<b>345</b>	<b>54</b>
<b>Grand Totals</b>	<b>15,878</b>	<b>36,165</b>	<b>2.3</b>	<b>8654</b>	<b>7224</b>	<b>55</b>

Source of data on articles: 1973 SCI\*

Source of data on citations: 1973-1978 SCI

**Table 5: Countries with impact of 4.0 or greater for articles their authors produced, ranked by impact. Asterisks indicate Third World countries.**

Country	Impact	Articles	Citations	Cited Articles	Uncited Articles	Percent Citedness
Bermuda	11.5	2	23	2	0	100
*Liberia	8.7	7	61	7	0	100
Sweden	8.4	4989	42,078	3748	1241	75
Denmark	7.7	2398	18,460	1745	653	73
Antilles	7.5	4	30	4	0	100
*Jamaica	7.1	77	545	63	14	82
*Thailand	7.0	138	970	96	42	70
Netherlands	6.9	4114	28,415	2971	1143	72
US	6.9	151,939	1,047,854	97,852	54,087	64
Israel	6.5	3199	20,788	2274	925	71
Switzerland	6.5	4483	29,078	2940	1543	66
UK	6.3	32,189	202,600	21,387	10,802	66
Norway	6.0	1850	11,200	1292	558	70
Finland	5.7	1669	9467	1162	507	70
Canada	5.6	15,362	86,654	10,688	4674	70
Australia	5.5	6985	38,342	4798	2187	69
*Guatemala	5.3	18	96	12	6	67
Northern Ireland	5.2	539	2791	359	180	67
*Panama	5.2	16	83	13	3	81
*Ethiopia	4.9	50	247	40	10	80
Belgium	4.7	2675	12,532	1772	903	66
*Iraq	4.7	54	248	31	23	58
*Kenya	4.7	127	595	89	38	70
FRG	4.6	20,137	93,233	12,981	7156	64
*Uganda	4.4	132	587	93	39	70
*Zambia	4.4	41	179	24	17	58
Japan	4.1	15,569	64,160	10,161	5408	65
*Cameroon	4.1	16	65	9	7	56
France	4.1	17,707	72,912	11,069	6638	62
*Congo Peop. Rep.	4.0	8	32	5	3	62

Source of data on articles: 1973 SCI\*

Source of data on citations: 1973-1978 SCI

citations over a six-year period. This comes close to matching the impact of those Scandinavian countries in the top ten—they averaged eight citations. Liberian, Jamaican, and Thai articles, together or singly, had a greater impact than US articles. But India is conspicuous by its absence.

If we examine the impact of Third World articles only (see Table 6), we see that 27 developing countries had an impact of 2.5 or greater. But India still does not appear, even though it dominated the Third World in authored articles. The average article from India was cited twice over six years. Argentina, which accounted for only a fifth of India's output, had a higher impact—2.7.

### Languages

Third World articles were written in ten different languages. More than 85

percent of the 16,000 Third World articles are in English. Spanish is a distant second, accounting for 11 percent. Also, Third World articles had the highest impact (measured as total articles published divided into number of citations) when they were authored in English (impact of 2.6). German-language articles had the next highest impact (2.0), followed by French (1.4) and Italian (1.0).

Clearly, English is the *lingua franca* of Third World science. This is even more true in recent years. For example, the 1978 SCI data base included 22,000 articles from the Third World; 92 percent of these were in English. And English-language articles again accounted for 92 percent of the 27,000 Third World articles in the 1981 SCI file.

In fact, the same pattern holds true for all the author countries in the SCI files, developed or developing. More than 80

**Table 6:** Third World countries with impact of 2.5 or greater for articles their authors produced, ranked by impact.

Country	Impact	Articles	Citations	Cited Articles	Uncited Articles	Percent Citedness
Liberia	8.7	7	61	7	0	100
Jamaica	7.1	77	545	63	14	82
Thailand	7.0	138	970	96	42	70
Guatemala	5.3	18	96	12	6	67
Panama	5.2	16	83	13	3	81
Ethiopia	4.9	50	247	40	10	80
Iraq	4.7	54	248	31	23	58
Kenya	4.7	127	595	89	38	70
Uganda	4.4	132	587	93	39	70
Zambia	4.4	41	179	24	17	58
Cameroon	4.1	16	65	9	7	56
Congo Peop. Rep.	4.0	8	32	5	3	62
Mexico	3.1	535	1652	258	277	48
Philippines	3.1	61	190	38	23	62
Burundi	3.0	1	3	1	0	100
Lesotho	3.0	2	6	2	0	100
Brazil	2.9	812	2355	401	411	49
Colombia	2.9	54	159	35	19	65
Barbados	2.8	5	14	4	1	80
Ivory Coast	2.8	35	99	28	7	80
Saudi Arabia	2.8	13	37	8	5	61
Sudan	2.8	57	161	36	21	63
Argentina	2.7	1526	4110	655	871	43
Indonesia	2.7	23	62	10	13	43
Tanzania	2.7	58	159	39	19	67
Lebanon	2.6	153	401	90	63	59
Zimbabwe	2.6	87	236	53	34	61
<b>Totals</b>	<b>3.2</b>	<b>4106</b>	<b>13,352</b>	<b>2140</b>	<b>1966</b>	<b>52</b>
<b>All Other Thrd World Nations</b>	<b>1.9</b>	<b>11,772</b>	<b>22,813</b>	<b>6514</b>	<b>5258</b>	<b>55</b>
<b>Grand Totals</b>	<b>2.3</b>	<b>15,878</b>	<b>36,165</b>	<b>8654</b>	<b>7224</b>	<b>54</b>

Source of data on articles: 1973 SCI\*

Source of data on citations: 1973-1978 SCI

**Table 7:** Third World publishing countries, ranked by the number of articles published in their journals.

Publishing Country	Articles	Citations	Impact	Cited Articles	Uncited Articles	Percent Citedness
India	3486	3815	1.1	1657	1829	48
Argentina	1137	379	.3	157	980	14
Venezuela	473	93	.2	49	424	10
Chile	288	123	.4	61	227	21
Mexico	187	99	.5	42	145	22
Brazil	109	29	.3	15	94	14
Costa Rica	71	74	1.0	31	40	44
Lebanon	21	6	.3	5	16	24
Ghana	18	3	.2	3	15	17
Peru	16	0	—	0	16	—
Nigeria	13	5	.4	4	9	31
Kuwait	10	0	—	0	10	—
Thailand	7	1	.1	1	6	14
Philippines	5	0	—	0	5	—
Colombia	2	0	—	0	2	—
<b>Totals</b>	<b>5843</b>	<b>4627</b>	<b>.8</b>	<b>2025</b>	<b>3818</b>	<b>35</b>

Source of data on articles: 1973 SCI\*

Source of data on citations: 1973-1978 SCI



percent of the 353,000 articles in the 1973 *SCI* were in English. And English-language articles had the highest impact—6.3. In the 1978 *SCI*, 87 percent of the 530,000 articles were in English. And English-language articles accounted for 88 percent of the 605,000 articles in the 1981 *SCI* file.

This reminds me of a controversy involving France that developed in 1976. I presented data showing that most French research had a low impact relative to many other countries.<sup>10</sup> And this was even worse when they published their results in French. I showed that the best articles from France, with a significantly higher impact, were written in English.<sup>11</sup> This so offended the Francophile establishment that I was accused of linguistic imperialism.<sup>12</sup> In fact, Michel Debré, a former Prime Minister of France, suggested that my data might threaten "the existence and permanence of the French nation" if it encouraged French scientists to publish in English!<sup>13</sup>

But a recent survey of PASCAL, a French documentation system, yielded some ironic results. In 1979, PASCAL indexed 155,000 articles in its life sciences file. Of these, 70 percent were in English. French amounted to only 12 percent, and German to seven percent.<sup>14</sup> Unfortunately, PASCAL does not record citations, so we have no measure of the relative impact of these articles. Even a data base that "is supposed to be strongly biased in favor of European languages"<sup>14</sup> shows that English is

the *lingua franca* of international science.

So far, we have looked at 353,000 articles in the 1973 *SCI* file by the nationality of the *first author*. We identified about 16,000 articles as having been authored in 93 Third World countries. India was found to be the 'superpower' of Third World research, accounting for half of all articles from developing countries. But when impact was considered, Indian articles did not rank among the top 25 countries, developed or developing. But three Third World countries—Liberia, Jamaica, and Thailand—had a combined impact close to Scandinavia's, and greater than that of the US. Also, English-language articles dominated the total output of Third World authors, and they had the highest impact.

### Nationality

We now consider the same articles by the nationality of the *publisher*. Fifteen Third World publishing countries are represented in the 1973 *SCI* data base. We covered 52 of their journals. These journals published 5,500 of the 16,000 articles written by Third World authors. That is, 35 percent of all the articles by Third World authors were published in Third World journals.

### Impact of Third World Publishing Countries

Again, India is the giant of Third World science. It published 60 percent

Table 8: Third World publishing countries, ranked by impact of articles their journals published.

Publishing Country	Impact	Articles	Citations	Cited Articles	Uncited Articles	Percent Citedness
India	1.1	3486	3815	1657	1829	48
Costa Rica	1.0	71	74	31	40	44
Mexico	.5	187	99	42	145	22
Chile	.4	288	123	61	227	21
Nigeria	.4	13	5	4	9	31
Argentina	.3	1137	379	157	980	14
Brazil	.3	109	29	15	94	14
Lebanon	.3	21	6	5	16	24
Ghana	.2	18	3	3	15	17
Venezuela	.2	473	93	49	424	10
Thailand	.1	7	1	1	6	14

Source of data on articles: 1973 *SCI*<sup>9</sup>

Source of data on citations: 1973-1978 *SCI*

of all articles in the Third World scientific press (see Table 7). Argentina ranks second, accounting for 20 percent. The remaining 13 Third World publishing countries account for only 20 percent.

India and Argentina also rank among the top 25 scientific publishing countries in the world. India ranks thirteenth and Argentina twentieth.

India also ranks first among Third World publishing countries when impact is taken into account (see Table 8). The average article published in an Indian journal was cited once from 1973 to 1978. Costa Rica has an equivalent impact, even though its output of published articles was much smaller than that of India. The publications of Peru, Kuwait, Philippines, and Colombia are not listed here because they were not cited from 1973 to 1978.

### Publishing Opportunities

The US published more Third World articles than any other country (see Table 9). It published over 3,700 Third

**Table 9:** Countries that published 50 or more Third World articles, ranked by the number of articles. Asterisks indicate Third World countries. A=publishing country. B=articles. C=citations. D=impact. E=Third World countries.

A	B	C	D	E
US	3755	13,706	3.6	75
*India	3351	3690	1.1	12
UK	2542	8401	3.3	68
*Argentina	1069	348	.3	13
Netherlands	885	3440	3.9	53
FRG	648	1512	2.3	43
Switzerland	555	1488	2.7	41
*Venezuela	431	53	.1	5
France	360	566	1.6	42
GDR	319	602	1.9	17
Japan	293	477	1.6	19
*Chile	283	123	.4	5
Italy	228	280	1.2	29
*Mexico	174	94	.5	7
Australia	134	267	2.0	20
Denmark	126	351	2.8	23
*Brazil	89	22	.2	2
Canada	86	152	1.8	20
Hungary	74	84	1.1	10
Austria	64	107	1.7	8
Czechoslovakia	54	94	1.7	9
*Costa Rica	50	58	1.2	12
<b>Totals</b>	<b>15,570</b>	<b>35,915</b>	<b>2.3</b>	
<b>All Others</b>	<b>308</b>	<b>250</b>	<b>.8</b>	
<b>Grand Totals</b>	<b>15,878</b>	<b>36,165</b>	<b>2.3</b>	

Source of data on articles: 1973 SCF\*  
Source of data on citations: 1973-1978 SCI

**Table 10:** Publishing countries with an impact of 1.5 or greater for Third World articles, ranked by impact. A=publishing country. B=impact. C=articles. D=citations. E=Third World countries.

A	B	C	D	E
Netherlands	3.9	885	3440	53
US	3.6	3755	13,706	75
UK	3.3	2542	8401	68
Ireland	3.0	1	3	1
Denmark	2.8	126	351	23
Switzerland	2.7	555	1488	41
FRG	2.3	648	1512	43
Sweden	2.2	28	61	14
Australia	2.0	134	267	20
Belgium	2.0	18	36	7
GDR	1.9	319	602	17
Canada	1.8	86	152	20
Israel	1.8	18	32	7
Austria	1.7	64	107	8
Czechoslovakia	1.7	54	94	9
France	1.6	360	566	42
Japan	1.6	293	477	19
Norway	1.5	2	3	2
<b>Totals</b>	<b>3.2</b>	<b>9888</b>	<b>31,298</b>	
<b>All Others</b>	<b>.8</b>	<b>5996</b>	<b>4867</b>	
<b>Grand Totals</b>	<b>2.3</b>	<b>15,878</b>	<b>36,165</b>	

Source of data on articles: 1973 SCF\*  
Source of data on citations: 1973-1978 SCI

World articles. This amounts to only two percent of all US published articles. But it accounts for 24 percent of all Third World articles. Also, Third World articles published in the US came from 75 different developing countries. That is, more Third World nations found a publishing opportunity in the US than in any other publishing country.

India is a close second, publishing over 3,300 Third World articles. But 98 percent of all Third World articles published in India were authored by Indian scientists. Eleven other developing countries managed to publish only 56 articles in Indian journals.

The other Third World publishing countries, indicated by asterisks, followed the same pattern. Seventy-five percent of the Third World articles published in Argentina were authored by Argentinean scientists. For Venezuela, this figure is 97 percent; for Chile, 98 percent; for Mexico, 95 percent; and for Brazil, 99 percent. Only Costa Rica published more articles from Third World countries other than itself. Of the 50 articles published in Costa Rican journals, 23 were from Costa Rica.

Significantly, no Third World publishing country had an impact of 1.5 or greater for the Third World articles it published (see Table 10). Costa Rica had an impact of 1.2, the highest of all 15 Third World publishers. India followed

with an impact of 1.1. Third World articles had the greatest impact when they were published in the Netherlands, US, or UK.

(Part 2 will be published next week.)

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