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ELEVEN YEARS OF CBRI RESEARCH OUTPUT, 1980-90 - A BIBLIOMETRIC STUDY

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CBRI research output, 1980-90 is the bibliometric study of research papers contributed by the scientists of CBRI Roorkee in the form of articles published in Indian and foreign periodicals and papers presented in national and international conferences. The study indicates the downward trend of the institute's research output. Suggestions are made to improve the situation by taking more R&D projects in future, keeping in view the needs of the country. A list of suggested journals with their rankings, impact factors and immediacy index is given. If CBRI scientists publish their work in some of these journals, the CBRI work will have better visibility to scientific community.

INTRODUCTION

The Central Building Research Institute is one of the engineering laboratories of the Council of Scientific and Industrial Research (C.S.I.R.). Its scientists have been generally publishing their works in journals (both Indian and foreign) and presenting papers in the national and international conferences. CBRI scientists are contributing papers and articles to 94 periodicals with varying impact factors (Table 1) and a number of national and international conferences which shows that the contribution of CBRI to the advancement of knowledge in diverse fields is significant.

A study is undertaken for systematic bibliometric analysis of the papers published by the scientists of CBRI in research journals of Indian and foreign origin and papers presented in the national and international conferences during 1980-90 to make an assessment of the impact of the research papers published by the CBRI scientists on scientific activity and assessment of implementation of the projects in the laboratory (Charts 3 &4).

METHODOLOGY

822 research papers were published by the scientists of CBRI during January 1980 to March 1990. Each paper was categorised on the basis of the journal in which it appeared and to the division to which it belonged.

It is observed that the journals in various fields of science such as physics, chemistry, biology, microbiology, drugs, etc. are covered by the Science Citation Index (SCI) and are regularly analysed in the Journal Citation Report (JCR). It is unfortunate that the engineering journals have not attracted much attention of SCI and therefore their impact factor, immediacy index, self-citation rate etc. are not known.

Impact Factor (IF): It is the ratio between the number of times a journal is cited and the number of citable articles published by the journal in a given span of time.

Immediacy Index: It is the rate at which an article is cited during the year of its publication.

Self Citation Rate : It is the rate at which an article cites itself.

IMPACT FACTORS OF JOURNALS OF INTEREST TO CBRI

The reputed journals in civil engineering which are covered by the Science Citation Index provide the basis for assigning impact factors to other journals in the same discipline. In every discipline of interest to CBRI, subject experts were also approached to make their judgement in assigning impact factors and guiding average was taken as the recommended values. For instance, the Journal of Geotechnical Engineering (American Society of Civil Engineers, New York) is assigned

Table 1

Impact Factor of Indian and Foreign Journals

Sl. No.	Title of Journal	I.F.
1.	ACI Structural Engineering (USA)	0.001
2.	Architects Trade Journal(INDIA)	0.001
3.	Architectural Science Review (AUSTRALIA)	0.222
4.	Bricks & Tile News (ANN No.) (INDIA)	0.010
5.	Builder's Friend (INDIA)	0.001
6.	Building & Environment (UK)	0.100
7.	Building & Prefabrication (UK)	0.010
8.	Building Research & Practice (UK)	0.035
9.	Cement (INDIA)	0.020
10.	Cement & Concrete Research (UK)	0.200
11.	Cement Industry (ANNUAL) (UK)	0.010
12.	Cera Murgia (ITALY)	0.010
13.	Changing Indian Village (INDIA)	0.001
14.	Chemical Age of India (INDIA)	0.010
15.	Chemical Era (INDIA)	0.001
16.	Civil Engg Construction Rev (INDIA)	0.001
17.	Construction Building Technology (INDIA)	0.060
18.	Corrosion Bulletin (INDIA)	0.020
19.	Design incorporating Indian Builder (INDIA)	0.010
20.	Durability of Building Materials (HOLLAND)	0.201
21.	Electrochemical Society of India (INDIA)	0.080
22.	Electrochemistry (INDIA)	0.080
23.	Engineering Construction Review (INDIA)	0.010
24.	Energy Management (INDIA)	0.010
25.	Euroclay (UK)	0.010
26.	Fire Engineer (UK)	0.200
27.	Fire Safety Journal (USA)	0.200
28.	Fire Technology (UK)	0.201
29.	Indian Architect (INDIA)	0.001
30.	Indian Architect Builder (INDIA)	0001
31.	Indian Ceramics (INDIA)	0.050
32.	Indian Concrete Journal (INDIA)	0.050
33.	Indian Construction (INDIA)	0.001
34.	Indian Geotechnical Journal (INDIA)	0.060
35.	Indian J Environ Health (INDIA)	0.189
36.	Indian J Pure & Appl Physics (INDIA)	0.124
37.	Indian J Power & River Vall Dev (INDIA)	0.004
38.	Indian J Technology (INDIA)	0.130
39.	Indian J Textile (INDIA)	0.001
40.	Indian Planner and Builder (INDIA)	0.001
41.	Indian Surveyor (INDIA)	0.010
42.	Indian Standards Bulletin (INDIA)	0.001
43.	Inter. J Dev. Technology (THAILAND)	0.010
44.	Inter. J Environ Studies (UK)	0.100
45.	Inter. J Num. & Analyt. Meth. in Geo. Mech. (UK)	0.740

contd.....

46.	Inter. J Num. Meth. in Engg. (UK)	0.941
47.	Inter. Library Movement (INDIA)	0.001
48.	ISI Bulletin (INDIA)	0.005
49.	J Chem. Tech. & Bio-Tech. (UK)	0.353
50.	J Colour Society (INDIA)	0.001
51.	J Energy Management (INDIA)	0.010
52.	J Engineering Design (INDIA)	0.001
53.	J Geotech. Engg. Div. Proc. of ASCE (USA)	0.471
54.	J Indian Acad. of Wood Sci. (INDIA)	0.001
55.	J Indian Instt. of Arch. (INDIA)	0.001
56.	J Indian Road Congress (INDIA)	0.020
57.	J Indian Water Works Assoc. (INDIA)	0.060
58.	J Inst. of Engg. Arch (INDIA)	0.020
59.	J Inst of Engrs (India)-Chem (INDIA)	0.020
60.	J Inst of Engrs (India)-Civil) (INDIA)	0.020
61.	J Engrs (India)-Env. (INDIA)	0.010
62.	J Inst of Engrs (India)-Hindi (INDIA)	0.010
63.	J National Building Organisation (INDIA)	0.010
64.	J Oil & Chemical Assoc. (UK)	0.250
65.	J Optics (USA)	1.411
66.	J School Plan Arch. (INDIA)	0.001
67.	J Sc & Ind Researach (INDIA)	0.248
68.	J Structural Engg: ASCE (USA)	0.515
69.	Khadi Gram Udyog (INDIA)	0.001
70.	Meri Journal (INDIA)	0.001
71.	Metal & Mineral Rev (INDIA)	0.010
72.	Paint India (INDIA)	0.300
73.	Periodica Polytechnica (POLAND)	0.010
74.	Plastics Rubb & Mat Appl (UK)	0.004
75.	Polytechnica (POLAND)	0.010
76.	Popular Plastics & Rubber (UK)	0.001
77.	Pragati Nirman (INDIA)	0.001
78.	Pragya (INDIA)	0.001
79.	Proceedings of ASCE (USA)	0.100
80.	Process & Plant Engg. (INDIA)	0.001
81.	Research & Industry (INDIA)	0.726
82.	Salt Research Industry (INDIA)	0.001
83.	Science Reporter (INDIA)	0.001
84.	Science Today (INDIA)	0.001
85.	Soil Mechanics and Found Engg (JAPAN)	0.019
86.	Tata Energy Research (INDIA)	0.019
87.	Trans of Indian Ceramics (INDIA)	0.050
88.	Trans of Indian Soc of Des Tech (INDIA)	0.050
89.	Tunnelling & Und Ground space Tech (USA)	0.200
90.	Urja (INDIA)	0.001
91.	Vigyan Pragati (INDIA)	0.001
92.	Voluntary Action (INDIA)	0.001
93.	Yojana (INDIA)	0.001
94.	Zement Kalk Gips (GERMANY)	0.762

CHART - 1

YEARWISE CONTRIBUTION IN INDIAN AND FOREIGN JOURNALS

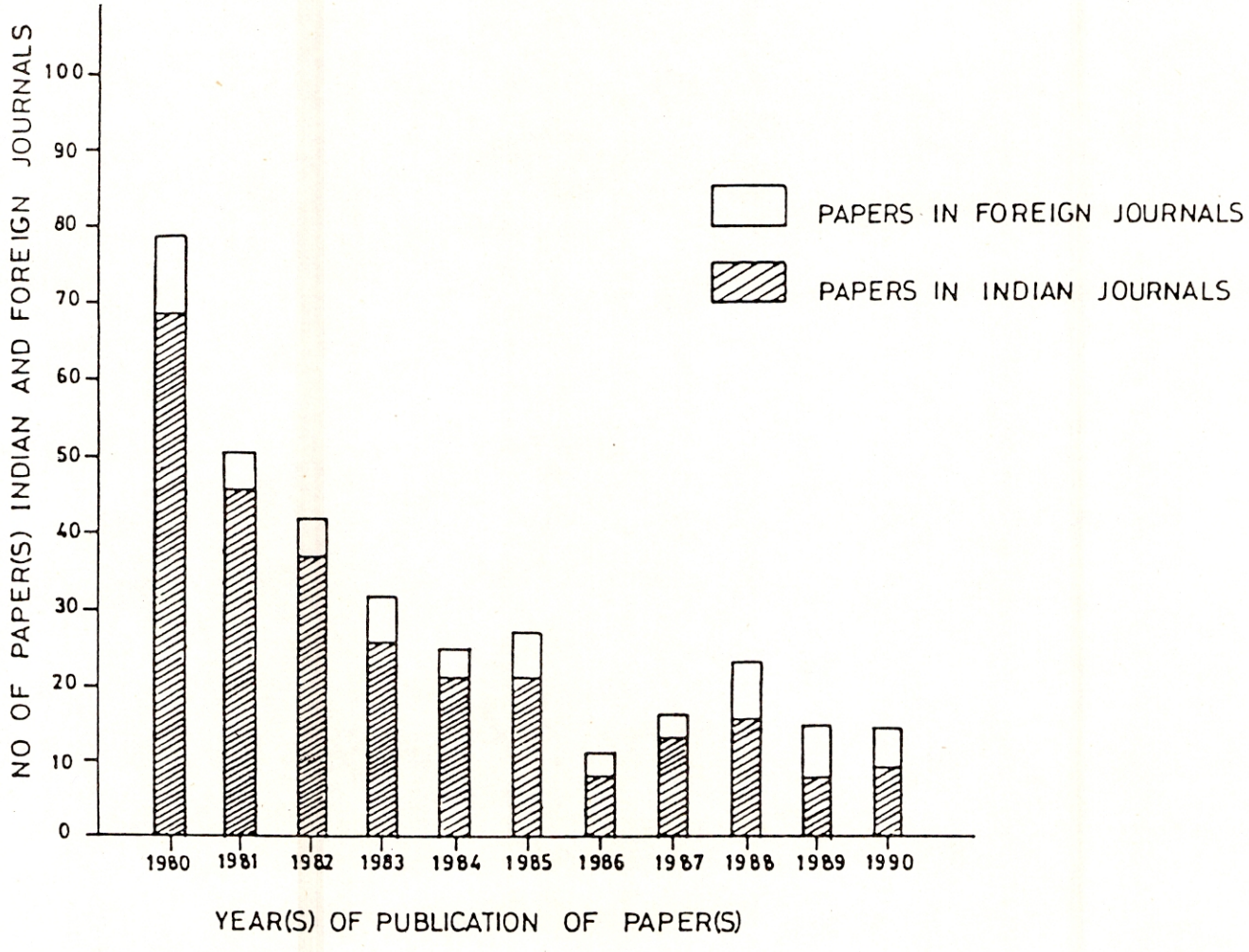


CHART - 2

DIVISIONWISE DISTRIBUTION OF PAPERS IN INDIAN AND FORIEGN PERIODICALS

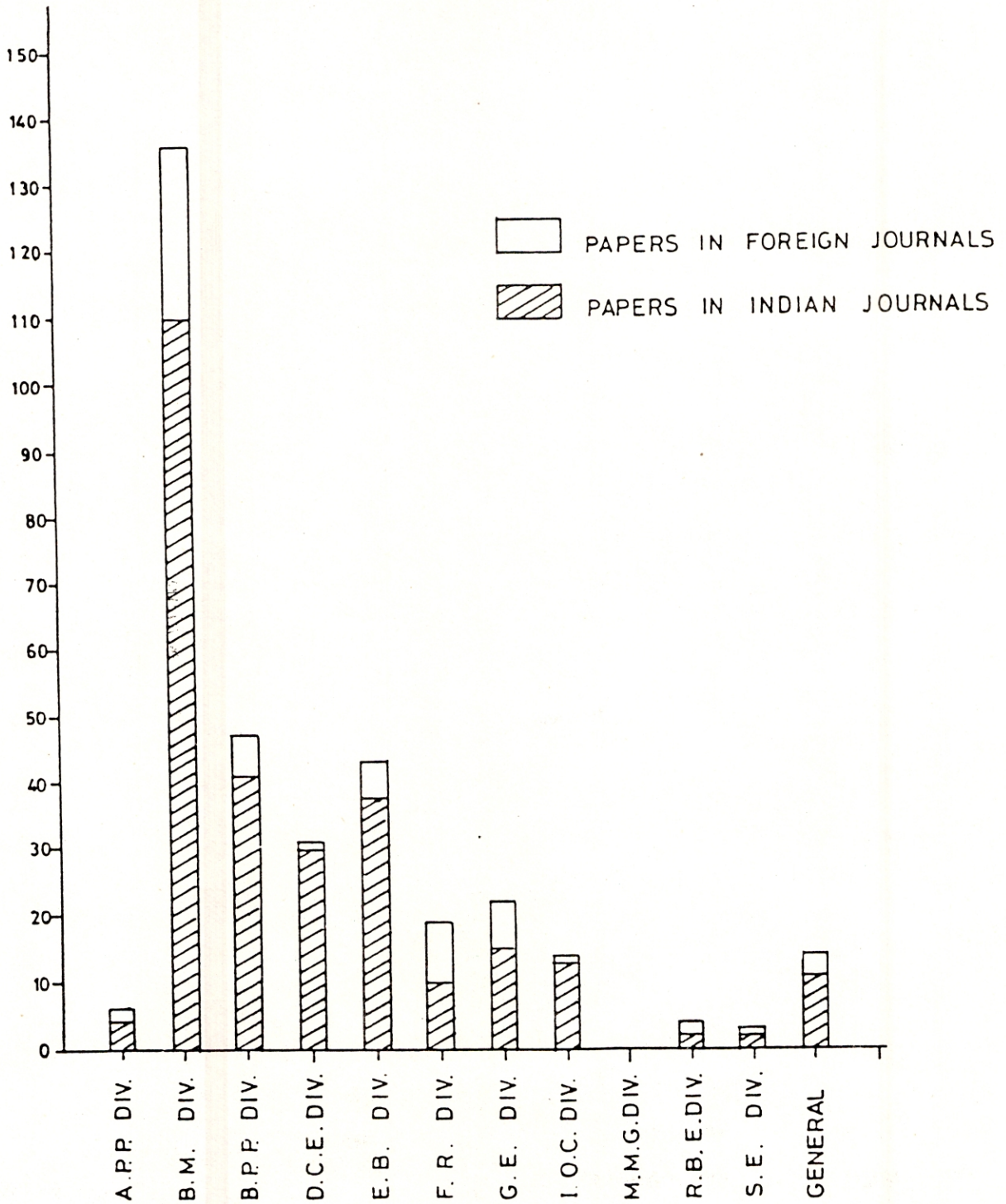


CHART - 3

CONTRIBUTION IN NATIONAL AND INTERNATIONL CONFERENCES 1980-1990

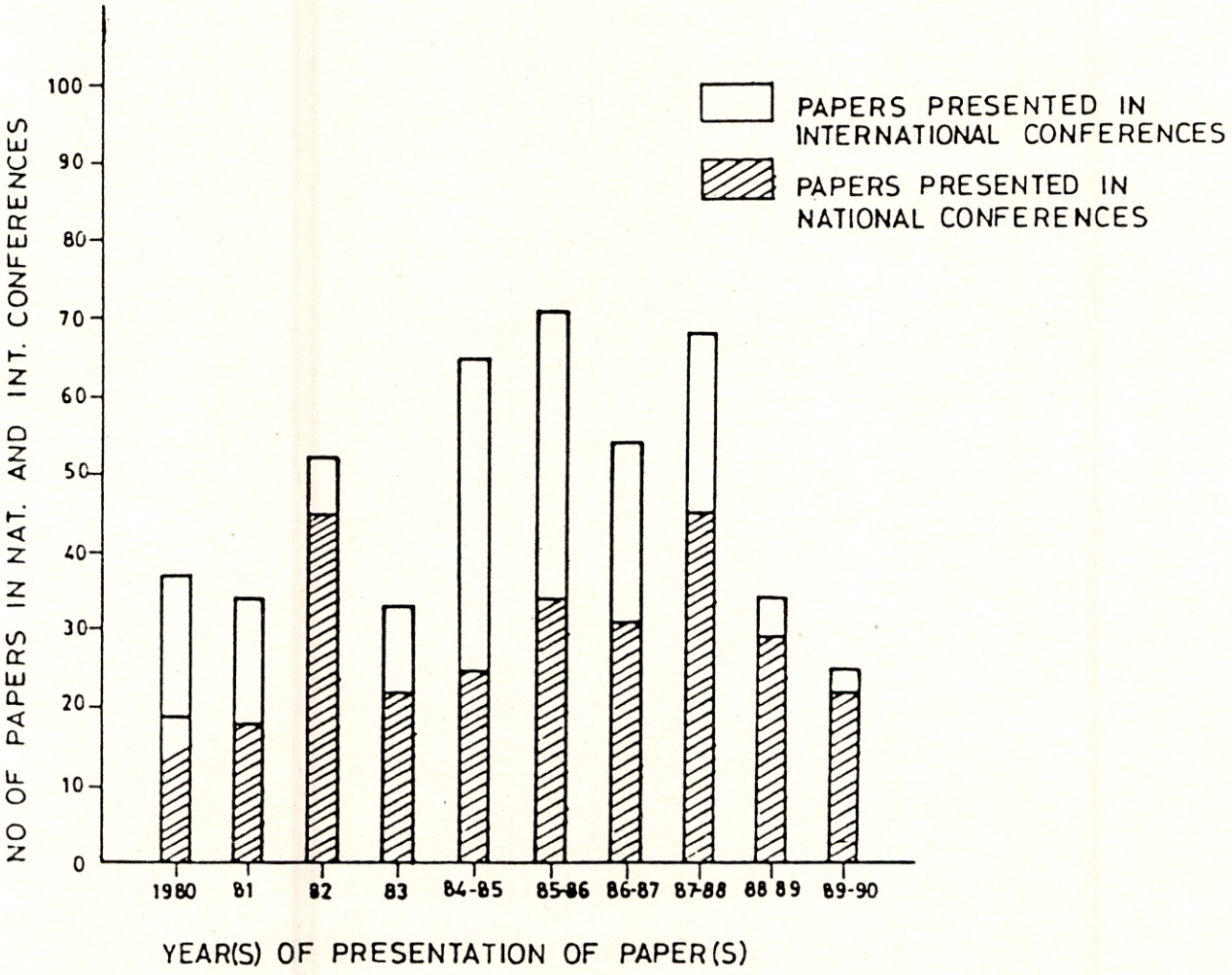


CHART - 4

DIVISIONWISE CONTRIBUTION IN NATIONAL AND INTERNATIONAL CONFERENCES

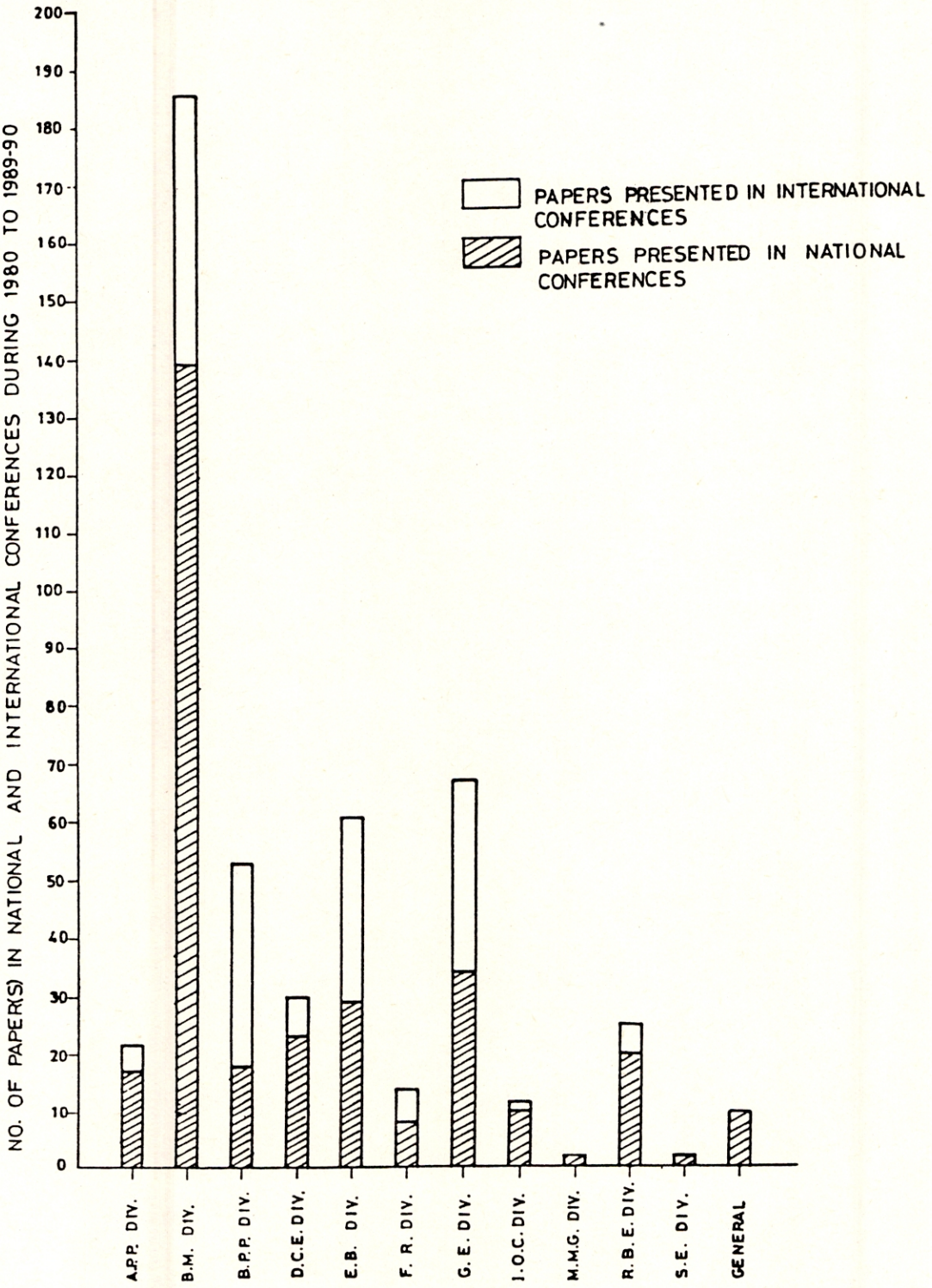
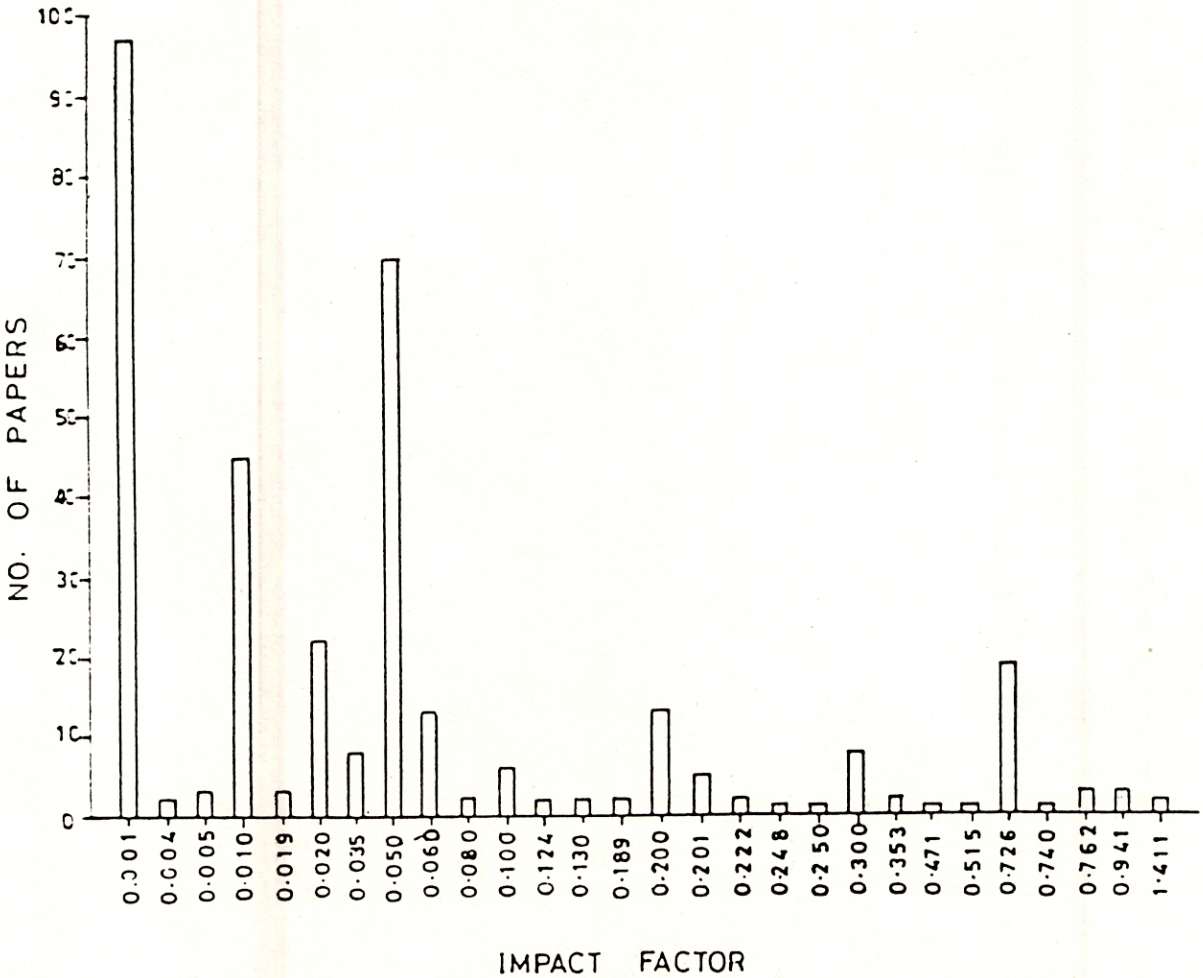


CHART - 5

IMPACT FACTOR OF PAPERS IN INDIAN AND FOREIGN JOURNALS (1980-90)



the Impact Factor of 0.471 by SCI (1988). Keeping this value in view, the impact factors for other journals like Indian Geotechnical Journal were arrived at, by keeping in consideration the relative merits and demerits. The total of impact factors of 339 papers published by the CBRI scientists during 1980-90 in Indian and foreign journals calculated in the manner specified above, worked out to be 36.006. It, therefore, follows that average impact factor per article lies close to 0.112 (Table 4).

The above analysis clearly indicates that the impact factors, worked out by taking the impact factors of a few outstanding civil engineering journals assigned by the SCI as the basis, would grossly underestimate the merit of papers in most other engineering journals. This is because the IF of papers published in the best of engineering journals fall way behind the IF of the front line disciplines viz. physics, chemistry and biology. Quite clearly, IF depends also on the status of a given discipline in the world of science and the scales tilt in favour of journals in such disciplines as are adequately covered by SCI. The professionals in the civil engineering laboratories have come to the conclusion that the journal published by the American Society of Civil Engineers, is amongst the best in the world and for this publication, the impact factor value assigned by SCI is just 0.471 as compared to the best journal, i.e. Biological Chemistry where the assigned value of impact factor is to the tune of 6.000 or even more. The evaluation of performance of the scientists in engineering laboratories, therefore, cannot be appropriately done by the kind of approach followed in the above anlysis. In fact, Eugene Garfield, one of the authorities on the theory and application of citation analysis, has time and again drawn attention to the differences in the citation characteristics that exist between the literature of different fields of science. More recently, Corneliers le Paier has argued in favour of not applying citation analysis to technology like applied sciences, engineering, instrumentation, etc., where patenting, product design and manufacturing are more important than paper writing and citing a paper.

ANALYSIS OF RESEARCH OUTPUT

339 articles from CBRI scientists were published in 94 jounrals. 79 articles were published in the year 1980. The research output of CBRI shows a zigzag trend during 1981 to 1990 (chart 1). It is also observed that there has been a declining trend duriing 1989 to 1990.

The study also shows that CBRI scientists prefered some Indian journals to publish their papers during 1980-1990 as shown below :

Name of the Journal	No. of Papers
Indian Concrete Journal	44
Indian Ceramics	22
Research and Industry	19
Journal of Instn. of Civil Engineers	12
Indian Construction	11
Indian Geotechnical Journal	11
Indian Architect	11
Paint India	8

Similarly, some selected foreign periodicals chosen by CBRI scientists to publish their papers are:

Name of the Journal	No. of Papers
Building Research and Practice	10
Cement and Concrete Research	8
Durability of Building Materials	3

By and large, it was found that 97 papers were published in substandard journals. It is suggested that CBRI building material chemists must publish some of their articles in Indian Journal of Chemistry Section A and B published by CSIR, Delhi.

Table 2 gives year-wise distribution of papers published in Indian and foreign journals. The preference of CBRI scientists to publish in Indian journals is established by the fact that as many as 278 papers were published by them in Indian journals. This may be due to the fact that papers in Indian journals are easily accepted,because of the weak refereeing system.

It is heartening to note that the CBRI technology could be published in 61 foreign journals despite the fact that the foreign periodicals are quite strict in accepting papers for publication. Only top class papers are accepted by them.

Table 3 and Chart 2 shows division-wise distribution of papers in Indian and foreign journals.

The Building Materials Division is found to have maximum number of papers to its credit. This may be attributed to the fact that the division is also having maximum number of scientific staff. In all, 136 papers (Table 3) were published by the division of which 110 papers appeared in Indian journals and 26 in foreign journals. Mathematical Modelling Group did not publish any paper in this decade as it was established in 1989 only.

Table 4 shows contribution of CBRI scientists in national and international conferences/seminars during the period. 483 papers were presented by CBRI scientists in various national/ international seminars/symposia. It is to be noted that papers are more easily accepted in the conferences than in Indian and foreign journals. Probably, this is the reason that as many as 483 papers were presented in various conferences, compared to 339 published in Indian and foreign journals.

From the table, it is evident that the Building Materials Division presented 185 papers in various conferences, of which 139 papers were presented in national and 46 papers in international conferences.

The Geotechnical Engineering Division presented 67 papers in various conferences. It is interesting to note that the division presented 34 papers in international conferences indicating good quality of research work.

The scientists of the Efficiency of Buildings Division have presented more papers (32) in international conferences than in national conferences (29). This may indicate that the CBRI technology in the area of building technology is more acceptable to foreign countries. Table 6 gives the impact factor of journals in which CBRI scientists published their papers. The total impact factor of 339 articles during the period 1980-90 is 38.371. The average impact factor per article is 0.113. The bar chart 5 clearly shows that maximum number of articles (i.e. 97) are published in the journals having very low impact factor i.e. 0.001. On the impact factor-based evaluation of publications, it was found that 28.6% of articles were published in the journals having impact factor 0.001, i.e., very low, 56.9% of articles were published in the journals having impact factor 0.004 to 0.200 (i.e. low to moderate), 5% of articles were published in the journals having impact factor 0.201 to 0.300 (i.e. moderate) and 9.4% of articles were published in the journals having impact factor 0.353 to 1.411 (i.e. quite high).

CONCLUSIONS

India is one of the countries having the largest scientific manpower in the world and the scientists are publishing their research outputs in more than thousand Indian and foreign periodicals. Such a large volume of scientific activity cannot be brushed aside. It is important to note

Table 2

Year-wise Distribution of Papers in Indian and Foreign Journals

Sl No.	Year	Indian journals	Foreign journals	Total
1.	1980	69	10	79
2.	1981	46	5	51
3.	1982	38	5	43
4.	1983	26	6	32
5.	1984	21	4	25
6.	1985	22	6	28
7.	1986	9	3	12
8.	1987	14	3	17
9.	1988	16	7	23
10.	1989	8	7	15
11.	1990	9	5	14
	Total	278	61	339

Table 3

Division-wise Distribution of Papers in Indian and Foreign Journals

S No.	YEAR(S)	APP DIV		BM DIV		BPPP DIV		DCE DIV		EB DIV		FR DIV		GE DIV		IOC DIV		MMG DIV		RBE DIV		SE DIV		GENERAL		TOTAL PUB.
		IJ	FJ	IJ	FJ	IJ	FJ	IJ	FJ	IJ	FJ	IJ	FJ	IJ	FJ	IJ	FJ	IJ	FJ	IJ	FJ	IJ	FJ	IJ	FJ	
1.	1980	1	1	24	3	7	2	6	-	10	2	2	1	6	1	6	-	-	-	3	-	-	-	4	-	79
2.	1981	-	-	12	3	7	2	8	-	8	-	4	-	3	-	4	-	-	-	-	-	-	-	-	-	51
3.	1982	1	-	15	-	6	-	1	-	11	2	1	3	1	-	2	-	-	-	-	-	-	-	-	-	43
4.	1983	1	1	12	3	4	-	4	-	3	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	32
5.	1984	1	-	5	2	5	-	4	1	3	-	1	1	1	-	-	-	-	-	1	-	-	-	-	-	25
6.	1985	-	-	12	2	3	1	4	-	1	-	2	1	-	1	-	1	-	-	-	-	-	-	-	-	28
7.	1986	-	-	6	2	3	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	12
8.	1987	-	-	10	2	2	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	17
9.	1988	-	-	5	4	2	-	1	-	1	-	-	-	1	-	-	-	-	-	-	-	-	6	3	23	
10.	1989	-	-	4	2	-	-	1	-	-	-	-	-	1	4	1	-	-	-	-	-	1	1	-	-	15
11.	1990	-	-	5	3	2	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	14
	Total	4	2	110	26	41	6	30	1	38	5	10	9	15	7	13	1	-	-	4	-	2	1	11	3	339
	G.Total	6		136		47		31		43		19		22		14		-		4		3		14		339

IJ = INDIAN JOURNALS
FJ = FOREIGN JOURNALS
APP = Architecture and Physical Planning Division
BM = Building Materials Division
BPPP = Building Processes Plant and Productivity Division
DCE = Development, Construction and Extension Division
EB = Effeciency of Buildings Division
FR = Fire Research Division

GE = Geotechnical Engineering Division
IOC = International Overseas Collaboration Division
MMG = Mathematical Modelling Group
RBE = Rural Buildings and Environment Division
SE = Structural Engineering Division

TABLE 4

Contribution in National and International Conferences/Seminars

Sl.	YEAR(S)	APP DIV		BM DIV		BPPP DIV		DCE DIV		EB DIV		FR DIV		GE DIV		IOC DIV		MMG DIV		RBE DIV		SE DIV		GENERAL		TOTAL
		NAT	INT	NAT	INT	NAT	INT	NAT	INT	NAT	INT	NAT	INT	NAT	INT	NAT	INT	NAT	INT	NAT	INT	NAT	INT	NAT	INT	
1.	1980	-	3	5	2	3	2	5	-	3	1	2	3	-	7	1	-	---	-	-	-	-	-	-	-	37
2.	1981	-	-	6	1	3	2	5	1	1	6	2	-	-	6	1	-	---	-	-	-	-	-	-	-	34
3.	1982	-	-	32	-	1	-	2	-	6	3	1	-	2	4	1	-	---	-	-	-	-	-	-	-	52
4.	1983	1	1	3	6	2	-	2	3	2	1	-	-	9	-	2	-	---	-	1	-	-	-	-	-	33
5.	1984-85	1	3	11	15	4	4	2	3	-	11	1	-	3	2	-	-	---	-	3	2	-	-	-	-	65
6.	1985-86	-	9	17	13	2	9	1	-	4	5	-	-	10	1	-	-	---	-	-	-	-	-	-	-	71
7.	1986-87	1	1	12	6	1	8	-	-	-	1	1	3	4	4	-	-	---	-	4	-	-	-	8	-	54
8.	1987-88	1	-	17	2	2	9	3	-	7	3	-	-	2	4	2	2	---	-	11	3	-	-	-	-	68
9.	1988-89	1	-	25	-	-	1	3	-	4	-	1	-	-	4	2	-	---	-	1	-	-	-	2	-	44
10.	1989-90	-	-	11	1	-	-	-	-	2	1	-	-	4	1	1	-	2	-	-	-	2	-	-	-	25
	TOTAL	5	17	139	46	18	35	23	7	29	32	8	6	34	33	10	2	2	-	20	5	2	-	10	-	483

IJ = INDIAN JOURNALS
FJ = FOREIGN JOURNALS
APP = Architecture and Physical Planning Division
BM = Building Materials Division
BPPP = Building Processes Plant and Productivity Division
DCE = Development, Construction and Extension Division
EB = Effeciency of Buildings Division
FR = Fire Research Division

GE = Geotechnical Engineering Division
IOC = International Overseas Collaboration Division
MMG = Mathematical Modelling Group
RBE = Rural Buildings and Environment Division
SE = Structural Engineering Division

TABLE 5

Year-wise Distribution of Papers Presented in National and International Conferences

Sl.No.	YEAR (s)	National Conferences	International Conferences	Total
1.	1980	19	18	37
2.	1981	18	16	34
3.	1982	45	7	52
4.	1983	22	11	33
5.	1984-85	25	40	65
6.	1985-86	34	37	71
7.	1986-87	31	23	54
8.	1987-88	45	23	68
9.	1988-89	39	5	44
10.	1989-90	22	3	25
	Total	300	183	483

Table 6

Total and Average Impact Factors

Number of Articles	Percentage of Articles	Impact Factor	Total
97	28.52	0.001	0.097
2	0.580	0.004	0.008
3	0.88	0.005	0.015
45	13.23	0.010	0.450
3	00.88	0.019	0.057
22	6.47	0.020	0.440
8	2.35	0.035	0.280
70	20.58	0.050	3.500
13	3.82	0.060	0.780
2	0.58	0.080	0.160
6	1.76	0.100	0.600
2	0.58	0.124	0.248
2	0.58	0.130	0.260
2	0.58	0.189	0.378
13	3.82	0.200	2.600
5	1.48	0.201	1.005
2	0.58	0.222	0.444
1	0.29	0.248	0.248
1	0.29	0.250	0.250
8	2.35	0.300	2.400
2	0.58	0.353	0.706
1	0.29	0.471	0.471
1	0.29	0.515	0.515
19	5.58	0.726	13.794
1	0.29	0.740	0.740
3	0.88	0.762	2.286
3	0.88	0.941	2.823
2	0.58	1.411	2.822
339 (340))	Total	38.371	100.00

Total impact factor of 340 article = 38.371
Average impact factor = 0.113

TABLE 7

Suggested Journals as Covered by Science Citation Index

SI.NO.	DIVISION	NAME OF JOURNAL	COUNTRY OF ORIGIN	RANKING AS PER IMPACT FACTOR	IMPACT FACTOR	IMMEDIACY INDEX
1.	APP Division	Building and Environmental	UK	3233	0.217	0.000
2.	BM Division	Jl. of Amer. Cer. Society	USA	700927	1.323	0.262
3.	BM Division	Amer. Cer. Soc. Buil.	USA	1459	0.872	0.072
4.	Em Division	Jl. of Coating Technology	UK	1502	0.850	0.149
5.	BM Division	Wood Science Technology	UK	2042	0.581	0.167
6.	BM Division	Corrosion	UK	2165	0.533	0.056
7.	BM Division	Jl. of Chem. Tech. and Biotech	UK	2456	0.435	0.149
8.	BM Division	Cement Concrete Research	UK	2580	0.396	0.111
9.	BM Division	Chemistry and Industry	UK	2818	0.329	0.058
10.	BM Division	Ind. Jl. of Chemistry-A	INDIA	2864	0.314	0.21
11.	BM Division	Ind Jl. of Chemistry-B	INDIA	2879	0.281	0.054
12.	BM Division	Plastic and Rubber Processing and Application	UK	3082	0.255	0.021
13.	BM Division	Jl. of Oil and Chemical Association	UK	3103	0.250	0.040

that the work of the Indian scientific community is not being recognised by scientific community of the developed countries. It may be due to various factors. The importance of the work of a scientist may be revealed through the publication of Indian Science Citation Index. INSDOC, which is doing a pioneering work in the field of bibliometrics, is already engaged in the compilation of Indian Science Citation Index.

No doubt, engineering sciences are poor from the bibliometric citation point of view but the impact factor of the engineering sciences can be improved upon if the scientists of engineering disciplines carry out qualitative work in their respective fields and publish their work in foreign journals having high impact factor and immediacy index. It is generally seen that engineers do not cite authors whose works they use in their work.

The impact of research output of CBRI scientists on the scientific activity in the world can be improved if they publish their work in the standard journals with high impact factors and quote the works honestly and exhaustively which they use in writing their papers.

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