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A Scientometric Assessment of Global Publication Output on RFID with Reference to India During 2006-15

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ABSTRACT

The present paper attempts to study the performance of India in RFID research using a series of bibliometric indicators. As seen from SCOPUS database, India's research output cumulated to 632 publications in 10 years during 2006-15. Indiais ranked13thtop country in the world in RFID research; it accounted for 2.58 % global publication. India showed faster growth rate of 20.69 % CAGR compared to -0.42 % by the world in RFID research during 2006-15. India's citation impact was low, 1.32 citations per paper; its output in terms of international collaborative publications was also low, accounting for just 9.81 % during 2006-15.The top 15 most productive Indian organisations in RFID research together contributed 35.60 % publications share and 38.18 % citation share during 2006-15. The top 15 most productive journals together accounted for 47.44% share of total country output in RFID research during 2006-15. Computer science accounted for the largest publication share (57.44 %) in RFID research output, followed by engineering (49.21 %), social sciences (7.28 %), mathematics (6.01 %), materials science (5.85 %), business, management & accounting (5.54 %) and physics & astronomy (4.75 %) during 2006-15.

keywords: Publication output, RFID, scientometrics, Indian publications

1. INTRODUCTION

Radio frequency identification (RFID) can be defined as automatic identification technology which uses radio-frequency electromagnetic fields to identify objects carrying tags when they come close to a reader. Data (identification number for instance) included in the electronic chip of the RFID label can be collected by the reader. This reader can also change the content of the label's memory. However, RFID cannot be reduced to one technology. The information contained within an RFID tag's electronic chip depends on its application. It may be a unique identifier (UII, Unique Item Identifier or EPC code, Electronic Product Code, etc.). From 2006 onwards, RFID technologies are now widely used in almost all industrial sectors. ISO took part in establishing technical and applicative standards that let to have a high degree of interoperability or interchangeability[1].

The RFID has been successfully integrated across a wide variety of industries including animal identification, pharmaceutical, building access control, toll collection, vehicle immobilization systems, aviation industry, waste management, and mining industries[2-4]. RFID provides new opportunities to use business intelligence (BI) to monitor organisational operations and learn more about markets, as well as consumer attitudes, behaviors, and product preferences[5]. Many IT software companies in India have forayed into RFID technology, offering solutions mainly for time and attendance for SMEs. Many respectable industry names like Siemens, Wipro, Infosys and Honeywell have established a fair base in the market[6]. In India, we will see very soon RFID intervention being used extensively. Neighborhood post offices using RFID to track lost parcels, Indian farmers keeping a tab on their cattle using RFID, these are two small examples of massive RFID deployment. Other applications include legal firms turning to RFID for tracking or automating files, airlines use the technology to track the location of luggage trolleys, construction companies using RFID tags inserted to concrete blocks for instant dissemination of results over the internet. With this objective, the ambitious 'National RFID Program' project was initiated in April, 2007. The program is being implemented jointly by IIT, Kanpur, C-DAC, Noida and SAMEER, Mumbai[7].

In India, the usage of RFID technology is growing at a considerable pace. Industries such as retail, healthcare, automotive, supply chain and public transit are opening up opportunities for the industry players. 'Chitale', one of the prominent dairy producers in Pune has deployed the RFID chips in cattle for the collection of feeding data, breeding data and also to keep a record of the animals[8].

2. LITERATURE REVIEW

Very few studies are available which undertake quantitative assessment of publications in RFID technology

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and its applications. Among such studies, Chao, Yang & Jen[9] used bibliometric techniques to examine RFID topic in SCI journals from 1991 through November 2005. A historical review method was used to analyse RFID innovation, adoption by organisations, and market diffusion. From this analysis, supply chain management (SCM), health industry, and privacy issues emerge as the major trends in RFID. Also, the contributions of the RFID industry and forecasts of technological trends were also analysed, concluding that RFID will be more ubiquitously diffused and assimilated into our daily lives in the near future. Irani, Gunasekaran & Dwivedi[10] analysed the distribution/trends of RFID research across subject category, source titles, geographical locations, document types and year of publications. It also identified frequently published authors and productive institutions for conducting RFID-related research and explored the trend of topics/research issues and utilised methods and synthesised the existing research to develop a research model/framework that reflects current status and trends of RFID research. Nagaia[11], *et al*., presented a review of literature on RFID, by reviewing 85 academic journal papers that were published on the subject between 1995 and 2005. The analysis is focused on four main categories: Technological issues, applications areas, policy and security issues, and other issues.

3. OBJECTIVES

The main objectives of this study are to study the performance of India's research on RFID during 2006-15, based on publications output, as indexed in Scopus database. In particular, the objectives of the study are to study the :

(a) Growth of Indian literature and its distribution by type of documents and publications sources and citation impact;

(b) Contribution, global share and citation impact of top 10 most productive countries;

(c) Distribution of Indian research output by broad subject areas; and identification of application areas in India;

(d) Publication productivity and citation impact of most productive organisations and authors;

(e) Leading medium of communication and characteristics of highly cited papers

4. METHODOLOGY

The study retrieved and downloaded the publication data of the world and of 15 most productive countries on RFID from the Scopus database during 2006-15. The keyword 'RFID' was used in 'title', abstract and keyword" search tag and restricted it to the period 2006-15 in 'date range' search tag for searching global publication data. This was used as the main search string as shown below. Further, the main search string was restricted to 10 most productive countries one by one in "country tag", the publication data on these individual countries were obtained. Furthermore, the main search string was "subject area" tag, "country" tag, "source title" tag, and "affiliation" tag, we were able to get stats on publications by subject, collaborating countries, organisation-wise and journal-wise, etc.

5. DATA ANALYSIS & RESULTS

The total country output of India in RFID research cumulated to 632 publications in 10 years during 2006-15, up from 18 in 2006 to 118 publications in 2015, witnessing 20.69 % (CAGR) growth during 2006-15. In contrast, the world output in RFID research witnessed -0.42 % CAGR growth down from 1492 in 2006 to 1431 publications in 2015. The total publication output of the world in RFID research cumulated to 24450 publications. The country registered citation impact per paper of 1.32 citations per paper during 2006-15 (Table 1). Of the total Indian publication on RFID research, 59.34 % (375) appeared as conference papers, 35.76 % (226) as articles, 1.90 % (12) as reviews, 1.7 4 % (11) as book chapters, 0.63 % (4) as books, 0.47 % (3) as articles in press and 0.16 % (1 each) as notes and short surveys during 2006-15.

5.1 International Collaboration

India'sresearch output from international collaboration accounted for 9.81 % share of total country output in RFID research during 2006-15. India's collaboration in research was the largest with the USA accounting for 32.26 % share of total international collaborated papers by the country, followed by U.K. (12.90 %), Australia and Singapore (9.68 % each), Finland, Iran and Sweden (8.06 % each), Saudi Arabia (6.4 5%), China and France (4.84 %) during 2006-15. The study however showed

Table 1. Growth of RFID publications: India vs World, 2006-2015.

Publication Year	World	India					
	TP	TP	TC	CPP	ICP	%ICP	%TP
2006	1492	18	94	5.22	4	22.22	1.21
2007	2144	24	96	4.00	5	20.83	1.12
2008	2295	25	21	0.84	5	20.00	1.09
2009	2648	46	47	1.02	3	6.52	1.74
2010	2920	57	121	2.12	6	10.53	1.95
2011	2990	63	159	2.52	6	9.52	2.11
2012	2907	75	110	1.47	13	17.33	2.58
2013	2936	85	87	1.02	3	3.53	2.90
2014	2687	121	90	0.74	11	9.09	4.50
2015	1431	118	8	0.07	6	5.08	8.25
CAGR	-0.42 %	20.69 %					
2006-15	24450	632	833	1.32	62	9.81	2.58
World Share		2.58 %					

TP=Total publications; TC=Total citations; CPP= Citations per paper; ICP=International collaborative papers

downward trend in India's collaboration in research over time. Its share of collaborative papers declined by 5.09 %; down from 13.53 % in 2006-10 to 8.44 % share of total country output in 2011-15 (Table 1). This downward trend in international collaboration in research could be attributed to decline in collaborative research activitywith U.K. (20.96 %), France (13.04 %), Australia and Singapore (12.26 % each) and USA (4.01 %) between 2006-10 and 2011-15. Nevertheless, collaborative research activity witnessed rise with partners in Sweden (12.82 %), followed by Saudi Arabia (10.26 %), Finland and Iran (5.91 %) and China (0.78 %) during 2006-10 to 2011-15 (Table 2).

Table 2. International collaborative papers by India in RFID research

S. No.	Collaborative country	No. of collaborative papers			Share of collaborative papers		
		2006-10	2011-15	2006-15	2006-10	2011-15	2006-15
1.	USA	8	12	20	34.78	30.77	32.26
2.	U.K.	6	2	8	26.09	5.13	12.90
3.	Australia	4	2	6	17.39	5.13	9.68
4.	Singapore	4	2	6	17.39	5.13	9.68
5.	Finland	1	4	5	4.35	10.26	8.06
6.	Iran	1	4	5	4.35	10.26	8.06
7.	Sweden	0	5	5	0	12.82	8.06
8.	Saudi Arabia	0	4	4	0	10.26	6.45
9.	China	1	2	3	4.35	5.13	4.84
10.	France	3	0	3	13.04	0	4.84
Total of India		23	39	62	100	100	100

4.2 Top 15 World Countries in RFID Research: Comparative Analysis

The top 15 most productive world countries in RFID research contributed individually 383 to 5425 publications in 10 years and together contributed 20889 publications, accounting for 85.432 % global publication share in RFID research during 2006-15. The individual country share of the top 15 countries on RFID research varied from 1.57 % to 22.19 %, with the largest share (22.19 %) coming from China, followed by USA. (15.14 %), South Korea (7.46%), Taiwan (6.19%), Germany (5.25 %), Japan, Italy, U.K. and France (from 3.25% to 4.18 %), Australia, Spain, Canada and India (from 2.58 % to 2.98 %)and Malaysia and Finland (from 1.57 % to 1.75 %) during 2006-15. The publication activity, as reflected in activity index witnessed largest increase in India (from 57.19 to 138.01), followed by Malaysia (from 64.93 to 131.14), China (from 75.29 to 121.94), France (from 77.39 to 120.07), Italy (from 77.45 to 120.02), Spain (from 78.94 to 118.70), Canada (from 81.02 to 116.86), Australia (from 89.25 to 109.54) and Taiwan (from 96.83 to 102.82), as against largest decrease in Japan (from 125.75 to 77.14), followed by USA (from 115.30 to 86.41), Germany (from 107.89 to 93.0) and Finland (from 101.59 to 98.58) from 2006-10 to 2011-15 (Table 3).

Table 3. Global publication share of top 15 most productive countries.

S. No.	Name of country	Number of papers			Activity index	
		2006-10	2011-15	2006-15	2006-10	2011-15
1.	China	1921	3504	5425	75.29	121.94
2.	USA	2007	1694	3701	115.30	86.41
3.	South Korea	1132	692	1824	131.96	71.62
4.	Taiwan	689	824	1513	96.83	102.82
5.	Germany	651	632	1283	107.89	93.00
6.	Japan	605	418	1023	125.75	77.14
7.	Italy	365	637	1002	77.45	120.02
8.	U.K.	380	425	805	100.37	99.67
9.	France	289	505	794	77.39	120.07
10.	Australia	306	423	729	89.25	109.54
11.	Spain	261	442	703	78.94	118.70
12.	Canada	245	398	643	81.02	116.86
13.	India	170	462	632	57.19	138.01
14.	Malaysia	131	298	429	64.93	131.14
15.	Finland	183	200	383	101.59	98.58
Total of 15 countries		9335	11554	20889		
World total		11499	12951	24450		
Share of 15 countries in world output		81.18	89.21	85.43		

4.3 Subject-wise Distribution of Publication

The publication output of India in RFID research has been classified into 7 subject categories in accordance with scheme provided by Scopus classification. The publications share of India in RFID research was largest in computer science (with 57.44 % share), followed by engineering (49.21 %), social sciences (7.28 %), mathematics (6.01 %), materials science (5.85 %), business, management & accounting (5.54 %) and physics & astronomy (4.75 %) during 2006-14. India's publication activity in RFID research,as reflected in activity index,witnessed upward trend in engineering (from 98.02 to 100.73), materials science (from 90.43 to 103.52) and physics & astronomy (from 61.96 to 114.0), as against decline in computer science (from 111.63 to 95.72), social sciences (from 161.64 to 77.32), mathematics (from 146.75 to 82.80) and business, management & accounting (from 148.71 to 82.08) in five years between 2006- 10 and 2011-15. Physics & astronomy registered the highest citation impact (4.80 citations per paper), followed by social sciences (2.0), materials science (1.76), business, management & accounting (1.66), mathematics (1.63), engineering (1.56) and computer science (1.32) during 2006-15 (Table 4).

4.4 RFID Applications in India

India's publication output in RFID research was distributed by RFID applications. The publication share of India was the largest in RFID application on 'tracking

Table 4. Subject-wise distribution of publications output by India in RFID research

S. No.	Subject	Number of papers			Activity index		TC	CPP	HI	% TP
		2006-10	2011-15	2006-15	2006-10	2011-15	2006-15	2006-15	2006-15	2006-15
1.	Computer science	109	254	363	111.63	95.72	478	1.32	10	57.44
2.	Engineering	82	229	311	98.02	100.73	484	1.56	11	49.21
3.	Social sciences	20	26	46	161.64	77.32	92	2.00	6	7.28
4.	Mathematics	15	23	38	146.75	82.80	62	1.63	4	6.01
5.	Materials science	9	28	37	90.43	103.52	65	1.76	5	5.85
6.	Business, management & accounting	14	21	35	148.71	82.08	58	1.66	5	5.54
7.	Physics & astronomy	5	25	30	61.96	114.00	144	4.80	5	4.75
Total of India		170	462	632	100.00	100.00		0.00		

TP=Total publications; TC=Total citations; CPP= Citations per paper; HI-h-index; ICP=International collaborative papers

of items or products' (15.35 %, 97 papers), followed by health applications (64 papers, 10.13 %), supply chain management (8.99 %, 55 papers), internet of things (40 papers, 6.33 %), etc during 2006-15. The country witnessed rising trend in its research output in RFID applications such as health applications, internet of things, toll plaza, food sector, passport, as against declining trend in RFID applications such as tracking of items, supply chain management, hospitals, libraries and livestock & dairy sector from 2006-10 to 2011-15. The RFID application on livestock & dairy made the highest citation impact per paper (6.0), followed by hospitals (5.0), health sector applications (2.48), tracking of items (1.34), toll plaza (1.28), libraries (1.26), etc., during 2006-15 (Table 5).

4.5 Scientometric Profile of Top 15 organisations in RFID Research

The top 15 most productive organisations on RFID research in India individually contributed 8 to 28 papers and together contributed 225 papers (35.6 % share), and cumulated 318 citations (38.18 % share) in 10 years during 2006-15. The scientometric profile of top 15 most productive Indian organisations is given in Table 6.

Only 4 organisations reached publications productivity above the group average (5.0): Anna University, Chennai (28 papers), SASTRA University (24 papers), Jadavpur University, Kolkata (20 papers) and Indian Institute of Technology, Kanpur (16 papers) during 2006-15. Five organisations registered citation impact above group average (1.41 average citation impact per paper): Indian Institute of Technology, Gauwhati (5.33), Indian Institute of Technology, Roorkee (3.75), Indian Institute of Technology, Kanpur (2.69), Cochin University of Science & Technology, Cochin (2.0) and Centre for Development of Advanced Technology (C-DAC) (1.75), during 2006-15. Seven organisations scored h-index above the group average (2.2): Indian Institute of Technology, Roorkee and Indian Institute of Technology, Kanpur (4.0 each), Indian Institute of Technology, Gauhati , Cochin University of Science & Technology, Cochin, Anna University, Chennai Jadavpur University, Kolkata and SASTRA University (3.0 each) during 2006-15. Five organisations registered share of international collaborative (ICP) papers above the group average (4.44 %): Tata Consultancy Services (28.57 %), Cochin University of Science & Technology, Cochin (21.43 %), Indian Institute of Technology, Roorkee (8.33 %), National Institute of

Table 5. Publications analysis by major RFID applications in India

S. No.	Name of application	Number of papers			Share of papers			TC	CPP	HI
		2006-10	2011-15	2006-15	2006-10	2011-15	2006-15	2006-15	2006-15	2006-15
1.	Tracking of items	29	68	97	17.06	14.72	15.35	130	1.34	6
2.	Supply chain management	19	36	55	11.18	7.79	8.99	88	1.60	6
3.	Medical or health applications	17	47	64	10.00	10.17	10.13	159	2.48	7
4.	Internet of things	1	39	40	0.59	8.44	6.33	29	0.73	2
5.	Toll plaza	4	14	18	2.35	3.03	2.85	23	1.28	2
6.	Hospitals	4	0	4	2.35	0.00	0.63	20	5.00	3
7.	Libraries	9	18	27	5.29	3.90	4.27	34	1.26	3
8.	Livestock & dairy sector	1	2	3	0.59	0.43	0.47	18	6.00	2
9.	Food sector	2	9	11	1.18	1.95	1.74	30	2.73	2
10.	Passport	4	14	18	2.35	3.03	2.85	23	1.28	2
Total of India		170	462	632						

TP=Total publications; TC=Total citations; CPP= Citations per paper; ICP=International collaborative papers

Technology, Tiruchirrappali (7.14 %) and Indian Institute of Technology, Kanpur (6.25) during 2006-15. Only six Indian organisations have registered the value of RCI above 1 and they are: Indian Institute of Technology, Gauwhati (4.04); Indian Institute of Technology, Roorkee (2.84); Indian Institute of Technology, Kanpur (2.04). Cochin University of Science & Technology, Cochin (1.52); Centre for Development of Advanced Technology (1.33); and Anna University, Chennai (1.05) during 2006-15 (Table 6).

4.6 Scientometric Profile of Top 15 Authors in RFID Research

The top 15 most productive authors on RFID research from India individually contributed from 6 to 14 papers in 10 years and together contributed 121 papers (19.15 %) and cumulated 306 citations (36.73 %) during 2006-15. The scientometric profile of top 15 most productive Indian authors is given in Table 7.

Only 5 authors reached publications productivity

Table 6. Scientometric profile of top 15 most productive organisations in RFID research

S. No.	Name of the organisations	TP	TC	ACPP	HI	ICP	% ICP	RCI
1.	Anna University, Chennai	28	39	1.39	3	0	0	1.05
2.	SASTRA University	24	20	0.83	3	0	0	0.63
3.	Jadavpur University, Kolkata	20	20	1.00	3	0	0	0.76
4.	Indian Institute of Technology, Kanpur	16	43	2.69	4	1	6.25	2.04
5.	Sathyabama University	15	4	0.27	1	0	0.00	0.20
6.	National Institute of Technology, Tiruchirrappali	14	6	0.43	1	1	7.14	0.33
7.	Cochin University of Science & Technology, Cochin	14	28	2.00	3	3	21.43	1.52
8.	Tata Consultancy Services	14	5	0.36	1	4	28.57	0.27
9.	B S Abdur Rahman University, Chennai	13	6	0.46	1	0	0	0.35
10.	Indian Institute of Technology, Gauwhati	15	80	5.33	3	0	0	4.04
11.	Bharath University, Chennai	13	2	0.15	1	0	0	0.11
12.	Indian Institute of Technology, Roorkee	12	45	3.75	4	1	8.33	2.84
13.	Vellore Institute of Technology, Vellore	10	5	0.50	2	0	0	0.38
14.	Amrita School of Engineering	9	1	0.11	1	0	0	0.08
15.	Centre for Development of Advanced Technology (C-DAC)	8	14	1.75	2	0	0	1.33
Total of 15 organisations		225	318	1.41	2.2	10	4.44	
Total of India		632	833	1.32				
Share of 15 organisations in total of India		35.6	38.18					

TP=Total publications; TC=Total citations; CPP= Citations per paper; HI-h-index; CIP=International collaborative papers; RCI=Relative citation index

Table 7. Scientometric profile of top 15 most productive organisations

S. No.	Name of author	Affiliation of the author	TP	TC	ACPP	HI	ICP	% ICP	RCI
1.	P. Mohanan	Cochin University of Science & Technology	14	28	2.00	3	3	21.43	1.52
2.	C.M. Nijas	Cochin University of Science & Technology	12	28	2.33	3	3	25.00	1.77
3.	R.S. Kshetrimayum	IIT-Guwhati	11	85	7.73	4	0	0.00	5.86
4.	J.R. Panda	IIT-Guwhati	10	85	8.50	4	0	0.00	6.44
5.	A.R. Harish	IIT-Kanpur	9	29	3.22	3	0	0.00	2.44
6.	R. Dhanasekaran	Syed Ammal Engineering College, Ramana-thapuram	8	9	1.13	2	0	0.00	0.86
7.	K.A. Ansal	Pondicherry University	7	2	0.29	1	0	0.00	0.22
8.	S.K. Sarkar	Jadavpur Universty, Kolkata	7	2	0.29	1	0	0.00	0.22
9.	S. Raghavan	NIT-Thir National Institute of Technology, Tiruchirrappali	7	2	0.29	1	0	0.00	0.22
10.	J. Bag	Jadavpur University, Kolkata	6	2	0.33	1	0	0.00	0.25
11.	M.A. Khan	C-DAC, Noida	6	3	0.50	1	0	0.00	0.38
12.	M. Periyasamy	Syed Ammal Engineering College, Ramana-thapuram	6	1	0.17	1	0	0.00	0.13
13.	R. Pathak	Acropolis Institute of Technology, Indore	6	1	0.17	1	0	0.00	0.13

14.	S. Joshi	Acropolis Institute of Technology, Indore	6	1	0.17	1	0	0.00	0.13
15.	S. Mridula	Cochin University of Science & Technology	6	28	4.67	3	1	16.67	3.54
Total of 15 authors			121	306	2.53	2.0	7	5.78	
Total of India			632	833	1.32				
Share of 15 authors in total of India			19.15	36.73					

TP=Total publications; TC=Total citations; CPP= Citations per paper; HI-h-index; ICP= International collaborative papers; RCI=Relative citation index

above the group average (8.07): P. Mohanan (14 papers), C.M. Nijas (12 papers), R.S. Kshetrimayum (11 papers), J.R. Panda (10 papers) and A.R. Harish (9 papers) during 2006-15. Four authors registered citation impact above the group average (2.53 citations per paper): J.R. Panda (8.50), R.S. Kshetrimayum (7.73), S.Mridula (4.67) and A.R. Harish (3.22) during 2006-15. Six organisations scored h-index above the group average (2.0): J.R. Panda and R.S. Kshetrimayum (4 each), S. Mridula, A.R. Harish, C.M. Nijas, and P. Mohanan (3 each) during 2006-15. Three organisations registered international collaborative (ICP) papers above the group average (5.78 %): C.M. Nijas (25.0 %), P. Mohanan (21.43 %) and S. Mridula (16.67 %) during 2006-15 . Only six authors have registered relative citation index above 1 and they are: J.R. Panda (6.44), R.S. Kshetrimayum (5.86), S. Mridula (3.54), A.R. Harish (2.44), C.M. Nijas (1.77) and P. Mohanan (1.52) during 2006-15.

4.7 Medium of Communication

Of the total publications output (632) by India on RFID research, 52.06 % share (329) appeared in conference proceedings, 37.03 % (234) in journals, 7.44 % (47) in book series, 2.37 % as books and 1.11 % as trade publications during 2006-15. In all, 234 articles were published in 128 journals. The publication of RFID articles in journals was widely scattered. For example, 88 journals published just 1 article each, 15 journals published 2 articles each, 8 journals published3 articles each, 4 journals published 4 articles each, 1 journal each published 5, 7, 8, 15 and 41 articles respectively in 10 years 2006-15. The top 15 most productive journals accounted for 47.44 % share of total papers by India in journals. *International Journal of Applied Engineering Research* reported the largest number of papers (41), followed by *International Journal of Engineering & Technology* (15 papers), *Microwave & Optical Technology Letters* (8 papers), *ARPN Journal of Engineering & Applied Science* (7 papers), etc (Table 8).

Table 8. Top 15 most productive journals on RFID research in India, 2006-15

S. No.	Name of the journal	No. of papers	IF 2014
1.	*International Journal of Applied Engineering Research*	41	NA
2.	*International Journal of Engineering & Technology*	15	NA
3.	*Microwave & Optical Technology Letters*	8	0.568
4.	*ARPN Journal of Engineering & Applied Science*	7	NA
5.	*Indian Journal of Science & Technology*	5	NA
6.	*Middle East Journal of Scientific Research*	5	NA
7.	*Journal of Theoretical & Applied Information Technology*	4	NA
8.	*Journal of Mechanical Systems*	4	NA
9.	*Research Journal of Pharmaceutical, Biological & Chemical Sciences*	4	0.35
10.	*Program*	3	0.651
11.	*International Journal of Computer & Software*	3	NA
12.	*Journal of Electromagnetic Waves & Applications*	3	0.726
13.	*IEEE Antennas & Wireless Propagation*	3	1.579
14.	*IEEE Sensors Journal*	3	1.762
15.	*IEEE Transactions on Antennas & Propagation*	3	2.181
	Total of 15 journals	111	
	Total journal articles of India	234	
	Share of 15 journals in total journal articles of India	47.44	

5. SUMMARY AND SUGGESTIONS

India is ranked13th top country in the world for its global publication share (2.58 %) in RFID research during 2006-15.India showed faster growth (20.69 % CAGR) compared to the world (-0.42 %., CAGR).However, India's performance in terms of quality of its publication output was not as significant. Itscitation impact in RFID research was comparatively low,just 1.32 citations per paper. India's collaboration in RFID research with USA was the largest accounting for 32.26 % share of total international collaborative papers, followed by U.K. (12.90 %) and many other countries during 2006-15. The country output in terms of its international collaborative papers was low, accounting for just 9.81 % share. Computer science accounted for the largest publication share (57.44 %) in India's total output on RFID research during 2006-15, followed engineering (49.21 %), social sciences (7.28 %), mathematics (6.01 %), materials science (5.85 %), business, management & accounting (5.54 %) and physics & astronomy (4.75 %) during 2006-15. The publication activity of India witnessed rising trend in engineering, materials science and physics & astronomy, as against declining trend in computer science, social sciences, mathematics and business, management & accounting from 2006-10 to 2011-15. The top 15 most

productive organisations in RFID research in India together contributed 35.60 % publications share and 38.18 % citation share during 2006-15.The top 15 most productive authors in RFID research in India together accounted for 19.15 % publications share and 36.73 % citation share during 2006-15. The top 15 most productive journals together accounted for 47.44 % share of total country output in RFID research during 2006-15.

India's performance in RFID research is not encouraging both in terms of quantity and quality of publications. No wonder that India is ranked at 13th position in the world in RFID research. India's publications output on RFID research is scattered widelyacross journals and that this trend seems to be one of the reasons for its low citation impact.

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