

E-COMMERCE IN INDIA: A BIBLIOMETRIC ANALYSIS OF INDIAN RESEARCH PUBLICATIONS OUTPUT DURING 2003-18

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The paper provides a quantitative and qualitative assessment of e-commerce research in India in global context. As seen from Scopus database, e-commerce research by India during 2003-18 registered 22.40% growth, published an average of 161 papers per year, and averaged low citation impact of 4.67 citations per paper. Compared to India, global average growth in the subject was even slower 3%. The top 10 countries accounted for bulk of (78.12%) global output in the subject (59725). India has been the sixth most productive country in the world, it contributed 4.67% (2587 papers) share to global output. The study profiles top 15 global organizations, top 15 global authors in the field, top subject areas intersecting e-commerce research, and top channels in research communications. In addition, it provides a brief bibliometric analysis of high cited papers.

Keywords: E-commerce, Indian publications, Scientometrics, Bibliometrics

INTRODUCTION

E-commerce has since evolved as a major transformational tool for markets across India and abroad enabling buying and selling of goods and services or transmitting funds or data, over electronic networks, online on the internet or mobile networks. Innovative e-commerce technologies that catalyzed e-business include: mobile commerce, electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange, inventory management systems and automated data collection systems, World Wide Web and e-mail ^[1]. Broadly, e-commerce transactions can be grouped as business-to-business (B2B), business-to-consumer (B2C), and consumer-to-consumer (C2C) and consumer-to-business (C2B) ^[1-2].

In addition to these developments, aggregators across several sectors played a significant role in driving growth and development of e-commerce research. Unlike e-commerce operators (Flipkart), firms aggregate information on several goods and services and conglomerate them into a

single platform. Category-wise examples of aggregators include (i) Tourism: MakeMyTrip; Goibibo; Yatra; IRCTC; (ii) Education: EduKart; Meritnation; (iii) Healthcare: Portea; Healthkart; (iv) Entertainment/ Ticket booking: Netflix; bookmyshow; (iv) Real Estate: MagicBricks; Housing, 99 acres and (v) Fin-tech: PayTM, Freecharge, PayUmoney, Mobikwik, PhonePe ^[3].

It is estimated that e-commerce market is expected to grow from US\$ 38.5 billion in 2017 to US\$ 200 billion by 2026. The major drivers of e-commerce transformation include: growing internet technologies, smartphone penetration, and launch of 4G and 5G networks. Further, a significant rise of total internet user base is expected in India from 604.21 million in December 2018 to 829 million by 2021 ^[4]. Technology-enabled innovations such as digital payments, hyper-local logistics, analytics driven customer engagement and digital advertisements have enabled the e-commerce industry in India to grow at a much faster rate. Since 2014, government initiatives and programs such as Digital India, Skill India, Startup India and Make in India are also contributing to the growth of the e-commerce industry ^[2,4]. Currently, 1 - 1.2 million transactions per day are registered in e-commerce retailing, with 48% in electronics, 29% in apparel, 9% in home and furnishing, 8% in baby, beauty & personal care, 3% in books (3%) and 3% in other sectors ^[5]. Besides, e-commerce has seen a significant rise in the growth in research literature. Given these developments, it is deemed necessary and urgent that a bibliometric study is undertaken in e-commerce research across India with the purpose to understand the current status of research in the

subject at national, institutional, and individual researcher level.

LITERATURE REVIEW

A review of e-commerce literature revealed that bibliometric studies in the subject were very few in number. One such study was by Lin, Hsu and Chiang ^[6] examined 853 global articles on e-commerce as published in ten leading management/business journals during 1991-2014. Their data sample for research study included only such works that have had the greatest citation impact, such other works that formed the basis for intellectual interconnections across authors, such other papers that were published through collaboration, and such other papers that explored research themes in Information Systems and MIS studies. Yang ^[7] analyzed research output in electronic commerce by publication year, significant countries, significant authors, important journals, and highly cited papers. Wang and Chen ^[8] analyzed 4948 and 2875 papers as listed in the SCIE and SSCI respectively during 1999-2008 by significant authors under seven e-commerce categories. Mou, Cui and Kurcz ^[9] undertook quantitative and qualitative assessment of papers published across six e-commerce-focused journals during 1999-2016 in terms of authorship, country of publication, institutions, keywords and source journals. The authors found that the mainstream research methodology is currently shifting away from structural equation modeling to data analytics (e.g. sentiment, big data, and semantic analysis). Tsai and Chiang ^[10] surveyed research output (2655 records) on e-commerce, as indexed in SSCI database during 1989-2009 for technology trends and technology forecasts. Gupta, Dhawan and Gupta evaluated

global publications data in the field of mobile commerce research (4803 publications), as covered in Scopus database during 2007-16, on select parameters such as publication growth, leading participating countries, organizations, authors and journals as well as provided a detailed analysis of highly-cited papers^[11]

The literature also comprised a few other non-bibliometric studies on e-commerce research at national level. Fatima, Abbas, Ming, Zaheer and Akhtar^[12] studied the latest academic research trends on e-commerce topics/themes in China during 2010-15. The authors concluded that e-commerce is a potential area of research of interest to China. The paper provided guidelines of interest to the government, IT policy makers and to academia researchers. Further, the paper underlined the need to focus on such topics and themes wherein China had been lagging behind other nations in e-commerce. Vaithianathan^[13] examined the existing status of e-commerce research in India and highlighted the view that adoption of e-commerce technologies across India could provide the country a definite edge over other leading countries in the world.

OBJECTIVES OF THE STUDY

The study seeks to analyze e-commerce research studies by India as indexed in Scopus database during 2003-18 for assessing research performance of the country in the subject. The study will focus on (i) distribution of research publications by document type and source publication type; (ii) annual and cumulative growth in the subject, citation impact of the publications output, and distribution of international collaborative papers by countries in collaborative research with India; (iii) profile top

10 most productive countries in the world in the subject; (iv) distribution of research publications by broad subject areas, (v) profile top 15 organizations and authors by publication output, citation impact and international collaboration; (vi) identify important channels of research communications; and (vii) describe characteristics of high-cited papers in the subject.

METHODOLOGY

E-commerce research publications data as needed for undertaking the present study was retrieved and downloaded from the Scopus database (<http://www.scopus.com>) covering 16-year period 2003-18. Keywords used for database search included “electronic commerce”, “e-commerce”, “ecommerce”, “mobile commerce”, “m-commerce”, “mcommerce”, “electronic shopping”, “e-shopping”, “electronic retailing”, “e-retailing”, “internet shopping”, “electronic business”, and “e-business”. The proposed keywords were listed in search statement using Bullion operator “OR” and suffixed it to “TITLE-ABS-KEY” tag. The global search output in the subject was refined by publication period ‘2003-18’. The study used analytical provisions of Scopus database for analyzing global output by most productive countries. Besides, the Indian search output was distributed by subject, collaborating countries, author-wise, organization-wise and journal-wise, etc. Citations to publications were counted from date of their publication till 23 August 2019. The study used various bibliometric indicators for analyzing publications data with a view to understand the dynamics of Indian research in e-commerce. (TITLE-ABS-KEY (“electronic commerce” or “e-commerce” or “ecommerce” or “mobile

commerce” or “m-commerce” or “mcommerce”) OR TITLE-ABS-KEY(“electronic shopping” or “e-shopping” or “electronic retailing” or “e-retailing” or “internet shopping” or “electronic business” or “e-business”)) AND PUBYEAR > 2002 AND PUBYEAR < 2019

ANALYSIS AND RESULTS

Publications Growth Analysis

As seen from Scopus database, the total research output of the world in e-commerce was 59725 publications and it was 2587 publications by India, accounting for 4.6% global publications

share in a 16-year window covering the period 2003-18. India registered relatively faster 22.42% average annual growth compared to 3.02% by the world during the period. Eight-year cumulative publications output of the world in the subject dropped from 31467 in 2003-10 to 28258 (-10.20% fall) in 2011-18. In contrast, India registered 308.25% rise from 509 to 2078 publications during the same period. This implies that India witnessed significant jump in its global publication share from 1.62% in the 1st half of the study period compared to 7.35% in the 2nd half (Table 1, Fig 1).

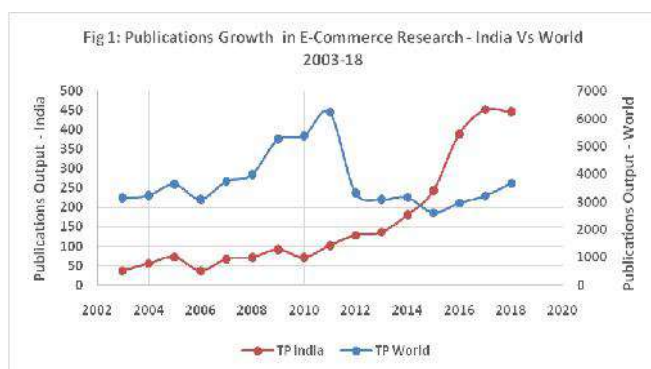
Table 1: Publication Output and Citations Registered in Indian E-Commerce Research, 2003-18

Publication Period	World	India					
	TP	TP	TC	CPP	ICP	%ICP	%TP
2003	3141	38	791s	20.82	9	23.68	1.21
2004	3232	56	371	6.63	8	14.29	1.73
2005	3637	73	517	7.08	12	16.44	2.01
2006	3093	38	237	6.24	8	21.05	1.23
2007	3745	68	444	6.53	22	32.35	1.82
2008	3987	72	1488	20.67	20	27.78	1.81
2009	5257	92	706	7.67	17	18.48	1.75
2010	5375	72	484	6.72	9	12.50	1.34
2011	6227	103	999	9.70	14	13.59	1.65
2012	3325	129	1132	8.78	18	13.95	3.88
2013	3081	137	780	5.69	14	10.22	4.45
2014	3164	181	822	4.54	13	7.18	5.72
2015	2615	243	970	3.99	19	7.82	9.29
2016	2960	388	832	2.14	25	6.44	13.11
2017	3215	451	1148	2.55	47	10.42	14.03
2018	3671	446	369	0.83	47	10.54	12.15
Av Ann Growth	3.02%	22.42%					
2003-10	31467	509	5038	9.90	105	20.63	1.62
2011-18	28258	2078	7052	3.39	197	9.48	7.35
2003-18	59725	2587	12090	4.67	302	11.67	4.33

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper

The citation impact of e-commerce research by India averaged to 4.67 citations per paper in a 16-year window; but on a 8-year window, it dropped

from 9.90 citations per paper in 2003-10 to 3.39 CPP in 2011-18. Of the total Indian publications, 54.28% appeared as conference papers, 35.49%



as articles, 4.98% as book chapters, 2.24% as reviews, and others less than 1%: books (0.35%), editorials (0.15%), notes (0.08%), letters and short surveys (0.04% each) and undefined (0.66%).

Top 10 Most Productive Countries in E-Commerce

Even though e-commerce research studies were undertaken across as many as 114 countries, but just top 10 countries together accounted for bulk of global publication output (78.12% share) during the 16-year period. China and the USA are

in the leading position accounting for the largest publication share (31.56% and 16.85% respectively), followed distantly by 8 others. Their global publication share ranged in single digit from 2.33% to 5.44%. China, India and Spain witnessed rise in their 8-year global publication share (from 0.47% to 8.98%), as against marginal decline in respect of 7 other countries from 3.03% to 3.28% from 2003-10 to 2011-18 (Table 2, Fig 2).

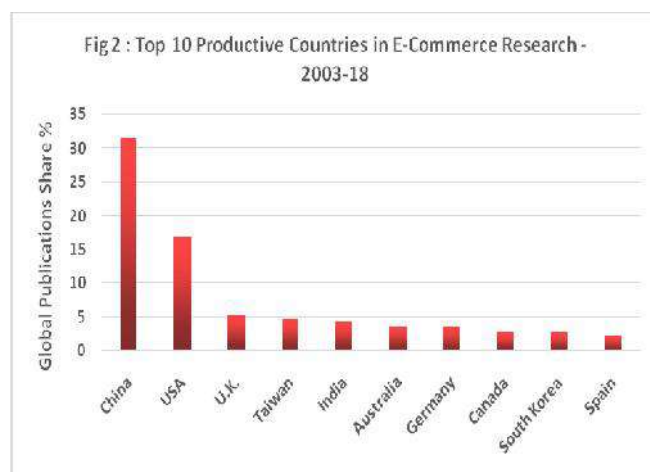


Table 2: Global Publication Output & Share of Top 10 Most Productive Countries in E-Commerce during 2003-18

Sl. No	Name of the Country	Number of Papers			Share of Papers		
		2003-10	2011-18	2003-18	2003-10	2011-18	2003-18
1	China	8596	10256	18852	27.32	36.29	31.56
2	USA	6549	3512	10061	20.81	12.43	16.85
3	U.K.	2021	1230	3251	6.42	4.35	5.44
4	Taiwan	1502	1333	2835	4.77	4.72	4.75
5	India	516	2079	2595	1.64	7.36	4.34
6	Australia	1411	796	2207	4.48	2.82	3.70
7	Germany	1210	928	2138	3.85	3.28	3.58
8	Canada	1083	609	1692	3.44	2.16	2.83
9	South Korea	955	679	1634	3.03	2.40	2.74
10	Spain	664	728	1392	2.11	2.58	2.33
	Total	24507	22150	46657	77.88	78.38	78.12
	World	31467	28258	59725			
	Share of top 10 countries in world total	77.88	78.38	78.12			

India's International Collaboration

During 2003-18, India published 11.67% share of its national output in e-commerce research as international collaborative papers (ICP). The USA was the largest collaborating partner of India in e-commerce research accounting for 42.38% of total ICP output by the

country. India collaborated with nine other countries but its ICP share with these nine countries ranged in single digit between 2.65% and 7.95%. India's international collaborative papers (302) output in the subject received a total 4010 citations with an average of 13.23 citations per paper.

Table 3: Share of Foreign Countries in India's Collaborative Papers in E-commerce during 2003-18

Collaborative Country	Number of ICP			Share of ICP		
	2003-10	2011-18	2003-18	2003-10	2011-18	2003-18
USA	56	72	128	53.33	36.36	42.38
U.K.	4	20	24	3.81	10.10	7.95
Canada	9	7	16	8.57	3.54	5.30
China	2	14	16	1.90	7.07	5.30
South Korea	5	10	15	4.76	5.05	4.97
Australia	1	12	13	0.95	6.06	4.30
Saudi Arabia	1	10	11	0.95	5.05	3.64
France	4	5	9	3.81	2.53	2.98
Oman	4	5	9	3.81	2.53	2.98
Malaysia	1	7	8	0.95	3.54	2.65
Total of India	105	198	303			

ICP=International Collaborative Papers

Subject-Wise Distribution of Research Output by India in E-Commerce

Computer Science is the most favored subject for research in e-commerce, accounting for 70.35% share of the total output by the country in the subject, followed

by engineering (30.77%), business management and accounting (19.60%), mathematics (13.49%), decision sciences (8.74%), social sciences (7.31%) and economics, econometrics and finance (5.60%) during the study period 2003-18 (Table 4).

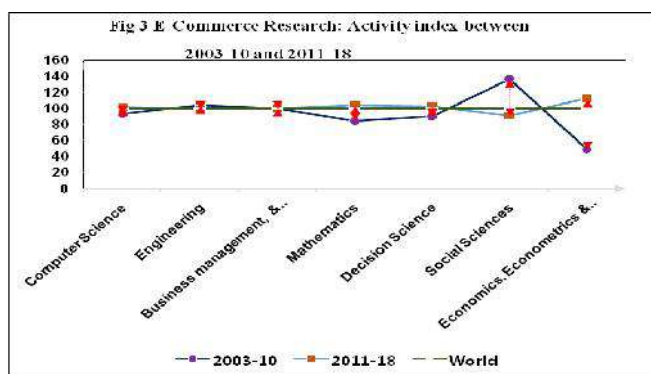
Table 4: Subject-Wise Breakup of Indian Publications on E-Commerce during 2003-18

Sl. No.	Subject*	Number of Papers (TP)			Activity Index		TC	CPP	%TP
		2003-10	2011-18	2003-18	2003-10	2011-18			
1	Computer Science	334	1486	1820	93.27	101.65	7610	4.18	70.35
2	Engineering	163	633	796	104.08	99.00	3291	4.13	30.77
3	Business management, & Accounting	100	407	507	100.25	99.94	3476	6.86	19.60
4	Mathematics	58	291	349	84.47	103.81	898	2.57	13.49
5	Decision Science	40	186	226	89.96	102.46	1358	6.01	8.74
6	Social Sciences	51	138	189	137.15	90.90	1027	5.43	7.31
7	Economics, Econometrics & Finance	14	131	145	49.07	112.47	733	5.06	5.60
	Indian Output	509	2078	2587			12090	4.67	

*There is overlapping of literature covered under various subjects

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper

India's research activity in e-commerce research intersected with 7 sub-fields (and as identified in Scopus database classification). The research activity across these 7 subjects witnessed fluctuations between 2003-10 to 2011-18. The world average activity index of every subject field by default is 100. In three subjects rise in research activity index was marginal: Computer science (from 93.27 to 101.65), mathematics (84.47 to 103.81) and decision science (89.96 to 102.46). In economics, econometrics and finance rise in activity index was significant (49.07 to 112.47). On the other hand, in two subjects, drop in research activity was also marginal — engineering (104.08 to 99.0), business management and accounting (100.25 to 99.94). But in social sciences, the drop in research activity index was substantial (137.15 to 90.90). Business management and accounting recorded the highest citation impact per paper of 6.86 and mathematics the least (2.57) (Table 4, Fig 3).



Significant Keywords

Electronic commerce has been the most productive keyword in searching databases for literature on e-commerce research in India. In all, around 40 keywords were identified for the purpose. The distribution of publications output across these keywords

highlights e-commerce research trends in the country. The keywords are listed in Table 5, in decreasing order of frequency of their occurrence in the literature.

Table 5: List of Significant Keywords in E-commerce research by India 2003-18

Sl. No.	Keywords	Frequency
1	Electronic Commerce	1391
2	Data Mining	284
3	Sales	249
4	Internet	211
5	Websites	208
6	Recommender System	200
7	Social Networks (Online)	156
8	Cryptography	144
9	Artificial Intelligence	142
10	Mobile Commerce	136
11	e-Commerce Websites	130
12	Collaborative Filtering	129
13	Network Security	119
14	Authentication	118
15	Algorithms	112
16	Sentiment Analysis	104
17	Web Services	103
18	Online Shopping	100
19	Security of Data	88
20	Customer Satisfaction	84
21	Opinion Mining	84
22	Big Data	76
23	E-Commerce Applications	74
24	Marketing	71
25	Online Systems	70
26	Cloud Computing	59
27	Machine Learning	54
28	Learning Algorithms	52
29	Trust	49
30	Computer Software	46
31	Social Media	44
32	E-Business	42
33	Supply Chain Management	33
34	E-Learning	29
35	Credit Cards	25
36	Internet of Things	25
37	Personalized Commendations	24
38	E-Commerce Transactions	21
39	Social Network Sites	20

Top 15 Most Productive Indian Organizations

A total of 356 organizations participated in e-commerce research in India during 2003-18, of which 205 published 1-5 papers each, 83 organizations 6-10 papers each, 39 organizations 11-20 papers each, 25 organizations 21-50 papers each and 4 organizations 51-64 papers each during 2003-18.

The productivity of top 15 most productive organizations varied from 27 to 64 publications per organization; together they contributed 23.93% (619) global publications share and 27.25% (3294) global citations share during

2003-18. Their scientometric profile is presented in Table 6.

- Six organizations contributed publications above the group average (41.27) of all organizations: Vellore Institute of Technology (64 papers), Anna University, Chennai and Indian Institute of Technology, New Delhi (59 papers each), Indian Institute of Technology, Kharagpur (58 papers), Indian Institute of Science, Bangalore (47 papers) and Amity University, Noida (43 papers) during 2003-18; and
- Seven organizations registered their citation impact per paper and relative citation index

Table 6: Scientometric Profile of Top 15 Most Productive Indian Organizations in E-Commerce Research during 2003-18

Sl. No.	Name of the Organization	TP	TC	CPP	ICP	%ICP	RCI
1	Vellore Institute of Technology	64	220	3.44	8	12.50	0.74
2	Anna University, Chennai	59	168	2.85	0	0.00	0.61
3	Indian Institute of Technology, New Delhi	59	391	6.63	8	13.56	1.42
4	Indian Institute of Technology, Kharagpur	58	480	8.28	12	20.69	1.77
5	Indian Institute of Science, Bangalore	47	498	10.60	6	12.77	2.27
6	Amity University, Noida	43	73	1.70	2	4.65	0.36
7	University of Delhi	39	77	1.97	4	10.26	0.42
8	IBM, India	37	271	7.32	22	59.46	1.57
9	Sathyabama Institute of Science & Technology	34	64	1.88	1	2.94	0.40
10	Amrita VishwaVidyapeetham	34	185	5.44	1	2.94	1.17
11	Bharath Institute of Higher Education & Research	30	88	2.93	0	0.00	0.63
12	Indian Institute of Management, Kolkata	33	173	5.24	9	27.27	1.12
13	Bharathiar University	28	61	2.18	0	0.00	0.47
14	Indian Institute of Technology, Chennai	27	193	7.15	5	18.52	1.53
15	Indian Institute of Management, Lucknow	27	352	13.04	8	29.63	2.79
	Total of 15 organizations	619	3294	5.32	86	13.89	1.14
	Total of India	2587	12090	4.67			
	Share of top 15 organizations in World total output	23.93	27.25				
TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; ICP=International Collaborative Papers; RCI=Relative Citation Index							

above the group average (5.32 and 1.14) of all organizations: Indian Institute of Management, Lucknow (13.04 and 2.70), Indian Institute of Science, Bangalore (10.6 and 2.27), Indian Institute of Technology, Kharagpur (8.28 and 1.77), IBM, India (7.32 and 1.57), Indian Institute of Technology, Chennai (7.15 and 1.53), Indian Institute of Technology, New Delhi (6.63 and 1.42) and Amrita VishwaVidyaapeetham (5.44 and 1.17) during 2003-18.

Top 15 Most Productive Authors

A total of 378 authors participated in e-commerce research during 2003-18, of which 340 authors published 1-5 papers each, 35 authors 6-10 papers each and 3 authors 12-190 papers each. The research productivity of top 15 most productive authors varied from 8 to 19 publications per author. Together they contributed 5.99% (155) global publications share and 14.19% (1715) global citations share during

Table 7: Scientometric Profile of Top 15 Most Productive Authors in e-Commerce Research during 2003-18

Sl. No	Name of the Author	Affiliation of the Author	TP	TC	CPP	HI	ICP	%ICP	RCI
1	A.K. Kar	Indian Institute of Technology, New Delhi	19	68	3.58	4	2	10.53	0.77
2	Y. Narahari	Indian Institute of Science, Bangalore	17	222	13.06	7	3	17.65	2.80
3	S. Gupta	ShriShankaracharya Institute of Technology & Management, Bhilai	12	680	56.67	9	11	91.67	12.13
4	M. Majhi	National Institute of Technology, Rourkela	11	36	3.27	4	1	9.09	0.70
5	S.S. Manvi	Indian Institute of Science, Bangalore	11	227	20.64	7	1	9.09	4.42
6	D. Mukhopadhyay	Maharashtra Institute of Technology, Pune	10	74	7.40	5	0	0.00	1.58
7	P. Bedi	University of Delhi	9	13	1.44	2	0	0.00	0.31
8	M. Jenamani	Indian Institute of Technology, Kharagpur	9	92	10.22	6	1	11.11	2.19
9	A.Kumar	ABV-Indian Institute of Information Technology & Management, Gwalior	9	45	5.00	4	0	0.00	1.07
10	B.Bhasker	Indian Institute of Management, Lucknow	8	102	12.75	3	0	0.00	2.73
11	I.Bose	Indian Institute of Management, Kolkata	8	16	2.00	1	3	37.50	0.43
12	A.Mahanti	Indian Institute of Management, Kolkata	8	31	3.88	4	3	37.50	0.83
13	S.K. Mathew	Indian Institute of Technology, Chennai	8	22	2.75	2	2	25.00	0.59
14	S.K.Mohanty	National Institute of Technology, Rourkela	8	18	2.25	3	0	0.00	0.48
15	P.K.J.Mohapatra	Indian Institute of Technology, Kharagpur	8	69	8.63	5	0	0.00	1.85
	Total		155	1715	11.06	4.4	27	17.42	2.37
	Total of India		2587	12090	4.67				
	Share of 15 Authors in World Total Output		5.99	14.19					

TP=Total Papers; TC=Total Citations; CPP=Citations Per Paper; HI=h-index; ICP=International Collaborative Papers;

2003-18. Their detailed scientometric profile is presented in Table 7.

- Five authors registered their publications output above the group average of 10.33: A.K. Kar (19 papers), Y. Narahari (17 papers), S. Gupta (12 papers), M. Majhi and S.S. Manvi (11 papers each);
- Four authors registered their citation impact per paper and relative citation index above the group average (11.06 and 2.37) of all authors: S. Gupta (56.67 and 12.13), S.S. Manvi (20.64 and 4.42), Y. Narahari (13.06 and 2.80) and B. Bhasker (12.75 and 2.73).

Medium of Research Communication

Of the total output in e-commerce research by India, 45.56% (1181) appeared in conference proceedings, 38.16% (989 articles) in 313 journals, 11.46% (297) in book series, 4.51% (117) as books and 0.31 % (9) in trade publications. Of the 313 journals, 285 published 1-5 papers each, 13 published 6-10 papers each, 12 published 11-20 papers each, 2 published 21-50 papers each and 1 published 54 papers each during 2003-18.

The top 20 most productive journals accounted for 31.45% of total journals output in e-commerce during 2003-18. The top most journal (with 54 papers) in the

Table 8: Top 20 Most Productive Journals in E-Commerce Research during 2003-18

Sl. No.	Name of the Journal	Number of Papers		
		2003-10	2011-18	2003-18
1	International Journal of Applied Engineering Research	0	54	54
2	Indian Journal of Science & Technology	1	39	40
3	International Journal of Applied Business & Economic Research	0	21	21
4	Journal of Theoretical & Applied Information Technology	0	18	18
5	Journal of Advanced Research in Dynamical & Control Systems	0	18	18
6	Indian Journal of Marketing	0	14	14
7	International Journal of Control Theory & Applications	0	14	14
8	International Journal of Business Information Systems	1	12	13
9	Sadhya Academy Proceedings in Engineering Sciences	13	0	13
10	Electronic Commerce & Applications	7	5	12
11	International Journal of Mechanical Engineering & Technology	0	12	12
12	Journal of Internet Banking & Commerce	2	10	12
13	ARNP Journal Engineering & Applied Sciences	0	11	11
14	Expert Systems with Applications	1	9	10
15	Decision Support Systems	4	5	9
16	International Journal of Engineering & Technology	1	8	9
17	Journal of Internet Commerce	1	8	9
18	International Journal of Economic Research	0	8	8
19	Cluster Computing	0	7	7
20	International Journal of E-Business Research	2	5	7
	Total of 20 journals	33	278	311
	Total global journal output	179	810	989
	Share of top 20 journals in global journal output	18.44	34.32	31.45

list is *International Journal of Applied Engineering Research*, followed by *Indian Journal of Science & Technology* (40 papers), *International Journal of Applied Business & Economic Research* (21 papers), *Journal of Theoretical & Applied Information Technology* and *Journal of Advanced Research in Dynamical & Control Systems* (18 papers each), etc. during 2003-18 (Table 8).

Highly-cited Papers

Of the total Indian output in e-commerce research (2587 publications), only 7 publications accumulated high end 100+ citations ranging from 111 to 622 citations per paper (cumulative total 1700 citations) since their publication during 2003-18, averaging 240.3 citations per paper. The distribution of 7 highly-cited papers is skewed. Five papers accumulated citations in the range 111-200 per paper and 2 papers received 302 and 622 citations per paper.

- Of the 7 highly cited papers, 3 resulted from contribution by single organizations per paper (non-collaborative papers) and 4 from two or more organizations per paper (all international collaborative papers).
- Among highly-cited papers, China collaborated in the largest number of papers (2 papers), followed by Finland, South Korea and USA (1 paper each);
- The 7 highly cited papers belonged to 20 authors and 15 organizations.
- The leading Indian organizations participating in highly cited papers were: Shankaracharya Institute of Technology and Management, Bhilai (2 papers) and Indian Institute of Technology, Kharagpur, Indian Institute of Technology, Roorkee, Indian School of

Business, Hyderabad, India, Jawaharlal Nehru University, New Delhi, National Institute for Interdisciplinary Science and Technology, Trivandrum (1 paper each).

- Of the 7 highly cited papers, 5 were published as articles, 1 each as review and conference paper;.
- These 7 highly cited papers appeared across 6 journals, of which 2 papers were published in *Electronic Commerce Research and Applications* and 1 paper each in *Computers in Human Behavior*, *IEEE Transactions on Dependable and Secure Computing*, *International Materials Reviews*, *Journal of the Academy of Marketing Science* and *Journal of Network and Computer Applications*.

SUMMARY AND CONCLUSION

The paper provides an update on the current status of e-commerce research in India in the global context. This study is based on bibliometric analysis of e-commerce research publications by India and the world. The data was sourced from Scopus database covering 16-year period 2003-18. India is the 6th most productive country in the world in e-commerce research. However, compared to top two countries in the world ranking — China (31.56%) and USA (16.85%) — India's world share is relatively smaller and insignificant, just 4.33%. (India, 2587 publications). In all, a total of 114 countries contributed to e-commerce research (59725 publications) during the period. India registered faster growth 22.42% compared to 3.02% average world growth. India's citation impact has been low, 4.67 citations per paper on a 16-year window.

Besides, India registered just 0.27% (7 papers) share of its total output (2587) as highly-cited papers. As seen from activity index, India did not witness any major and significant change in research activity between 2003-08 and 2009-18. Top 15 most productive organizations contributed just 23.93% share to national output, and the top 15 authors contributed just 5.99% share to national output. These statistics underline the fact that e-commerce research productivity at institutional level and individual author level in India by far has been rather insignificant.

Vellore Institute of Technology (64 papers) topped the list of the top 15 most productive organizations, and Indian Institute of Management, Lucknow topped as most cited organization (13.04 citations per paper and 2.70 relative citation index) respectively. A.K. Kar (19 papers) topped the list of top 15 most productive authors, and S. Gupta (56.67 CPP and 12.13 RCI) topped as the most cited author. Computer Science and engineering were the most preferred areas intersecting e-commerce research with 70.35% and 30.77% shares respectively. *International Journal of Applied Engineering Research* was the most sought journal for publishing research in the subject with highest 54 papers. China has been the largest collaborating partner of India in e-commerce research.

Given these developments it could be concluded that the quantitative and qualitative performance of India in e-commerce has not been not very promising. E-commerce research is still not a priority area of academic research in the country. This trend in e-commerce research could be attributed to India's low and insignificant authorship strength at organizational level in e-

commerce research, just 1.06 authors per organization.

REFERENCES

1. E-Commerce. 20 November 2019. <https://en.wikipedia.org/wiki/E-commerce>
2. E-commerce (electronic commerce). 2007-19. <https://searchcio.techtarget.com/definition/e-commerce>
3. India – eCommerce. <https://www.export.gov/article?id=India-e-Commerce>
4. India Brand Equity Foundation. E-commerce Industry in India, September, 2019 <https://www.ibef.org/industry/ecommerce.aspx>
5. E-Commerce. March 2018 <https://www.ibef.org/download/Ecommerce-March-2018.pdf>
6. Lin, A.J., Hsu, C.L. and Chiang, C.H. Bibliometric study of electronic commerce research in information systems and MIS journals. *Scientometrics* 2016 109(3): 1455-1476. <https://doi.org/10.1007/s11192-016-2142-8>
7. Yang, Yann-Jy. Recent development trend of electronic commerce research: 2000 to 2016. *Contemporary Management Research* June 2017, 13(2), 131-142. doi:10.7903/cmr.17824.
8. Wang, Chih-Chien and Chen, Chien-Chang. Electronic commerce research in latest decade: A literature review. *International Journal of Electronic Commerce Studies* 2010, 1(1), 1-14
9. Mou, Jian, Cui, Yi and Kurcz, Kerry. Bibliometric and visualized analysis of research on major e-commerce journals using

- Citespace. *Journal of Electronics Commerce Research* 2019, 20(4), 219-237.
10. Tsai, Hsu-Hao and Chiang, J. K. E-commerce literature trend forecasting: A study of bibliometric methodology, 4th International Conference on New Trends in Information Science and Service Science, Gyeongju, 2010, p. 671-676.
11. Gupta, B.M., Dhawan, S.M. and Gupta, R. Mobile commerce global publications: A quantitative and qualitative assessment during 2007-16. *DESIDOC Journal of Library & Information Technology* May 2018, 38(3), 179-186, DOI: 10.14429/djlit.38.3.12129@2018
12. Fatima, Anam, Abbas, Asad, Ming, Wan, Zaheer, A. N, Akhtar, M. H. Analyzing the academic research trends by using university digital resources: A bibliometric study of electronic commerce in China. *Universal Journal of Educational Research* 2017, 5(9), 1606-1613
13. Vaithianathan, Sridhar. A review of e-commerce literature on India and research agenda for the future. *Electronic Commerce Research* March 2010, 10(1), 83-97, DOI: 10.1007/s10660-010-9046-0

