# Supply Chain Management & RFID: An Analysis of Research Productivity

Divya Prakash Shrivastava#[1], Anil Kumar*[2]

# Higher Colleges of Technology, Dubai-UAE
* VNS Group of Institution Bhopal MP-India
[1] dprakash@hct.ac.ae
[2] anilkr.iimt@gmail.com

***Abstract-*** **Radio frequency identification (RFID) & Supply chain management (SCM) are an integral part of today's business world. RFID increases productivity and convenience. There are several studies conducted in the past to examine the question of productivity of the authors. However, prior studies have not discussed in detail the research productivity patterns of individual RFID & SCM authors together, across a relatively large number of journals and a lengthy time frame. Previous studies have also not established any benchmark of individual research productivity, regarding both the number of publications, i.e. quantity and the impact of those published papers, i.e. quality, required to place among the leading contributors in the field of RFID & SCM collectively. The present study examined 631 global publications on "RFID & Supply Chain Management" downloaded from Scopus database during 1999-2015. The positioning and associated percentiles of individual authors were calculated and prepared six quality and quantity metrics from equal credit method and direct count method; authors identify the aggregate productivity standards necessary for an individual author to be ranked at various places in the field of RFID & SCM together.**

***Keywords—*** *Supply chain management; RFID; authors' productivity; productivity standards, Equal credit method.*

## 1. Introduction

There is tough competition for having good academicians and researchers in universities and colleges in the current scenario. Thus it is the immense requirement of having information for measuring the productivity of an individual academician. The academicians require research standards for the amount and quality of research necessary to get tenure and promotion.

Research output consists of different kind of work in the form of inventions, databases, patents, techniques, books, and published papers. Published papers are one of the good indicator of personal quality, and it represent an important aspect of research productivity [1] and in defining individual careers and institutional success in the field of academics [2]. The examination of trends and productivity patterns in academic research has been considered an area of interest for scholars. Research publication recognised as one of the most important parameters for research-oriented schools, and it is equally important to teach at many teaching-oriented schools [3]. However, there is a lack of previous studies that can be used by faculty and administrators to plan and evaluate research productivity in the field of RFID & SCM together. Administrators and faculty evaluation committees need research standards for hiring, tenure, promotion, performance evaluations, and assessment in all over the world and this is the rationale of this study and the reason to conduct this research work and setting the benchmarks for researchers. In the past three types of criteria were presented for research productivity measurement concerning either qualitative measures; quantitative measures; and Quantitative and qualitative measures combined. However, research benchmarks that developed in the past were either quantitative or qualitative nature, but not both. This paper is an attempt to put the measures separately in six metrics. The goal of this article is to provide a set of empirical research benchmarks for establishing cutoff for research productivity as measured by publication. In this paper, we have identified research standard values of performance that are necessary to place an individual author at various level in the ranking scale. Authors investigated three research questions taken from the study of [19]:

***International Journal of Supply Chain Management***
IJSCM, ISSN: 2050-7399 (Online), 2051-3771 (Print)

1. How many research papers needed for an author to be ranked among the leaders in RFID & SCM publication productivity which is the quantitative measures?
2. How many citations are necessary for an author to be listed among the leaders in RFID & SCM publication productivity which is the qualitative measures?
3. What h-index value keeps an author as a leader in RFID & SCM publication productivity which is the combination of quantitative & qualitative measures?

The study starts with an overview of the available literature. Authors subsequently describe the methodology employed, and follow that with a presentation of the results from the analysis. Next, the results and implications of the study discussed. In the end, the contributions and limitations of this study and scope for future research presented.

## 2. Literature Review

The amount of the investigation generated is often used to measure the quality of an individual researcher. Previous studies that rank and evaluate research productivity are common in many disciplines. Earlier such research focused on individual methods, while these days recent work has used more objective methods and focused on a particular interest area [4]. As the discipline progresses and reaches towards maturity, an interest in knowing the 'state of the art' of the literature tends to grow amongst its researchers[5] and published research is considered the best available method for judging the quality of faculty, and institutions. The published research work is the primary indicator of academic quality in most of the previous studies and the reputation of institutions in terms of research is the prime factor for both the preliminary screenings and the final choices of faculty candidates to get appointed[6,7].

Researchers have used three techniques to assess research productivity: counting, citation analysis, and surveys. There are several studies based on it [8, 9, 10]. In previous studies, the individual contribution was assessed to SCM field based either on counting or on citation based [9,4]. Advantages of counting research papers include objectivity and simplicity though counting the number of publications is not said to be objective. The counting methodology assesses the quantity of published material but does not provide measures of the quality of faculty research. Citation analysis used to measures the frequency in which articles, authors, or journals cited in other publications. The number of citations is just counted, without consideration of the quality of the paper or reason for making the quote. There are several studies conducted in the past based on the citations [11, 12]. Citation analysis to some extent is considered to be objective because an article is either cited or not cited, but it is also not said to be adequate. Researchers have used surveys to assess the quality of the journal and related publications. Some previous studies in this category have ranked academic institutions through survey methods [13, 14]. Surveys also have potential flaws. The previous study depicts continued expansion of the SCM discipline with downward linear trends and authors contribute scholarly output individually [15]. In past few years, a new category of focus has emerged that might be entitled "individual researcher productivity." To date, however, such research in the RFID & SCM together is not available. Some of the previous studies would be worth mentioning here. [16] Conducted an empirical study using survey data to examine scientific collaboration impact on research productivity in a developing country and found that publication productivity is significantly linked to professional network factors. Similarly, [17] examine the global publication output on RFID and libraries and found 3.91 citations per paper. [18] the study results evaluate a half century of SCM research and confirm the growth of new scholars and expansion of SCM programs.

[9], shows the individual contribution to supply chain management: an international journal for the time frame of 10 years. The study carried out by [19], where they computed the individual ranking in the field of logistics and identifies the benchmarks using quality, quantity and quality& quantity measures together. [22], conducted a bibliometric study on RFID for 15 years period and found that employing RFID in organisations enhance the efficiency of operations. While the above studies have made significant contributions to different literature, there remains an opportunity for research that identifies individual publication productivity standards regarding both quantity and quality, spreading in a larger group of journals, a lengthy time frame for the RFID&SCM field taken together. Identifying the benchmarks to be among the leaders in RFID&SCM research productivity is the focus area of this paper and presenting these results are the rationale for the current work.

## 3. Research Methodology

Authors examined the articles published from 1999 to 2015 in the month of May – June 2016 in different journals downloaded from SCOPUS database. The dataset consists of 631 articles written by 1399 authors. The quantitative metrics for each author developed with the help of author names associated with each published paper. The number of citations used to measure the quality of the contribution. The number of citations for each article was collected as of May-June 2016, as reported by Google Scholar [20, 21].

Authors employ two versions of article counts as measures of quantity. Article counts represent the frequency of an author's contribution to the discipline, and are perhaps the most commonly used method of research productivity in academe. Similarly, Authors employ two versions of citation counts as measures of the quality of an author's contributions.

To address the first research question regarding research standards for publications (quantity) an author needs to be among the leading contributors in RFID& SCM together. Authors used the approaches used earlier in several studies [9,10]. Authors computed two versions of an article count for each author. One based on direct count method and represented the total number of authorships, computed simply as the total number of articles on which that individual was an author (or co-author). This metric gave full credit for an article to each and every author on that article, and treated single authorships the same as joint authorships. For the second measure of quantity Authors used equal credit method for which the authorship credit on a given article was computed simply as the inverse of the number of authors. Thus, each author on a two-author article received a credit of 0.50 credit, each author on a three-author article received a credit of 0.33, etc.

To address the second research question regarding minimum required value for the publication quality standard value required to be among the leading contributors in RFID&SCM publications, and consistent with the dual approach to article counts, We computed two versions of a citation count for each author. One represented the total number of citations received for all articles on which that individual appeared as an author based on direct count method. Like our first quantity measure, this metric gave full credit for all of an article's citations to each and every one of its authors, regardless of the number of authors. The second measure of quality based on equal credit method for each author, authors computed the proportionally adjusted number of citations, where the citation credit assigned to each author on a given article was computed as the number of citations for that article, divided by the number of authors. As examples, on a two author article with 60 citations, each author would be assigned credit for 30 citations, whereas each author on a three-author article with 60 citations would receive credit for 20 citations.

To address the third research question, the authors computed two versions of h-index. One is based on direct count method and another on equal credit method. H-index metrics represented the combined research productivity for an author and show the minimum value required for an author to be in leading position.

Once the raw values of each metric computed for each researcher, Authors constructed frequency tables based on each of the six metrics (quantity, quality and combined) tables and arranged them in ascending order. This approach generated six separate publication productivity rankings. Within each ranking table, Authors also computed the percentile associated with each value of the metric. Thus prepared tables helps an individual author to easily compares his/her totals to the entire distribution of authors, and to determine where they stand and what percentage of the authors in the discipline they are ahead.

## 4. Result Analysis

Total 633 articles were used as a dataset for this study. A total of 1399 authors contributed in these 633 articles, indicating an average of 2.21 authors on each article, and an average of .45 articles for each author.

Table 1 contains the ranking based on the number of articles based on direct count method and Table 2 showing the ranking based on equal credit method for total number of proportionally adjusted articles. It would be worth mentioning here, that the ranks shown in these and all other tables reflect the impact of ties in the respective metric.

From the table 1 it is clear that the highest number of articles published during our time frame was 11. Further analysis indicates that the necessary cutoff for the top 10, top 20, and top 50 were 6, 5, and 4 articles, respectively.

Table 1. Ranking the distribution of number of papers based on direct count

| **Rank** | **No of papers** | **Percentile** | **Rank** | **No of papers** | **Percentile** |
|---|---|---|---|---|---|
| 1 | 11 | 99.93 | 19 | 5 | 98.64 |
| 2 | 10 | 99.86 | 30 | 4 | 97.85 |
| 4 | 8 | 99.71 | 53 | 3 | 96.21 |
| 7 | 7 | 99.49 | 88 | 2 | 93.71 |
| 9 | 6 | 99.35 | 244 | 1 | 82.55 |

As shown in Table 2, the results are based on equal credit method. A total of 10 proportionally adjusted articles represent the top-line benchmark for that metric, followed by 4.41, 4.33, 3.82 and 3.51. The thresholds necessary to reach the top 10, top 20, and top 50 were 2.25, 1.94, and 1.25, respectively. A total of 1 proportionally adjusted article would have placed an author in the top 100.

**Table2.**Ranking the distribution of number of papers based on equal credit method

| Rank | No of papers | Percentile | Rank | No of papers | Percentile | Rank | No of papers | Percentile |
|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 99.93 | 50 | 1.25 | 96.42 | 239 | 0.62 | 82.91 |
| 2 | 4.41 | 99.86 | 55 | 1.24 | 96.06 | 240 | 0.61 | 82.84 |
| 3 | 4.33 | 99.79 | 56 | 1.2 | 95.99 | 241 | 0.58 | 82.77 |
| 4 | 3.82 | 99.71 | 57 | 1.16 | 95.93 | 254 | 0.57 | 81.84 |
| 5 | 3.51 | 99.64 | 62 | 1.15 | 95.56 | 256 | 0.56 | 81.7 |
| 6 | 3.25 | 99.57 | 63 | 1.14 | 95.49 | 257 | 0.53 | 81.63 |
| 7 | 3 | 99.49 | 65 | 1.12 | 95.35 | 265 | 0.52 | 81.06 |
| 8 | 2.74 | 99.43 | 66 | 1.11 | 95.28 | 266 | 0.5 | 80.98 |
| 9 | 2.65 | 99.35 | 67 | 1.1 | 95.21 | 480 | 0.49 | 65.68 |
| 10 | 2.25 | 99.28 | 68 | 1.09 | 95.14 | 484 | 0.47 | 65.4 |
| 11 | 2.08 | 99.21 | 69 | 1.07 | 95.07 | 485 | 0.45 | 65.33 |
| 13 | 2.01 | 99.07 | 70 | 1.06 | 94.99 | 499 | 0.41 | 64.33 |
| 14 | 2 | 98.99 | 71 | 1.04 | 94.92 | 501 | 0.4 | 64.18 |
| 20 | 1.94 | 98.57 | 72 | 1.03 | 94.85 | 503 | 0.39 | 64.05 |
| 21 | 1.93 | 98.49 | 75 | 1 | 94.64 | 504 | 0.36 | 63.97 |
| 22 | 1.91 | 98.42 | 176 | 0.95 | 87.42 | 505 | 0.33 | 63.9 |
| 23 | 1.83 | 98.35 | 180 | 0.92 | 87.13 | 806 | 0.32 | 42.38 |
| 24 | 1.82 | 98.28 | 181 | 0.91 | 87.06 | 815 | 0.3 | 41.74 |
| 25 | 1.8 | 98.21 | 183 | 0.9 | 86.92 | 816 | 0.26 | 41.67 |
| 26 | 1.78 | 98.14 | 184 | 0.86 | 86.85 | 820 | 0.25 | 41.39 |
| 27 | 1.66 | 98.07 | 185 | 0.83 | 86.78 | 1090 | 0.2 | 22.08 |
| 29 | 1.65 | 97.93 | 200 | 0.82 | 85.7 | 1216 | 0.16 | 13.08 |
| 30 | 1.63 | 97.86 | 201 | 0.75 | 85.63 | 1315 | 0.14 | 6 |
| 31 | 1.62 | 97.78 | 203 | 0.74 | 85.49 | 1340 | 0.125 | 4.22 |
| 32 | 1.58 | 97.71 | 204 | 0.72 | 85.41 | 1364 | 0.1 | 2.5 |
| 33 | 1.5 | 97.64 | 205 | 0.7 | 85.35 | 1374 | 0.09 | 1.79 |
| 38 | 1.41 | 97.28 | 211 | 0.66 | 84.92 | 1384 | 0.067 | 1.07 |
| 41 | 1.33 | 97.07 | 238 | 0.64 | 82.98 | | | |

Table 3 contains the ranking based on number of citations using direct count method. The top-line benchmark was 547 citations, with a drop-off down to a threshold of 447 for the tenth highly cited author. Furthermore, examination of the table indicates that the necessary cutoff for reaching the top 20, and top 50 were 315 and 216 respectively. Reaching the top 100 required 149 total citations. A total of 227 authors (16%) had yet to be cited.

Table3.Ranking the distribution of number of citations based on direct count method

| Rank | No of citations | Percentile | Rank | No of citations | Percentile | Rank | No of citations | Percentile |
|---|---|---|---|---|---|---|---|---|
| 1 | 547 | 99.93 | 101 | 147 | 92.78 | 265 | 53 | 81.06 |
| 2 | 517 | 99.86 | 102 | 142 | 92.71 | 282 | 52 | 79.84 |
| 3 | 511 | 99.79 | 105 | 141 | 92.49 | 294 | 51 | 78.98 |
| 4 | 505 | 99.71 | 106 | 136 | 92.42 | 295 | 50 | 78.91 |
| 5 | 469 | 99.64 | 110 | 133 | 92.14 | 304 | 49 | 78.27 |
| 9 | 448 | 99.36 | 111 | 131 | 92.07 | 309 | 48 | 77.91 |
| 10 | 447 | 99.29 | 112 | 128 | 91.99 | 319 | 47 | 77.2 |
| 11 | 414 | 99.21 | 113 | 126 | 91.92 | 324 | 46 | 76.84 |
| 12 | 390 | 99.14 | 117 | 122 | 91.64 | 326 | 45 | 76.7 |
| 13 | 386 | 99.07 | 118 | 120 | 91.57 | 338 | 44 | 75.84 |
| 14 | 359 | 99 | 119 | 119 | 91.49 | 342 | 43 | 75.55 |
| 15 | 352 | 98.93 | 123 | 110 | 91.21 | 353 | 42 | 74.77 |
| 16 | 344 | 98.86 | 126 | 108 | 90.99 | 365 | 41 | 73.91 |
| 17 | 332 | 98.78 | 127 | 107 | 90.92 | 369 | 40 | 73.62 |
| 18 | 326 | 98.71 | 129 | 106 | 90.78 | 378 | 39 | 72.98 |
| 19 | 315 | 98.64 | 131 | 105 | 90.64 | 383 | 38 | 72.62 |
| 21 | 314 | 98.5 | 134 | 104 | 90.42 | 390 | 37 | 72.12 |
| 38 | 308 | 97.28 | 136 | 101 | 90.28 | 397 | 36 | 71.62 |
| 48 | 307 | 96.57 | 137 | 100 | 90.21 | 407 | 35 | 70.91 |
| 49 | 306 | 96.5 | 138 | 98 | 90.14 | 421 | 34 | 69.91 |
| 50 | 296 | 96.43 | 142 | 94 | 89.85 | 436 | 33 | 68.83 |
| 51 | 285 | 96.35 | 143 | 93 | 89.78 | 438 | 32 | 68.69 |
| 52 | 283 | 96.28 | 149 | 92 | 89.35 | 449 | 31 | 67.91 |
| 53 | 282 | 96.21 | 158 | 90 | 88.71 | 463 | 29 | 66.9 |
| 54 | 278 | 96.14 | 160 | 89 | 88.56 | 475 | 28 | 66.05 |
| 55 | 269 | 96.07 | 161 | 88 | 88.49 | 477 | 27 | 65.9 |
| 56 | 265 | 96 | 163 | 84 | 88.35 | 486 | 26 | 65.26 |
| 57 | 251 | 95.93 | 164 | 83 | 88.28 | 510 | 25 | 63.55 |
| 58 | 248 | 95.85 | 168 | 82 | 87.99 | 521 | 24 | 62.76 |
| 62 | 237 | 95.57 | 171 | 81 | 87.78 | 525 | 23 | 62.47 |
| 63 | 236 | 95.5 | 173 | 80 | 87.63 | 527 | 22 | 62.33 |
| 64 | 233 | 95.43 | 176 | 79 | 87.42 | 538 | 21 | 61.54 |
| 65 | 228 | 95.35 | 178 | 78 | 87.28 | 560 | 20 | 59.97 |
| 66 | 209 | 95.28 | 179 | 77 | 87.21 | 576 | 19 | 58.83 |
| 67 | 208 | 95.21 | 186 | 76 | 86.7 | 594 | 18 | 57.54 |
| 68 | 197 | 95.14 | 189 | 75 | 86.49 | 612 | 17 | 56.25 |
| 70 | 193 | 95 | 192 | 74 | 86.28 | 634 | 16 | 54.68 |

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|---|---|---|---|---|---|---|---|---|
| 71 | 192 | 94.92 | 201 | 72 | 85.63 | 648 | 15 | 53.68 |
| 72 | 187 | 94.85 | 203 | 70 | 85.49 | 667 | 14 | 52.32 |
| 73 | 185 | 94.78 | 204 | 69 | 85.42 | 682 | 13 | 51.25 |
| 74 | 184 | 94.71 | 210 | 68 | 84.99 | 704 | 12 | 49.68 |
| 75 | 182 | 94.64 | 211 | 67 | 84.92 | 722 | 11 | 48.39 |
| 77 | 177 | 94.5 | 217 | 66 | 84.49 | 761 | 10 | 45.6 |
| 78 | 166 | 94.42 | 223 | 64 | 84.06 | 785 | 9 | 43.89 |
| 81 | 161 | 94.21 | 234 | 63 | 83.27 | 810 | 8 | 42.1 |
| 82 | 160 | 94.14 | 237 | 62 | 83.06 | 838 | 7 | 40.1 |
| 86 | 158 | 93.85 | 238 | 61 | 82.99 | 859 | 6 | 38.6 |
| 87 | 155 | 93.78 | 242 | 60 | 82.7 | 893 | 5 | 36.17 |
| 92 | 153 | 93.42 | 246 | 59 | 82.42 | 928 | 4 | 33.67 |
| 94 | 152 | 93.28 | 253 | 58 | 81.92 | 966 | 3 | 30.95 |
| 96 | 151 | 93.14 | 254 | 57 | 81.84 | 1016 | 2 | 27.38 |
| 97 | 150 | 93.07 | 256 | 56 | 81.7 | 1096 | 1 | 21.66 |
| 98 | 149 | 92.99 | 260 | 54 | 81.42 | 1173 | 0 | 16.15 |

The table 4 is showing the citation count based on equal credit method. The top-line benchmark is 352, followed by 251, 244, 224.32 and 222.8. The benchmark to reach the top 10, top 20, top 50, and top 100 most cited authors were 177, 117.25, 76.5, and 40.66 respectively. 391 authors have less than one cite which is near to 28 percent of the total authorship while 228 authors have no citations yet which is 16.29 %.

**Table 4**.Ranking the distribution of number of citations based on equal credit method

| Rank | No of citations | Percentile | Rank | No of citations | Percentile | Rank | No of citations | Percentile |
|---|---|---|---|---|---|---|---|---|
| 1 | 352 | 99.93 | 140 | 30.66 | 89.99 | 402 | 9.75 | 71.27 |
| 2 | 251 | 99.86 | 143 | 30.33 | 89.78 | 406 | 9.66 | 70.98 |
| 3 | 244 | 99.79 | 145 | 30 | 89.64 | 409 | 9.4 | 70.76 |
| 4 | 224.32 | 99.71 | 147 | 29.75 | 89.49 | 415 | 9.25 | 70.34 |
| 5 | 222.8 | 99.64 | 151 | 29 | 89.21 | 421 | 9.06 | 69.91 |
| 6 | 220.74 | 99.57 | 152 | 28 | 89.14 | 422 | 9 | 69.84 |
| 7 | 192 | 99.5 | 154 | 27.91 | 88.99 | 440 | 8.75 | 68.55 |
| 8 | 186 | 99.43 | 155 | 27.33 | 88.92 | 444 | 8.67 | 68.26 |
| 9 | 185 | 99.36 | 158 | 27.16 | 88.71 | 445 | 8.66 | 68.19 |
| 10 | 177 | 99.29 | 159 | 27 | 88.63 | 447 | 8.53 | 68.05 |
| 11 | 169 | 99.21 | 162 | 26 | 88.42 | 448 | 8.5 | 67.98 |
| 12 | 165.08 | 99.14 | 169 | 25.66 | 87.92 | 453 | 8.4 | 67.62 |
| 13 | 163.05 | 99.07 | 175 | 25 | 87.49 | 455 | 8.33 | 67.48 |
| 14 | 161.75 | 99 | 176 | 24.7 | 87.42 | 456 | 8 | 67.41 |
| 15 | 143.83 | 98.93 | 177 | 24.66 | 87.35 | 471 | 7.75 | 66.33 |
| 16 | 127.57 | 98.86 | 180 | 24.5 | 87.13 | 477 | 7.65 | 65.9 |
| 17 | 127.33 | 98.78 | 181 | 24 | 87.06 | 478 | 7.5 | 65.83 |
| 18 | 126.24 | 98.71 | 185 | 22.75 | 86.78 | 487 | 7.33 | 65.19 |
| 19 | 120.74 | 98.64 | 186 | 22.66 | 86.7 | 488 | 7.08 | 65.12 |
| 20 | 117.25 | 98.57 | 187 | 22.5 | 86.63 | 489 | 7 | 65.05 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 24 | 114.65 | 98.28 | 189 | 22.33 | 86.49 | 508 | 6.85 | 63.69 |
| 25 | 112 | 98.21 | 191 | 22.13 | 86.35 | 511 | 6.83 | 63.47 |
| 26 | 110.49 | 98.14 | 192 | 22 | 86.28 | 512 | 6.8 | 63.4 |
| 27 | 108.64 | 98.07 | 197 | 21.86 | 85.92 | 514 | 6.75 | 63.26 |
| 28 | 102.66 | 98 | 199 | 21.5 | 85.78 | 518 | 6.66 | 62.97 |
| 32 | 100.83 | 97.71 | 202 | 21.33 | 85.56 | 521 | 6.5 | 62.76 |
| 33 | 99.66 | 97.64 | 205 | 21.2 | 85.35 | 530 | 6.33 | 62.12 |
| 34 | 99.6 | 97.57 | 206 | 21 | 85.28 | 538 | 6.25 | 61.54 |
| 35 | 98.66 | 97.5 | 212 | 20.5 | 84.85 | 540 | 6 | 61.4 |
| 36 | 94.33 | 97.43 | 213 | 20.49 | 84.77 | 552 | 5.9 | 60.54 |
| 37 | 92 | 97.36 | 214 | 20.33 | 84.7 | 553 | 5.8 | 60.47 |
| 38 | 89.66 | 97.28 | 217 | 20 | 84.49 | 558 | 5.7 | 60.11 |
| 39 | 88.33 | 97.21 | 222 | 19.73 | 84.13 | 562 | 5.66 | 59.83 |
| 40 | 85.49 | 97.14 | 223 | 19.66 | 84.06 | 571 | 5.6 | 59.19 |
| 41 | 84 | 97.07 | 228 | 19.63 | 83.7 | 572 | 5.5 | 59.11 |
| 42 | 83 | 97 | 244 | 19.5 | 82.56 | 580 | 5.4 | 58.54 |
| 43 | 82.66 | 96.93 | 245 | 19.25 | 82.49 | 585 | 5.33 | 58.18 |
| 47 | 80 | 96.64 | 247 | 19 | 82.34 | 590 | 5.3 | 57.83 |
| 48 | 79 | 96.57 | 248 | 18.66 | 82.27 | 605 | 5.2 | 56.75 |
| 49 | 76.5 | 96.5 | 249 | 18.55 | 82.2 | 616 | 5 | 55.97 |
| 51 | 75 | 96.35 | 250 | 18.4 | 82.13 | 634 | 4.75 | 54.68 |
| 52 | 71 | 96.28 | 254 | 17.66 | 81.84 | 638 | 4.5 | 54.4 |
| 54 | 66.5 | 96.14 | 255 | 17.58 | 81.77 | 639 | 4.4 | 54.32 |
| 55 | 66 | 96.07 | 257 | 17.5 | 81.63 | 640 | 4.33 | 54.25 |
| 56 | 65.75 | 96 | 259 | 17.25 | 81.49 | 655 | 4.25 | 53.18 |
| 57 | 64.93 | 95.93 | 261 | 17.2 | 81.34 | 661 | 4.2 | 52.75 |
| 58 | 64 | 95.85 | 262 | 17.05 | 81.27 | 662 | 4.2 | 52.68 |
| 59 | 62.57 | 95.78 | 263 | 17 | 81.2 | 663 | 4.05 | 52.61 |
| 61 | 62.42 | 95.64 | 264 | 16.83 | 81.13 | 664 | 4 | 52.54 |
| 62 | 61.38 | 95.57 | 265 | 16.75 | 81.06 | 676 | 3.66 | 51.68 |
| 63 | 61.17 | 95.5 | 269 | 16.66 | 80.77 | 685 | 3.5 | 51.04 |
| 64 | 56 | 95.43 | 272 | 16.5 | 80.56 | 700 | 3.4 | 49.96 |
| 66 | 55.83 | 95.28 | 273 | 16.35 | 80.49 | 706 | 3.33 | 49.54 |
| 67 | 55.33 | 95.21 | 274 | 16.33 | 80.41 | 712 | 3.32 | 49.11 |
| 70 | 54.25 | 95 | 276 | 16.32 | 80.27 | 714 | 3.25 | 48.96 |
| 71 | 54 | 94.92 | 277 | 16.13 | 80.2 | 731 | 3 | 47.75 |
| 72 | 53.5 | 94.85 | 278 | 16 | 80.13 | 763 | 2.8 | 45.46 |
| 74 | 53.33 | 94.71 | 282 | 15.5 | 79.84 | 770 | 2.75 | 44.96 |
| 76 | 53.32 | 94.57 | 287 | 15.33 | 79.49 | 779 | 2.74 | 44.32 |
| 77 | 51.33 | 94.5 | 288 | 15 | 79.41 | 780 | 2.7 | 44.25 |
| 83 | 50.08 | 94.07 | 295 | 14.8 | 78.91 | 785 | 2.66 | 43.89 |
| 84 | 49.7 | 94 | 300 | 14.75 | 78.56 | 793 | 2.5 | 43.32 |
| 85 | 49.66 | 93.92 | 301 | 14.5 | 78.48 | 801 | 2.4 | 42.74 |
| 87 | 49.45 | 93.78 | 304 | 14.33 | 78.27 | 806 | 2.33 | 42.39 |
| 88 | 47 | 93.71 | 310 | 14.3 | 77.84 | 808 | 2.25 | 42.24 |
| 89 | 46.49 | 93.64 | 311 | 14.16 | 77.77 | 816 | 2.2 | 41.67 |

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|---|---|---|---|---|---|---|---|---|
| 90 | 44.61 | 93.57 | 312 | 14 | 77.7 | 818 | 2.08 | 41.53 |
| 91 | 44.49 | 93.5 | 318 | 13.66 | 77.27 | 819 | 2 | 41.46 |
| 92 | 43.5 | 93.42 | 322 | 13.5 | 76.98 | 838 | 1.83 | 40.1 |
| 93 | 43 | 93.35 | 324 | 13.33 | 76.84 | 840 | 1.8 | 39.96 |
| 94 | 42 | 93.28 | 326 | 13 | 76.7 | 863 | 1.66 | 38.31 |
| 98 | 41.5 | 92.99 | 331 | 12.8 | 76.34 | 872 | 1.6 | 37.67 |
| 100 | 40.66 | 92.85 | 332 | 12.66 | 76.27 | 879 | 1.5 | 37.17 |
| 101 | 40.5 | 92.78 | 333 | 12.5 | 76.2 | 892 | 1.4 | 36.24 |
| 103 | 40.35 | 92.64 | 341 | 12 | 75.63 | 899 | 1.33 | 35.74 |
| 104 | 40 | 92.57 | 344 | 11.66 | 75.41 | 922 | 1.25 | 34.1 |
| 107 | 39.5 | 92.35 | 348 | 11.55 | 75.13 | 939 | 1.2 | 32.88 |
| 109 | 39 | 92.21 | 350 | 11.5 | 74.98 | 942 | 1 | 32.67 |
| 114 | 38.75 | 91.85 | 352 | 11.36 | 74.84 | 1009 | 0.9 | 27.88 |
| 118 | 36.66 | 91.57 | 353 | 11.33 | 74.77 | 1010 | 0.82 | 27.81 |
| 121 | 35.5 | 91.35 | 362 | 11.25 | 74.12 | 1012 | 0.8 | 27.66 |
| 123 | 35 | 91.21 | 365 | 11.16 | 73.91 | 1015 | 0.75 | 27.45 |
| 126 | 33 | 90.99 | 366 | 11 | 73.84 | 1035 | 0.73 | 26.02 |
| 127 | 32.66 | 90.92 | 372 | 10.8 | 73.41 | 1036 | 0.7 | 25.95 |
| 130 | 32.2 | 90.71 | 373 | 10.66 | 73.34 | 1038 | 0.66 | 25.8 |
| 131 | 32 | 90.64 | 378 | 10.6 | 72.98 | 1053 | 0.6 | 24.73 |
| 134 | 31.92 | 90.42 | 383 | 10.55 | 72.62 | 1062 | 0.5 | 24.09 |
| 135 | 31.25 | 90.35 | 384 | 10.5 | 72.55 | 1096 | 0.4 | 21.66 |
| 136 | 31.16 | 90.28 | 392 | 10.33 | 71.98 | 1110 | 0.33 | 20.66 |
| 137 | 31.13 | 90.21 | 396 | 10.32 | 71.69 | 1147 | 0.25 | 18.01 |
| 138 | 31 | 90.14 | 397 | 10 | 71.62 | 1160 | 0.2 | 17.08 |
| 139 | 30.7 | 90.06 | 400 | 9.8 | 71.41 | 1172 | 0 | 16.23 |

The table 5 is showing the combined (quantity & quality) productivity of the authors measured by h-index value through direct count method. From the table 5, it is clear that to be the leader in publication productivity an author required minimum h-index value 8. For the position of top 10, top 20 top 50 and top 100 an author required minimum h-index value 5, 4, 3 and 2 respectively.

Table5.Ranking the distribution of papers based on h-index through direct count method

| Rank | h-index based on direct count | Percentile |
|---|---|---|
| 1 | 8 | 99.92 |
| 2 | 7 | 99.85 |
| 3 | 6 | 99.78 |
| 5 | 5 | 99.64 |
| 14 | 4 | 98.99 |
| 35 | 3 | 97.49 |
| 57 | 2 | 95.92 |
| 163 | 1 | 88.35 |
| 1173 | 0 | 16.15 |

Table 6 is showing the combined (quantity & quality) productivity of the authors measured by h-index value through equal credit method. From the table 6, it is clear that to be the leader in publication productivity an author required minimum h-index value 6. For the position of top 10, top 20, and top 50 an author required minimum h-index value 4, 3, and two respectively.

**Table 6.**Ranking the distribution of papers based on h-index through equal credit method

| Rank | h-index based on equal credit method | Percentile |
|---|---|---|
| 1 | 6 | 99.92 |
| 3 | 5 | 99.78 |
| 4 | 4 | 99.71 |
| 12 | 3 | 99.14 |
| 37 | 2 | 97.35 |
| 110 | 1 | 92.13 |
| 212 | 0 | 84.84 |

## 5. Conclusion, limitations and future research scope

This paper presents a set of comprehensive, useful and research benchmarks or yardsticks for individual publication productivity in RFID & SCM field. The study is first of its kind which is presenting the results on SCM and RFID authors' productivity together. The research adds value to the literature by identifying the standard value of individual research performance across three different metrics of quantity and quality. This study represents the most extensive effort thus far to establish individual publication productivity standards/benchmark in the RFID & SCM field. Authors do so across three different metrics, for which there is either no prior literature available or literature is scarce. The distributions represent mechanisms by which RFID & SCM authors, and those who may evaluate them, can assess their position within the field. In addition to the contributions as mentioned above, this work complements and extends previous literature in different disciplines.

This study has limitations common to prior productivity studies based on article counts and citation analysis. First, the limitation is the general inability of any study to fully capture the total publications in a given field. Second, the publication productivity metrics do not directly capture the overall scholarly influence an individual may have the discipline. The current focus on publication productivity metrics should in no way be construed as a claim that the measures employed here are the only measures of disciplinary impact. A third limitation related to the general nature of citation and the number of citations is not necessarily a perfect metric for determining researchers productivity. Regarding future directions, lengthy time frame presented here provide a basis for the tracking of trends and changes in individual research productivity as the discipline evolves over time. Assessing how individual publication productivity develops in the future represents an excellent area for further studies. For further study different variants of h-index can be computed and compare the results from the past studies.

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