

## Evolution and Collaboration Structure of Library Services Research: A Scientometric Analysis of G20 Countries

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The purpose of this study is to examine the development and collaboration structure of library services research in the G20 countries from 1989 to 2023 from a scientometric perspective. The data were retrieved from the Web of Science Core Collection, and 6,756 publications were analyzed for publication trends, impact, document types, collaborations, top countries, institutions, journals, and funding agencies. The findings indicate that the number of publications has been gradually rising from 141 in 1989 to 241 in 2005. After 2005, publication growth became less consistent, while the relative growth rate gradually declined, indicating that the field had entered a more mature stage of development. Citation analysis revealed that the highest number of publications cited was in 2005, and the highest average citations per article were in 2009 and 2010. The country-level results show that the most productive countries are those that are economically advanced, with the United States as the top country in terms of research production, followed by the United Kingdom, China, Australia, and Canada. Emerging economies such as India and South Africa are also increasing their participation, mainly through international collaboration. Collaboration between the USA and China emerged as one of the strongest international research partnerships in this field. The study also highlights the important role of government funding agencies in supporting influential research. The findings provide empirical evidence to guide library services research, development, and policy planning.

**Keywords:** Library Services Research; Scientometric Analysis; Research Trends; Scholarly Collaboration; G20 Countries

### 1. Introduction

Library services play an important role in information access, academic support, and community engagement in contemporary societies<sup>1,2</sup>. Over the past three decades, library services have changed considerably due to advances in technology, social transformation, and changing user needs<sup>3</sup>. The role of libraries has expanded beyond information storage to include support for learning, research, innovation, and community services<sup>4</sup>. As library services have evolved, research has increasingly focused on service quality, user behavior, digital infrastructure, and evidence-based librarianship. Bibliometric and scientometric methods are widely used to examine research trends, intellectual influence, and collaboration patterns within a field<sup>5</sup>. Systematic analysis of publication trends, citation impact, and institutional contributions can be done with these methods and gives insights into the maturity and trends of a research field.

Scholarly activities vary across countries due to the differences in economic capacity, investments in

research, and institutional priorities<sup>7</sup>. Although library services have undergone major digital changes, relatively few studies have examined the field from a cross-national perspective. This study examines patterns of research productivity and scholarly influence in library services research across G20 countries. Accordingly, this study provides a comprehensive scientometric analysis of library services research published by G20 countries between 1989 and 2023.

### 2. Overview of G20 Countries

The Group of Twenty (G20) is an international forum that brings together 19 countries and the European Union, as well as the African Union, which account for close to 80% of global GDP, and 75% of world trade, and nearly two-thirds of the world's population. The G20 comprises economically advanced countries, such as the United States, the United Kingdom, Germany, Japan, Canada, and Australia, as well as emerging economies such as China, India, Brazil, South Africa, and Indonesia.

The G20 countries account for a substantial share of global research activity and play an important role in shaping international research agendas.

In higher education and research, G20 countries host a significant share of the world's top universities, key funding agencies, and high-impact scholarly journals<sup>6</sup>. Substantial public funding for research and development has enabled these countries to take a leading role in innovation across scientific and social science disciplines. Prior studies have shown a positive relationship between the economic strength of nations and research productivity, especially in knowledge-intensive fields, such as Library and Information Science<sup>8</sup>. However, research output by the G20 countries is uneven, with advanced economies continuing to dominate both the volume of publications and citation impact, while several emerging G20 members, backed by targeted R&D investments and expanding international collaboration, have substantially raised their share of global publications and scientific influence in recent years<sup>9</sup>. Examining library services research within the G20 context helps reveal patterns of research productivity, collaboration, and scholarly influence, as well as the role of economic capacity in supporting scholarly communication.

### 3. Objectives of the study

The specific objectives of the study are:

- i) To examine the year-wise growth and citation impact of library services research produced by G20 countries from 1989 to 2023.
- ii) To analyze the distribution of various document types in library services research.
- iii) To determine the relative growth rate (RGR) and doubling time (Dt) of publications in the field.
- iv) To identify prolific countries, institutions, journals, and funding agencies in the research of library services.
- v) To assess international collaboration patterns and the degree of authorship collaboration over time.
- vi) To estimate future growth trends of library services research using time-series analysis.

### 4. Methodology

The study uses a quantitative scientometric approach and relies entirely on bibliographic data from the Web of Science Core Collection (WoSCC). Data were collected from three major WoSCC citation indexes that are relevant to Library and Information Science, i.e., the Science Citation Index Expanded

(SCI-EXPANDED), the Social Sciences Citation Index (SSCI), and the Arts & Humanities Citation Index (AHCI). The search strategy was designed to maximize the retrieval of relevant literature. A carefully refined set of keywords related to library services was used to develop the search strategy. These terms were chosen from Library of Congress Subject Headings (LCSH) and other common terms used in the LIS. Boolean operators (AND and OR) were used to combine related search terms in the Title (TI) field for the search strategy. The search strategy employed a double-filter approach in which the root term "Librar\*" was combined with 311 related keywords using the Boolean operator AND; the complete list of keywords is provided in the

### Supplementary Material.

These keyterms were categorized into four core dimensions: (1) *Service Management* (e.g., 'Library Service Quality', 'Reference Service', 'Circulation'); (2) *Technology & Access* (e.g., 'Digital Preservation', 'IoT', 'Research Data Management'); (3) *User Demographics* (e.g., 'Visually Impaired', 'LGBTQ', 'Refugees'); and (4) *Outreach & Society* (e.g., 'Community Engagement', 'Makerspaces', 'Social Media'). The complete list of these 311 keywords is available in the supplementary material. A Title (TI) search strategy was adopted instead of a Topic (TS) search strategy to improve retrieval accuracy and reduce the inclusion of less relevant records. This strategy helped maintain thematic consistency across the retrieved records<sup>10</sup>.

The initial search retrieved 7,232 records. To enhance data reliability and relevance, the initial dataset was screened using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework<sup>11</sup> (Fig. 1), resulting in the removal of 476 duplicate and irrelevant documents. The final dataset consisted of 6,756 records for the analysis. Bibliometric indicators, including total publications, citations, relative growth rate, and degree of collaboration, were calculated. Time-series analysis was applied to forecast future trends in publication. Data processing and analysis were conducted using standard bibliometric tools and spreadsheet-based statistical techniques.

### 5. Results

#### 5.1 Year-wise growth

The research output and citation performance of studies on library services in G20 countries from 1989 to 2023 are shown in Table 1. During this period,

6,756 publications were produced, indicating continued research activity in the field. The highest number of publications was recorded in 2005 (241),

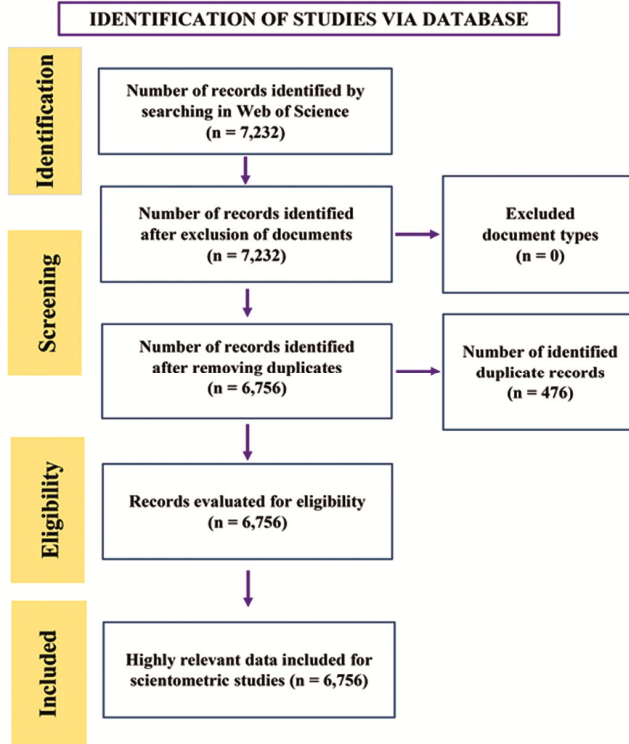


Fig. 1 — PRISMA flowchart showing the data exclusion and inclusion.

followed by 2022 (234), 2021 (223), and 1995 (219). The lowest research output occurred in 1989, when only 141 publications were recorded.

Research output increased steadily between 1989 and 2005, a period that coincided with the growing adoption of digital technologies in libraries. After 2005, publication output fluctuated and showed no consistent upward trend, indicating that the growth in library services research has not been steady. This uneven pattern is further supported by the low  $R^2$  value of 0.185 (Fig. 2), indicating irregular research development over time. The dominance of research articles suggests that original empirical studies remain the primary mode of scholarly communication in this field. Citation analysis showed that publications from 2005 received the highest number of citations with a TC of 1,800, followed by those from 2020 and 2013. The highest average number of citations per publication (C/P) was recorded in 2009 and 2010, suggesting that publications from these years received greater academic attention. The citation data indicate that several publication years produced highly influential studies despite fluctuations in annual output.

## 5.2 Analysis of document types

Table 2 shows the distribution and impact in terms of citations of various types of documents appearing in library services research. Articles are the predominant genre of scholarly communication in library services research (TP = 3,685), with the highest number of citations (49,314) and h-index (79).

Table 1 — Annual publication and citation structure on library services literature

| Year | TP  | TC   | TCP | C/P  | C/CP  | h-index | Year         | TP          | TC           | TCP         | C/P         | C/CP         | h-index |
|------|-----|------|-----|------|-------|---------|--------------|-------------|--------------|-------------|-------------|--------------|---------|
| 1989 | 141 | 194  | 45  | 1.38 | 4.31  | 7       | 2007         | 180         | 1502         | 116         | 8.34        | 12.95        | 23      |
| 1990 | 156 | 383  | 55  | 2.46 | 6.96  | 7       | 2008         | 186         | 1415         | 103         | 7.61        | 13.74        | 20      |
| 1991 | 196 | 288  | 75  | 1.47 | 3.84  | 8       | 2009         | 181         | 1721         | 117         | 9.51        | 14.71        | 20      |
| 1992 | 150 | 277  | 62  | 1.85 | 4.47  | 9       | 2010         | 164         | 1540         | 98          | 9.39        | 15.71        | 20      |
| 1993 | 181 | 415  | 64  | 2.29 | 6.48  | 11      | 2011         | 185         | 1659         | 110         | 8.97        | 15.08        | 22      |
| 1994 | 184 | 381  | 59  | 2.07 | 6.46  | 10      | 2012         | 172         | 1320         | 118         | 7.67        | 11.19        | 20      |
| 1995 | 219 | 1648 | 95  | 7.53 | 17.35 | 16      | 2013         | 202         | 1735         | 122         | 8.59        | 14.22        | 21      |
| 1996 | 187 | 1034 | 86  | 5.53 | 12.02 | 16      | 2014         | 209         | 1725         | 124         | 8.25        | 13.91        | 20      |
| 1997 | 203 | 1147 | 103 | 5.65 | 11.14 | 19      | 2015         | 203         | 1441         | 108         | 7.10        | 13.34        | 19      |
| 1998 | 184 | 1021 | 93  | 5.55 | 10.98 | 18      | 2016         | 209         | 1496         | 135         | 7.16        | 11.08        | 20      |
| 1999 | 188 | 1532 | 98  | 8.15 | 15.63 | 18      | 2017         | 202         | 1311         | 135         | 6.49        | 9.71         | 17      |
| 2000 | 197 | 1703 | 118 | 8.64 | 14.43 | 22      | 2018         | 170         | 1347         | 128         | 7.92        | 10.52        | 18      |
| 2001 | 174 | 1459 | 95  | 8.39 | 15.36 | 18      | 2019         | 214         | 1551         | 152         | 7.25        | 10.20        | 18      |
| 2002 | 208 | 1532 | 110 | 7.37 | 13.93 | 21      | 2020         | 218         | 1783         | 168         | 8.18        | 10.61        | 22      |
| 2003 | 194 | 933  | 108 | 4.81 | 8.64  | 18      | 2021         | 223         | 1261         | 165         | 5.65        | 7.64         | 17      |
| 2004 | 218 | 1517 | 120 | 6.96 | 12.64 | 21      | 2022         | 234         | 981          | 169         | 4.19        | 5.80         | 14      |
| 2005 | 241 | 1800 | 129 | 7.47 | 13.95 | 21      | 2023         | 179         | 500          | 111         | 2.79        | 4.50         | 10      |
| 2006 | 204 | 1561 | 136 | 7.65 | 11.48 | 20      | <b>Total</b> | <b>6756</b> | <b>43113</b> | <b>3830</b> | <b>6.29</b> | <b>11.00</b> |         |

\*TP = Total number of publications; TC = Total number of citations; TCP = Total cited publications; C/P = Average citations per publication; C/CP = Average citations per cited publication

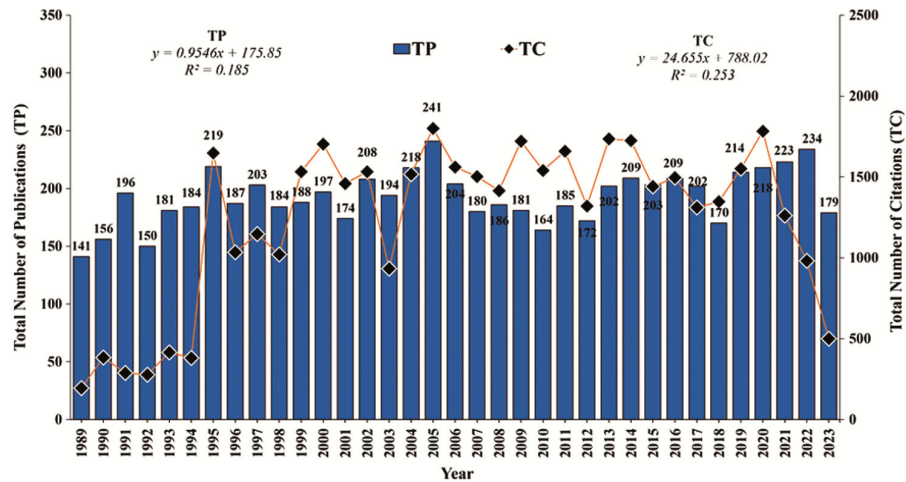


Fig. 2 — Growth trends of library services publications from 1989 to 2023.

Table 2 — Document types for library services research publications

| Documents                | TP   | TC    | C/P   | h-index | h-core |
|--------------------------|------|-------|-------|---------|--------|
| Article                  | 3685 | 49314 | 13.38 | 79      | 13289  |
| Book Review              | 1874 | 660   | 0.35  | 2       | 585    |
| Proceedings Paper        | 436  | 1909  | 4.38  | 19      | 714    |
| Editorial Material       | 329  | 955   | 2.90  | 15      | 404    |
| Meeting Abstract         | 170  | 22    | 0.13  | 2       | 10     |
| Review                   | 90   | 1994  | 22.16 | 23      | 1433   |
| Letter                   | 52   | 103   | 1.98  | 3       | 89     |
| Note                     | 35   | 187   | 5.34  | 6       | 141    |
| Software Review          | 18   | 7     | 0.39  | 1       | 2      |
| Early Access-Article     | 14   | 65    | 4.64  | 5       | 48     |
| Retracted Publication    | 12   | 36    | 3.00  | 4       | 29     |
| Correction               | 6    | 10    | 1.67  | 2       | 9      |
| Bibliography             | 6    | 3     | 0.50  | 1       | 1      |
| Art Exhibit Review       | 5    | 3     | 0.60  | 1       | 2      |
| Reprint                  | 5    | 6     | 1.20  | 2       | 6      |
| News Item                | 5    | 8     | 1.60  | 1       | 7      |
| Database Review          | 5    | 1     | 0.20  | 1       | 1      |
| Biographical-Item        | 4    | 8     | 2.00  | 1       | 6      |
| Discussion               | 3    | 14    | 4.67  | 1       | 14     |
| Item About an Individual | 1    | 0     | 0.00  | 0       | 0      |
| Fiction, Creative Prose  | 1    | 0     | 0.00  | 0       | 0      |

\*TP = Total number of publications; TC = Total number of citations; C/P = Average citations per publication

These findings indicate that research articles remain the primary channel of scholarly communication in library services research within G20 countries. The predominance of research articles reflects the importance of empirical studies in the field. The second most common type of document (1,874) is book reviews, which have very low citation impact, averaging 0.35 citations per publication. Proceedings papers showed a moderate citation impact, with an average C/P of 4.38 citations per publication, indicating that they are used for

disseminating new research. Review articles (90) have the highest citation impact (22.16 citations per article), and also have the highest h-index (23).

This highlights the important role of review articles in synthesizing existing knowledge. Other document types, such as editorials, letters, and notes, account for a relatively small proportion of the total output. The table suggests that research and review articles are the most influential papers in library services research.

Table 3 — Relative Growth Rate (RGR) and Doubling Time (Dt)

| Year | TP  | Cum. | N1    | N2    | RGR   | Dt     | Year         | TP          | Cum. | N1    | N2    | RGR         | Dt           |
|------|-----|------|-------|-------|-------|--------|--------------|-------------|------|-------|-------|-------------|--------------|
| 1989 | 141 | 141  | 0.000 | 4.949 |       |        | 2007         | 180         | 3605 | 8.139 | 8.190 | 0.051       | 13.533       |
| 1990 | 156 | 297  | 4.949 | 5.694 | 0.745 | 0.930  | 2008         | 186         | 3791 | 8.190 | 8.240 | 0.050       | 13.778       |
| 1991 | 196 | 493  | 5.694 | 6.201 | 0.507 | 1.368  | 2009         | 181         | 3972 | 8.240 | 8.287 | 0.047       | 14.862       |
| 1992 | 150 | 643  | 6.201 | 6.466 | 0.266 | 2.609  | 2010         | 164         | 4136 | 8.287 | 8.328 | 0.041       | 17.132       |
| 1993 | 181 | 824  | 6.466 | 6.714 | 0.248 | 2.795  | 2011         | 185         | 4321 | 8.328 | 8.371 | 0.044       | 15.841       |
| 1994 | 184 | 1008 | 6.714 | 6.916 | 0.202 | 3.439  | 2012         | 172         | 4493 | 8.371 | 8.410 | 0.039       | 17.758       |
| 1995 | 219 | 1227 | 6.916 | 7.112 | 0.197 | 3.526  | 2013         | 202         | 4695 | 8.410 | 8.454 | 0.044       | 15.761       |
| 1996 | 187 | 1414 | 7.112 | 7.254 | 0.142 | 4.887  | 2014         | 209         | 4904 | 8.454 | 8.498 | 0.044       | 15.915       |
| 1997 | 203 | 1617 | 7.254 | 7.388 | 0.134 | 5.167  | 2015         | 203         | 5107 | 8.498 | 8.538 | 0.041       | 17.089       |
| 1998 | 184 | 1801 | 7.388 | 7.496 | 0.108 | 6.432  | 2016         | 209         | 5316 | 8.538 | 8.579 | 0.040       | 17.282       |
| 1999 | 188 | 1989 | 7.496 | 7.595 | 0.099 | 6.981  | 2017         | 202         | 5518 | 8.579 | 8.616 | 0.037       | 18.586       |
| 2000 | 197 | 2186 | 7.595 | 7.690 | 0.094 | 7.339  | 2018         | 170         | 5688 | 8.616 | 8.646 | 0.030       | 22.844       |
| 2001 | 174 | 2360 | 7.690 | 7.766 | 0.077 | 9.050  | 2019         | 214         | 5902 | 8.646 | 8.683 | 0.037       | 18.768       |
| 2002 | 208 | 2568 | 7.766 | 7.851 | 0.085 | 8.206  | 2020         | 218         | 6120 | 8.683 | 8.719 | 0.036       | 19.110       |
| 2003 | 194 | 2762 | 7.851 | 7.924 | 0.073 | 9.518  | 2021         | 223         | 6343 | 8.719 | 8.755 | 0.036       | 19.367       |
| 2004 | 218 | 2980 | 7.924 | 8.000 | 0.076 | 9.124  | 2022         | 234         | 6577 | 8.755 | 8.791 | 0.036       | 19.134       |
| 2005 | 241 | 3221 | 8.000 | 8.077 | 0.078 | 8.913  | 2023         | 179         | 6756 | 8.791 | 8.818 | 0.027       | 25.813       |
| 2006 | 204 | 3425 | 8.077 | 8.139 | 0.061 | 11.287 | <b>Total</b> | <b>6756</b> |      |       |       | <b>0.11</b> | <b>11.89</b> |

\*TP = Total number of publications

### 5.3 Relative Growth Rate (RGR) and Doubling Time (Dt)

Table 3 shows that research publications on library services in the G20 have slowed over time. The Relative Growth Rate (RGR) declined steadily from 0.745 in 1989 to 0.027 in 2023. This means that new publications are being added at a much slower rate than in earlier years.

In contrast, the Doubling Time (Dt) has increased from 0.930 in 1989 to 25.813 in 2023, with an average of 11.89. This indicates that, despite the declining growth rate, the overall volume of library services research continues to grow steadily, albeit at a slower pace.

### 5.4 Time Series Analysis

Time series analysis is a statistical method for analyzing data recorded over time. It helps identify patterns and make predictions about future trends. This method is used to track the growth and development of research contributions in library services across G20 countries, as shown in Table 4.

This study applies the straight-line equation in time series analysis to predict the growth of library services research publications.

Straight-line equation:

$Y = a + bX$ , Since  $\sum X = 0$ , where  $Y$  represents predicted publications,  $a$  is the intercept,  $b$  is the slope coefficient, and  $X$  represents time.

$$a = \frac{\sum Y}{N}, \text{ where, } \sum Y$$

= Total Number of Publications (TP), i.e. 6,756 &

$N$  = Number of Years, i.e. 35 Years

$$b = \frac{\sum XY}{\sum X^2}, \text{ where, } \sum XY$$

= Total Number of  $XY$ , i.e. 3,565 &

$\sum X^2$  = Total of  $X^2$ , i.e. 3885

$$a = \frac{\sum Y}{N} = \frac{6756}{35} = 193.028; b = \frac{\sum XY}{\sum X^2} = \frac{3565}{3885} = 0.9176$$

The estimated number of publications in library services research for 2035 is:

When  $X = 2035 - 2015 = 20$ , where 2015 represents the midpoint year of the dataset.

$$Y = a + bX = 193.028 + 0.9176 * 20 = 211$$

The estimated number of publications in library services research for 2040 is:

When  $X = 2040 - 2015 = 25$

$$Yc = a + bX = 193.028 + 0.9176 * 25 = 216$$

The projections indicate a modest increase in publication output among G20 countries over the coming years. By 2035, G20 countries are expected to collectively produce around 211 scientific articles on the subject, with a slight increase to 216 projected by 2040.

### 5.5 Prolific Countries

A total of 75 countries collaborated to produce research publications on library services in G20 countries. Table 5 presents the top 10 G20 countries, ranked by position. The USA was the most productive country, contributing 3,475 publications during the

Table 4 — Time series analysis for the G20 countries

| Year | TP (Y) | X     | X2  | XY      | Year         | TP (Y)      | X    | X2          | XY          |
|------|--------|-------|-----|---------|--------------|-------------|------|-------------|-------------|
| 1989 | 141    | -17.5 | 306 | -2467.5 | 2007         | 180         | 1.5  | 2           | 270         |
| 1990 | 156    | -16.5 | 272 | -2574   | 2008         | 186         | 2.5  | 6           | 465         |
| 1991 | 196    | -15.5 | 240 | -3038   | 2009         | 181         | 3.5  | 12          | 633.5       |
| 1992 | 150    | -14.5 | 210 | -2175   | 2010         | 164         | 4.5  | 20          | 738         |
| 1993 | 181    | -13.5 | 182 | -2443.5 | 2011         | 185         | 5.5  | 30          | 1017.5      |
| 1994 | 184    | -12.5 | 156 | -2300   | 2012         | 172         | 6.5  | 42          | 1118        |
| 1995 | 219    | -11.5 | 132 | -2518.5 | 2013         | 202         | 7.5  | 56          | 1515        |
| 1996 | 187    | -10.5 | 110 | -1963.5 | 2014         | 209         | 8.5  | 72          | 1776.5      |
| 1997 | 203    | -9.5  | 90  | -1928.5 | 2015         | 203         | 9.5  | 90          | 1928.5      |
| 1998 | 184    | -8.5  | 72  | -1564   | 2016         | 209         | 10.5 | 110         | 2194.5      |
| 1999 | 188    | -7.5  | 56  | -1410   | 2017         | 202         | 11.5 | 132         | 2323        |
| 2000 | 197    | -6.5  | 42  | -1280.5 | 2018         | 170         | 12.5 | 156         | 2125        |
| 2001 | 174    | -5.5  | 30  | -957    | 2019         | 214         | 13.5 | 182         | 2889        |
| 2002 | 208    | -4.5  | 20  | -936    | 2020         | 218         | 14.5 | 210         | 3161        |
| 2003 | 194    | -3.5  | 12  | -679    | 2021         | 223         | 15.5 | 240         | 3456.5      |
| 2004 | 218    | -2.5  | 6   | -545    | 2022         | 234         | 16.5 | 272         | 3861        |
| 2005 | 241    | -1.5  | 2   | -361.5  | 2023         | 179         | 17.5 | 306         | 3132.5      |
| 2006 | 204    | 0.5   | 0   | 102     | <b>Total</b> | <b>6756</b> |      | <b>3885</b> | <b>3565</b> |

\*TP = Total number of publications

Table 5 — Prolific countries with their citations on library services research.

| Rank | Country        | Continent     | Status      | GDP<br>(2023) | TP   | TC    | C/P   |
|------|----------------|---------------|-------------|---------------|------|-------|-------|
| 1.   | USA            | North America | G20; G7     | \$27.72 T     | 3475 | 31571 | 9.09  |
| 2.   | United Kingdom | Europe        | G20; G7     | \$3.38 T      | 658  | 5784  | 8.79  |
| 3.   | China          | Asia          | G20         | \$17.79 T     | 486  | 5955  | 12.25 |
| 4.   | Australia      | Australia     | G20         | \$1.73 T      | 337  | 2277  | 6.76  |
| 5.   | Canada         | North America | G20; G7     | \$2.14 T      | 280  | 3227  | 11.53 |
| 6.   | Germany        | Europe        | G20; EU; G7 | \$4.53 T      | 198  | 2142  | 10.82 |
| 7.   | South Africa   | Africa        | G20         | \$380.7 B     | 159  | 659   | 4.14  |
| 8.   | India          | Asia          | G20         | \$3.57 T      | 118  | 1024  | 8.68  |
| 9.   | Japan          | Asia          | G20; G7     | \$4.2 T       | 102  | 892   | 8.75  |
| 10.  | South Korea    | Asia          | G20         | \$1.71 T      | 89   | 790   | 8.88  |

\*TP = Total number of publications; TC = Total number of citations; C/P = Average citations per publication; GDP = Gross Domestic Product

study period which shows that researchers from the USA have made the largest contribution to library services research among G20 nations, followed by the United Kingdom (TP = 658), China (TP = 486), Australia (TP = 337), Canada (TP = 280), Germany (TP = 198), South Africa (TP = 159), India (TP = 118), Japan (TP = 102) and South Korea (TP = 89), respectively.

Regarding the total number of citations (TC) received by the respective countries, research publications from the USA received the maximum number of citations with a TC of 31,571, followed by China (TC = 5,955), the United Kingdom (TC = 5,784), Canada (TC = 3,227), Australia (TC = 2,277), and Germany (TC = 2,142), respectively. These countries also recorded the highest citation counts during the study period.

Due to their strong economic capacity and sustained investment in research and development, and innovation, these countries produce a high number of research publications. Among the G20 countries, the USA has the largest economy (\$27.72 trillion), followed by China (\$17.79 trillion), Germany (\$4.53 trillion), Japan (\$4.2 trillion), and India (\$3.57 trillion). The countries with higher GDPs generally have more research published about library services, which indicates that financial resources are important to the production of research on library services<sup>12</sup>. However, economic power is not enough to account for the performance of research. For instance, although South Africa's economy is not as large as some other countries, it has demonstrated strong research activity in the field of Library Services. This suggests that factors beyond economic

Table 6 — Collaborated frequency of the top 40 collaborating countries.

| R. |                | Between        | Freq. | R. |                | Between     | Freq. |
|----|----------------|----------------|-------|----|----------------|-------------|-------|
| 1  | USA            | China          | 77    | 21 | USA            | India       | 7     |
| 2  | USA            | Canada         | 38    | 22 | USA            | New Zealand | 7     |
| 3  | USA            | United Kingdom | 28    | 23 | USA            | Spain       | 7     |
| 4  | South Africa   | Ghana          | 15    | 24 | China          | Canada      | 6     |
| 5  | USA            | Japan          | 15    | 25 | USA            | Brazil      | 6     |
| 6  | China          | Australia      | 12    | 26 | USA            | France      | 6     |
| 7  | United Kingdom | China          | 12    | 27 | Australia      | New Zealand | 5     |
| 8  | USA            | Germany        | 12    | 28 | South Africa   | Nigeria     | 5     |
| 9  | USA            | Italy          | 12    | 29 | United Kingdom | Italy       | 5     |
| 10 | Saudi Arabia   | Pakistan       | 10    | 30 | Brazil         | Spain       | 4     |
| 11 | China          | Japan          | 9     | 31 | Canada         | Japan       | 4     |
| 12 | United Kingdom | Canada         | 9     | 32 | Canada         | New Zealand | 4     |
| 13 | China          | Pakistan       | 8     | 33 | South Africa   | Tanzania    | 4     |
| 14 | United Kingdom | New Zealand    | 8     | 34 | United Kingdom | Ireland     | 4     |
| 15 | USA            | Australia      | 8     | 35 | United Kingdom | Netherlands | 4     |
| 16 | USA            | South Korea    | 8     | 36 | USA            | Belgium     | 4     |
| 17 | USA            | South Africa   | 8     | 37 | USA            | Mexico      | 4     |
| 18 | United Kingdom | Australia      | 7     | 38 | USA            | Poland      | 4     |
| 19 | United Kingdom | Germany        | 7     | 39 | Canada         | Germany     | 3     |
| 20 | United Kingdom | Spain          | 7     | 40 | Canada         | Nigeria     | 3     |

\*R. = Rank; Freq. = Frequency

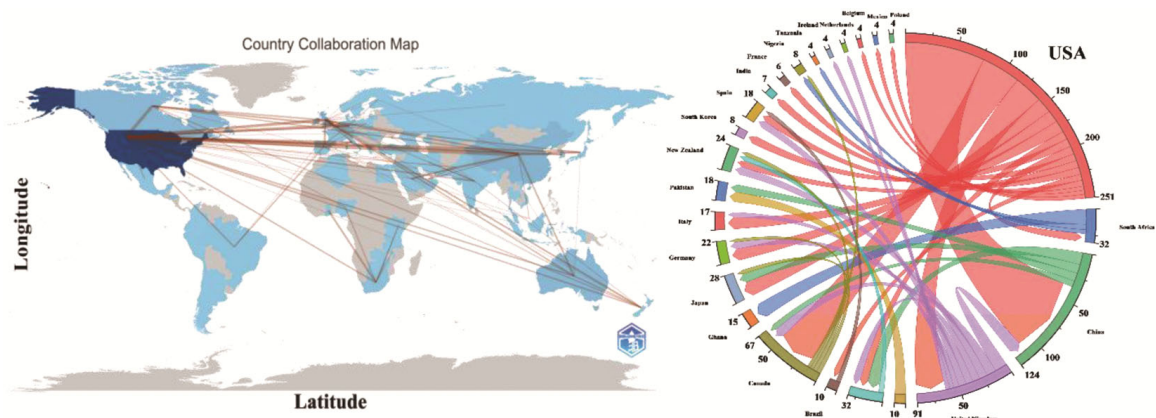


Fig. 3 — G20 countries collaboration network in library services publications.

size may also influence research productivity<sup>13</sup>. The findings indicate that several emerging economies are contributing more actively to library services research than in previous decades.

### 5.6 Collaborative perspective of countries

The countries that actively partnered with G20 nations in library services research are highlighted in Table 6. Major collaborations include the USA–China (77 publications), USA–Canada (38), and USA–United Kingdom (28), South Africa–Ghana (15), USA–Japan (15), China–Australia (12), United Kingdom–China (12), the USA–Germany (12), and USA–Italy (12), respectively. The USA and Canada were among the most

active collaborators, maintaining research partnerships with both developed and developing countries.

Fig. 3 shows the network of collaboration between the G20 countries in the field of library services research. The world map illustrates collaborative links among countries, whereas the chord diagram highlights the strength of these collaborations. Larger segments and thicker links in the network indicate stronger and more frequent research collaborations<sup>14</sup> show more intensive and frequent research partnerships, particularly in the USA. The network shows that collaboration is concentrated around a small group of highly connected countries.

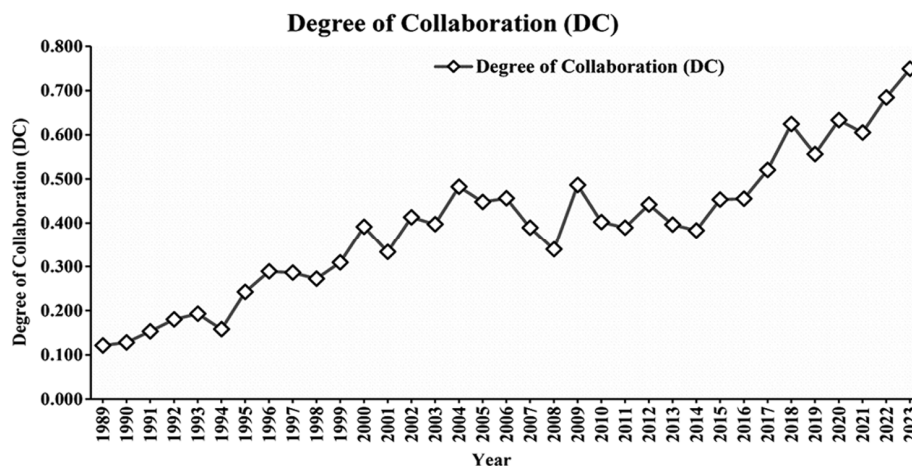


Fig. 4 — Year-wise trends of Degree of Collaboration (DC) from 1989 to 2023.

### 5.7 Degree of collaboration

The degree of collaboration (DC) in library services research in the past three decades (1989–2023) is given in Table 7, which is derived from the formula adopted by Subramanyam (1971)<sup>15</sup>. During the first few years of this study, most of the research was carried out by a single author. In the early years of the study, for example, there was little collaboration in 1989 (DC = 0.121) and not much above 0.20 until 1993.

There was a gradual increase in collaboration from the mid-1990s. The DC rose to 0.242 in 1995 and continued to improve, reaching 0.309 in 1999 (Fig. 4). By the early 2000s, collaborative authorship had become increasingly common. The degree of collaboration reached 0.482 in 2004, indicating a substantial increase in multi-authored publications. After 2010, collaborative authorship continued to increase. DC values exceeded 0.40 in most years and crossed 0.60 in 2018 (0.624), 2020 (0.633), 2021 (0.605), and 2022 (0.684). Collaborative research significantly outnumbered other forms of research, with the highest degree of collaboration in 2023 (DC 0.749). The average degree of collaboration throughout the period is 0.402, which indicates that there has been a gradual shift towards collaborative research in the provision of library services over time.

### 5.8 Prolific Journals

Table 8 lists the top 30 journals that have published the most research on library services between 1989 and 2023. The journal that published the highest number of documents is the *Journal of Academic Librarianship*, with 536 papers, and also received the most citations, at 4,840. The *Library Journal* comes

next with 315 papers and 655 citations. Other highly productive journals include *College & Research Libraries*, *Electronic Library*, and *Journal of the Medical Library Association*. Regarding the average number of citations per publication (C/P), *Library Trends* ranks highest at 11.49 citations per article. Other top journals in this category include *Library Hi Tech* (11.38), *Library & Information Science Research* (11.36), and *Information Technology and Libraries* (10.03), respectively. According to the 2024 Journal Impact Factor (JIF) report, *Journal of the Medical Library Association* has the highest impact factor of 2.9. Seven journals listed in Table 8 were not assigned an impact factor in the 2024 Journal Citation Reports.

### 5.9 Prolific Institutions

From 1989 to 2023, 2,639 institutions contributed to 6,756 library services research publications. Table 9 lists the top 10 most productive institutions by publication count. The University of Illinois (USA) leads with 137 publications, followed by the University of Wisconsin (USA), each with 76 publications, and Rutgers University (USA) with 69 publications. Wuhan University (China) ranks fifth with 62 publications.

In total citations, the University of Illinois received the most, with 1,693, followed by Indiana University (1,303), the University of North Carolina (1,112), the University of Wisconsin (1,076), and the University of Maryland (1,037). Although Indiana University ranks tenth in publication output among the institutions examined, it records the highest average citations per publication (C/P) of 28.33 among the institutions listed. The study also checked the ranking

Table 8 — Prolific journals on library services research with their citation impact.

| Journal                                               | Publisher                      | TP  | TC   | C/P   | PY-start | IF-2024 | Q  |
|-------------------------------------------------------|--------------------------------|-----|------|-------|----------|---------|----|
| Journal of Academic Librarianship                     | Elsevier                       | 536 | 4840 | 9.03  | 1989     | 2.5     | Q1 |
| Library Journal                                       | Reed Business Information      | 315 | 655  | 2.08  | 1989     | 1.6     | NA |
| College & Research Libraries                          | ACRL                           | 269 | 2236 | 8.31  | 1989     | 1.4     | Q1 |
| Electronic Library                                    | Emerald Group Publishing Ltd.  | 224 | 1530 | 6.83  | 1989     | 1.5     | Q2 |
| Journal of the Medical Library Association            | Medical Library Association    | 204 | 1653 | 8.10  | 2002     | 2.9     | Q1 |
| Journal of Librarianship and Information Science      | SAGE Publications Ltd          | 199 | 1257 | 6.32  | 1991     | 1.4     | Q1 |
| Library Quarterly                                     | University of Chicago          | 196 | 976  | 4.98  | 1989     | 1.6     | Q1 |
| Reference & User Services Quarterly                   | ALA                            | 191 | 626  | 3.28  | 1997     | NA      | Q3 |
| Library Trends                                        | Johns Hopkins University Press | 173 | 1988 | 11.49 | 1989     | 0.3     | Q3 |
| Library Hi Tech                                       | Emerald Group Publishing Ltd.  | 154 | 1752 | 11.38 | 1995     | NA      | Q1 |
| Library Resources & Technical Services                | ALA                            | 149 | 476  | 3.19  | 1989     | 0.6     | Q2 |
| Information Technology and Libraries                  | ALA                            | 147 | 1475 | 10.03 | 1989     | 1.5     | Q2 |
| Library & Information Science Research                | Elsevier                       | 139 | 1579 | 11.36 | 1989     | 2.4     | Q2 |
| Portal-Libraries and the Academy                      | Johns Hopkins University Press | 137 | 975  | 7.12  | 2001     | 0.8     | NA |
| Library Acquisitions-Practice and Theory              | Elsevier                       | 114 | 131  | 1.15  | 1989     | NA      | NA |
| Journal of Documentation                              | Emerald Group Publishing Ltd.  | 112 | 656  | 5.86  | 1989     | 1.7     | Q1 |
| Bulletin of the Medical Library Association           | Medical Library Association    | 106 | 537  | 5.07  | 1989     | NA      | NA |
| Program-Electronic Library and Information Systems    | Emerald Group Publishing Ltd.  | 103 | 560  | 5.44  | 1996     | NA      | NA |
| Library Collections Acquisitions & Technical Services | Taylor & Francis               | 92  | 483  | 5.25  | 1999     | NA      | NA |
| Australian Library Journal                            | Taylor & Francis               | 90  | 246  | 2.73  | 2009     | NA      | NA |

\*TP = Total number of publications; TC = Total number of citations; C/P = Average citations per publication; PY-Start = Publication Year-Start; Q = Quartile; NA = Not Available

Table 9 — Top 30 prolific institutions in library services research publications.

| Institution                   | Country | TP  | TC   | C/P   | QS (2024) | THE (2024) |
|-------------------------------|---------|-----|------|-------|-----------|------------|
| University of Illinois        | USA     | 137 | 1693 | 12.36 | 64        | 42         |
| University of North Carolina  | USA     | 76  | 1112 | 14.63 | =132      | 72         |
| University of Wisconsin       | USA     | 76  | 1076 | 14.16 | 102       | 63         |
| Rutgers University            | USA     | 69  | 1001 | 14.51 | 299       | 201-250    |
| Wuhan University              | China   | 62  | 727  | 11.73 | 194       | =164       |
| University of Maryland        | USA     | 60  | 1037 | 17.28 | =169      | 114        |
| Pennsylvania State University | USA     | 52  | 450  | 8.65  | 83        | 122        |
| Texas A&M University          | USA     | 49  | 917  | 18.71 | =134      | 118        |
| University of Tennessee       | USA     | 49  | 454  | 9.27  | =446      | 301-350    |
| Indiana University            | USA     | 46  | 1303 | 28.33 | =313      | 198        |

\*TP = Total number of publications; TC = Total number of citations; C/P = Average citations per publication; QS = Quacquarelli Symonds; THE = Times Higher Education

of the institutions in the global university lists of 2024. Most of the highly productive institutions are located in economically developed countries.

#### 5.10 Research Publication Funding

The funding agencies for library services research publications are listed in Table 10. The leading funding body is the National Institutes of Health (NIH) of the USA, with 64 publications (31.99%) and 2161 citations, giving it a very high C/P of 33.77.

This reflects the substantial contribution of NIH-funded studies to the field. The National Natural Science Foundation of China (NSFC) was the second most active funding agency in terms of publication support by funding 48 publications, which have garnered 690 citations, yielding a C/P ratio of 14.38. The Institute of Museum and Library Services (IMLS) in the USA and the National Social Science Foundation of China (NSSFC) are other important agencies in which IMLS has funded 38 publications and produced 357 citations, while NSSFC has funded

Table 10 — Top funders in library services research publications.

| Funders                                                           | Country      | Organization Type | TP | TC   | C/P   | % Funded Publications |
|-------------------------------------------------------------------|--------------|-------------------|----|------|-------|-----------------------|
| National Institutes of Health (NIH)                               | USA          | Government        | 64 | 2161 | 33.77 | 31.99                 |
| National Natural Science Foundation of China (NSFC)               | China        | Government        | 48 | 690  | 14.38 | 10.21                 |
| Institute for Museum and Library Services (IMLS)                  | USA          | Government        | 38 | 357  | 9.39  | 5.28                  |
| National Social Science Foundation of China (NSSFC)               | China        | Government        | 29 | 395  | 13.62 | 5.85                  |
| National Research Foundation of Korea (NRF)                       | South Korea  | Government        | 12 | 74   | 6.17  | 1.10                  |
| China Scholarship Council (CSC)                                   | China        | Government        | 10 | 101  | 10.10 | 1.49                  |
| Konkuk University (KU)                                            | South Korea  | Private           | 4  | 33   | 8.25  | 0.49                  |
| The University of Hong Kong (HKU)                                 | Hong Kong    | Government        | 3  | 107  | 35.67 | 1.58                  |
| King Saud University (KSU)                                        | Saudi Arabia | Government        | 2  | 110  | 55.00 | 1.63                  |
| Social Sciences and Humanities Research Council of Canada (SSHRC) | Canada       | Government        | 2  | 41   | 20.50 | 0.61                  |

\*TP = Total number of publications; TC = Total number of citations; C/P = Average citations per publication

29 publications and produced 395 citations, each of which has an average of 13.62 C/P.

Among the international contributors, South Korea's National Research Foundation (NRF) and China Scholarship Council (CSC) have funded 12 and 10 publications, respectively. Although their total publication counts are relatively modest, they reflect the growing investments in library science research by South Korea and China. The University of Hong Kong (HKU) recorded a C/P value of 35.67 despite supporting only three publications. Similarly, King Saud University (KSU) in Saudi Arabia recorded the highest C/P of 55.00, although with only 2 publications.

All but one of the leading funders are government-supported institutions, underscoring the crucial role of public funding in advancing library services research. The results indicate that government-supported agencies account for a substantial share of funded publications in the field. The NIH in the USA encompasses 21 institutes and 6 centers, including the National Library of Medicine (NLM). The large share of NIH-funded publications (31.99% of funded output) suggests a strong connection between library services research and health-related information services. The results show a gradual shift from single-authored publications to collaborative research. This trend is further supported by the fact that medical-related papers within the LIS domain consistently garner higher citation counts than general library management studies<sup>16</sup>. These findings highlight the growing contribution of health-related library research within the broader LIS field.

## 6 Discussion

The findings indicate that research on library services has grown in the G20 countries during the past 35 years (1989–2023), with unevenly distributed growth. During this period, 6,756 publications were published. The number of papers increased significantly in some years, e.g., 2005 (241) and 2022 (234), but not continuously. This is because an  $R^2$  value of 0.185 for this pattern shows that there is no strong and steady increase, and the growth is irregular.

Citation analysis revealed changes in research impact over time. Papers published in the year 2005 were cited the most (1,800 citations), and papers published in 2009 and 2010 had the most citations per paper (C/P) of 9.51 and 9.39, respectively. This period coincided with a growing emphasis on user-centered and digital library services. Recent research has also demonstrated that 'Research Support Services,' including Research Data Management (RDM) and Open Access support, are now considered vital to the assessment of library quality<sup>17,18</sup>. Furthermore, emerging technologies such as Artificial Intelligence (AI) and the Internet of Things (IoT) are increasingly influencing library operations and service delivery<sup>19</sup>.

Although publication output has increased in recent years, citation counts have declined after 2020, possibly because the newer papers have not had the time to attract citations, and possibly because more papers are being published in recent years, leading to a lower average citation impact. The document-type analysis supports this observation. Research articles

are the most common type of publication, representing 54.6% of the total (3,685 papers). Review papers (90 papers) are few but have the highest impact (22.16 C/P), strong h-index (23 papers), and indicate their importance in summarizing and guiding research. Book reviews, on the other hand, do not seem to have had a large impact on research, as there are many of them (1,874 papers) but few citations (0.35 citations per paper).

The results indicate a gradual shift toward collaborative forms of research. Only a single author wrote more of the earlier studies; multi-author studies are becoming more frequent. Most of the authors collaborated with others, with a degree of collaboration of 0.402. The change over a long period of time is evident, too, as collaboration has grown from 0.121 in 1989 to 0.749 in 2023, showing a more collaborative team and international cooperation. This is confirmed by data for the country.

The strong research partnership between the USA and China is reflected in their 77 jointly authored publications. The findings suggest that international collaboration is increasingly associated with research visibility and impact. Velez-Estevez *et al.*<sup>20</sup> state that international efforts on LIS provide greater visibility and consequent citation impact than research undertaken only in the domestic context. The collaboration data indicate increasing research links among G20 countries over time. The funding analysis reveals that government funding is significant in supporting high-impact research. The funding of applied and service-oriented studies has been important in the development of such research as library service, especially for long-term studies and collaborative research, which is difficult with private funds.

### 7. Limitations and Future Research Directions

This study is a comprehensive longitudinal study, but it has limitations. The data were limited to the Web of Science Core Collection (WoSCC) only. Some regional literature from non-English speaking G20 countries may be under-represented in WoSCC, e.g., literature from Brazil and Indonesia that is more likely to be covered in Scopus or local databases. Secondly, the use of a Title-only (TI) search strategy was essential to ensure the high level of precision required, but might have missed publications in which the term “library services” was only used in the abstract. Comparative analysis with Scopus and Dimensions data should be investigated in future

work to see if it can provide a wider range of grey literature and policy documents.

### 8. Conclusion

This study provides empirical evidence on the growth, structure, and impact of library services research in G20 countries between 1989 and 2023. The findings show that research output has expanded over time, although growth has been uneven across years and countries. Economically developed countries continue to dominate publication output and citation impact, while several emerging economies have increased their research presence through international collaboration and targeted investment. The dominance of research articles and the high citation impact of review papers demonstrate their important roles in scholarly communication. The steady rise in collaborative authorship and international partnerships further reflects the growing interconnectedness of library services research. In addition, the findings suggest that public funding and institutional support contribute substantially to research productivity and impact. By identifying publication trends, leading contributors, and collaboration patterns, this study provides a useful overview of the development of library services research in G20 countries.

### Statements & Declarations

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### Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

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