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Development of a Novel Metric for Productivity Assessment of Researchers using Bibliometric Data

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The assessment of researchers' performance is vital in the research community, particularly in identifying influential authors through their publications. Despite the availability of various bibliometric metrics/models for evaluating researcher performance, each has limitations and field-specific sensitivities. This study introduces a novel metric, the Author Performance Indicator (AuthorPerIndic), which assesses scientists' productivity based on authorship status and journal ratings for a fair evaluation within their research domain. Validated using publication data from selected scientists at ICAR-Indian Agricultural Statistics Research Institute (IASRI), New Delhi, India. The bibliographic data is sourced from an online publication repository the KRISHI portal, this metric is also integrated into a web tool named as KRISHI-BAAT accessible at http://biblio.icar.gov.in/. The tool operates solely on publication data of ICAR scientists, with the developed metric integrated into its performance analysis.

Keywords: Science Citation Index, Bibliometrics, Impact Factor, Research Evaluation, h-Index, Performance Indicator

Introduction

Assessing the performance of any researcher has been a fundamental aspect in research community based on their research papers published in research journals, preferably in standard indexed ones. Evaluating the performance of any researcher is a basis of many crucial decisions such as claiming awards, identifying potential reviewers, applying for grants and funds from various funding agencies. Studies have been conducted to showcase the impact of assessments at a micro-level in universities or research organizations in many ways. It is observed that these assessments aid in monitoring and auditing mechanisms, sanctioning of grants to individual as well as groups[1].

Quality research has always been prioritized in research institutions due to the increase in competition among researchers and importance in global scholarly rankings[2]. Regular evaluations and reviews are conducted by the authorities to keep their research output relevant to the academic institutions or industries. Often, the evaluations are based on traditional methods such as number of research papers and rating of the journals, h-index, i-10 index etc. Furthermore, it is also a difficult task for universities or institutes to find qualified experts or reviewers who would devote enough efforts in reviewing the

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publications in order to evaluate performance of researchers[3]. The process is generally perceived as 'black-box' due to absence of any standard benchmarks and software tool. Hence, the experts need to adopt a method that can provide objective and more transparent assessment of the researchers[4]. These methods include quantification of researcher's publications which provide an impartial assessment.

Quantification of research work is the primary functionality of bibliometric studies[5]. These studies use quantifiable indicators to conduct performance analysis of researchers, laboratories, institutions, countries etc.[6]. One of the integral aspect of such studies is to measure researchers' performance based on bibliometric meta data of their publications. Metrics such as total number of research papers, total number of citations and citations per paper of a researcher are the basic and straightforward indicators followed by more sophisticated metrics like h-index, g-index, i10-index[7,8].

Use of bibliometric meta data as a part of research evaluation along with literature reviews are being actively used in countries like Australia, Norway, UK and Italy. It has been observed that the inclusion of bibliometric analysis led to frequent monitor of research output which otherwise takes years if it solely depends on peer review[3]. This will be simple, independent, flexible and less costly method. Despite all the benefits, the relationship between bibliometric analysis and peer review methods are yet to be established[9]. An Italian study concluded that bibliometric based evaluation significantly coincided with peer review evaluation in the disciplines of Economics, Management and Statistics based on the number of publications along with bibliometric meta data[3]. The time taken by bibliometric based evaluation is comparatively less than the traditional peer review process.

Bibliometric based evaluation of any researcher is effective, but it cannot entirely replace peer review evaluation. In order to take pivotal decisions like funding or promotion, bibliometric analysis of publications cannot completely be relied upon[9,10]. However, this can be used as an initial step to screen out few researchers from a larger pool, thereby making the assessment process easier. These indicators aid reviewers in making informed decisions. The conflicts among panel reviewers can be addressed through the use of such indicators. Hence, reviewers make their decisions based on the value of these indicators accordingly[9].

The aim of this study is to develop a novel performance indicator at the level of individual researcher. The indicator is termed as Author Performance Indicator (AuthorPerIndic). It is designe d to quantify a researcher's work by taking into account their authorship status in the research paper for an impartial and fair assessment. The authorship status is related to the contribution of any researcher in the publication. Generally, it is specified as senior author, co-author and corresponding author in the research publication. Therefore, an appropriate weightage needs to be given for authorship status in the publications. On the other hand, it is also very important to consider the rating or impact factor of the journal in which the research paper is published. Hence, the proposed metric considers the authorship status as well as rating or impact factor of the journal.

The score of the journal is termed as Impact Factor (IF) which signifies its importance in the research community[11]. A publication in a higher IF journal is considered as a good quality work. This claim has been backed by a research conducted in the discipline of Economics publication dataset[12]. A high correlation was observed between the journal IF and citation counts of the publication in the three years after its publication. Hence, recently published articles which are likely to have less citations, can be assessed using journal score in which they are published.

AuthorPerIndic utilizes both the authorship of a researcher in the publication and score of the journal. It is the overall sum of product of authorship status and journal score for all the papers of a particular author. This study explores the applicability of the proposed indicator based on the NAAS score developed by National Academy of Agricultural Sciences (NAAS, India) and impact factor calculated by Clarivate Web of Science (WoS) and Scopus. The NAAS score is mainly assigned to National and International Journals related to Agriculture. This score is being currently used in Indian Council of Agricultural Research (ICAR) for assessment as well as recruitment of scientists in various positions. In this study, a web based bibliometric analysis tool known as KRISHI-BAAT Bibliometric Author Analysis Tool available at http://biblio.icar.gov.in/ has been developed that utilizes AuthorPerIndic as a part of performance analysis of scientists working at ICAR - Indian Agricultural Statistics Research Institute (IASRI), New Delhi.

The paper is structured in following manner. Section 2 highlights existing bibliometric indicators commonly

used in assessing researchers along with a detailed analysis of national/international level research evaluation systems in India and other countries. Section 3 describes various resources used to develop the novel indicator. Section 4 discusses the developed web tool and results of the proposed indicator by considering the publication dataset of few agricultural researchers.

Related Work

This section details an extensive review of previous research conducted in the field of bibliometric analysis. The first part of the review deals with various metrics and indicators developed to quantify research output at the author level. Second part consists of country level research evaluation systems which utilize bibliometric analysis as the fundamental component for their evaluation process. Lastly, a brief review of the software tools available to carry out bibliometric and scientometric analyses.

Bibliometric Indicators

Various metrics and indicators have been in use since the introduction of bibliometric analysis[13]. Wildgaard in 2014[14] conducted an investigation by evaluating 108 bibliometric indicators at the author's level. These indicators were categorized into five categories based on their evaluation methods and complexity. For the present needs, a review has been done and these indicators were categorised based on their data requirement namely publication count, citation counts and others. A summary of some prominent indicators are shown in Table 1.

Publication count

Majority of indicators depend on publication counts of an author. Major indicators follow a methodology where all co-authors in a publication receive equal credit. Another indicator namely, Noblesse oblige accounts the specific authorship roles, i.e., First Author (FA) and Last Author (LA) receives credit. There exist indicators that credit weighted publication count to researchers based on different type of publications, one of them is patent application indicator[15]. Weighted contributions are also calculated according to the authorship status of researchers in a publication as seen in the methods like geometric counting and harmonic counting[14].

Citation counts

Citation counts of any publication highly relies on indexing in various publication repository. It measures the impact of a researcher's work. The citation count of any paper is the number of times a particular paper has been cited by various authors in their publications. There are many such indicators developed based on citation per paper (CPP), field citation score mean (FCSm), Journal Citation Score mean (JCSm), Maximum Citation (MaxC) and i-10 index [13,16]. These metrics specifically consider the citation per paper without assigning any weightage to the authorship status.

The most commonly used indicator in any researcher's resume is the h-index[7]. Variations of h-index have also been developed such as n-index[17] for cross field author comparisons and POPh[18] which includes co-authorship contributions to h-index. The h-index opened the doors for the development of few more metrics such as m-index[19], e-index[20], h^2-index[21], hmx index [22], Hg-index[23]. However, these indicators face similar challenges with respect to authorship status in the papers or citation count[14]. In addition to these, many other indicators have also been developed such as w-index[24], g-index[8], f-index and t-index[25] which are independent of h-index.

Others

This category of indicators is sophisticated in nature and determined by combining other statistics in developing long term predictors. Prediction of article impact index[12] uses cumulative citations count and journal Impact Factor of an article to predict long term citations. Indicators such as AR index[26], m quotient[7], Age Weighted Citation Rate (AWCR) [27], Price Index[28] provide an overview of impact over time, and these indicators are normalized according to researcher's profile[14]. Indicators which demonstrate impact over time normalized to a specific field of research are deemed to be considered as too complex to compute[14]. Classification of Durability[16,29,30] is an indicator that is adjusted according to field and type of document to indicate the distribution of citations over time. Authors also proposed an indicator to calculate the aging rate of any publication[31].

National Level Researcher Evaluation Systems

The efficacy of bibliometric indicators is important. These indicators perform best when they utilize meticulously curated database which facilitates all required resources for analysis. They highlight the achievements and cumulative progress of any individual scientist. Integrating the outcomes of bibliometric analysis with diverse metrics such as awards, grants, funds, promotions, and even policy formulation

Table 1 — Summary of Bibliometric Indicators

S.No.	Bibliometric Indicator	Type of Indicators	Description
1	Noblesse Oblige	Publication Counts	Counts the number of research papers only for Last Author or First Author
2	Patent application		Counts only the patents of an author
3	Geometric Counting		Author publication count is based on the order of authorship where First author receives maximum score and rest of the authors are scored in decreasing fashion.
4	Harmonic Counting		Credit to authors based on the harmonic progression in the order of authorship
5	Citation Per Paper (CPP)	Citation Counts	Average number of citations of an author for each paper
6	Field Citation Score mean (FCSm)		A field-based world average based on all the papers published in all the journals specialised in specific field of research
7	Maximum Citation (MaxC)		Highest cited paper
8	i-10 index (Google)		The number of publications with at least 10 citations
9	g-index		'g' number of papers which are cited g^2 or more times
10	n-index		The h-index of a researcher divided by the highest h-index of journals within their primary field of study as way of normalizing unequal citations in different fields
11	e-index		Complements the h-index for the ignored excess citations (e^2)
12	w-index		The number of papers which have at least 10w or more citations
13	f-index and t-index		A customized weight to citations are given where f or t is the number of papers which are cited more than f or t times on average; f-index is more egalitarian than the t-index
14	m-index		Represents the minimum number of papers that account for the square of the total citations received by those papers
15	h^2 index		Involves summing the squares of the citation counts of an author's top h publications
16	POPh		Includes co-authorship contributions to h-index
17	hmx		Ranking of researchers for their recommendation based on the citation data across all databases
18	Prediction of article impact	Others	Long term citations predictor
19	AuthorRank index (AR)		Indicates for the citation intensity by taking square root of average citation rate per year
20	Age Weighted Citation Rate (AWCR)		Measures the number of citation which are adjusted for the age of the paper
21	Price Index		Percentage citations to documents which are not older than 5 years from the citing article

contributes to a comprehensive system of research evaluation on a large scale. Few selected countries are using these metrics for selecting the researchers in awards and further research grants. The Excellence in Research in Australia (ERA) framework and the 'Norwegian Model' are such notable examples which are described in following sub-sections.

Excellence in Research for Australia

It is an evaluation framework introduced in the year 2010 with an objective to identify and promote all kinds of research activities in Australian higher education institutions. Institutes submit their research publications for a period of over six years, prior to two years before evaluation year[32]. This model has been executed in year 2010, 2015 and 2018 which have faced multiple alterations in the performance indicator. According to the most recent guidelines[33], the quality of research work by any university is assessed according to the Field of Research (FoR). In the Science, Technology, Engineering and Mathematics (STEM) research, the quality of any research work is determined from citation analysis of the publications whose data has been derived from SCOPUS till 2018[32] and now shifted to Clarivate Analytics in 2023. The bibliometric indicators used in the ERA are Citation Per Paper (CPP) and Relative Citation Impact (RCI). If an article has been assigned with multiple FoRs, then the number of citations will be multiplied by the assigned apportionment for each of these FoRs[32]. The model successfully overcame the drawbacks of the h-index by adopting multiple

indicators. The benchmark values of indicators are set according to field of research, which resolved the issue related to less prominent areas of research.

Norwegian Model

In the year 2006, an evaluation model, known as 'Norwegian Model'[34] was proposed to assess the research and academic institutes using bibliographic data with specified weightage to the journals. A unique indicator was developed to assess the research efforts across departments and institutions by encompassing all peer-reviewed scholarly literature in various disciplines. This indicator is being used to compare institutions based on the publications in order to grant research funds. Indicator primarily depends on the type of publications. There are three categories of publication considered i.e., (a) papers published in the journal with ISSN-titles, (b) papers published in the journal with ISBN-titles, and (c) papers published in the journal without ISBN-titles. Each category of these journals are assigned with score based on publication type. There are two levels: Level-1 signifies the 'normal' publications, and Level-2 means 'prestigious' publications. It is to be noted that the Norwegian National Research Council reserves their rights in deciding the level of the journal. Each institution is given a point for a publication based on the affiliated author from that institute. Equal points are given to all the institutes that have collaborated in the publication. If any author is affiliated with more than one institute, the publication point is fractionalized and divided equally among the institutes. Hence, for each publication, an institute score is the fraction of authors credited to the institution multiplied by publication point of the individual publication[35]. This nullifies the importance of authorship status which is also very important in determining the individual contributions. Furthermore, the categorization of journals by the Norwegian Authorities was a matter of debate as the less popular research field were overlooked.

Bibliometric Analysis Software Tools

Nowadays bibliometric analysis has been enhanced by readily available software tools. These tools include major bibliometric metrics for performance analysis with the help of rich set of visualization tools[36]. One of the earliest applications developed for bibliometric analysis is Bibexcel[37], which featured co-citation, bibliographic coupling, co-word and co-author analysis. Biblioshiny is one of the most powerful web based tools developed in R for bibliometric analysis[38] based on Web of Science (WoS), Scopus and Dimension data repositories. It offers a well organised user interface with diverse and impactful visualization options. Another tool, CitNetExplorer[39] exclusively works on citation data for visualizing citation networks based on historiography algorithm[40]. VosViewer[41] is a versatile software that can be employed at journals, researchers or individual publication levels. It contains vast number of techniques for visualization network, overlay and density. It also extracts important terms from literature using data mining techniques.

Background of the problem

From the previous studies, it is evident that a generalized bibliometric indicator cannot be relied for an accurate assessment of researchers belonging to a specific field. Most of these indicators rely on citation data, which can only be accessed through WoS or Scopus, based on a subscription. Research papers which are published recently or in journals which are not indexed in these big corpuses are completely overlooked by the citation-based indicators. Many indicators do not have clear provision to identify authorship status in individual papers[10]. This deficiency results in an absence of distinction between first author, corresponding authors and co-authors, leading to an inherently biased evaluation process.

Each research domain has its distinct methods to assess research. Food is the primary requirement of any individual for survival and agriculture stands as the most important research domain in the academia and industry. It comprises of multiple disciplines of specialized fields such as agronomy, microbiology, soil sciences, plant breeding, biotechnology and more recently integrated with other disciplines like agricultural statistics, computer applications and bioinformatics. India has been an active participant of agricultural research. Indian Council of Agricultural Research (ICAR), an autonomous organization established under Ministry of Agriculture and Farmers Welfare, Government of India, is dedicated to plan, undertake, coordinate and promote research and technology development for sustainable agriculture. This includes capacity building by imparting research, extension and education in agriculture. Scientists working in various research institutes of ICAR are regularly conducting and contributing to effective research since its inception and publishing in nationally and internationally recognized journals of repute.

Table 2 — Journal Categories

S.No.	Type of Journal	Rating/Score	Number of Journals as per NAAS (2023)
1	The journals assessed based on information provided by the Publishers/Society in a prescribed proforma.	The score will be assigned based on the evaluation committee of NAAS	2730
2	For Clarivate's Web of Science or Scopus indexed journals	The equivalent score is 6.00 + Impact Factor with maximum score up to 20.00	-
3	The journals neither have NAAS score nor indexed in Web of Science or Scopus	The score will be assigned as 1.00	396

Bibliometric analysis is a discipline to study researchers' output and impact. The existing indicators are not suitable in determining the real impact of the researchers and to address this issue, a novel indicator is developed that addresses the authorship status in a publication and score of journal it is published in. As the new indicator is demonstrated on agricultural publications, the journals' score considered is called NAAS ratings which are published yearly by National Academy of Agricultural Sciences. It is an exclusive rating of agricultural journals in India. In the absence of NAAS rating, Impact Factor either from Web of Science or Scopus is taken into consideration.

Materials and Methods

NAAS Journal Scoring

Indian Council of Agricultural Research (ICAR) is an autonomous organization established under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. The Council is an apex body for coordinating, guiding and managing agricultural research and education in the country through 113 ICAR research institutes and 74 agricultural universities and also known as one of the largest national agricultural systems in the world. In 1990, the National Academy of Agricultural Sciences (NAAS) was established to provide a platform for agricultural research, education and extension scientists by providing policy inputs to planners and decision makers at various levels[42]. The academy also publishes journal rating/scoring for national and international journals of repute related to Agricultural Sciences. The rating of journals is published annually and released on 1st January of every year. The score of journals is based on the strict guidelines laid by NAAS. These include concerned journal to submit their citation data, frequency and timeliness of the issue publication, impact and coverage, indexing in various others resources and with nomination[43]. The academy also recognises Science Citation Index from Web of Science (WoS) and provide the score to such journals by adding a factor of 6.00 with this index for creating an equivalent NAAS rating of the journal subject to a maximum score of 20.00. In this study, while calculating the new performance indicator, if any journal does not have NAAS rating or Impact Factor from WoS or Scopus databases, then such journal will be assigned a score of 1.00. This step ensures the inclusion of entire publication work of scientist in order to calculate his/her performance. Thus, journals are categorised into three categories as mentioned in Table 2. As per the NAAS journal list for 2023[44], there existed considerable number of journals which failed to receive a score as shown in Table 2.

Recently, an initiative has been taken to establish a publication repository under Knowledge Resources and Information System Hub for Innovations (KRISHI) project to collate the ICAR publications. In this, ICAR scientists upload their publications data regularly which makes the repository a useful resource in determining the number of research papers published by ICAR scientists or institutes along with their ratings[45]. The Publication repository of KRISHI is considered as primary data source for this study.

Authorship Status

There are three types of authorships in any publications namely, first author, corresponding author and co-authors. It is generally assumed that first author is the primary contributor of the publication who executes the idea, conducts the experiment and drafts the manuscript. The corresponding author is responsible for conceptualizing the study, designing of experiment, coordinating with other contributors, and finalize the manuscript including communicates with the journal for publication. Usually, equal score is assigned to all authors of the publication by most of the metrics which

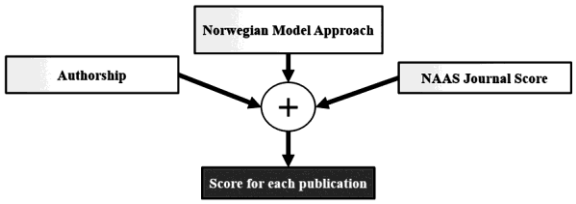

Fig. 1 — Proposed design for new indicator

Table 3 — Authorship weights

Type of Authorship	Weights
First Author	1.00
Corresponding Author	1.00
Co-Author	0.75

completely ignores the authorship status. To overcome this drawback, authors in this paper devised a criterion to assign suitable weightage to scientists as per their authorship status in the publication as mentioned in Table 3. Many a times the first author is also the corresponding author in the same publication. In such cases, the publication will be counted only once with the highest weightage for the author.

Research methodology

The primary idea has been taken from the Norwegian model[34] and extended to scientists working in ICAR for assessing their performance. The proposed model considers NAAS score of the journal and authorship status in the publications as shown Figure 1.

A novel bibliometric indicator, Author Performance Indicator (AuthorPerIndic) has been developed that allows to assess the performance of any scientist based on their publications and its weightage. This can be calculated as follows

$$AuthorPerIndic = \frac{1}{n * 20}\sum_{i=1}^{n}(Authorship\_Weight_i * NAAS\_Score_i)$$

where n is the total number of publications by the scientist and for each i[th] publication, $\boldsymbol{Authorship\_Weight}_i$ is multiplied by corresponding $\boldsymbol{NAAS\_Score}_i$ of the i[th] journal. The score obtained will be further divided by 20, being the highest NAAS score of any journal and then divided by the total number of publications. This division yields the final score of a scientist, referred to as AuthorPerIndic. The range of this score is between 0 to 1. The scientist with the highest score will be considered as most productive and impactful scientist. This indicator will further help in comparing the performance of scientists at various parameters such as designation, subject domain, division, institute etc.

Authorship in Publication 1

*Niyati Rai;**D. C. Mishra**1**;Sanjeev Kumar**2**;Anil Rai**3**;K. K. Chaturvedi;**S. B. Lal**4**;Anil Kumar;**Mohammad Samir Farooqi**5**;P. G. Majumdar;Sunil Archak;*

Authorship in Publication 2

***Mishra Dwijesh Chandra**1**;Arora Devender;Budhlakoti Neeraj;Solanke Amolkumar U;Sevanthi Amitha Mithra V;Kumar Anuj;Pandey PS;Srivastava Sudhir;**Kumar Sanjeev**2**;Farooqi M S**5**;Lal Shashi Bhushan**4**;Rai Anil**3**;K. K. Chaturvedi;*

Fig. 2 — Same authors having different formats

Data collection for validation

The details of research publications are entered in the ICAR - KRISHI publication repository directly by the affiliated scientists. The metadata for the analysis is extracted by writing a Python script. The script scrapes the required publication data in order to find the authorship and journal name of all research papers published by individual scientists. Currently, this repository does not contain information about the corresponding author and the same is also ignored in the study. Hence, the equal score is assigned to first author and corresponding authors whereas, 75% weightage is being assigned to co-author of the publication as mentioned in Table 3. Presently, the AuthorPerIndic score is calculated only for the scientists working at ICAR-IASRI.

Data cleaning and limitation of the study

The proposed metric relies on the publication data available in the KRISHI publication repository. The data is uploaded by respective authors. It is important to mention that the publication count of any scientist may be less than the actual number of publications. During data exploration and processing, it has become evident that certain scientists' names appeared in various formats as in Figure 2. This figure consists of authors from two different publications where each author is separated by semi colon (;). It is noted that the authorships of both the research publications share few common authors which are displayed in different formats. For example, “D.C. Mishra” and “Mishra Dwijesh Chandra” refer to the same author whose full name is Dwijesh Chandra Mishra. This presents a significant challenge when searching for publications featuring specific authors, as they may be associated with multiple aliases. Such a problem is prevalent in other databases like PubMed[46].

A significant effort has been made to identify all the possible aliases of scientists from ICAR-IASRI, New Delhi to carry out this study. The publications with possible aliases in authors are

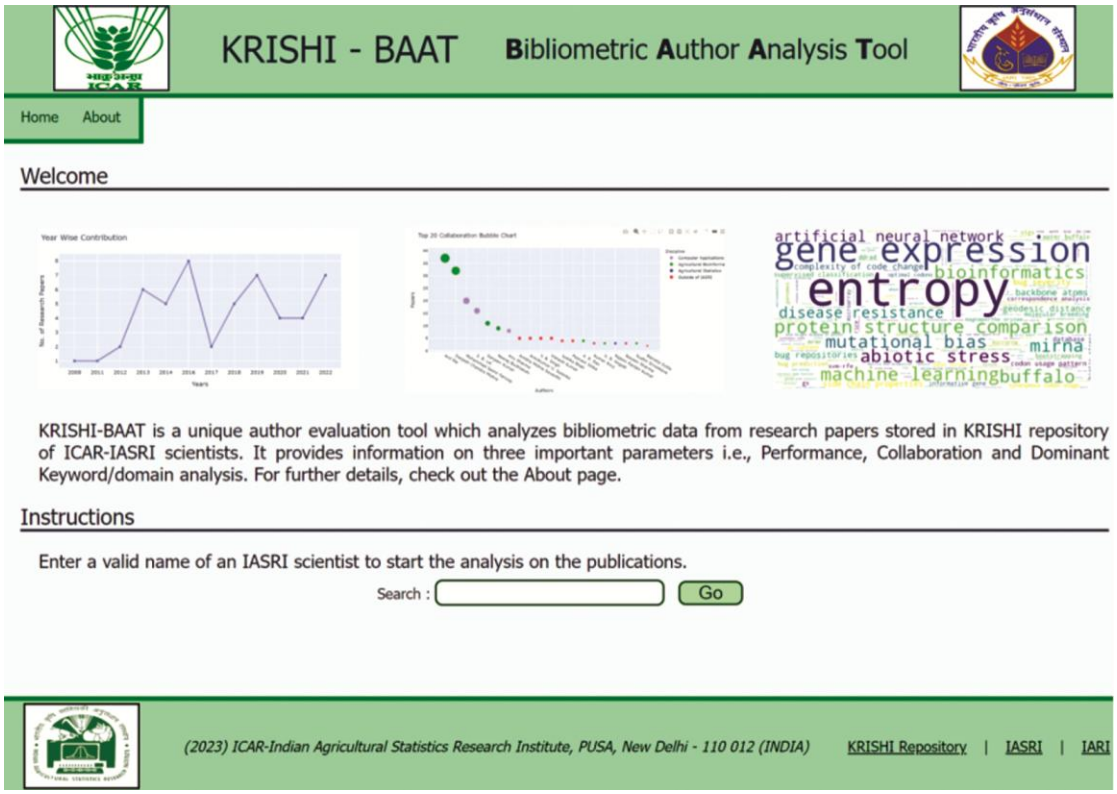

Fig. 3 — KRISHI – BAAT Homepage

collated for a specific scientist by eliminating such inconsistencies.

Journal scores were assigned based on the NAAS rating. In cases where a journal lacked NAAS rating, it was searched in the WoS or Scopus databases to retrieve the latest Impact Factor (IF). If the journal was indexed in both databases, the higher IF was chosen for subsequent computation of the journal score, as illustrated in Table 2.

Data Description

The publication data of 35 scientists affiliated to ICAR-IASRI, New Delhi is studied. The performance of these scientists has been compared based on their designations *i.e.*, Senior Scientist, Principal Scientist and Head of Divisions. To maintain the anonymity of the scientists, their names are not revealed in the analysis. The publication data which is extracted from KRISHI publication repository comprises of title, authorship, journal name, year of publication, abstract, and keywords. Among these six data elements, Authorship and Journal are employed to calculate the corresponding AuthorPerIndic for each scientist. The remaining data items are utilized to identify and manage duplicate publications.

Results and discussion

KRISHI-BAAT Bibliometric Author Analysis Tool

The performance indicator known as Author Performance Indicator (AuthorPerIndic) developed in this study is a score that evaluates a scientist's productivity based on the journal score and their authorship. It has been successfully integrated with a novel web tool named as KRISHI – BAAT Bibliometric Author Analysis Tool available at http://biblio.icar.gov.in/. The homepage of the tool is depicted in Figure 3. The data is collected from the ICAR initiated KRISHI publication repository that stores all research publications and processed to meet the requirement of data for the analysis. In the tool, AuthorPerIndic is used in the performance analysis as part of the summary of the publications belonging to a scientist as shown in Figure 4. The screenshots of the tool are shown below.

The tool creates a bubble chart which depicts the collaboration pattern of scientist based on their publication authorship. Using authorship as a measure of collaboration is particularly advantageous as it is non-reactive[47]. Simultaneously, the department of collaborators has also been incorporated if they belong

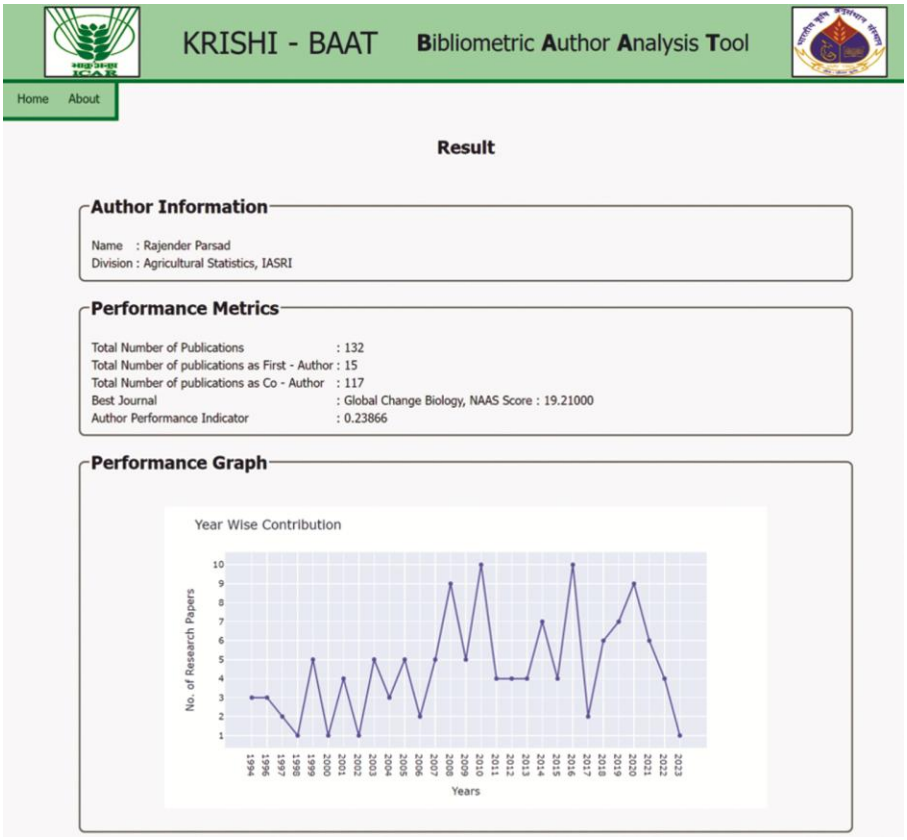

Fig. 4 — KRISHI – BAAT Performance Analysis

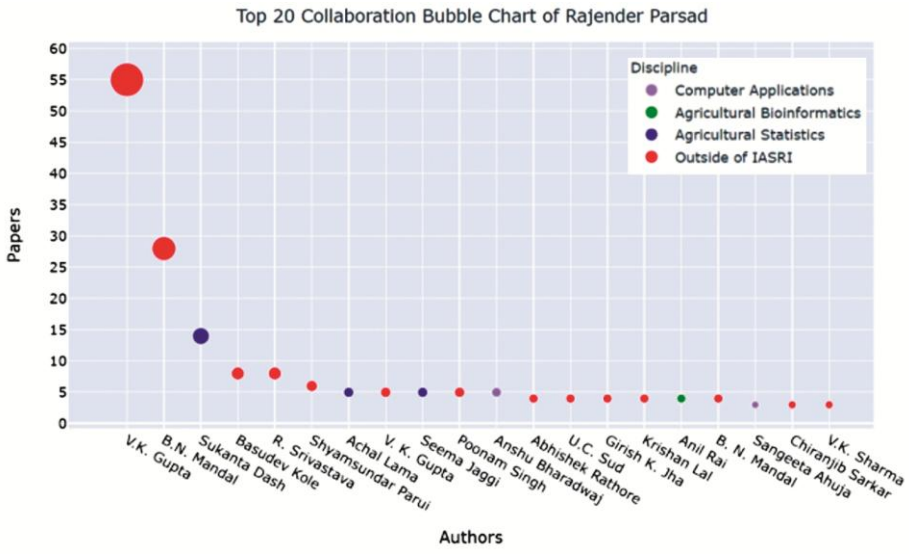

Fig. 5 — KRISHI-BAAT Collaboration Chart

to ICAR system. This is immensely helpful in the examination and assessment of links and interactions among scholars, institutions, or other entities. The chart is shown in Figure 5.

A word cloud is also created as shown in Figure 6, highlighting the dominating themes and subjects by evaluating the keywords used in a set of publications by a scientist. At a glance, larger keywords in the word cloud indicate a frequent occurrence of those terms in the scientist's work, effectively highlighting the dominant themes in their research.

Application of AuthorPerIndic on IASRI scientist publication data

The following section presents the outcomes of Author PerIndic applied to the publication data of IASRI scientists, categorized based on their designations, namely Senior Scientist, Principal Scientist, and Head of Divisions.

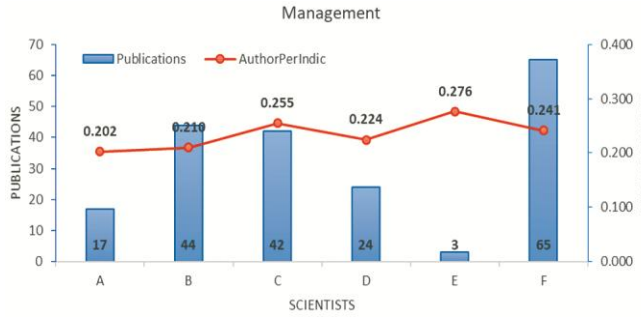

Figure 7 — Analysis of Scientists at Management Designation

AuthorPerIndic for the scientists as Head of Divisions

Error! Reference source not found. Figure 7 illustrates the relationship between Author PerIndic and the number of publications for scientists in management positions. These include 6 Head of Divisions and their publication data available on KRISHI Repository. It is evident that the quality of research work of a scientist measured using the proposed indicator is independent with respect to number of their publications. Additionally, a consistent trend in the Author PerIndic values is observed for each scientist in management positions.

AuthorPerIndic for Principal Scientists

In this, 13 principal scientists have been considered to find the proposed indicator and the same is shown in Figure 8. It is to be noted that several scientists have larger score Author PerIndic in comparison to the scientists in management positions. This observation

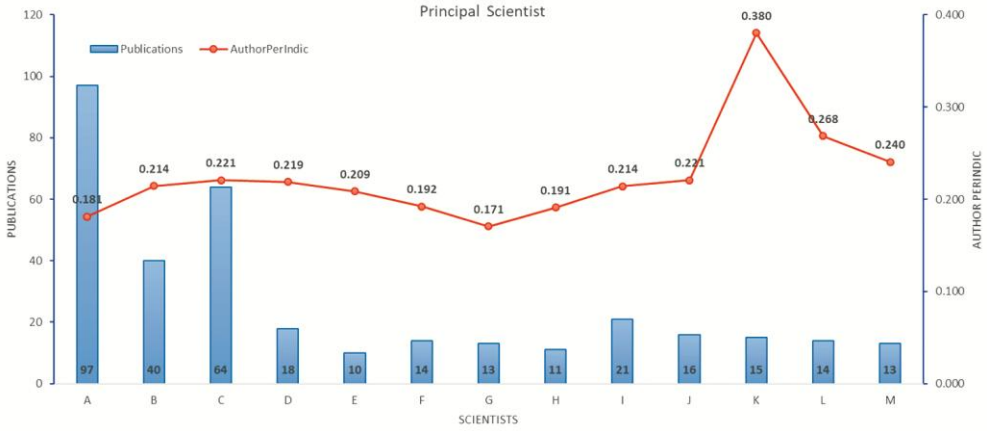

Figure 8 — Analysis of Scientists at Principal Scientist Designation

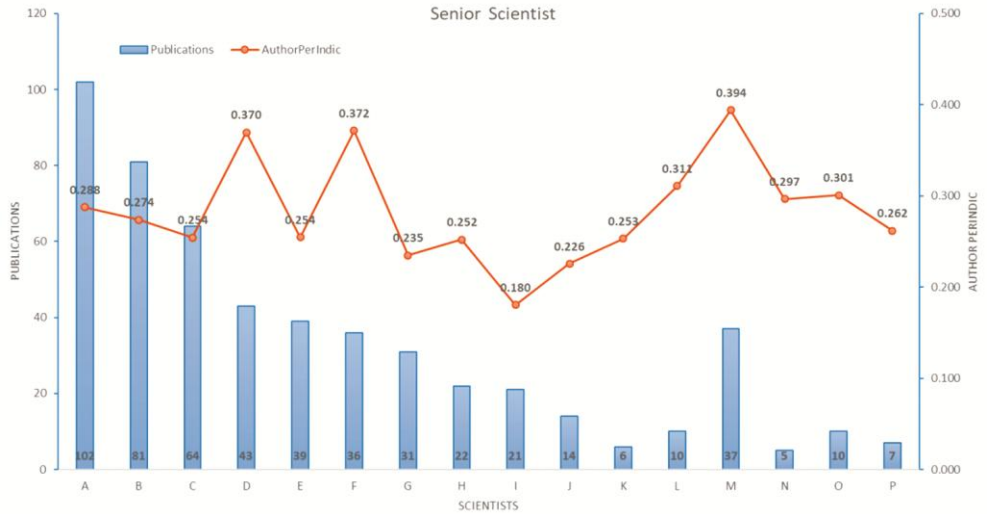

Figure 8 — Analysis of Scientists at Senior Scientist Designation

may be attributed to the nature of management roles, which often involve administrative responsibilities, potentially over shadowing the primary focus on research activities including uploading of their publication data in the repository.

AuthorPerIndic for Senior Scientists

In this case, the metrics for 16 Senior Scientists are calculated and shown in Figure 9. It is very important to mention here that the senior scientists are having higher number of publications in the KRISHI publication repository and also significantly higher AuthorPerIndic Score. This concludes that their active involvement in conducting the experiments and writing of the manuscripts as their majority of research publications are first-authored in contrast to other scientists senior to them.

Conclusion

This article introduces a novel bibliometric indicator, known as AuthorPerIndic. It is designed to evaluate researchers on the basis of their publications and the impact of the journals. The application of this indicator is demonstrated on ICAR-IASRI scientists. The distinguished feature of this indicator is the inclusion of authorship status and score of the journals. This indicator will be quite useful in comparing the performance of the scientists across their peers. It can further be enhanced for teams, divisions as groups and institute level. It is evident that most of the scholarly research is being digitized which brings a massive amount of digital data for further comprehensive analysis. Further, the developed web application will help any individual to assess their performance with other scientists based their publication data. Researchers can use it as a systematic tool to track and evaluate their progress by enabling them to monitor their achievements chronologically. AuthorPerIndic, as an author-level indicator, is flexible and can be extended for application in journals across diverse domains, not limited to agriculture, as long as these journals are a part of a domain-specific scoring system. This metric can be further enhanced by incorporating the other publications such as reports, conference proceedings, and book chapters with specified weightage along with number of citations.

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