Higher Education with the Most Publication in Focus Area of Basic Science using Frequency Distribution

A Fauzy¹, L Chabib², Kasam³, Mustangimah⁴ and F Nurlette⁴

¹Department of Statistics, Islamic University of Indonesia
²Department of Pharmacy, Islamic University of Indonesia
³Department of Environmental Engineering, Islamic University of Indonesia
⁴Directorate of Research and Community Services-Ministry of Research, Technology, and Higher Education, Jakarta 10270, Indonesia

akhmad.fauzy@uii.ac.id

Abstract. This study investigated scientific research on determine the strength of Basic Science focus research BASED on the 2014-2018 Scopus data. The Ministry of Research Technology and (Kemenristekdikti), especially the Directorate General of Research and Development (RISBANG), has a significant role in improving the quality of higher education. One way to improve higher education quality is through mapping the strengths of research. The advantage of the study that forms the basis of this mapping refers to RPJPN 2005-2025 and RPJMN 2015-2019, which focuses on Basic Science. This study used three steps methodology. First, secondary Scopus data year 2014-2018 from Kemenristekdikti in scientific publication focus on Basic Science were collected. Second, Scopus data based on sub-focus of Basic Science were identified. Last, we analyzed the data using frequency distribution, which consist of determining the range of data, the class number, and the class interval). This study concluded that 96.4 % (611) of 634 universities published journals indexed Scopus on range 1-136 journal publications within five years. UI (University of Indonesia) has the most journal publications of Basic Science focus.

1. Introduction

In two recent reports from the National Science Foundation, Characteristics of Scientific Journal, 1949-1959, and Characteristics of The Professional Scientific Journal, 1962, contained a little information about 500 U.S journals which serves important scientific function by devoting more than half of their space to basic reports research (not including technology, agriculture, and medicine) [1]. The world is now more inclined towards science and technology, citizens are required to be scientifically literate in order to compete with the international world [2]. The fourth most populated country in the world is Indonesia. This number is increasing every year, the number of students entering the university every year also increases by more than 1.5 million. This number is very potential as a source of scientific publications. This increase will also increase the need for quality journals in Indonesia. Most journals are published by universities, faculties or departments. In recent years, the number of journals indexed in Scopus has increased substantially [3].

Data of reputable international journal indexed in Scopus based on data from each Higher Education then continue to do analyze to see which college with the highest number of publication.
According to Law No. 2 of 1989 concerning the National Education System in article 16 explains that the education unit that organizes higher education is called a college that can take the form of academies, polytechnics, high schools, institutes or universities [4]. Based on higher education data, there are 960 academies, 300 polytechnics, 2501 high schools, 226 institutes, and 628 universities in Indonesia. There are many colleges in Indonesia, each college trying to promote their excellence. For example, university A promotes their excellence in advance material, and university B promotes its excellence in basic science, and so on. We conducted further research to find out the university with excellence publication using frequency distribution. The frequency distribution results can provide information on how many colleges publish reputable international journals. Publication in renowned international journals is one.

The assessment criteria were chosen from the Ministry of Research, Technology, and Higher Education guidelines. Ministry of Research, Technology, and Higher Education in assessing reputable international journals is Scopus indexed international journals. Scopus is the largest abstract and citation database of peer-reviewed literature: scientific journals, books, and conference proceedings. They are delivering a comprehensive overview of the world's research output in the fields of science, technology, medicine, social sciences, and arts and humanities. In this paper, we would focus on the basic science area. The fundamental theoretical sciences are dividing into studies of Mathematics and Natural Sciences, which include Mathematics, Chemistry, Biology, and Physics [5].

One of the studies included into chemical sub-focus such as the “Chemistry of Atmospheric Mercury: A Review” that discusses the chemical processes present in atmospheric mercury and explains the physical and chemical properties of atmospheric mercury [6]. For the physics sub-focus, one of the studies included in this sub-focus is the “Review of Particle Physics” which explains physics particles compiled from several data sources from previous editions, new measurements made and summarizes hypothetical particles [7]. Whereas for research that is included in the sub-focus of mathematics as in the study titled “Greedy Function Approximation: A Gradient Boosting Machine”, which explains the gradient boosting algorithm for regression and classification problems [8] and other studies with the title “Stochastic gradient boosting” which describes the development of the algorithm gradient boosting for regression and classification problems [9].

For research that is included in the sub focus of biology, one of them is the “Essential Biodiversity Variables” which explains the efforts to reduce the level of biodiversity extinction and prevent changes in biodiversity which are targeted by Aichi for 2020 by the Parties to the United Nations Convention on Biological Diversity after experiencing a target failure in 2010 [10] and also other research titles included in the sub-focus of biology with titled “Degeneracy and complexity in biological systems” that discuss the ability of elements that are structurally different to perform the same function and is a characteristic of the genetic code and the immune system [11].

Unfortunately, there are still some obstacles that detained developments in this field. This research group experienced several obstacles. These constraints related to the lack of research funds and also research tools. Even though it is proved that mathematics and natural science contribute substantially to daily life, the development of new technology is essential [12].

In this study, we used the frequency distribution to map the focus areas of basic science. The frequency distribution is the arrangement of numerical data according to the amount (quantity) or by category (quality) [13]. The advantage of using a frequency distribution is data presented in certain classes or groups together with the corresponding frequencies. The strength of mapping using frequency distribution in this field is very beneficial for the Ministry of Research, Technology, and Higher Education, especially the Director-General of Research and Development, in developing strategic policies, especially in the field of theoretical foundations. The findings or outputs from this study are academic texts in the form of policy briefs, policy recommendations, or strategic policy models on an issue according to the field of theoretical foundations.
2. Methodology

The data used in this study are secondary data, which is the data from Scopus in 2014 – 2018 that was obtained from the Research and Community Service Management Information System (SIMLITABMAS). The sample taken in this study is the Scopus data of the focus areas of basic science in 2014 - 2018. The method we used in this research is descriptive analysis using frequency distribution. The following steps are below:

2.1 Collecting data

Data was collected from the Research and Community Service Management Information System in the focus area of basic science.

2.2 Identify scopus data based on areas of focus basic science

The determination of the focus area of a study refers to the title published in Scopus. This title was later identified as being included in the focus area of basic science.

2.3 Analysis data using a frequency distribution

Data from all universities included in the field of basic science focus is mapped using frequency distribution. The frequency distribution is useful for looking at class divisions for universities that publish the most journals on Scopus. The frequency distribution is used to determine the class in the publication such as 1) determine the scope of data, 2) determine the level of data, 3) determine the interval of the data class, 4) determination of the range of data using the maximum and the minimum value of data [7]. Range data is the difference between the maximum value and the minimum value.

\[ R = X_{\text{max}} - X_{\text{min}} \]  

where:
\[ R \] = Range
\[ X_{\text{max}} \] = Maximum value
\[ X_{\text{min}} \] = Minimum value

After that, we determine the number of classes \((K)\) using the equation below.

\[ K = 1 + 3.322 (n) \]  

where:
\[ K \] = Class

Determine the length of the class interval, where the length of the class interval is the difference between maximum value and minimum. Then we divided it by a total of classes.

\[ P = \frac{R}{K} \]  

where:
\[ P \] = Class Length
\[ R \] = Range
\[ K \] = Classes

3. Results and Discussion

The data in this study were obtained from a collection of reputable journals Scopus indexed in 2014-2018. Data collection from 11 focus areas (Food-Agriculture; Energy - New and Renewable Energy; Health - Medicine; Transportation; Information and Communication Technology; Defense and Security; Materials Advanced; Maritime; Disaster; and Social Humanities - Cultural Arts - Education and Basic Sciences. This study uses data from the focus areas of basic science with a total of 16,235 data from 634 colleges. This data is presented using distribution frequency to determine which college in Indonesia with the highest number of publications for the focus area of basic science. The result of
using frequency distribution will be shown in table 1.

**Table 1. Frequency distribution of Scopus indexed journal publications in Indonesia**

| No | Interval  | Frequency | Percentage |
|----|-----------|-----------|------------|
| 1  | 1 – 136   | 611       | 96.4       |
| 2  | 137 – 272 | 8         | 1.3        |
| 3  | 273 – 408 | 4         | 0.6        |
| 4  | 409 – 544 | 2         | 0.3        |
| 5  | 545-680   | 3         | 0.5        |
| 6  | 681-816   | 2         | 0.3        |
| 7  | 817-952   | 2         | 0.3        |
| 8  | 953-1088  | 0         | 0.0        |
| 9  | 1089-1224 | 0         | 0.0        |
| 10 | 1225-1360 | 0         | 0.0        |
| 11 | 1361-1496 | 2         | 0.3        |
|    | TOTAL     | 634       | 100        |

From the frequency in table 1, it is known that 611 colleges enter the class interval 1-136, and 2 colleges enter the class interval of 1361-1496. We can see a hugely significant difference between these two class intervals.

**Table 2. Top 3 University with the highest-publication**

| Ranking | University | Publication | Sub-Focus Areas | Summary |
|---------|------------|-------------|-----------------|---------|
|         |            |             | Biology         | 450     |
| 1       | UI         | 1491        | Physics         | 308     |
|         |            |             | Chemistry       | 475     |
|         |            |             | Mathematics     | 258     |
| 2       | ITB        | 1475        | Biology         | 262     |
|         |            |             | Physics         | 492     |
|         |            |             | Chemistry       | 323     |
|         |            |             | Mathematics     | 398     |
| 3       | UGM        | 897         | Biology         | 314     |
|         |            |             | Physics         | 168     |
|         |            |             | Chemistry       | 247     |
|         |            |             | Mathematics     | 168     |

Based on table 2, college with the most basic publications focuses areas are the University of Indonesia (UI) with 1491 publications, followed by the Bandung Institute of Technology (ITB) with 1475 publications and Gadjah Mada University (UGM) with 897 publications. This focus area is then divided into four sub-focus areas, including chemistry, physics, biology, and mathematics. Each college excels in particular sub-areas of focus. UI with 475 publications for chemical focus sub-fields. ITB with 492 publications for the physics focus sub-field and UGM with 314 publications for the biological focus sub-field. For the mathematics sub-field, the college with the most publications is ITB with 398 publications. Based on the analysis, it is expected that each high school can participate in playing a more active role in conducting research. We hope that the government can make policies and provide more facilities for college to be more active in conducting research.
4. Conclusion

Based on the results, we concluded that there are significant gaps between colleges. So that it can cause imbalances between universities and cause public perception. Therefore, it is necessary to increase higher education efforts with the government to create an increase in the quality of the college.

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