Frequency Distribution Method to Calculate the Strength of Research Renewable Energy in Indonesia

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Abstract. This study investigated scientific research on mapping the strength of New and Renewable Energy 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 huge role in improving the quality of higher education. One way to improve higher education quality is through mapping the strengths of research. The strength of the research that form the basis of this mapping, refers to RPJPN 2005-2025 and RPJMN 2015-2019 which focuses on New and Renewable Energy. This study, used three steps methodology; (1). Collecting Data, were collected from secondary Scopus data year 2014-2018 from KemenristekDIKTI in scientific publication focus on New and Renewable Energy, (2) identifying Scopus data based on sub-focus of New and Renewable Energy, (3). Data analysis using frequency distribution, (Determine the range of data, determine the classes, and determine the class interval). This study concluded that 94 % (250) of 266 universities published journal indexed Scopus on range 1-44 journal publications within 5 years. ITB (Bandung Institute of Technology) has the most journal publications of New and Renewable Energy.

1. Introduction

According to the mandate of Law Number 17, the Year 2007 on the National Long-Term Development Plan (RPJPN) that embodies the nation's competitiveness is one of the missions of national development. This is done through the development of human resources quality and competitiveness as well as an increase in the acquisition and utilization of science and technology (science) through research, development, and application towards continuous innovation. However, in realizing this, the Indonesian nation is still facing weak conditions: 1) the capacity and competence of research, 2) the ability of the development towards the creation process based on science and technology; 3) institutional networks and researchers in the realm of local, regional, and global; 4) The national R & D productivity and relevance of technology to address the needs of society;

Universities are obliged to provide education, research, and community service [1]. Research in Higher Education aimed to develop science and technology, and improve the welfare of society and the nation's competitiveness. The research results should have benefits for enrichment and learning of science and technology, improving the quality of higher education and the progress of civilization,
improve the independence, progress, and competitiveness of the nation, fulfilling the strategic needs of national development, and community change into a knowledge-based society [2]. To ensure the quality of higher education, higher education national set the standards. One such standard is the standard of the national study. National research standards used to measure the quality of research activities. This standard is also used as a minimum performance standard for research activities conducted by the University of Indonesia. In other words, some rules must be achieved minimum results for each research activity.

National Research Master Plan (RIRN) Year 2017-2045 is structured to align the long-term research needs with the direction of national development related to science and technology. RIRN be necessary for national development requires planning to integrate integrated sectoral measures and integrated, particularly between the Ministries/Agencies, to improve the efficiency and effectiveness of the implementation [3].

There are ten research focus has been listed in RIRN, among others, the Food - Agriculture; Energy - New and Renewable Energy; Health - Medicine; transportation; Information and communication technology; defense and security; Advanced Materials; maritime; disaster; Social and Humanities - Arts and Culture - Education. In order to determine the distribution of each field is the focus of research, it is necessary to do sustainable mapping.

The dependence of the industrial sector on fossil or petroleum energy, as well as fluctuations in the price of petroleum energy, are obstacles for industrial development [4]. The dependence will have an impact on energy needs for the transportation sector, household energy, and the electricity needs of agricultural processing equipment [5]. One way to reduce dependence on fossil energy is by developing renewable energy (non-fossil) based on renewable biomass materials [6]. The opportunity to develop non-fossil renewable energy is quite large, this is because 1) the availability of a variety of new and renewable energy resources, 2) better economic growth will increase the demand for energy and the ability / purchasing power of the community and which will be a private investment in the development sector industry, and 3) national, regional and international energy market potentials are still open [7].

On the other hand, to anticipate energy scarcity in Indonesia, the government has encouraged the use of new and renewable energy (EBT) which has abundant potential in Indonesia, but their use is not yet optimal [8]. Biomass that is used as a source of energy (fuel) in Indonesia in general, has a low economic value, or is a waste that has been taken primary products [9]. The biomass can come from plantation waste, agricultural waste, forest waste, byproducts of processing agricultural products, and livestock manure [10]. Biomass as a by-product of agriculture or plantations must take a greater role in Indonesia going forward. Indonesia's biomass energy potential is 49,807 Mwe and only 0.36% is utilized [11]. For the ASEAN region, Indonesia is the largest producer of biomass, but Indonesia is the smallest beneficiary because it has not been economically managed so there is a gap between potential and utilization [12].

Among the great potential of biomass that can be used as energy or solid fuels is the waste produced from coconut coir or cocopeat processing [4]. Cocopeat biomass waste has a fairly large amount, especially in coconut-producing areas where coir waste is processed for coco fiber, but most of it is not utilized and only as waste or bioamssa waste [13]. Actually this waste can be used as household solid fuel or as fuel in the processing industry or other purposes (drying agricultural materials). On the other hand, some companies export plantation waste such as palm shells. Several large industries have been able to create electricity from waste biomass and use it for company operations.

Therefore the development of the biofuel industry must be a priority activity in supporting the substitution of national energy needs and economic development whose results or added value can be felt by the public and domestic industries [14]. For this reason, mastery of biomass processing techniques into biofuels in Indonesia is absolutely mastered and implemented in the country.
One way to modify biomass into biofuel or solid fuel is by torefaction. Torefaction (torrefaction) is a process of thermal degradation with a low heating rate at temperatures of 200-300 °C with no air conditions [15].

Torefaction can also be interpreted as a thermal treatment of biomass (especially wood) in the absence of oxygen for ±15-60 minutes at temperatures of 200-300oC and atmospheric pressure. As a result, the biomass will turn into a product similar to coke or charcoal. Torefaction transformation is a process with high efficiency (85-95% conversion) [16].

In this study, researchers used to map the frequency distribution of the focal plane Energy - New and Renewable Energy, the frequency distribution is an arrangement of numeric data according to size (quantity) or by category (qualitative) [17].

It is expected that this research can be useful for Kemenristekdikti, especially DG of Risbang in developing strategic policies, especially in the field of new and renewable energy focus. Results from this study is a script that can be used as one of the considerations in determining policy recommendations to a problem in areas of new and renewable energy focus.

2. Methodology

This study uses secondary data obtained from the Ministry of Research and Technology. The population used is the Scopus data for 2014-2018, with samples in the field of new and renewable energy in 2014-2018.

2.1. Collecting the data

The data used are journals in the field of new and renewable energy in 2014-2018, which were obtained from the Ministry of Research and Technology by screening the paper titles.

2.2. Identify Scopus data of energy field - new and renewable energy

The data is a journal on the fields of new and renewable energy in 2014-2018, which was obtained from the Ministry of Research and Technology by screening the paper titles.

2.3. Analysis the data using frequency distribution

At this stage, an analysis will be conducted using the frequency distribution of the data previously explained, to find out which universities sent the most journals in Scopus in 2014-2018. The steps of the analysis are:

2.3.1. Define the data range

Find data ranges by using formulas:

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

Where:

\( R \) = the data range
\( X_{\text{max}} \) = the largest value of the data
\( X_{\text{min}} \) = the smallest value of the data

2.3.2. Determine the class

Determine the class by using the formula:

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

Where:

\( K \) = the total of classes
\( n \) = the total of data
2.3.3. **Determine the class interval**
Determine class intervals using formulas.

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

(2.3)

Where:
\[ P \] = the class Length
\[ R \] = the data range
\[ K \] = the total of classes

3. **Result and discussion**
At this stage an analysis is carried out using a frequency distribution which is useful for mapping tertiary institutions based on journals that have been published on Scopus. The results of the mapping are as follows.

| No. | Interval | Frequency | Percentage |
|-----|----------|-----------|------------|
| 1.  | 1-44     | 250       | 94.0       |
| 2.  | 45-88    | 6         | 2.3        |
| 3.  | 89-132   | 2         | 0.8        |
| 4.  | 133-176  | 3         | 1.1        |
| 5.  | 177-220  | 1         | 0.4        |
| 6.  | 221-264  | 1         | 0.4        |
| 7.  | 265-308  | 1         | 0.4        |
| 8.  | 309-352  | 0         | 0.0        |
| 9.  | 353-396  | 0         | 0.0        |
| 10. | 397-440  | 2         | 0.8        |
|     | **TOTAL**| 266       | **100**    |

From the table 1, it can be seen that the majority of universities in Indonesia, or about 94% of the total college to publish Scopus indexed journals are only able to publish in small amounts, which only ranged between 1-44 publications. While universities are able to publish in large quantities amounted to only one college, or only 0.8 of the total number of colleges to publish Scopus indexed journals. From the analysis above, the government is expected to make a sustainable policy regarding the number of publications, which makes the minimum limit for a university publication, so that all universities will be together - equally competent in the established standards. As for college has published a journal in large quantities that are expected to be awarded by the government, so that the universities can maintain and even increase the quality and quantity of their research.

| Ranking | University | Number of Publications | Research Focus | Number of Research Focus |
|---------|------------|------------------------|----------------|--------------------------|
| 1       | ITB        | 435                    | Independence of power generation technologies | 125 |
|         |            |                        | Resistance technology, energy diversification and strengthening of the | 67 |
Table 2 shows that the ITB (Bandung Institute of Technology) is the university with the highest journal publication, with the focus of most research in the field of power generation technological independence. UI (University of Indonesia) occupies the second-highest, with the focus of most research in the field of fuel substitution technologies. ITS (Institute of Technology) occupies the third position, with the focus of most research in the field of independent power generation technologies.

4. Conclusion

Based on the results of the analysis, it concludes that the majority of universities in Indonesia, or about 94% of the total college Scopus indexed journals publish only able to publish in small amounts, which only ranged between 1-44 publications. While universities can publish in large numbers only account for two colleges, or only 0.8 of the total number of colleges to publish Scopus indexed journals. The college with the highest number of Scopus journal publications in the field of renewable energy is the Bandung Institute of Technology, with the highest focus on the independence of subfields electricity generation technologies with a total of 125 journal publications. The University of Indonesia occupied the second position with the highest focus on fuel substitution technologies subfields with the number 135 journal publications.

The Institute of Technology occupies third place with the highest amount of focus on the independence of subfields electricity generation technologies with a total of 82 journal publications.

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