Energy Economics in Islamic Countries: A Bibliometric Review

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ABSTRACT

Energy has an important role in the economic growth of a country, the more energy a country has, the better the country's economy. This study tries to map the development of research published in the field of energy economics. The research was conducted using VOSViewer software. The data analyzed were in the form of scientific research related to energy economics in Islamic countries as many as 45 articles published in the last 10 years. The results showed that the number of publications on the development of research results in the field of energy economics continued to increase, with various research methods and countries of study objects. The network visualization shows that the energy economy research development map is divided into 5 clusters. Cluster 1 consists of 7 keywords, cluster 2 consists of 7 keywords, cluster 3 consists of 5 keywords, cluster 4 consists of 5 keywords and cluster 5 consists of 2 keywords. It was found that the most familiar keywords are Country, Renewable Energy, CO_2 Emission. Other findings based on the results of text mining are the analysis of Kaya Identity in Islamic countries and solutions in the form of sustainable energy use.

Keywords: Energy Economics, Kaya Identity, Bibliometrics
JEL Classifications: Q40, Q43, Q56

1. INTRODUCTION

Energy is the most important element in the economic development of a country and provides services that are essential to improve the quality of life (Gamoori et al., 2017). The need for energy will be increasingly felt considering the fulfillment of basic human needs, such as food, health, agriculture, education, information to other infrastructure services, so that access to energy services is very important to meet all these human needs with the aim of encouraging the economy and human development. In addition, energy services also have an impact on productivity, clean water, communication services, and so on (Asim et al., 2011).

Economic development, population growth, energy prices and increasing energy efficiency are the most important factors affecting energy demand (Alarenan et al., 2019). On the other hand, until now, the demand for energy has been met by the limited number of fossil fuels (in the form of oil and natural gas), (Badeeb and Lean, 2018), while the demand continues to increase along with the increase in human population, so that the world's energy future becomes unsustainable (Sopian et al., 2011).

Energy sources themselves are an active element that has a role in helping producing countries get between the political and economic forces globally (Yalçın, 2018). Thus, energy sources become an important pillar in the economic sector for a country.

In fact, the importance of energy sources has resulted in energy sources being the reason for wars in several countries of the world (Oudat et al., 2015). The relationship between the economy and energy use as well as economic growth and environmental pollution has become a topic that has been widely discussed in recent years, (Darus et al., 2013; Malik et al., 2019; Saudi et al., 2019; Yusoff et al., 2013), especially regarding the link between energy consumption, carbon dioxide emissions and economic growth (Magazzino, 2016; Hanif, 2020).

Several previous studies have been conducted in researching the energy economy on various themes, for example on monetary integration in several Islamic countries (Agustiar, 2020a, 2020b), energy growth nexus (Ahmad et al., 2020), geopolitical risks (Alsagr and Almazor, 2020), social economic welfare (Aris et al., 2013), Islamic stocks and equity (Hassan et al., 2019; Mensi et al., 2017; Nagayev et al., 2016), sukuk (Handayani and Surachman, 2017; Mat Rahim and Mohamad, 2018; Morea and Poggi, 2017) to the theme of renewable energy (Mekhilef et al., 2014; Rimantho et al., 2018).

There are 45 scientific research papers published by various journals both national and international within the period of 10 years of observation until the time this paper was written, namely October 2020, which discusses the energy economy in Islamic countries. This paper with this theme is interesting to discuss considering the importance of scientific research to be carried out in order to generate ideas and innovations that can answer economic problems, especially in facing energy limitations in the future.

This research is structured as follows. The second part reviews in general the research method, namely the bibliometric method. The third section presents and reports the results of descriptive research as well as provides content analysis of each cluster category in a meta-analysis consisting of the number of published papers on the theme of energy economics, the methodological approach used and the country as the top study object. The fourth part will explain the visualization of bibliometric mapping starting from the trend of keywords, authors, journals, to the top citation in the energy economy theme paper. The fifth part is the closing of the paper which contains a summary of the main discussion and conclusions.

2. METHOD

Bibliometric mapping is an important research topic in the bibliometric field. Two distinguishable bibliometric aspects are the construction of the bibliometric map and the graphical representation of the map. In the bibliometric literature, the greatest concern is the construction of the bibliometric map. Research related to the effects of differences in similarity measures (Van Eck and Waltman 2009), and they tested with different mapping techniques. The graphic representation of the bibliometric map has received less attention. Although some researchers seriously study issues related to graphical representation, most articles published in the bibliometric literature rely on simple graphical representations provided by computer programs such as SPSS and Pajek.

For thumbnails containing no more than, say, 100 items, a simple graphical representation usually yields satisfactory results. However, there appears to be a trend toward larger maps and for such maps simple graphical representations are not adequate. The graphical representation of a large bibliometric map can be further improved by, for example, a zoom function, special labeling algorithms, and density metaphors. Such functionality is not included in the computer programs commonly used by bibliometric researchers. In this paper, we introduce a new computer program for bibliometric mapping. This program pays special attention to the graphical representation of bibliometric maps.

This section discusses the use of VOS, which is to build a bibliometric map. The purpose of VOS is to place items in such a low dimension that the distance between two items accurately reflects the uniformity or association of these items. For each pair of items i and j, VOS requires a similarity input sij (sij ≥0). VOS treats the equation sij as a measure on a ratio scale. The equation sij is usually calculated using the strength of the association defined in Equation 1 (eg Van Eck and Waltman, 2007). VOS determines the location of items in the map by minimizing

$$V\left(x_i,\ldots,x_n\right)=\sum_{i<j}\left\|s_{ij}x_i-x_j{}^2\right\|$$

(1)

to:

$$\frac{2}{n\left(n-1\right)}\sum_{i<j}\left\|x_i-x_j\right\|=1$$

(2)

Therefore, the idea of VOS is to minimize the weighted sum of the squares of the distance between all pairs of items. The square of the distance between pairs of items is weighted by the equation between those items. To avoid worthless solutions, where all items have the same location, a limit is imposed so that the average distance between two items must be equal to one.

There are two computer programs that have implemented the VOS mapping technique. Both are available free of charge. A simple open source program is available at www.neesjanvaneck.nl/vos/, and a more advanced program called VOSviewer (Van Eck and Waltman, 2010) is available at www.vosviewer.com. Both programs use the variant of the SMACOF algorithm mentioned above to minimize Equation 1 to Equation 2.

This study uses paper publication data sourced from various journals with research on the theme of energy economics. The data was collected through tracing papers in the last 10 years, to be precise in 2011-2020. From the search results, 45 published articles were obtained. Data in the form of the number of published papers on the theme of energy economy in Islamic countries, methodological approaches and the top countries that were the objects of the study were analyzed using Microsoft Excel 2010. Meanwhile, the trend of the development of energy economy theme publications was analyzed using the VOSViewer software.

The computer program that was introduced was called VOSviewer. VOSviewer is a program developed for building and viewing bibliometric maps. This program is freely available to the bibliometric research community (see www.vosviewer.com). VOSviewer for example can be used to create author maps or journals based on cocitation data or to build keyword maps based on shared incident data. The program offers a viewer that allows the bibliometric map to be examined in detail.

VOSviewer can display maps in a variety of ways, each emphasizing a different aspect of the map. It has functions for zooming, scrolling, and searching, which facilitate detailed inspection of the map. VOSviewer's display capability is especially useful for maps containing at least a large number of items (e.g., at least 100 items). Most computer programs used for bibliometric mapping do not display such maps in a satisfactory manner.

To build maps, VOSviewer uses the VOS mapping technique, where VOS stands for similarity visualization. For previous studies in which VOS mapping techniques were used, refer to Van Eck and Waltman (2007). VOSviewer can display maps built using suitable mapping techniques. Therefore, this program can be used not only to display maps built using the VOS mapping technique but also to display maps built using techniques such as multidimensional scaling. VOSviewer runs on a large number of hardware and operating system platforms and can be started directly from the internet.

3. RESULTS AND DISCUSSION

This section describes the number of papers published on the theme of energy economics. There are 45 documents consisting of published papers, working papers and proceedings published during the last 10 years of observation. The distribution of papers with a large number dominates the themes in economic and financial journals. The publication of papers on the theme of energy economy until October 2020, which we make as the object of study, totals 45 papers. Table 1 describes the distribution of papers per year which varied over the last 10 years with a range of 0 to 9 papers. The highest number of paper publications was in 2020 with 9 papers and the fewest publications, namely in 2012, there were no published papers or a total of 0.

Based on the Table 1 and graph above, there is an increasing trend in the number of papers published on the theme of the energy economy, where in 2011-2015, the maximum number of publications was 5 papers, then increased to more than 5 from 2016 to 2020, however, this number of papers it is still possible to increase and experience improvement, the data collection of papers studied in this study is until October 2020.

3.1. Research Approach Types

Based on Punch (2013), there are 3 types of research approaches, namely a qualitative approach, a quantitative approach and a mixed methodology approach. Table 1 shows the research methodology used by each published paper over the past 10 years. In this observation, the most widely used research approach was the quantitative approach, namely 22 papers (48.8%), followed by a qualitative approach of 20 papers (44.4%) and a mixed approach of 3 papers (66.6%).

The results of the research findings indicate that the number of empirical research on energy economics is more than that which is conceptual in nature. The most widely used empirical research model is linear regression modeling. The research model that is widely used in qualitative methods is descriptive. Meanwhile, papers that used mix method between qualitative and quantitative methods were found only 3 papers, or at least.

3.2. Country

Table 3 shows the top 12 rankings of countries that were used as objects of study for the last 10 years in the energy economy theme paper. The following table shows the number of papers that discuss these countries.

The results showed that the most popular country in research related to energy economics, in the first rank was Malaysia with a total of 29 papers discussing it, followed by Indonesia with 22 papers in second place, then in the third rank, namely the Kingdom of Saudi Arabia (KSA) with the number of 19 papers.

Table 2: Research approach

Research approach	Number of paper
Quantitative	22
Qualitative	20
Mixed	3
Total	45

Table 1: Number of paper

Year	Number of paper
2011	2
2012	0
2013	5
2014	2
2015	3
2016	6
2017	6
2018	7
2019	5
2020	9
Total	45

Table 3: Country as research object

Country	Number of paper
Malaysia	29
Indonesia	22
KSA	19
Turkey	17
Iran	17
UAE	15
Qatar	14
Kuwait	13
Bahrain	12
Pakistan	12
Oman	11
Iraq	10

3.3. Bibliometric Graphic Analysis

To explore the results of the meta-analysis above, this section will present a graphic visual mapping of the publication of a paper on the theme of energy economics. The result of the keyword mapping analysis forms the basis for the co-occurrence mapping of important or unique terms contained in a particular article. Mapping is a process that allows a person to recognize elements of knowledge and their configuration, dynamics, interdependencies, and interactions.

Related to bibliometrics, science mapping is a method of visualizing a field of science. This visualization is done by creating a landscape map that can display topics from science (Royani et al., 2013). The results of the visualization of the co-word map network for the publication of a paper on the theme of energy economy can be seen in Figure 1 above.

In this mapping, several key words that have frequently appeared in papers on the energy economy theme in the last 10 years are displayed and their relation to other keywords in the 5 clusters, namely:

- Cluster 1 in red consists of 7 keywords, namely: challenge, energy, field, renewable energy, review, study, sustainable development.
- Cluster 2 in green consists of 7 keywords, namely: CO_2 emission, country, economic growth, energy consumption, energy use, oil, relationship.
- Cluster 3 in blue consists of 5 keywords, namely u: islamic conference, islamic cooperation, oic, oil exporter countries, organization.
- Cluster 4 in yellow consists of 5 keywords, namely: energy efficiency, gcc country, oil price, policy, sustainability.
- Cluster 5 in purple consists of 2 keywords, namely: evidence, islamic stock market.

The keywords which are divided into 5 clusters above are arranged in the form of a colored circle indicating the clusters, this data can be used in determining the trend of the keywords in the last 10 years. Bibliometric analysis shows several keywords that are widely used in the paper which is the object of study. The keywords that appear the most are indicated by the larger the circle. Meanwhile, the line relationship between keywords shows how much it is related to other keywords. It was found that the most familiar keywords are Country, Renewable Energy, CO_2 Emission.

Furthermore, using the VOSViewer software, we found the bibliometric mapping of the authors as in Figure 2 below. The bigger and the lighter the circle of the author's name is, indicating the more papers he has published in energy economy themes in the last 10 years.

The cluster density view, is the item (label) which is marked the same as the visible item. Each item dot has a color depending on the density of the item at that time. This identifies that the color of the points on the map depends on the number of items associated with other items. This section is very useful for obtaining an overview of the general structure of the bibliometric map by paying attention to which parts of the items are considered important to be analyzed. Through this worksheet, we can see the authors who have written the most publications.

Based on these results, a density map is displayed which is the result of an analysis using all published articles on energy economy themes, both related and unrelated. There are many clusters when sorted by author. The most popular authors writing publications related to energy economics based on bibliometric mapping are Zulkefly Abdul Karim, Ismaila Rimi Abubakar, Shahad Alarenan and Obadia Bishoge.

The order in this mapping may have a difference with the author's top ranking if we calculate manually, but apart from calculating the quantity of papers published on the theme of energy economy, VOSViewer also takes into account the number of links and their size with other authors.
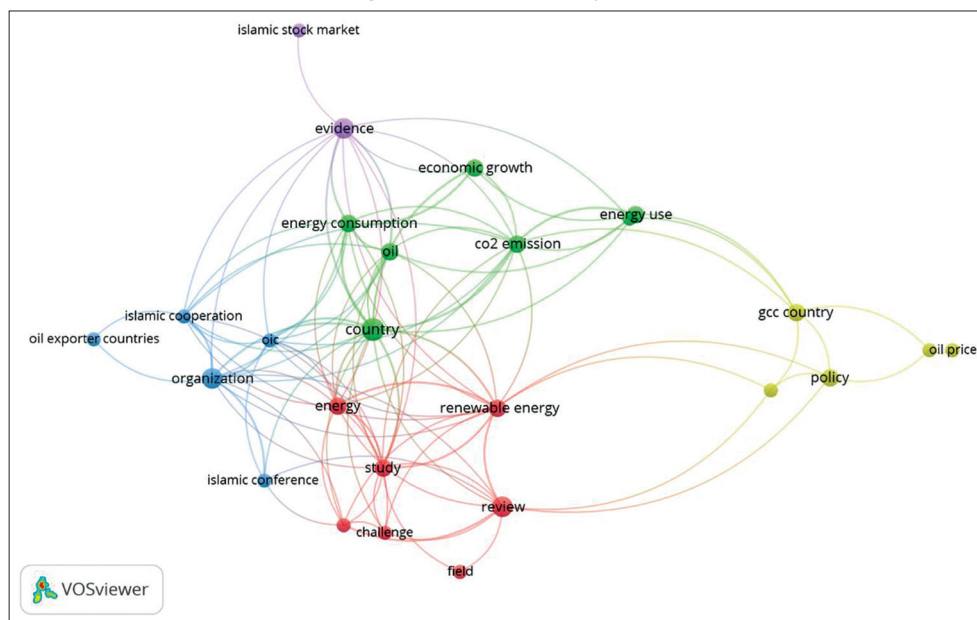
Figure 1: Bibliometric keyword
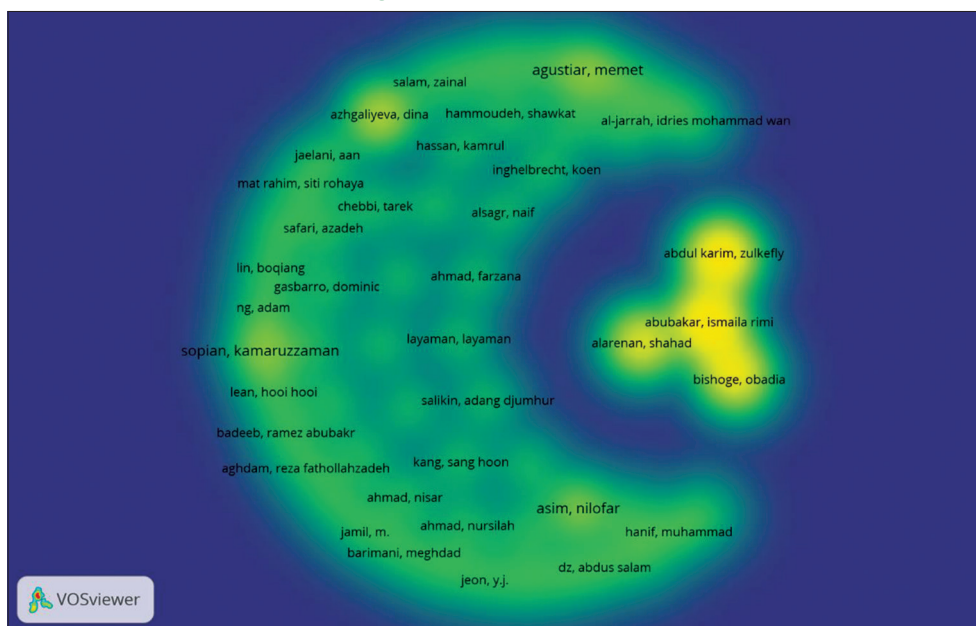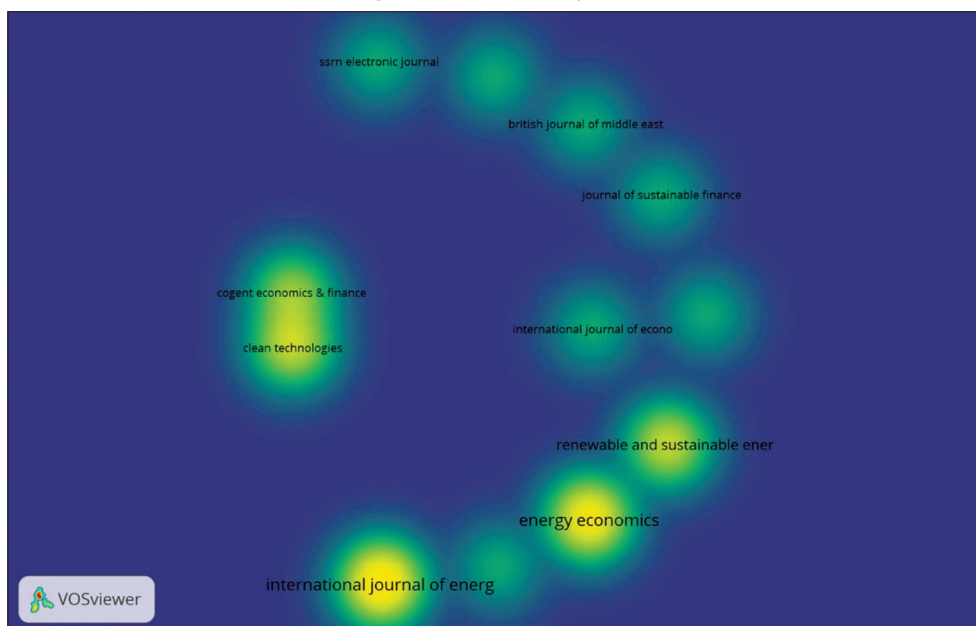
Figure 2: Bibliometric author

Figure 3: Bibliometric journal

Furthermore, the journal mapping visualization is depicted in the bibliometric Figure 3 below. Based on this picture, there are several journal clusters that appear to be listed in a glowing circle, showing the journal's productivity in contributing to publishing its paper on the theme of energy economics.

Most journals in terms of number of publications and number of links to other journals, where a paper writer can write many papers in different journals. The top journals are ranked first, namely Energy Economics, followed by the International Journal of Energy Economics and Policy in second place and Renewable and Sustainable Energy Reviews in third.

In addition, this study also looks for the top ranking of the number of citations for each paper, Figure 4 above shows the mapping.

The results of data processing show that the paper that is cited the most compared to other papers in the first place is a paper entitled "The relationship between real GDP, CO_2 emissions, and energy use in the GCC countries: A time series approach" (Magazzino, 2016) and The paper in the second highest citation is a paper entitled "Research collaboration networks of two OIC nations: Comparative study between Turkey and Malaysia in the field of 'Energy Fuels', 2009-2011" (Kumar and Jan, 2014).

3.4. Findings
Based on the results of meta-analysis and bibliometrics, some information was obtained regarding the development of previous research trends in the theme of energy economics. The findings of this study are the special attention to the energy economy in Islamic countries and the identification of the Kaya Identity equation. The

Figure 4: Bibliometric citation
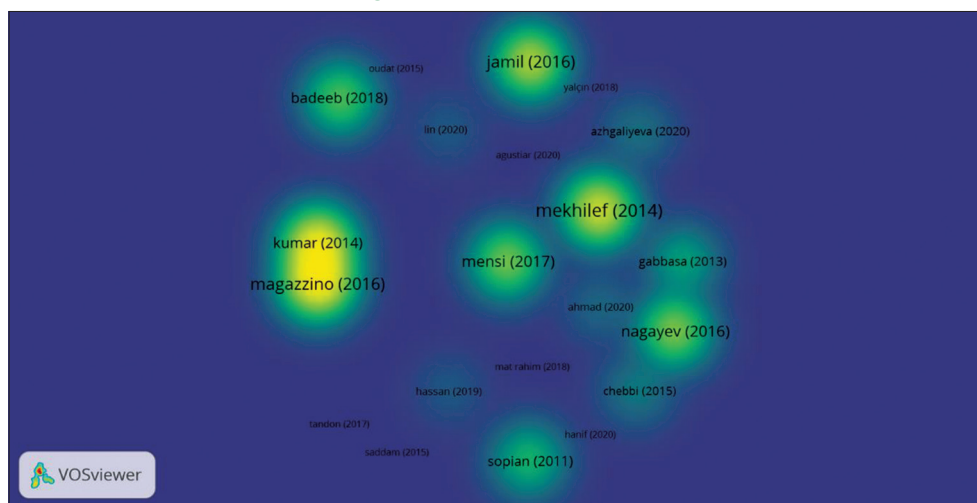
equation states that the level of carbon dioxide emissions from greenhouse gases is expressed as a product of 4 factors, namely (1) Global human population, (2) GDP per capita, (3) global energy intensity/energy consumption, and (4) carbon emission intensity. (Jung et al., 2012; Ma and Cai, 2018; O'Mahony, 2013).

The first element, namely population. The population in Islamic countries, which amounts to 21.6% of the world's population, can be stated to represent the substantial portion of developing countries. The global population in general was approximately 6.6 billion in 2009 and continues to increase. More specifically, the ratio of population growth in Islamic countries is faster than Western countries based on observations from 57 OIC countries (Gabbasa et al., 2013; Anwar et al., 2017). This increase in population has implications for industrial growth in various sectors, so that energy use also increases (Jaelani et al., 2017). In fact, the availability of fossil-based energy is limited and economic growth of some countries especially in Middle East depends on the oil (Effendi, 2019), so the efficiency of energy use in the midst of the high population in Islamic countries is a challenge in itself.

The second element, namely GDP. Real GDP has a large impact on energy use in several Islamic countries. When energy is a crucial component in economic growth, a decrease in energy consumption can actually lead to a decline in GDP (Magazzino, 2016). On the other hand, an increase in energy, whether sustainable or not, has a positive effect on GDP growth (Altaturi et al., 2016; Hidayat, 2018). Islamic countries which are developing countries tend to have low GDP, but have increased in recent years (Tabash and Khan, 2018), so that one effort that can be made to maintain this situation is to pay more attention to efficient energy consumption so that GDP can be increased (Behboudi et al., 2013).

The third element, namely energy consumption. Sustainable and renewable energy consumption is mainly related to economic growth (Bishoge et al., 2018; Handayani and Surachman, 2017), where energy consumption has an important role in the process of economic growth directly or as an addition to capital and labor, even changes in economic growth are a reflection of the state of energy consumption of the country (Behboudi et al., 2013). The

increasing global energy consumption, especially from Islamic countries which have high population, has resulted in an increasing demand for fossil oil which is decreasing in number and cannot be produced in a short time (Tandon and Ahmed, 2016). This increase is the result of the process of urbanization, industrialization and population growth (Saddam, 2015).

The fourth element, namely the intensity of carbon dioxide emissions. Increasing the amount of energy used can result in increased production of CO_2 emissions while also affecting air quality. Furthermore, CO_2 emissions are the main cause of the greenhouse effect which affects global warming. CO_2 emissions in particular in Islamic countries continue to experience a significant increase (Shaari et al., 2020), so that Islamic countries need to carry out energy conservation, energy efficiency and save energy consumption in order to reduce CO_2 emissions, one of which is by using energy. sustainable (Azhgaliyeva et al., 2020).

In general, the Kaya Identity of Islamic countries in the energy economy shows high numbers for each of its elements. In the first and third elements, namely population and GDP, of course, will continue to increase and cannot be suppressed. As for the second and fourth elements, namely energy consumption and CO_2 emissions, efforts must be made to reduce as much as possible. The solution is to delinquent energy sourced from sustainable energy and reduce unsustainable energy (Mekhilef et al., 2014), especially energy derived from fossils (Jaelani et al., 2017).

In its application, sustainable energy requires a lot of innovation and support in terms of technology, usage planning and clear regulations (Jamil et al., 2016). The regulations that are formed must support clean and safe energy, so that this energy source can be an efficient and efficient solution for the future. In addition, among the strategies that can be carried out by Islamic countries are to form education and capacity building programs, sustainable energy markets and financial mechanisms, to improve regulations on energy, establish databases and international collaboration to promote sustainable energy technologies (Sopian et al., 2011).

4. CONCLUSION

The focus of this research is to try to find out the development of the energy economy theme in research, especially in papers with the theme of energy economics in Islamic countries. The results show that there is an increase in the number of paper publications on this theme from year to year with a total of 45 paper publications in the last 10 years. Research on this theme has been carried out with various methods, the most widely used research approach is the quantitative approach, namely 22 papers, followed by a qualitative approach of 20 papers and a mixed approach of 3 papers, the most widely used country as the object of study is Malaysia with a total of 29 papers, then Indonesia with 22 papers, and KSA with 19 papers.

The bibliometric mapping visualization shows that the research development map of this theme is divided into 5 clusters. Cluster 1 consists of 7 keywords, cluster 2 consists of 7 keywords, cluster 3 consists of 5 keywords, cluster 4 consists of 5 keywords and cluster 5 consists of 2 keywords. It was found that the most familiar keywords are Country, Renewable energy, CO_2 Emission. The most popular writer is Zulkefly Abdul Karim. The top journal ranking is Energy Economics. The most cited paper with the title "The relationship between real GDP, CO_2 emissions, and energy use in the GCC countries: A time series approach" (Magazzino, 2016).

The condition of energy economics refer to the Kaya Identity of Islamic countries shows high numbers for each of its elements. The number of population and economic growth, of course, will continue to increase. As for the second and fourth elements, namely energy consumption and CO_2 emissions, efforts must be made to reduce as much as possible by using technology and innovation in the future.

It should be noted that the purpose of this study is to present an overview of the research trends on the theme of energy economics, but its limitation has only been in the last 10 years. Although the research has been conducted using meta-analysis and specific bibliometric indicators so that readers can obtain a general representation of the most significant data on this theme, the results presented are still dynamic and may change over time with new emerging trends or increasing and diminishing variables in this theme going forward.

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