Analysis of The Correlation Between Mechanical Engineering Research and COVID-19 Situation: Bibliometric Study

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Abstract. The rapid spread of the coronavirus has a bad impact on many things, including education, government, the economy. This study was conducted to investigate the development of mechanical engineering research by mapping bibliometrics using the R programming language and VOSviewer. Bibliometric classifications indicate the types of publications, keywords trend, and authors of scientific papers. In this study, data collection was performed from the SCOPUS and dimensions.ai website. This website provides a dataset of scientific papers published in international peer-reviewed journals. The keyword that we used to collected the metadata "mechanical" "engineering" "COVID-19". Based on study that carried out Mechanical research has gradually increased the number of publications in the last ten years even during the COVID-19 pandemic, which indicates this topic is interesting research and continues to increase along with technological developments. Based on keyword analysis, in the era of the COVID-19 pandemic, the keyword that often appears in mechanical engineering research is "e-learning". this indicates that during the covid 19 pandemic, many researchers studied how to teach related to mechanical engineering when schools were still on lockdown. Based on Country Mapping show that USA is the country with the most publications of mechanical engineering research in the COVID-19 pandemic. Europe is the continent that publishes the most with 5 countries in the top 10 rankings of the most publishers. Based on bibliographic mapping from Scopus, the author with the most publications related to mechanical engineering in the COVID-19 pandemic is Kanetaki, Z.

Keywords: COVID-19, education, mechanical engineering research, bibliometric study, VOSviewer

INTRODUCTION

Along with the rapid development of technology, research in the field of mechanical engineering is increasingly being carried out by researchers. The reason is that in the industrial era 4.0, there are many tools or production machines that can be developed with the help of renewable technology. For example, planning or production processes that can be done with the help of Artificial Intelligence (AI). AI itself is an artificial intelligence whose intelligence is made like human intelligence so that AI can learn and solve various problems based on its learning outcomes (Shinde & Shah, 2018). However, since the COVID-19 pandemic in early 2020, many studies have declined. This is because many countries at that time established a political emergency to prevent contagion and its burdensome consequences (Tosato et al., 2022). The existence of this policy makes almost all research activities have to be carried out remotely.

Research developments in the field of mechanical engineering during the pandemic include studies on the preparation of machining stage plans for operators carried out by deep learning algorithms (Peddireddy et al., 2020), the introduction of basic symbols by deep learning for the assembly process based on CAD drawings (Neb et al., 2020), introduction of technical drawing symbols using the advanced-bounding box method (Elyan et al., 2020), etc. To our knowledge, by looking at various research developments in the field of mechanical engineering during the pandemic, there has been no research related to bibliometric analysis regarding research in the field of mechanical engineering during the pandemic.

Based on the development of this research, we took the opportunity to conduct a bibliometric analysis related to the correlation of research in the field of mechanical engineering during the pandemic. This is done to find out the extent of research trends in the field of mechanical engineering during the

pandemic. In addition, we also feature comprehensive analysis of the most in-demand documents, citations, authors and keywords. We will also analyze and predict what research in the field of mechanical engineering will be carried out in the future. This analysis was made using the help of tools such as open refine, VOSviewer, R studio, and Ms. Excel.

METHODS

This research begins by collecting research metadata with the keywords "Mechanical Engineering" and "COVID-19". The metadata used in this study is based on research publications published in Scopus indexed journals. The metadata has been collected, exported and downloaded in a comma separated format (*.csv) file.

After the metadata is collected, the metadata is analyzed using Scopus Analyzer to find out trends from related research based on affiliation, document types, country, author, funding sponsor, and subject. After that, the metadata was filtered using OpenRefine software before bibliometric mapping was performed using VOSViewer and R Programming Language. The steps in this study are shown in Figure 1.
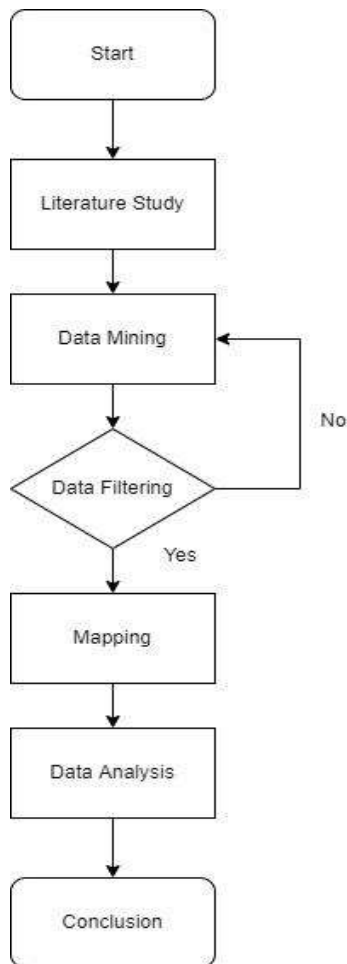

Figure 1. Flowchart of Bibliometric Research Methods

The bibliometric mapping shown in the VOSViewer software and R Programming Language includes the Co-occurrence keyword mapping, country mapping, and co-authorship to find out research trends related to mechanical engineering during the COVID-19 pandemic.

RESULTS AND DISCUSSIONS
Mechanical Engineering Research Trends Every Year
      In this study, we collect research trends in mechanical engineering in the last 10 years based on the number of articles published on the Scopus website. The trend is shown in Figure 2.
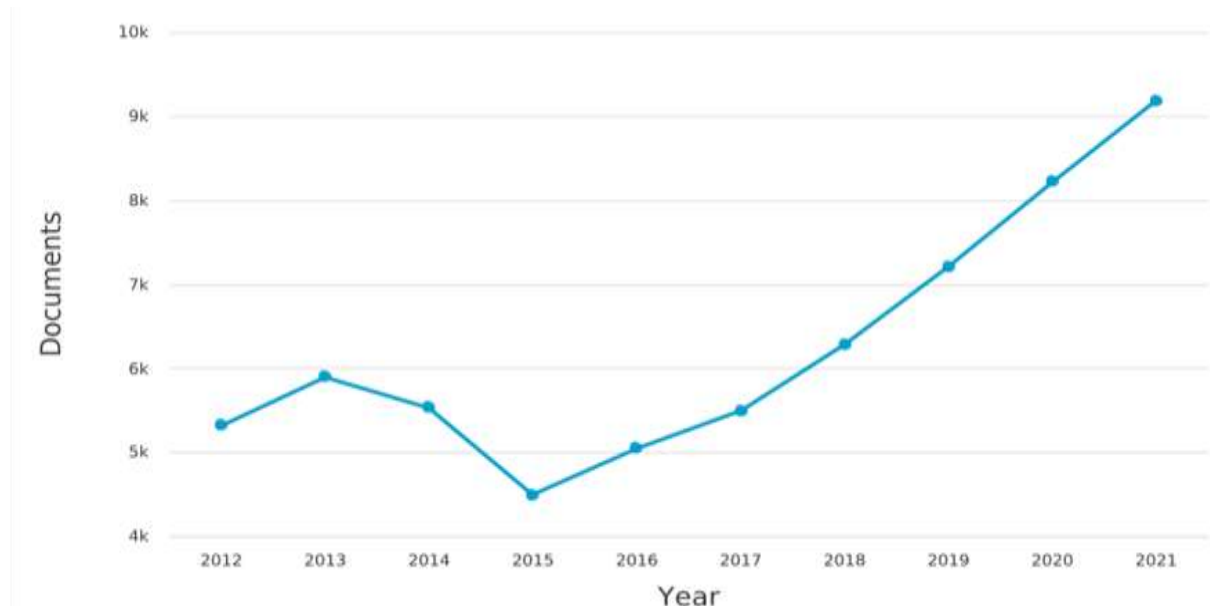

Figure 2. Mechanical Engineering Research trends last ten years

      Based on Figure 2. Mechanical engineering research tends to increase every year, even in the era of the COVID-19 pandemic (2019-2021) where there are social boundaries/lockdowns, mechanical engineering research continues to increase. This indicates that the topic of mechanical engineering is an interesting topic so that it will continue to increase gradually in line with technological developments

Most Publication Keyword in Mechanical Engineering During COVID-19 Pandemic
      Based on the metadata that has been collected from Scopus, we filter the data using the Open Refine software. After that, we mapped using VOSViewer and Rstudio Software. The mapping results from VOSViewer and Rstudio are shown in Figure 3 and Figure 4.
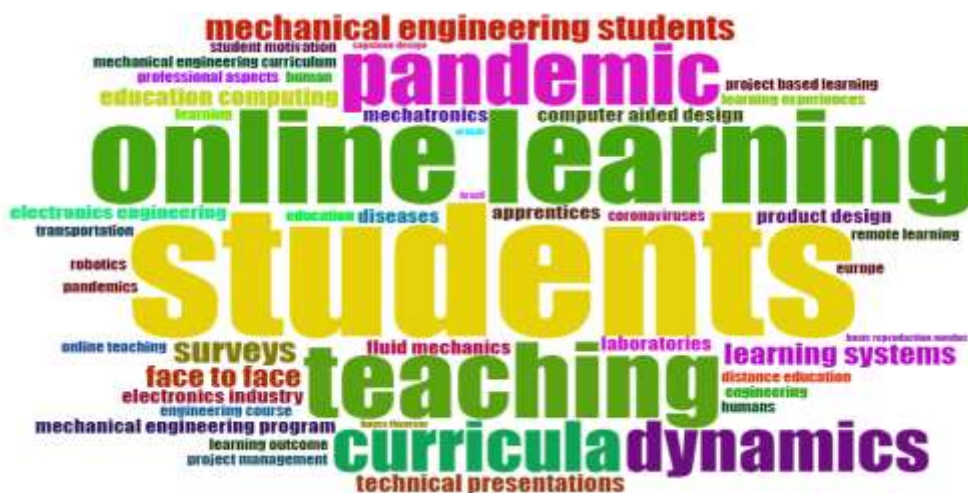

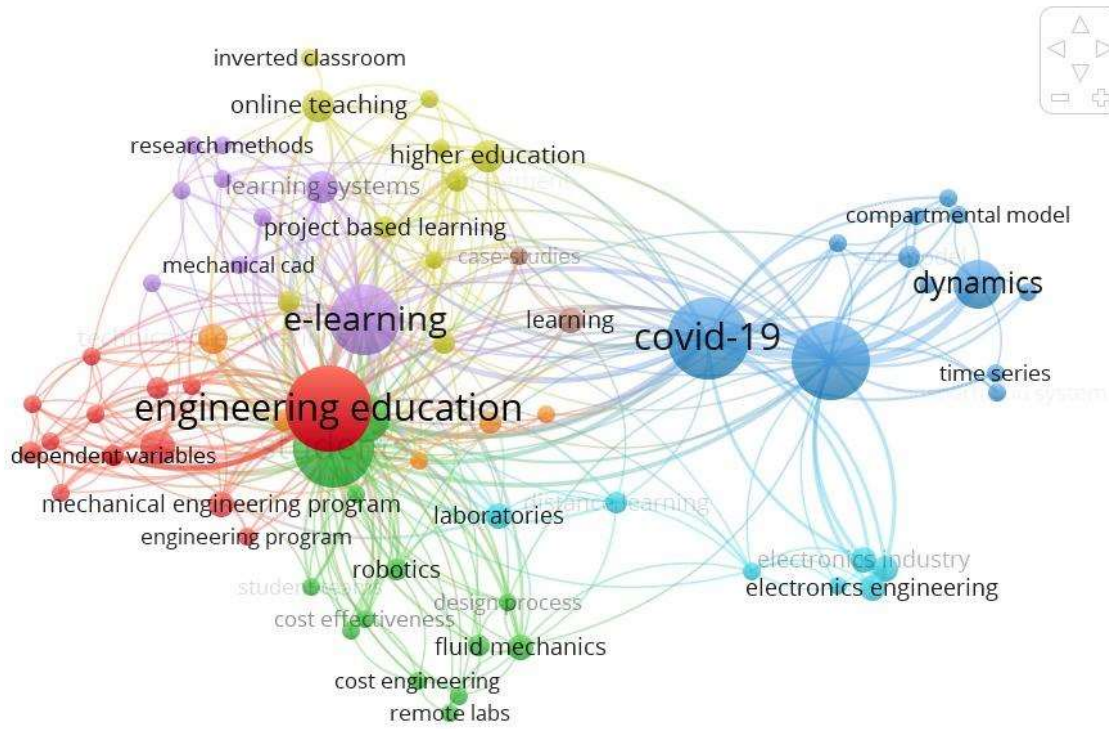Figure 3. Wordclouds Bibliometric Mapping using RStudio

Figure 4. Co-Occurences Mapping using VOSViewer

Based on the mapping shown in Figure 3 and Figure 4, the keywords that often appears in mechanical engineering research in the COVID-19 pandemic era is "online learning". this indicates that during the covid 19 pandemic, many researchers studied how to teach related to mechanical engineering when schools were still on lockdown

Most Publication Country in Mechanical Engineering During COVID-19 Pandemic

In this study, we mapped the country's data that published the most research related to mechanical engineering during the COVID-19 pandemic. We mapped using data from Scopus Analyzer and R programming language. The mapping results are shown in Figure 5 and Figure 6.
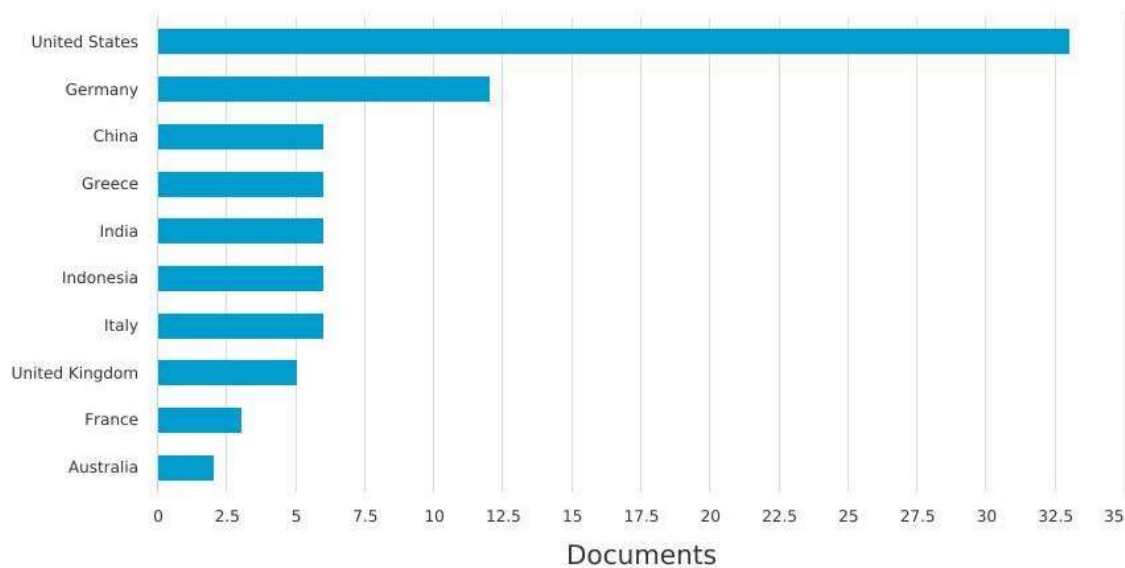

Figure 5. Most Publication Country Ranks in Mechanical Engineering During COVID-19 Pandemic

Figure 6. Most Publication Country Global Mapping in Mechanical Engineering During COVID-19 Pandemic

Based on the mapping shown in Figure 5 and Figure 6. USA is the country with the most publications of mechanical engineering research in the COVID-19 pandemic. Europe is the continent that publishes the most with 5 countries in the top 10 rankings of the most publishers.

These results indicate that there are many authors who publish mechanical engineering research documents in a country during the covid 19 pandemic, but come from many different authors from different organizations so that the number of collaborative relationships is only shown by the mapping of collaborations between countries. In addition, documents published by an author or an organization do not necessarily indicate a high level of collaboration between authors or between organizations. The reputation of an organization and the advancement of mechanical engineering in a country also does not always indicate a greater number of research publications from that organization or country.

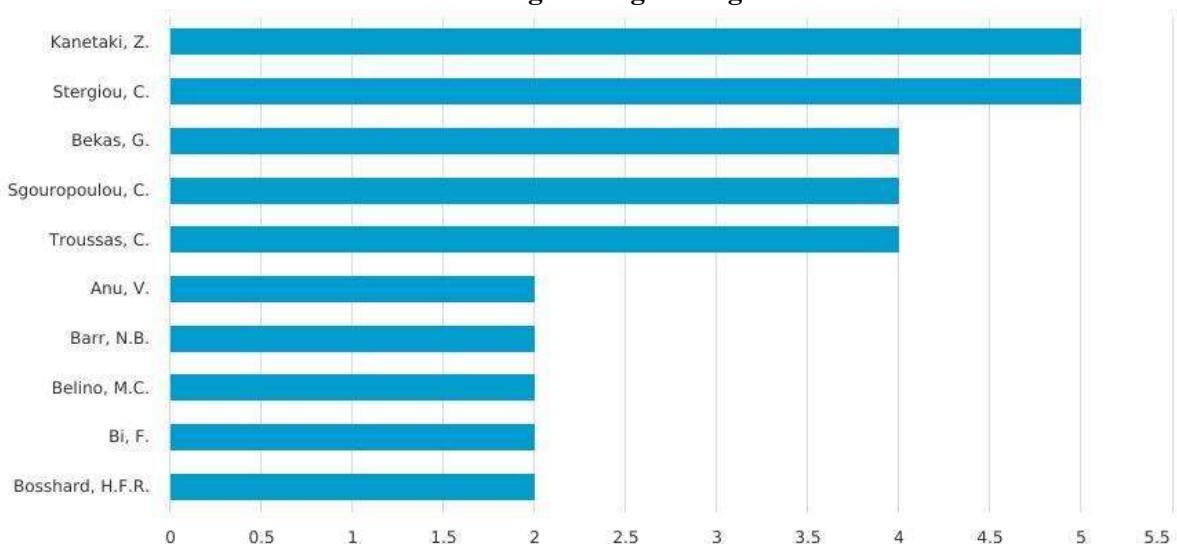**Most Publications Author in Mechanical Engineering During COVID-19 Pandemic**

Figure 7. Most Publication Authors Ranks in Mechanical Engineering During COVID-19 Pandemic

Based on bibliographic mapping from Scopus, the author with the most publications related to mechanical engineering in the COVID-19 pandemic is Kanetaki, Z.

CONCLUSION

Based on the findings and discussion, the following conclusions can be drawn:

1. Mechanical research has gradually increased the number of publications in the last ten years even during the COVID-19 pandemic, which indicates this topic is interesting research and continues to increase along with technological developments. Based on keyword analysis, in the era of the COVID-19 pandemic, the keyword that often appears in mechanical engineering research is "e-learning". this indicates that during the covid 19 pandemic, many researchers studied how to teach related to mechanical engineering when schools were still on lockdown (Tsang, et.al).

2. Based on Country Mapping mapping show that USA is the country with the most publications of mechanical engineering research in the COVID-19 pandemic. Europe is the continent that publishes the most with 5 countries in the top 10 rankings of the most publishers.

3. Based on bibliographic mapping from Scopus, the author with the most publications related to mechanical engineering in the COVID-19 pandemic is Kanetaki, Z.

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