

## Understanding World Research Network Toward Human Capital Indicator: A Bibliometric Analysis

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### Abstract

Globalisation in economics education develops rapidly across multidiscipline around the globe. It has made sense of exploring the trend in research focusing to government budgeting in education allocation; output of education; and productivity toward human capital development. Thus, the purposed of this study to identify the world research network trend in the education budget, output and productivity of human capital. Bibliometric analysis has been conducted in this research to achieve the objectives of the study. The data has been extracted from Web of Science database with the several keywords it is validated. Articles from 2013 to 2022 that related to the topic has been explored and VOS viewer software has been used to analyse the data. The research covered 16, 366 publications related to the research objective. The finding of this study exposed that, there are top 14 most prolific authors, USA is the top ranked country in producing articles related to the topic of research in the American continent. The finding concludes that western countries dominate in publishing the number of articles in this research compared to Asian countries. The findings also indicate that this research is focused more on quality education to enhance the productivity of human capital to reduce inequality. This leads to the growth of a country and will impact the performance of the labour market by making innovations. The outcome of this study benefiter to researcher to identify new research perspective in field of education investment.

**Keywords:** Bibliometric Analysis, Education Budget, Human Capital, Productivity, VOS Viewer

### Introduction

As we all know, the growth of the economy of a country is very important to a country. When the economy of a country is in a good state, it means the country is doing good and the people in the country are filled with all the wealth and basic needs. It is a must for a country to stabilize their economy to perform well in all the other aspects such as education, politics, business and many more. Generally, there are many factors that will influence the economic

growth of a country but recently human capital plays a vital role in improvising the organizational and also the economic growth of a country (Fadillah & Halimah, 2023).

Human capital means the skills, knowledge, and experience possessed by an individual or population, viewed in terms of their value or cost to an organization or country. In a simple way we can say that human capital refers to the value human beings contribute towards achieving the set goals of a given organization. According to Schuller (2001) mention that human capital focuses on the economic behavior of individuals, especially on the way their accumulation of knowledge and skills enables them to increase their productivity and their earnings in doing so, to increase the productivity and wealth of societies they live in. Human capital in education means that producing skilled and educated labors to the economy will affect the growth of the economy. The idea of how the government is focusing on improving the productivity of the human capital will be explained in this article and the relationship between education budget, output and productivity of human capital will be discussed as well.

Human capital via education plays an important role in the process of economic development because it is the key factor for increasing the long-term competitiveness of an economy (Wahilah & Yusma, 2018). Education will help to improve the productivity of human capital by increasing their knowledge and their skills. So, education will produce more skilled and productive workers. The productivity of human capital will affect economic growth. This idea has been promoted by Phoong et al (2017), where they stated in their article that education has always been perceived to have a significant impact on the economy of a country through the development of human capital. It is proposed that workers with higher education attainment are more skilled and productive which eventually contributes to economic growth.

This is why the government is investing higher amounts in the education sector because various research has proved that education will contribute to economic growth in the long run. That is why the Malaysian government has allocated a large amount of money in the budget for education. Malaysian education is divided into three levels which are primary, secondary, and tertiary. In the Malaysian budget the government will allocate a certain amount of money for all levels of education. This is to enhance the education system of the country and to produce more productive individuals through a quality education system. In Malaysia, the government has been investing a high amount of expenditure on education. The UNESCO Institute of Education Statistics shows that Malaysia's government expenditure on education as percent GDP was the highest as compared to Singapore and Thailand (Phoong et al., 2017).

One of the government's efforts to integrate the quality of education in the country to achieve human resource productivity is to enact effective education policies and to have a realistic education plan. We have the 'Pelan Pembangunan Pendidikan Malaysia 2013-2015' (Ministry of Education, 2013) and 'Pelan pembangunan Pendidikan Malaysia (Pendidikan Tinggi) 2015-2025' (Ministry of Education, 2015). These plans were developed after much research and study on the education system and methods in Malaysia. The purpose of this education plan is to help students achieve five overall outcomes, namely access, quality, equity, unity and

efficiency. This plan also has objectives that the education system wants to achieve clearly and is divided into specific waves so that it is easily implied.

This plan will greatly help in improving the quality of the Malaysian education system. Every student who studies in Malaysia will be able to reach a professional level and be able to think quickly and realistically. With this, students can succeed in their careers and contribute to the productivity of human resources. Thus, the purposed of the study to identify the trend of research in budget of education, output and productivity toward human capital.

## **Methodology**

### *Data sources and search strategy*

According to Lee et al (2020) bibliometric as an analytical approach, utilises mathematical and statistical techniques to evaluate the interrelationships and impact of scholarly publications within a particular academic domain. This approach has the capability to offer a comprehensive overview of vast quantities of scholarly literature, while simultaneously recognising valuable research, authors, journals, organisations, and countries across different time periods. According to Clarivate (2023) Web of Science, previously recognised as Web of Knowledge, stands as the establishing bibliographic database. Its inception can be attributed to the visionary Eugene Garfield in the 1960s, when he established the Institute for Scientific Information (ISI). Particularly, following its acquisition by Thompson Reuters in 1992, ISI underwent a transformation and adopted its current names Web of Science, commonly abbreviated as WoS. The database additionally provides bibliometric database sources for conducting literature searches across various research domains. These sources consist of research areas, references, document types, publication years, author lists, regions, and institutes.

The search terms utilised have been entered into the 'topic' field, which effectively scours publications by conducting a comprehensive search of their article titles, abstracts, and keywords. The data retrieval strategy was as follows: (("education" AND "education investment" OR "education budget" AND "output" OR "graduates" AND "productivity" OR "human capital")). The main research focus for this study was identified as the 10-year period which is from 2013 to 2022, thereby affording a more comprehensive perspective on the evolution of research evaluation over the past few decades. In order avoid bias, the task of conducting a search for relevant articles was immediately carried out on the same day, corresponding with the daily update of the regarded WOS database. The results were obtained on July 1, 2023. Due to the language's dominance in academic research, only English-language publications were considered for inclusion on the list.

### *Data Analysis*

Descriptive analysis was used and the research assessments included (1) publication trend by year and subject category; (2) performance by authors; and (3) most productive countries. A software VOS viewer was used to construct and visualise a bibliometric network. VOS viewer provides clear information on visualisation in different research areas via creating a graphic map from the network datasets. The software also helps to visualise links in scientific publications, journals, citations, authorship, institution and countries. VOS viewer has distinct advantages because it can analyse complex networks based on the mapping knowledge domain. Each network map refers to the lines connecting the nodes with thickness based on

“link strength” and represents the strength of network collaborations and connections. The nodes’ size is reflected by the “total link strength” and the number of publications or frequency. For example, the bigger the node means the higher the number of publications. The VOS viewer software was utilised to conduct a co-occurrence analysis, with the aim of visually representing and comprehending the extensive interconnections among the keywords found in the publications. The present study assessed the efficacy of author keywords in the retrieval of article content and scientific notions. The term "co-occurrence frequency" pertains to the frequency at which a pair of keywords appear together, while the frequency of an author keyword is the number of times a specific keyword occurs (Liu et al., 2013). The VOS viewer software facilitates the examination of scientific mapping in a cluster format, which is determined by the robustness of the links within the network data. The co-occurrence analysis does not consider meaningless words and repeated words. This was achieved by examining a specific set of publications within three distinct time periods 2013 to 2022. Conducting an examination of co-occurrence between authors and keywords at a distinct level of research units might provide valuable insights into the connections among network analysis. In addition to that, the use of author keyword co-occurrence analysis allows this study to construct and visually represent the many relationships among the research networks for 10 years’ period. This article presents a map that is constructed using the author keywords. The purpose of this map is to delimit the breadth of the topic, provide a comprehensive perspective of the keywords utilised by the authors, and identify several subtopics within the subject matter.

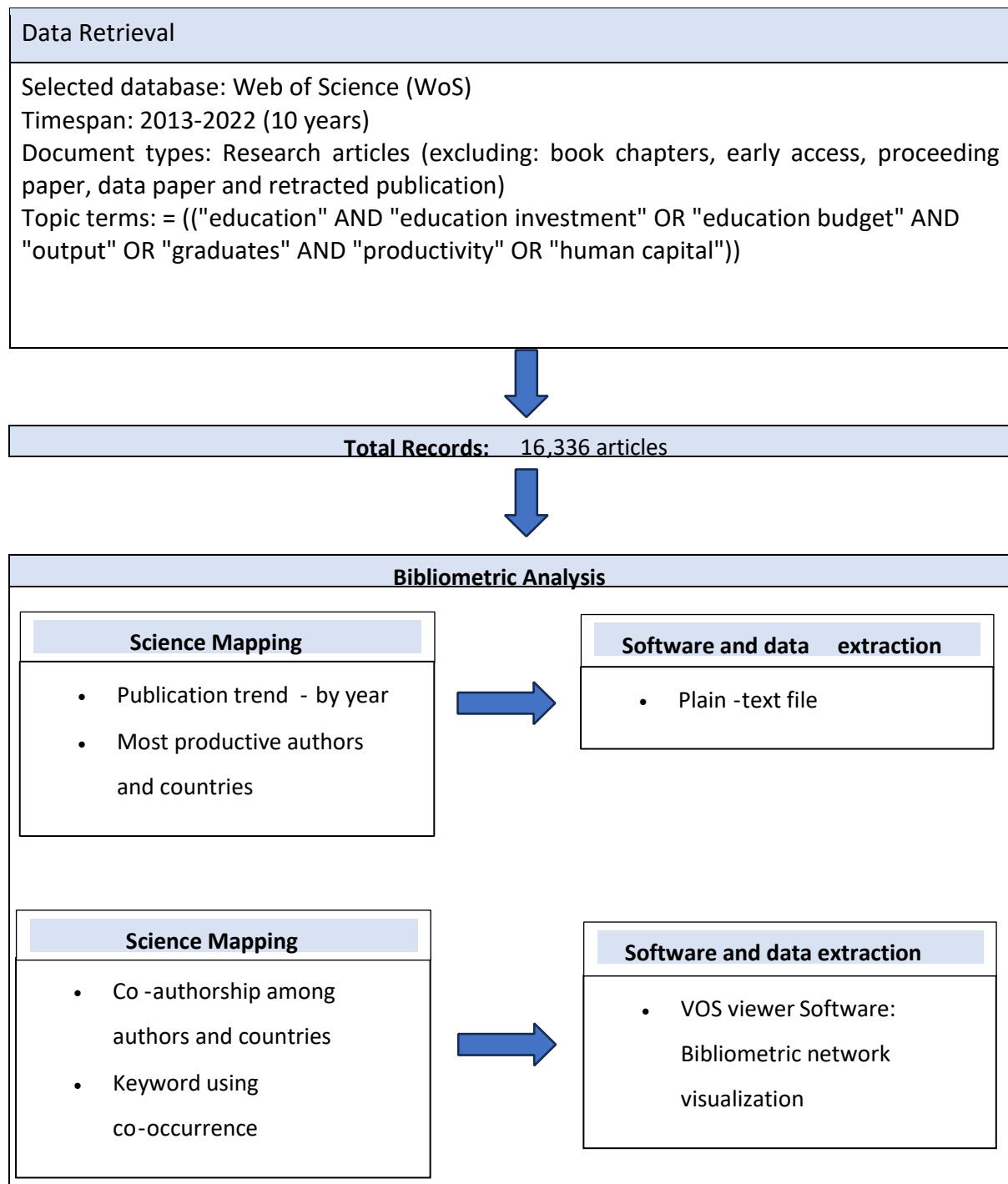


Figure 1: Research procedure

**Results**

*The publishing performance of authors*

*i. Number of publications by authors*

This study involved many authors who participated in this research. A total of 14 authors were found to publish more than 10 research articles during the last 10 years. Table 1 below shows the top 12 most prolific authors worldwide who have published more than 12 papers in this area of research. Most of the articles were published in Italy, where the author has published 19 articles regarding the topic of research. The USA is the most productive and impactful

country, three authors are from USA who have published more than 10 papers each and are among the top 12 authors. The second top author is from Netherlands, where the author has published 16 articles meanwhile the third top author is from Canada who has published 15 articles that related to the topic of research. The rest of the authors who were in the top 12 authors came from various countries, which are from Singapore, Africa, China, Portugal, Japan and Austria. We can conclude that the authors who have published articles that related to the topic of research are from various countries and there are no collaborations were conducted between the authors from the same institutions and countries except for USA.

Table 1

*Top 14 prolific authors*

Scholar	Region	Number of articles	of Total citations (TC)	Average citations per item
Faggian, Alessandra	Italy	19	397	20
Nikjamp, Peter	Netherlands	16	223	13
Bontis, Nick	Canada	15	595	39
Xu, Jian	Singapore	15	465	31
Asongu, Simplicie	Africa	14	187	13
Behrman, Jere R	America	13	755	58
Kong, Dongmin	China	13	257	19
Teixeira, Aurora A.C.	Portugal	13	299	23
Managi, Shunsuke	Japan	13	157	12
Prettner, Klaus	Austria	12	322	26
Guerrero, Maribel	Arizona	12	513	42
Carvajal, Manuel J.	Florida	12	52	4
Martin-Alcazar, Fernando	Spain	11	77	7
Lutz, Wolfgang	Australia	11	972	88

*ii. Co-authorship among authors*

The co-authorship analysis among the authors figure 2 is restricted to research articles with a maximum of 30 authors per document, which resulted in 378 authors. This number was reduced to 55 authors by counting with a minimum of five publications. The network map (see Figure 2) with a significant set of linked items involves 11 authors within three clusters. Cluster 1 (marked in red) consists of 5 core authors (i.e., Behrman, Jere.R., Maluccio, John.A., Martorell, Reynaldo, Ramirez-Zea, Manuel and Stein, Aryeh D). The core authors' network of Cluster 1 is connected closely with those cluster 3 (marked in light blue), which comprises the following three core authors: Horta, Bernardo. I., Norris, Shane.A. and Ritcher, Linda.M. The core authors of cluster 3 is connected with those in cluster 2 (marked in green). Those in cluster 2 (marked in green) consist of three core authors: Barros, Fernando. C., Gonclaves, Helen, Victoria, Cesar.G. In summary, the network map between the authors clearly demonstrates the authorship relations among the authors.

The most active authors that are involved in this research.

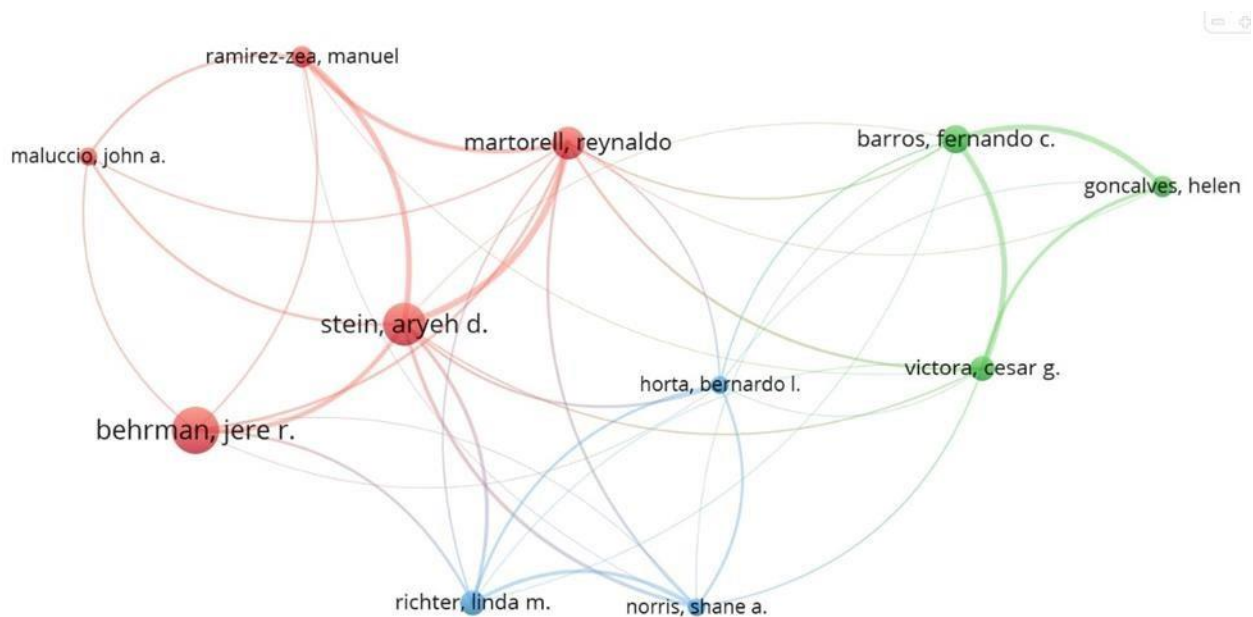


Figure 2: Co-authorship among teachers

### iii. The publishing performance of countries

#### a) Number of publications by countries

This research has been emphasised on number of publications by countries. The most productive countries are from the European region (i.e., England, Germany, Italy, France, Spain, Sweden and Switzerland). Other productive countries are from the American continent (USA), Asian continent (China) and the Australia continent (Australia). Almost 4,321 articles 26.5 % have been published in the USA. According to the Organization for Economic Co-operation and Development (OECD), consistently advocates for countries to undertake reforms in their education and training systems.

Economists frequently utilize the term "enhancing human capital" to describe this phenomenon. The second most productive country is England (1414 articles published) and this indicates that according to data from the OECD, there has been a significant increase in the proportion of the England population having tertiary education by 2019. Among individuals aged 55-64 years old, this share has risen to 39 %, while among those aged 25-34 years old, it has reached 52%. China is becoming the third most productive country 2, 155 articles published. This is followed by three other western countries: Germany (1, 025 publications), the Australia (867 publications) and Italy (843 publications). The available evidence suggests that the level of involvement in this research in Asia is relatively low in compared to European countries. Hence, western countries dominate in publishing the number of articles in this research compared to Asian countries.

#### b) Co-authorship among countries

Around 170 countries have fulfilled this requirement; 116 countries complied with the threshold of having at least five documents. Figure 3 shows the network of co-authors of this research across the countries, which involves 9 clusters with 116 items. The size of the nodes determines the strength of the links. A country with a greater node reflects more significant interaction and collaboration with these researchers in other countries. The USA node size is almost equal to England's, Peoples R China's and Germany's, although the USA had the

highest total link strength 2, 377. Such signifies that England, China, Germany, Australia and Italy have a strong cooperative relationship in conducting this research. England (Cluster 7, marked in orange) has the second largest research network (with other countries) in research-related disciplines, with 91 networks and total network strength of 1605 recorded. It is followed by China (Cluster 2, marked in green) as the third-highest Asian continent country among authors countries (a comprehensive network of 73 and a network strength of 1, 155 recorded). The Germany (Cluster 8, marked in light brown) recorded 74 networks of authors between countries. However, Australia showed a higher network strength 686 than the Italy's 658. Overall, the network analysis indicates that Asian nations exhibit lower levels of productivity in establishing research networks for this research about education investment, output and productivity of human capital.

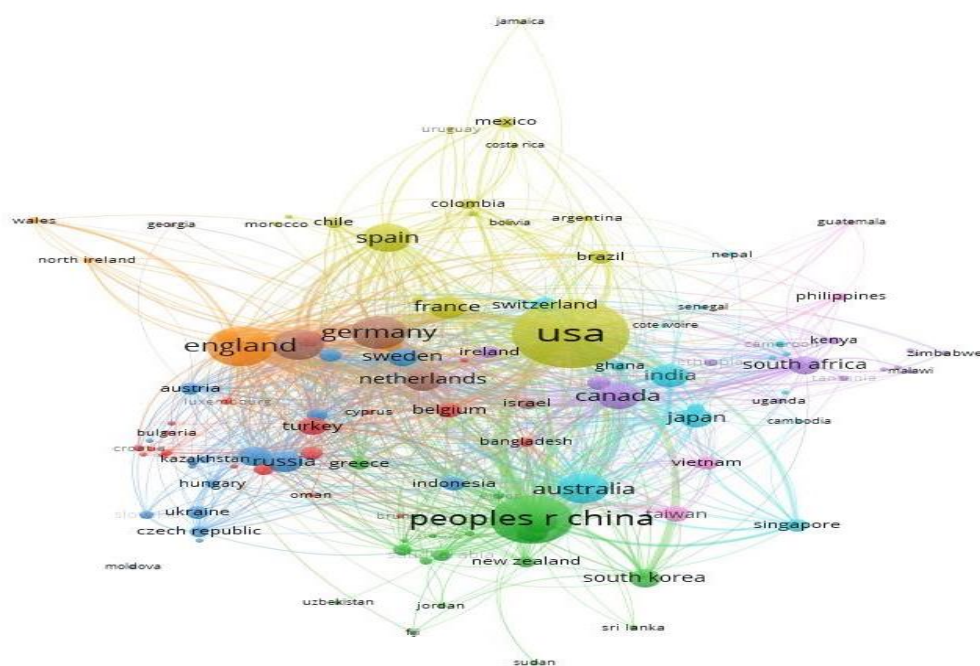


Figure 3: Co-authorship among countries

#### iv. Research status based on keywords cluster analysis

Keywords are essential in scientific publications to comprehend research trends and overall research emphasis and direction. Understanding keywords assist researchers in identifying the research areas of concentration and research gaps. Table 2 illustrates the occurrence of keyword revolution by cluster in the field of research from the year 2013 till 2022. A groundbreaking analysis of the author's keywords over the 10 years revealed a total of 3 clusters. Figure 4 illustrates the map analysis using VOS viewer. The co-occurrence of keywords is restricted to maximum of 5 keywords per document and later it resulted as 50 keywords. The keywords were then reduced to 48 which resulted in 3 clusters: 18 items in cluster 1, 15 items in cluster 2 and 15 items in cluster 3. To explain the relationship between the keywords, the size of variation was referred to as the total link strength value (see Table 2).



Table 2

*Author keyword based on clusters*

Cluster	Author-Keyword	Occurrences	Total Link Strength
Cluster 1 (red colour)	Earnings Education	572	1324
		1763	4222
	Employment	535	1261
	Gender	551	1116
	Health	693	1321
	Human capital	4431	9618
	Income	450	1080
	Inequality	748	1873
	Labor	314	786
	Labor-market	315	751
	Migration	584	1317
	Mobility	351	846
	Outcomes	292	629
	Quality	452	1123
	Returns	439	1226
	Skills	324	848
	United-states	342	734
	work	427	844
Cluster 2 (green colour)	China	597	1369 846
	Countries	294	
	Determinants	698	1835
	Economic growth	651	1511
	Financial development	245	753
	Foreign direct investments	274	868
	Growth	1573	3984
	Institutions	371	1075
	Investment	848	2343
	Panel-data	362	1118
	Policy	438	898
	Productivity	913	2599
	Research-and-development	453	1535
	Technology	555	1626
	Trade	349	1014
Cluster 3 (blue colour)	Competitive advantage Entrepreneurship	316	1011
		506	1504
	Firm	278	758
	Firm performance	445	1151
	Human-resource management	293	854
	Impact	1823	4557
	Innovation	1201	3557
	Intellectual capital	478	1187
	Knowledge	732	2199
	Management	689	1648

Based on Table 2 and Figure 4 illustrated an author keyword based on clusters. This finding found that tree main cluster i.e. clusters 1 (marked in red colour) which consists of 18 items is connected closely to Cluster 2 (marked in green colour) consists of 15 items. Those in Cluster 2 connected closely to Cluster 3 (marked in blue colour) which consists of 15 items. In Cluster

1, the biggest node size is the key word human capital which has total link strength of 9, 618. The second highest keyword used in Cluster 1 is education with total link strength of 4, 222. The third highest keyword is inequality who total link strength of 1873. The keywords used in the Cluster 1 shows that this research focused more on education to enhance the productivity of human capital and to reduce the inequality in labour market.

In Cluster 2, the map illustration also indicates that the keyword growth is the biggest node size with higher total link strength value 3, 984 connections. The growth keyword represented by Cluster 2 (marked in green colour) is the dominant keyword in that cluster. The same keyword is also linked to another keyword including productivity as the second-highest total link strength value 2, 599. These keywords focused more on economic growth that based to productivity.

Meanwhile in the Cluster 3 (blue colour), the highest keyword is impact with total link strength value 4, 557. The second highest keyword that has 4, 353 as total link strength value is performance. The third highest is innovation with total link strength value of 3, 557. In summary, this research topic focused more on quality education to enhance the productivity of human capital to reduce inequality. This leads to the growth of a country and will impact the performance of labour market by making innovations.

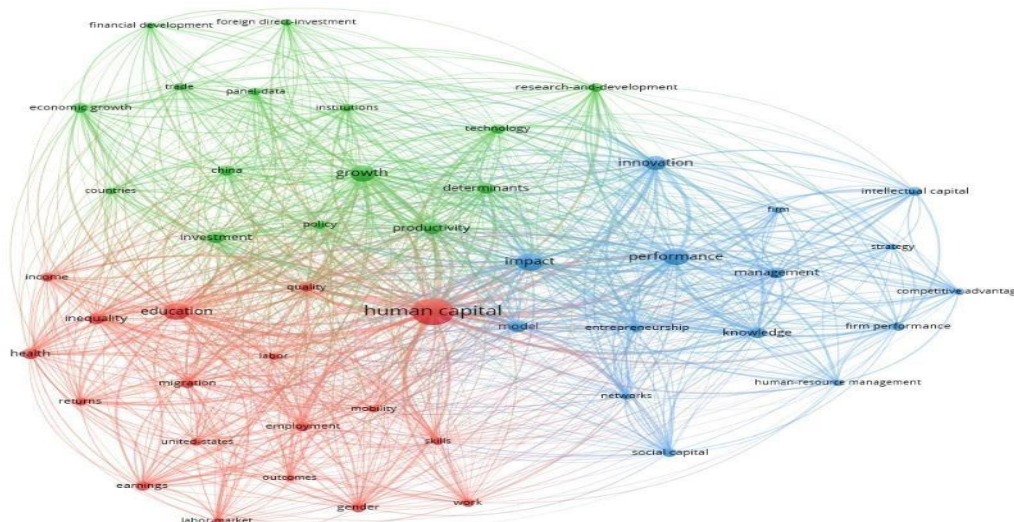


Figure 4: Three cluster of keywords based on VOS viewer Future Research Directions

The most remarkable limitation of the current research is the method used. The study searched only the WoS database and excluded Scopus or Google Scholar. Second, the study included only research articles published in English. This research has not used articles that are published in other languages. Most of the previous studies published between 2013 until 2022 note the relationship between educational investment, output and productivity of human capital. The trend of this research is focused on economic growth, labor market, employment and entrepreneurship. Mostly, the articles focused in identifying the impact of education investment towards the productivity of human capital.

Future research in this field can be more focused on Asian countries because according to our bibliometric analysis in this research topic the most number of articles has been published at western countries such as United States of America, Germany, Switzerland, Italy and many

more. This shows there is a lack of research in this topic from Asian countries. Researchers from Asian countries should publish to fill the research gap that arise. This will help to improve the education system of Asian in coming days and also to enhance the productivity of human capital.

### **Conclusion**

This paper reports the findings of a comprehensive bibliometric analysis on the relationship between education investment, output and productivity of human capital by covering peer reviewed articles published from 2013 until 2022 through the WoS data based. The results can assist researchers in recognising the strengths and trends in this research around the world and recommend future research areas. The research covered 16,366 publications related to this field of research. Regarding the top 14 most prolific authors, Faggian, Alessandra is the most productive author (19 articles), followed by Nikjamp, Peter (16 articles), Bontis, Nick (15 articles, Xu, Jian (15 articles) and the rest others (fewer than 14 articles). Such indicates that the USA is the top ranked country in producing articles related to the topic of research in the American continent. We can conclude that western countries dominate in publishing the number of articles in this research compared to Asian countries. The co-occurrence analysis of keywords was conducted to evaluate this research studies in terms of research areas between 2013 and 2022. The findings indicate that this research is focused more on quality education to enhance the productivity of human capital to reduce inequality. This leads to the growth of a country and will impact the performance of labour market by making innovations.

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