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MATHEMATICAL MODELING ON ISLAMIC ECONOMICS AND FINANCE: A SCIENTOMETRIC

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Abstract

This study aims to determine the development map of mathematic model in islamic economics and finance research that is indexed by Dimensions with the keyword "Mathematical in Islamic economics finance". The data analyzed were 76 selected publications. The development map of mathematic model in islamic economics and finance research analyzed using the Biblioshiny-R and VOSviewer application program to find out the bibliometric map. The results showed that the number of publications on the development of mathematic model in islamic economics and finance research from 1980-2020 experienced a significant increase and the highest impact were published in International Journal of Islamic and Middle Eastern Finance and Management. Network visualization showed that the map of the development of mathematic model in islamic economics and finance research was divided into 3 clusters. The majority of research is related to modeling of Profit Loss Sharing (PLS) schemes. Islamic bank financing is still an interesting trend topic in recent research. However, despite the development of using mathematical model in those researches, the approach tends to be adaptive (inductive) from conventional models that already exist. A challenge to review the mainstream model need to be further critically reviewed.

Keywords: *Mathematical Model; Islamic Economics & Finance; Bibliometric; Scientometric*

INTRODUCTION

Background

The growth of the Islamic finance industry must be supported by economic development and Islamic finance in theory. The practice and theory of Islamic economics and finance must go hand in hand so that a practical-implementative manifests itself from the application of science at the theoretical-level. Based on this argument, researches on the development of Islamic economic knowledge are very important. In terms of Islamic economic and financial development that is academic-theoretical, Islam has its own paradigm, namely an approach through Islamic economic experiences (behavior) in the past to study the current hot issues that are happening in the field. Then the problem is analyzed with a contemporary economic approach with modern analytical tools that will produce postulates, axioms and Islamic economic theory as a result of empirical experience. Theory testing is done to find the deficiencies of the theory so that it can be evaluated so that the Islamic economic theory model obtained can be better and relatively applicable in many places and times. Among these processes there is the role of mathematical modeling that can be used for testing calculations and describing economic assumptions.

Mathematical modeling in Islamic economics and finance is a mathematical application consisting of real or complex numbers, vectors, matrices, symbols, mathematical operations, and others that form a model that can explain the conditions of an Islamic economic and financial problem (Mirakhor & Krinchene, 2014). Then in the perspective of Islamic economics and finance, students or professionals need the ability to calculate mathematics and statistics used to complete tasks both in financial institutions and non-financial institutions. Without calculation skills, students and professionals will not be able to manipulate economic and financial data.

Financial institutions such as pension fund institutions, securities companies, insurance companies, and asset management companies that require actuarial knowledge, investment modeling, and risk management. Professionals may be quite satisfied with the standards provided by their company and the software used to process data and complete calculation tasks plus the availability of the internet which makes it easy to obtain calculation results quickly and easily. However, it is very important to understand the theory underlying mathematical calculation procedures. Then the development of mathematics and modeling has progressed and even training on the application of mathematical models has been done, but unfortunately not many applications of mathematical modeling on topics relevant to Islamic economics and finance. From this background, the authors are interested in discussing the development of the application of mathematical models in Islamic economic and financial research that has been indexed by Dimensions since 1980 until 2020 with 76 selected publications. So far, there is still very little or even no research that maps research and studies related to the use of mathematical models in research on Islamic economics and finance. Therefore, this study becomes important to do to fill the research gap.

This study aims to determine the map of research developments related to the application of mathematical models in Islamic economic and financial research that are indexed by Dimensions using VOSviewer and Biblioshiny-R software. This analysis is called bibliometric analysis. In addition, prior to bibliometric analysis, publications related to mathematical models in Islamic economic and financial research that were indexed by Dimensions were analyzed based on text mining, namely Meta Analysis. Matters presented in the meta-analysis are related to publication, year of publication, country case studies, number of article authors, research topics, citations, and methodological approaches used by paper related to the application of mathematical models in Islamic economic and financial research.

LITERATURE REVIEW

In general, the notion of a model is an attempt to create a replica or imitation of a social phenomenon or natural event. There are three types of models namely physical models, analogical models and mathematical models. Physical modeling is used to simulate the space or domain in which the phenomenon occurs while analogical modeling is carried out by analogizing phenomena with other phenomena to then construct the physical model. The replica of mathematical model is implemented by describing phenomena in a set of equations. The suitability of the model for the phenomenon depends on the accuracy of the formulation of mathematical equations in describing the phenomena that are imitated (Luknanto, 2003).

Mikrakhor and Krinchene (2014) explain a model that presents a theory and simplifies the situation that occurs in the field by describing it into an equation. It is written in the form of formulas that are compared with the explanation of the description of long words. Economics is closely related to the use of mathematical functions and models. Some examples of important and often used functions are demand and supply functions, budget functions, production possibilities curve functions, production functions, and other economic functions.

Another aim of mathematical approach is to derive a set of conclusions or theorems from a given set of assumptions or postulates Chiang (2005). Instead, any worldviews where set of assumptions or postulates as a point of embarkation should be critically reviewed. In this context, economics is instilled by values which is derived from a certain worldview. In other words, the normative values/ethics which are derived from a particular worldview will come up with theoretical differences, including mathematical model. Mathematical model which derived from Western worldview will certainly claimed that economics shall be positive science devoid of value judgment.

Unfortunately, there are many researches in Islamic economic and financial are still working on conventional mathematical model. The model that presents a theory is mainly developed within the framework of Western worldview. There is a tendency for the scientification process of economics based on secular values to eliminate the vision or purpose of life of a Muslim.

Al-Attas (1995) asserts that the stage of islamization is a solution to organize science to fit the moral message of the Qur'an which does not recognize dichotomy. Islamic economics will not provide a conventional dichotomic customary space between substantive and normative descriptions in social science (Abusaud 1993). Because consideration to make ethics or morals into endogenous variables in a socio-economic system becomes a necessity (Choudhury 1990). Al-Attas's (2014) method of Islamization of Knowledge consists of two steps. First, is to carry out the stage of isolation or elimination of foreign elements and key concepts from the body of existing knowledge, and second, to infuse Islamic values and key concepts into it.

However, Islamic economics methodology (including the usage of mathematical model) should not start from scratch but use the relatively more advanced development in conventional economics (theories and methodologies) and attempt to make them compatible with Islamic economics (Hasan, 2016; Haneef & Furqani, 2012). Therefore, apart from the beneficial usage of mathematical model, the current working researches shouldn't just purely adopt or a mere infusing the Islamic values into the mainstream's model. What really matter for adopting mathematical models into the Islamic economics is that, it shouldn't cause obstacles in achieving the aim of Islamic economics, which is Falah (Abdullahi, 2018).

Bibliometric mapping is an important research topic in literature studies. Two aspects of bibliometrics which will be distinguished are the development of the bibliometric map and therefore

the graphical illustration of the map. Bibliometrics is used as a methodology in many fields of science, first and foremost for publication patterns in different scientific disciplines. For several decades bibliometrics has provided advantages in management science for making decisions. The use of bibliometrics is a quantitative and statistical analysis to describe patterns of publications without involving segments or describing patterns from publications or entire sections of literature. Researchers can use the bibliometrics method in evaluations to determine the influence of a single author or to describe the relationship between two or more authors.

Van Eck & Waltman (2007b) stated that bibliometrics is a study of the production and dissemination of information which is operationally reviewed through the production and dissemination of media that records information to be stored and disseminated. Some previous studies related to Islamic economics and finance using this method include research conducted by Rahman et al. (2020) related to SRI sukuk, Ahmid & Ondes (2019) on PhD research on the theme of Islamic banking and finance in the UK, and Rehman & Othman (1994) related to Islamic economic literature in general.

METHODOLOGY

This study uses international publication data on the application of mathematical models in Islamic economic and financial research sourced from the Dimensions database with the categories article titles, abstracts, keywords in the period 1980 - 2020. From the search results obtained as many as 76 selected publication articles. Data in the form of publications, years of publication, country case studies, number of article authors, research topics, citations, and methodological approaches used by each publication article were analyzed using Microsoft Excel 2010. Whereas the development trends of mathematical model publications in Islamic economic and financial research analyzed using VOSviewer and Biblioshiny-R software.

To create maps, VOSviewer uses VOS mapping techniques (Van Eck and Waltman 2007a), where VOS stands for visualization of similarity. VOSviewer can display maps that are built using appropriate mapping techniques. Therefore, this program can be used not only to display maps built using VOS mapping techniques but also to display maps constructed 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 like Web of Science or Scopus database.

The purpose of VOS is to place items in low dimensions such that the distance between the two items accurately reflects the uniformity or interrelation of the items. For each pair of items i and j , VOS requires an input similarity s_{ij} ($s_{ij} \geq 0$). VOS treats the S_{ij} equation as a measurement on a ratio scale. The equations of s_{ij} are usually calculated using the power of association defined in Equation 1 (for example Van Eck & Waltman, 2007b). VOS determines the location of items in the map by minimizing.

$$V(x_i, \dots, x_n) = \sum_{i < j} s_{ij} \|x_i - x_j\|^2 \quad (1)$$

to be:

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

There are two computer programs that have already implemented VOS mapping techniques. Both of these programs use the SMACOF algorithm variants mentioned above to minimize Equation 1 to Equation 2.

In addition to the mapping of Islamic economic and financial research that uses the mathematical model application approach, this study also tries to map the quality of these studies based on the Islamization framework proposed by Al-Attas. Two terms are used in mapping these studies; 1. Originative, meaning that the research carried out has carried out the process or stages of Islamization, 2. Adaptive, meaning that the research carried out only adopts an existing mathematical model with or without any process or stages of Islamization framework.

The basic idea of originative and adaptive has come from the fundamental issue, whereby Islamic economics and finance and conventional ones were departing from different worldviews. The difference between the theoretical foundation of the two might come up with a different conceptual outcome. The ethical foundation of Islamic economics will certainly recognize a specific scientific body of knowledge, including realistic model building (Hasan, 2016). Using the Islamization framework of Al-Attas (2014), any attempts that carry out the stage of isolation or elimination of foreign elements and key concepts from the body of existing knowledge, and infusing Islamic values and key concepts into it are considered as originative paper. According to Choudhury (2012), the originative process should be deductively carried out from the basic teaching of Islamic economy. He argued to totally reject the conventional neoclassicism and returning to an epistemological system premised on the Tawhidi worldview of unity of knowledge.

Whereas adaptive paper, could be and the two form, namely incorporated-adaptive and purely-adaptive papers. The former is characterized by papers that employing the existing conventional mathematical model with any attempts to critically evaluate the basic concept behind the model. Whereas the later, the papers only replicating the existing mathematical model and apply it as an analysis basis or framework to the practices of Islamic economic and finance.

RESULTS AND ANALYSIS

This study reviewed 76 studies with publishing from 1980 to 2020 on mathematical models in Islamic economic and finance (IEF) research indexed by Dimensions. In 76 papers, the most research on mathematical models in Islamic economic and financial research that was indexed by Dimensions was conducted in Malaysia with 23 papers and the second highest in Indonesia with 15 papers. Other mathematical model studies in Islamic economic and financial research take place in Pakistan, Saudi Arabia, the United States, Oman, Iran, and UK with 11, 9, 6, 4, 2, and 2 papers respectively (Table 1). This finding is relevant to the results of the publication of the Islamic Finance Development Report (2019) which put Malaysia, Indonesia, and Pakistan as the best countries based on Islamic finance knowledge indicators, especially the number of peer-reviewed articles and the number of research papers.

Table 1: Classification of Publications by Case Study

No.	Country	Number of Article
1.	Malaysia	23
2.	Indonesia	15
3.	Pakistan	11
4.	Kingdom of Saudi Arabia	9

5.	United States	6
6.	Oman	4
7.	Iran	2
8.	United Kingdom	2
9.	Italy	1
10.	Kuwait	1
11.	Morocoo	1
12.	Nigeria	1
Total		76

Classification of articles based on the number of citations is shown in Table 2. There are 10 articles that have the most citations. The number of citations from each journal was obtained from Google Scholar on January 22, 2021. The article with the most citations was titled "Islamic interest-free banking, A theoretical analysis" which discusses mathematical models on Islamic banking with as many as 490 citations. Then the topic of many mathematical models used as citation is the topic of Islamic economics and followed by the topic of Islamic banking, and Islamic capital markets. The article with the 10 most citations is dominated by articles published under 2000.

Khan's article (1986) was the most cited because it's one of the first research uses mathematical models for Islamic banking at a time when other similar research still rarely use it. Khan criticizes Islamic economic academics for the absence of theories that strengthen the building of the Islamic economics system, especially in the research about Islamic banking and monetary compared to conventional banking. Meanwhile, Choudhury & Hoque (2006) discussing on corporate governance related to Islamic socio-scientific epistemology. The results show that there is a big difference between the concept of Islamic corporate governance with mainstream literature. In its time, this paper was also one of the first to discuss mathematical modeling in the Islamic version of corporate governance theory proposals.

Another research that often used as a reference is an article written by Khan (1989). Slightly different from Khan's (1986) research article, this research tries to use mathematical modeling to compare Islamic financial systems based on a variable return scheme (VRS) with conventional systems based on a fixed return scheme (FRS). Substantial results found in this article include mentioning that debt-based transactions (fixed) frequently used in financial transactions due to asymmetric information and high monitoring costs.

Table 2: Classification of Publications by Citation

No	Year of Publication	Title	Citation
1	1986	Islamic interest-free banking, A theoretical analysis	490
2	2006	Corporate governance in Islamic perspective	192
3	1989	Towards an Interest-Free Islamic Economic System	179
4	1984	Macro Consumption Function in Islamic Framework	113
5	1983	Portfolio management of Islamic banks, Certainty model	73
6	1994	Comparative economics of some Islamic financing techniques	70
7	1993	Equilibrium in a Non-Interest Open Economy	70
8	1996	Cost of capital and investment in a non-interest economy	58
9	1984	The Role of Sock Exchange in Islamic Economy	47
10	1993	Equity capital, profit sharing contracts and investment, Theory and evidence	43

Map of Development Mathematical Model in Islamic Economics and Finance Research

From the search results from the database 76 documents were then exported to the .txt format, inputted and analyzed with VOSViewer, the following results were obtained.

1. Visualization of Network Co-Word Maps

The results of the co-word map analysis of these keywords form the basis of mapping co-occurrence of important or unique terms contained in certain articles. Mapping is a process that allows one to recognize elements of knowledge and configuration, dynamics, interdependence, and their interactions. Knowledge mapping is used for the purposes of technology management, which includes the definition of research programs, decisions related to technology activities, the design of knowledge base structures, and the making of education and training programs. Related to bibliometrics, science mapping is a method of visualizing a 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 network map of mathematical model research in Islamic economic and financial research can be seen in Figure 1.

Figure 1: Network visualization of co-word maps

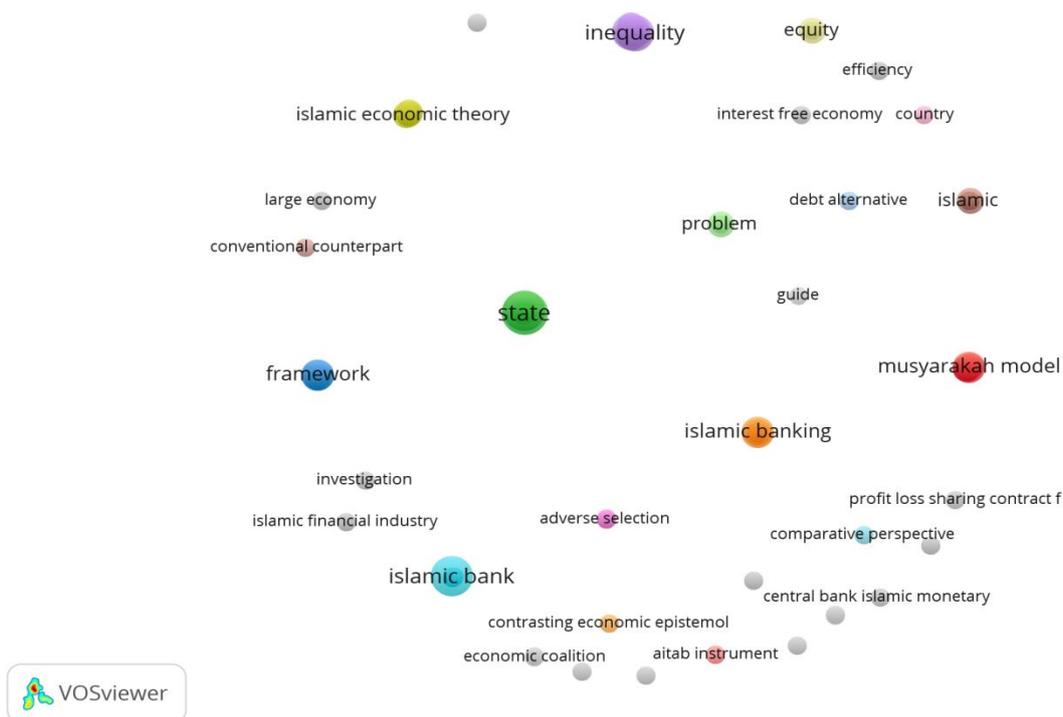


Figure 1 shows that the map of the development of mathematical model research in Islamic economic and financial research is divided into 3 clusters as follows.

- Cluster1 consists of 14 terms that is *Islamic banking, musyarakah model, profit loss sharing (PLS) contract, comparative, perspective, central bank, Islamic monetary, aitab (al-ijarah tsumma al-bai') instrument, contrasting economic epistemology, economic coalition, adverse selection, Islamic bank, islamic financial industry, and investigation.*

- Cluster 2 consists of 9 terms that is *inequality, equity, efficiency, interest free economy, country, debt alternative, problem, Islamic, and guide*.
- Cluster 3 consists of 5 terms that is *Islamic economic theory, large economy, conventional counterpart, state, and framework*.

Cluster 1 talks a lot about contracts and practices in Islamic banking, in particular the scheme and modeling of profit-loss sharing, both *mudharabah*, and *musyarakah*. Some modeling related to the PLS scheme, among others, was carried out by Bakhtiar et al. (2014), Halim (2013), Halim et al. (2016), Hasan (2010), Khaled & Khandker (2015), Sugema et al. (2010), Sumarti & Marendri (2017), Sumarti et al. (2015), Wahyudi & Sakti (2016) and Wolf et al. (2018). Meanwhile, specifically, the *mudharabah* profit-sharing modeling has been carried out by Cahyandani et al. (2017), Jaffar & Isa (2011), and Omar & Jaffar (2016). The mathematical modeling research for the *musharakah* scheme has been investigated by Jaffar (2010), Jaffar et al. (2017), Mostafa et al. (2016), and Samson et al. (2008). Although the majority is applied in the banking industry, there are also those who make the *takaful* industry and the capital market as the object of study.

For example, relatively recent research, for example, Wolf et al. (2018) proposes a simple mathematical model that shows that the PLS contract can be used between *mudharib* and *shahibul maal* as potential alternative contracts for institutional debt financing. The important conclusion in his research is that the PLS financing scheme is an effective financing alternative, especially for medium-term and long-term loans, not short-term.

Cluster 2 in the visualization of co-word maps has a lot to do with the issue of fairness and injustice in financial transactions. The researchers consider that the Islamic-based transaction agreement especially profit sharing can answer this problem. The results of research conducted by researchers are at least able to prove in a mathematical formula that PLS-based financing is an alternative to *ribawi*-based debt financing. Islamic guidelines in dealing are considered capable of providing solutions to achieve justice and benefit between investors and business people. Some research that shows this can be found in studies conducted by Bashir et al. (1993), Hasan & Siddiqui (1994), Hasan (2010), Khan (2015), and Tag el-Din (1992). Wolf et al. (2018) even prove that the PLS scheme can be an alternative to long-term interest-based loans in developing countries.

Meanwhile, cluster 3 in the co-word map visualization has a lot to do with theories that underlie Islamic financial and business transactions which are then reduced to mathematical models both macro as an economic system and micro as the form of Islamic economic and financial contracts as a comparison of conventional contracts in industry commercial banking in several countries. As has been shown previously, several Islamic banking scheme practices are found in countries such as Malaysia, Indonesia, Pakistan, and some GCC countries. An example is a research conducted by Abdullahi (2018), Kiaee et al. (2013), and Wahid (1985).

Indeed some terms and topics are among these three clusters. But in general, based on bibliometric calculations and mapping through VOSviewer, these three clusters are the largest and most structured. Some terms and topics are between the 2 clusters in which there is interconnectedness. Because in principle, in Islam and also Islamic finance and finance, there are no elements or variables that stand alone. The elements tend to relate to each other or are known as interdependence. The only one that is not affected is God (Allah) as an absolute independent variable (Choudhury, 1990, 2009, 2011).

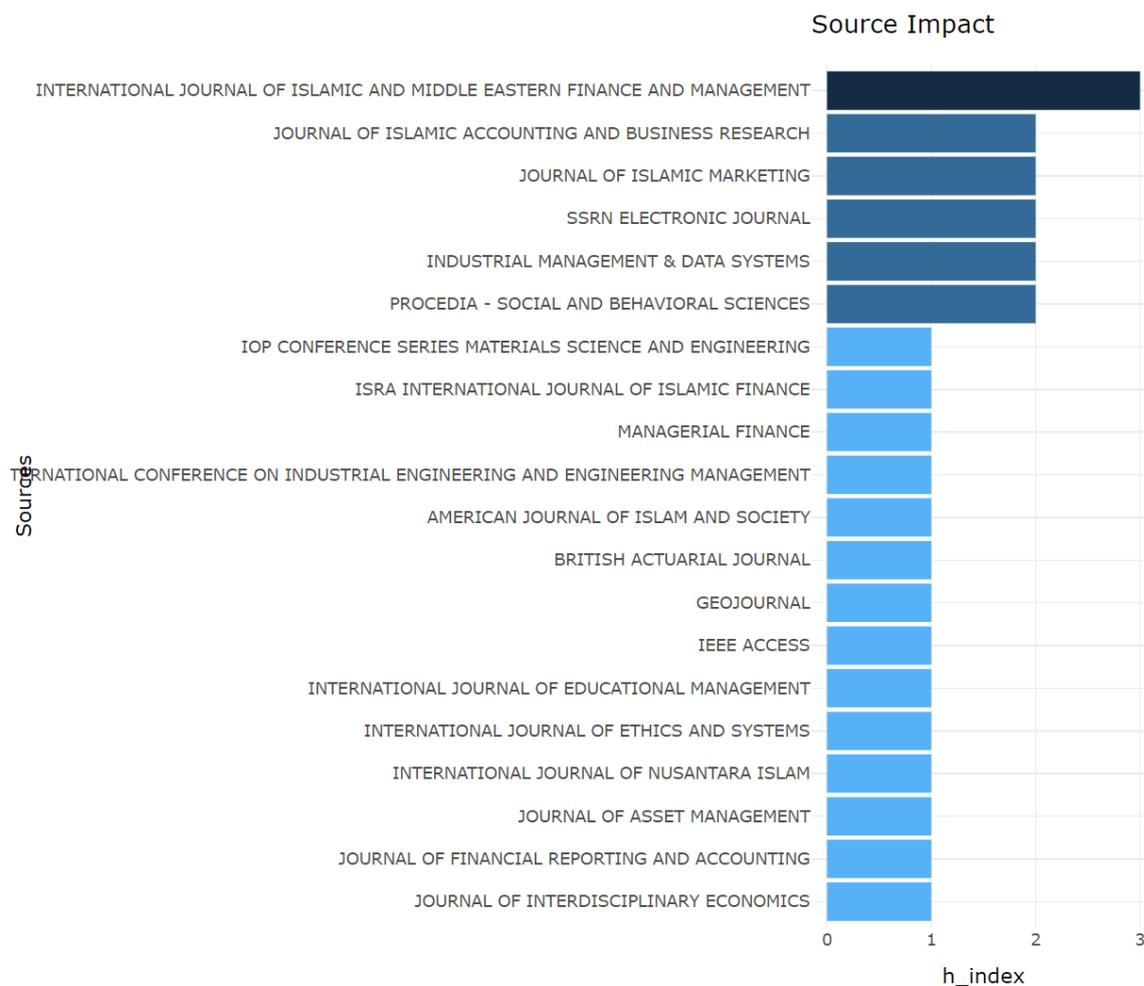
Based on the grouping done by the author, in general, Islamic economic and financial modeling research is divided into 3 groups: (1) Originative, (2) Incorporated-Adaptive, (3) Purely-Adaptive. Some examples of research included in the first group (Originative) are research conducted by

Choudhury (2014, 2012, 2011), Putri et al. (2018), Ahmad et al. (2011), and Hossain (2006). What Choudhury did, for example, he used a deductive approach in conducting his research. Choudhury proposed a concept known as Tawhidic String Relationship (TSR).

The example of research included in the second group (Incorporated-Adaptive) is research conducted by Ghazali et al. (2019), Khaldi & Hamdouni (2018), Saputra et al. (2017), Sumarti et al. (2015), Bakhtiar et al. (2014), Ismal (2014), Halim et al. (2012) and Ismail & Tohirin (2008). Meanwhile, some examples of the third group are those carried out by Derbali et al. (2017), Martan et al. (1984), Keen (2017), and Sapuan et al. (2015). In terms of numbers, research in the first group is relatively less compared to other research in the second and third groups.

However, as a truly solid concept, basic research is needed that tries to formulate a more comprehensive and robust concept of Islamic economics and finance. According to Choudhury (2012), the originative process should be deductively carried out from the basic teaching of Islamic economy. He argued to totally reject the conventional neoclassicism and returning to an epistemological system premised on the Tawhidi worldview of unity of knowledge, Tauhidic String Relations.

Figure 2: Source Impact

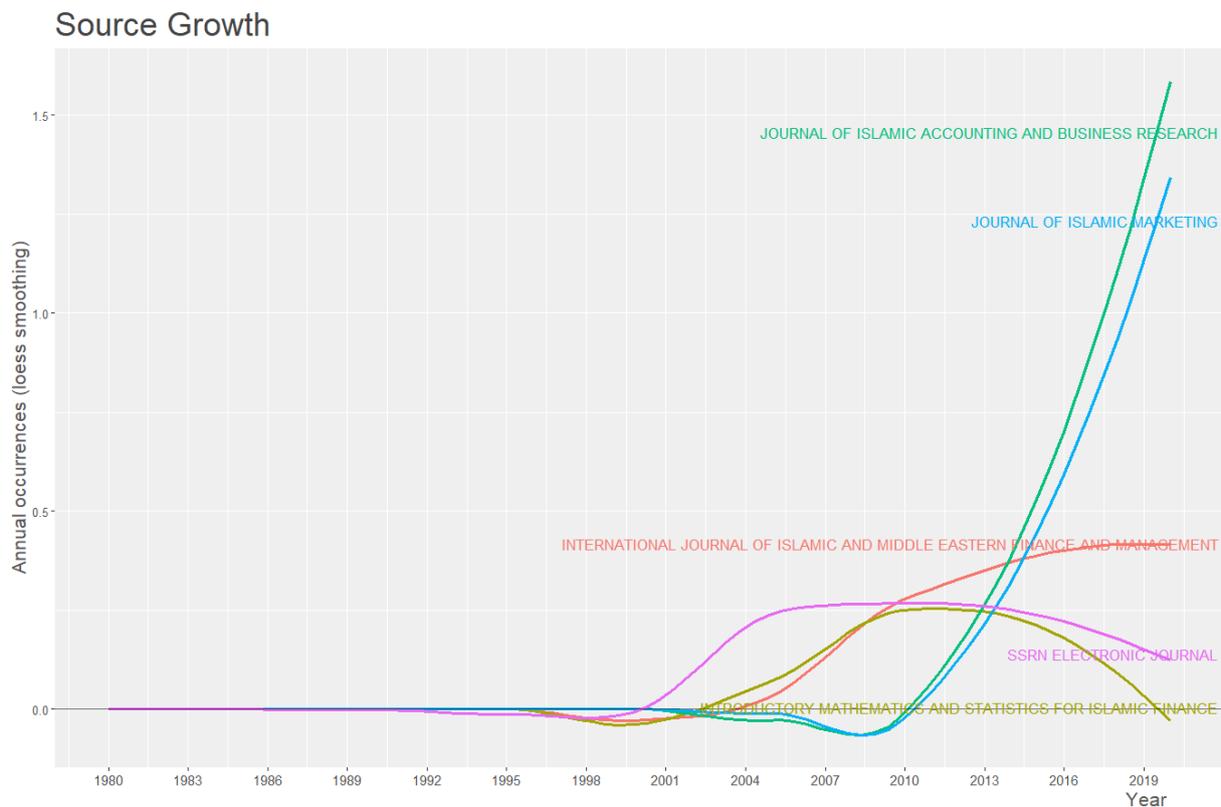


From the journal sources, this research is also carried out based on the impact of each journal that publishes a paper with the theme of the math model in IEF by calculating the journal's h-index which

is depicted in a blue bar chart. In addition to showing the h-Index value obtained, the diagram above also illustrates the impact produced by the journal through the blue color shown. The darker the blue on the diagram, the greater the impact the journal will have.

From the data above, it shows that the International Journal of Islamic and Middle Eastern Finance and Management. is in the top position with an h-Index of 3 marked in dark blue. Meanwhile, in the next positions are JIABR, Journal of Islamic Marketing, SSRN e-Journal and Procedia-Social and Behavioral Science with h-Index values of 2. As for the journals with h-Index 1, there are 14 journals marked in bright blue on the diagram, which indicates the low impact of the journal. The majority of journals come from Emerald publications.

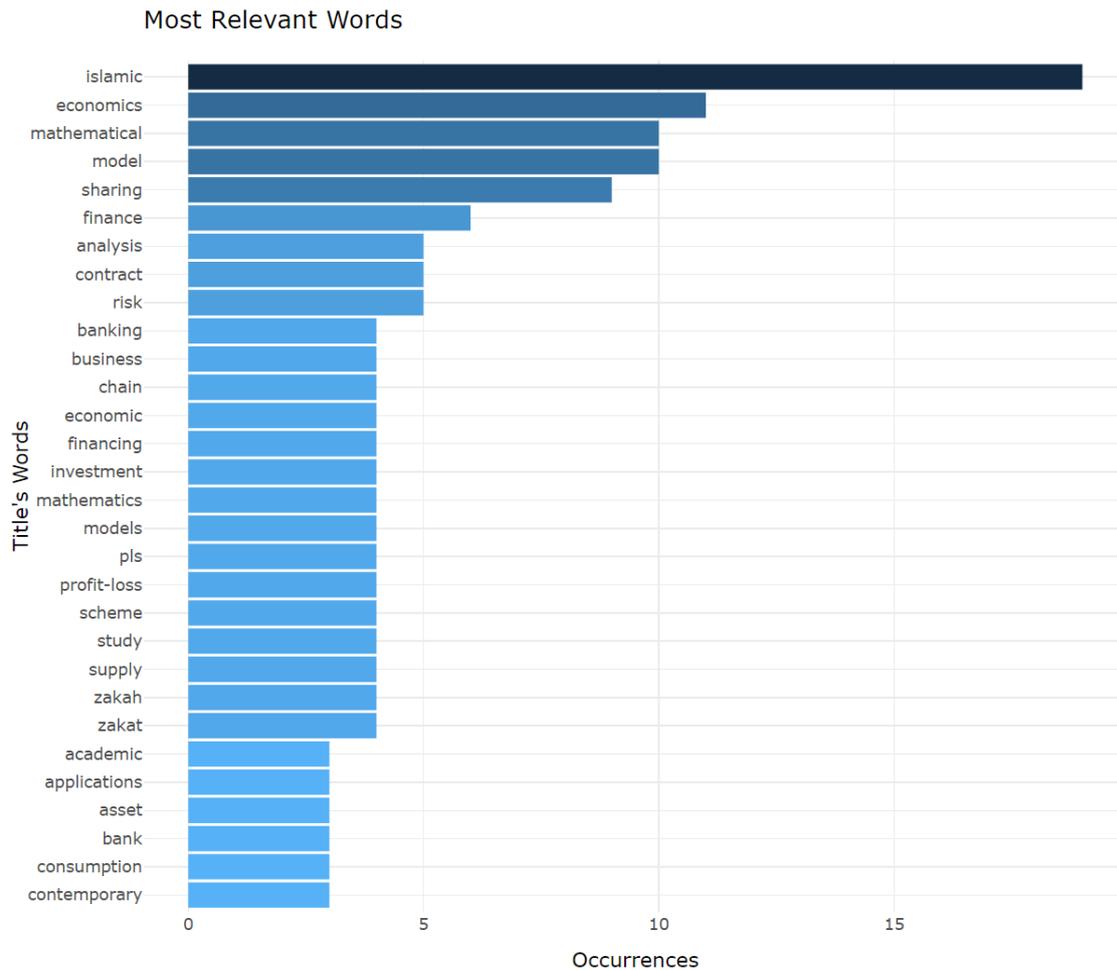
Figure 3: Source Growth



This study also discusses the development of journals that are a source of research on the mathematical modeling in Islamic economic and finance. The curve above shows the development of the annual occurrence of each journal from 1980 to 2020. Where the curve illustrates that research with the theme of the math modeling in Islamic economic and finance research tends to fluctuate in its publication.

From the curve above, it also shows that several journals began to experience development since 2001 and continued to increase even though in several years they had decreased, such as Journal of Islamic Accounting and Business Research, Journal of Islamic Marketing and International Journal of Islamic and Middle Eastern Finance and Management. Meanwhile, other papers that experienced a drastic decline, namely SSRN e-Journal and Introductory Mathematics and Statistics for Islamic Finance.

Figure 4: Most Relevant Words



This study also counts the relevant words used in the collection of documents that are the object of the study, where there are several words with several occurrences ranging from 3 to more than 15 times. The top 30 words listed which are marked with a blue diagram show the comparison of the number of occurrences of each word usage and its relevance to the math modeling in Islamic economic and finance research.

The top word with the highest number of occurrences and the most relevant to the research theme is the word 'Islamic' with a total usage of more than 15 times and the most relevant which is shown in the dark blue diagram. This illustrates that the theme of the math model in IEF research is closely related to the word Islamic finance which often appears in research with this theme. Furthermore, in second place is the word 'economic' with an occurrence quantity of more than 10 times. Then in the third and fourth sequence with a quantity approaching 10 and below.

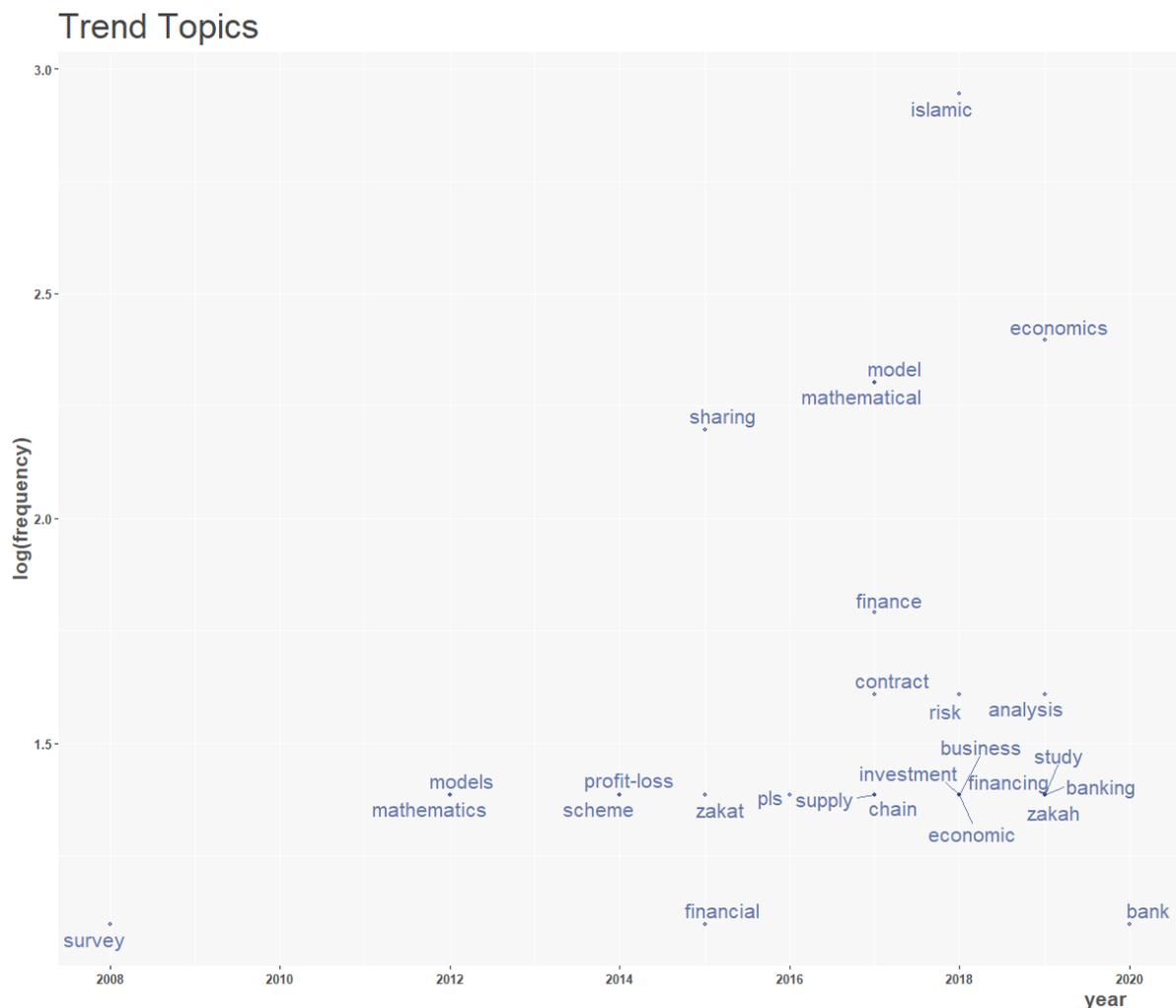


Figure 5: Trend Topics

Topic trends are also part of this research, where the picture above shows an overview of the development of the topic from time to time with the division per year. So that it is known what topics have been used for a long time and what topics have been used recently. The emergence of the topic is also adjusted to the frequency of the word's appearance in research on the theme of the math modeling in Islamic economic and finance research. The higher the more the word is used and the more to the right the more recent the word is used. The development of the topic began to experience a significant increase since 2008.

Based on the description of the data above, the topic has been used since 2008 understanding, especially those related to the math modeling in Islamic economic and finance research. Furthermore, in 2012 the topic of models and mathematics began to emerge. Even though it has been a long time, the quantity of the three topics that have emerged under 2015 is still small. Topics related to the PLS scheme in the Islamic banking industry began to be worked out a lot in 2014-2015. Meanwhile, many topics related to investment, business and Islamic bank financing began to be carried out in 2017 to 2019.

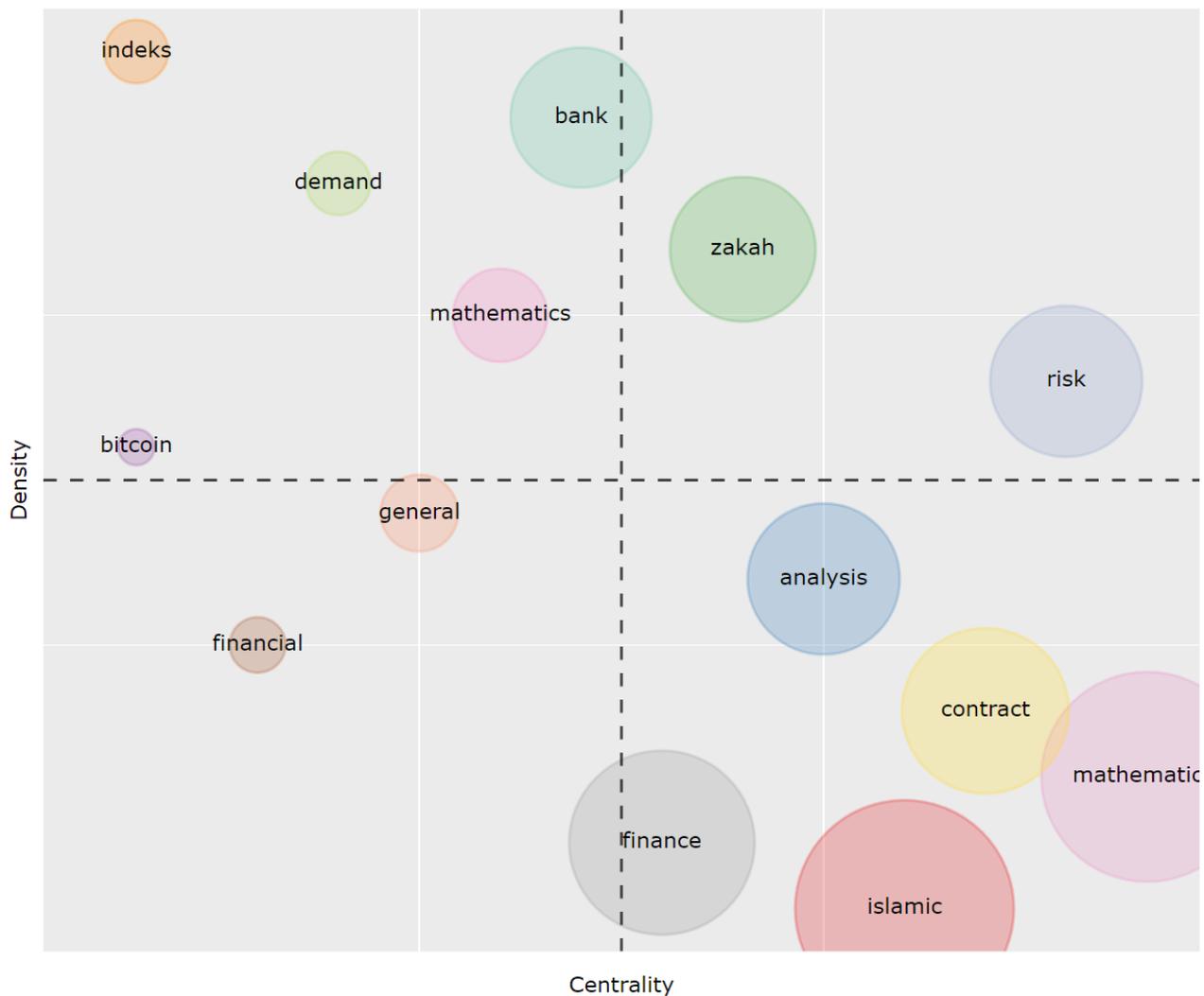


Figure 6: Thematic Map

In this study, an analysis of thematic maps was also carried out based on density and centrality which were divided into 4 theme quadrants as shown above. These results were obtained from a semi-automatic algorithm by reviewing the titles of all references to the research object with the addition of relevant keywords other than the author's keywords. So that the results can capture deeper variations.

The upper right quadrant is a driving theme characterized by high density and centrality, so it needs to be developed and it is important to be studied in further research. The themes in this quadrant include zakah and risk. Furthermore, the upper left quadrant shows a specific and rare theme but has a high development, which is indicated by high density but low centrality. The themes in this quadrant include bank, mathematics, demand, index and bitcoin.

Furthermore, in the lower-left quadrant are themes that have been used for a long time but have experienced a downward trend with marked low centrality. The themes in this quadrant include financial and general. Finally, the lower right quadrant is a basic theme characterized by high centrality but low density. These themes are important to be included in the research because they are general topics that are commonly used, including the themes of finance, Islamic, math, contract and analysis.

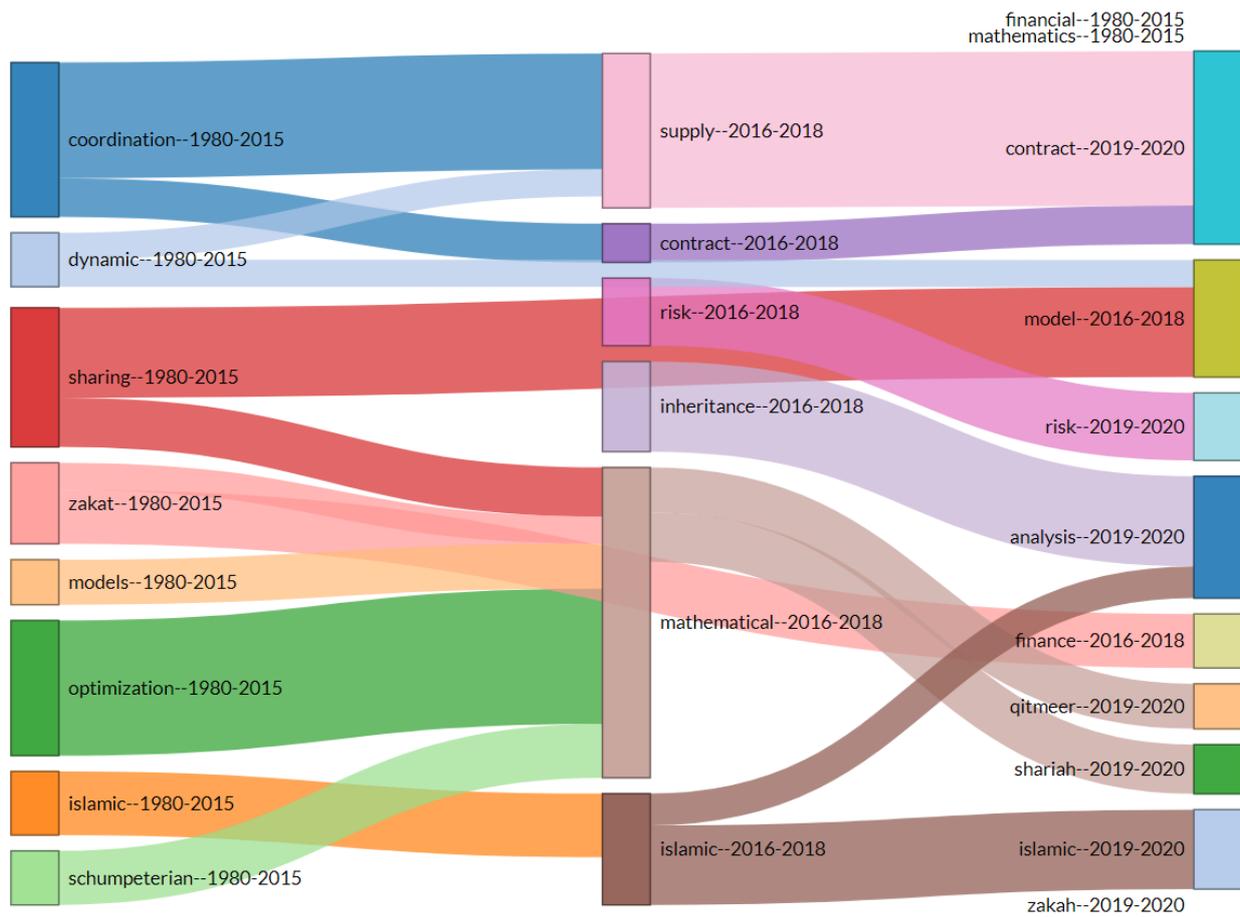


Figure 7: Thematic Evolution

The themes used in papers that are the object of research continue to change, especially from papers that have recently been published when compared to papers that have been published for a long time. The evolution of the theme is shown in the image above. Although the theme of this research is math model in IEF, this data shows several sub-themes that are widely used. The left side shows some of the themes that are widely used from 1980 to 2015, there are 8 themes listed with different sizes depending on the quantity of use of the theme. The theme "sharing" took first place, followed by the theme "optimization" and "coordination".

The second part of the middle section shows several themes that were widely used from 2016 to 2018. Some of the themes that emerged during this period were an evolution from the previously used themes and had a connection in their content, for example, the theme 'mathematical' emerged as a form of revolution from the theme 'sharing', 'zakat', 'models', 'optimization' and 'schumpeterian'. In this section, the most widely used themes are mathematical, supply and Islamic.

The third or right part shows the most recently used themes in the period between 2019 and 2020. There are 9 listed themes, of which 3 themes are an evolution of the themes that appeared in the previous period, namely the theme 'contract, risk and Islamic' which is an extension of several themes as indicated by the colorful grooves.

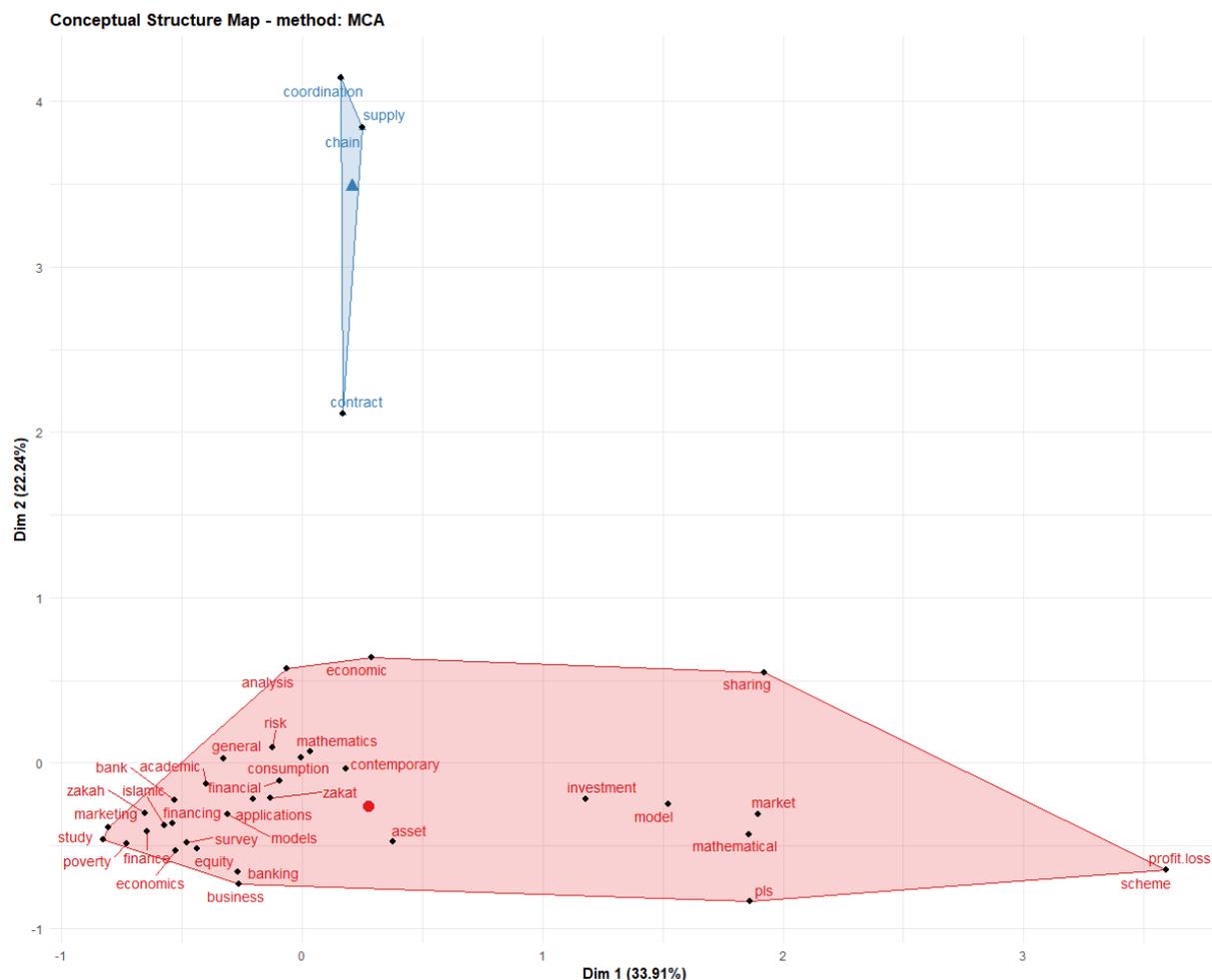


Figure 8: Conceptual Structure Map

This study also describes the conceptual structure map or contextual structure map of each word that often appears in research papers on math model in IEF theme by dividing it based on mapping the relationship between one word and another through area mapping. Each word is placed according to the values of Dim 1 and Dim 2 to produce a mapping between words whose values do not differ much. In this data, there are 2 parts of the area which are divided, namely the red area and the blue area, each area contains words that are related to each other. Based on the picture above, the red area shows more and more various words included in it, this shows that many research papers link between the words listed in this area.

CONCLUSIONS

Based on the results and discussion, the following conclusions are obtained. The number of publications of the development of mathematical model research results in Islamic economic and finance research indexed by Dimensions and other reputable publication from 1980-2020 has increased since 2010 but is still small. Network visualization shows that the map of the development of mathematical model research in Islamic economic and finance research is divided into 3 clusters. Cluster 1 consists of 14 terms. Cluster 2 consists of 9 terms and cluster 3 consists of 5 terms. Cluster 1 talks a lot about contracts and practices in Islamic banking, in particular the scheme and modeling of profit loss sharing, both mudharabah, and musyarakah. Cluster 2 in the visualization of co-word maps has a lot to do with the issue of fairness and injustice in financial transactions. Meanwhile, cluster 3 in the co-word map visualization has a lot to do with the theory underlying Islamic finance

and business transactions. The name of the publication that highly impact was the International Journal of Islamic and Middle Eastern Finance and Management.

Based on the grouping by the author, in general, Islamic economic and financial modeling research is divided into 3 categories: (1) Originative, (2) Incorporated-Adaptive, (3) Purely-Adaptive. In terms of numbers, research in the first group is relatively less compared to research in the second and third groups. Despite the development of using mathematical model in those researches, the approach tends to be adaptive (inductive) from conventional models that already exist. A challenge to review the mainstream model need to be further critically reviewed. Hence, it is necessary for researcher to formulate a mathematical model with a deductive approach that is reduced from Islamic norms or ethics derived from the Alquran and Sunnah.

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