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MACHINE LEARNING IN ISLAMIC ECONOMICS AND FINANCE: A COMPARATIVE BIBLIOMETRIC ANALYSIS WITH THE CONVENTIONAL FIELD

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ABSTRACT

The aim of the study is to perform a bibliometric mapping analysis of machine learning research on *Islāmic* economics and finance in the Web of Science (WOS) database. In the study, a bibliometric analysis was performed on all studies written on the topic of "Machine Learning" with WOS data and in the fields of "Economics" and "Finance" as well as "Islamic Economics" and "Islamic Finance." The tool VOSviewer (1.6.18) was used to classify the data within the research framework. As a result of the analysis, authoritative authors, journals, institutions, and the most frequently referenced sources in the field were identified. Besides that, information about the country that has done the most work in the field was also expressed as a result of the VOSViewer (1.6.18) program. When evaluating the literature, no study was identified that includes both economic and financial concerns on machine learning and presents a comparative bibliometric mapping analysis by studying *Islāmic* economics and *Islāmic* finance issues. It is believed that this study will contribute to literature in this regard.

JEL classification: G00, Z12, A10

Keywords: Bibliometric analysis, Economy, *Islāmic* finance, *Islāmic* economy, Machine learning

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1. INTRODUCTION

The study of economics and finance is a common subject in the field of economic and administrative sciences and is included in both microeconomics and macroeconomics. The functioning of both fields varies from country to country, and the most obvious difference is observed in the forms of adaptation, which differ according to religious beliefs. If we look at academic studies, we find that four different concepts are mentioned on two bases: *Islāmic* economy, *Islāmic* finance, economy, and finance. This observed distinction has been examined in *Islāmic* economics, and it has been observed that the density of studies in this field is less frequent than the generally published economic and financial studies. This situation explains the gap in the field.

If we evaluate *Islāmic* economics and *Islāmic* finance studies as a single group, it can be observed that religious sources form the basis and reference source of studies in this field. Among these religious sources, they mainly consist of the verses and sayings of the *Qurʾān*, *ḥadīth*, words, *Fiqh* books and the scientific books of religious scholars and pioneers. In addition, the basis for general economic and financial studies consists of legislation, including laws, regulations, statutes, and so forth, as well as sources published by economic schools, economic leaders and researchers conducting academic studies in this field.

In this case, it can be said that while the starting points to be used in general economic and financial studies may vary and new views may be spread in the field, basing the starting point of *Islāmic* studies on unchangeable verses negatively affects the changeability of studies in the field.

When evaluating the studies in the field, there are nine articles written in the field of machine learning and *Islāmic* economics and 11 articles written within machine learning and *Islāmic* finance indexed in the Web of Science database. In addition, it was found that there were 2,928 studies on general economics using machine learning and 1,683 studies on general finance using machine learning.

It can be stated that the studies on machine learning and the field of *Islāmic* economics (Yesilyaprak et al., 2023; Zakaria et al., 2023; Caraka et al., 2022; Hudaefi et al., 2022; Polyzos, Samitas, and Syriopoulos., 2022; Ghlamallah et al., 2021; Ghasiya and Okamura, 2021; Aslam et al., 2020) and *Islāmic* finance (Touri, Ahroum and Achchab, 2024; Caraka et al., 2022; Hudaefi et al., 2022; Polyzos et al., 2022; Ghlamallah et al., 2021; Khan and Rabbani, 2021; Mnif et

al., 2020; Tlemsani, Marir, and Majdalawieh, 2020; Cai et al., 2019; Kartiwi et al., 2018) covered a very small area in the literature.

It is incorrect to say that there are no studies in this field, but when the studies on machine learning in economics and finance are evaluated in general and when these studies in *Islāmic* economics are examined in return, not enough studies are indexed in the Web of Science and the field remains untouched. Although there is a developing understanding of *Islāmic* finance and *Islāmic* economics since the 1960s, when the *Islāmic* economics framework cannot catch up with the rapid rise in machine learning, it shows the lack of interested people and researchers in the field, hence the necessity of increasing studies in this direction.

Thus, this study determines keywords, studies, authors, journals, institutions, and countries regarding the studies in the field by using studies in the literature, in other words, qualitative data, and provides quantitative output by expressing the number of publications and citations. In this respect, the study will contribute to the literature and will serve as a guide for researchers in *Islāmic* economics and *Islāmic* finance in terms of areas to be researched in connection with machine learning.

2. REVIEW OF LITERATURE

Although multiple studies in the literature cover the concept of economy and finance, machine learning can be described as a relatively more current topic. In addition. Machine learning has been examined in more than one field; it has been observed that the number of studies on economics and finance is constantly increasing. In addition, it has been observed that machine learning research on *Islāmic* economics and *Islāmic* finance remains very untouched. This study aims at carrying out bibliometric mapping analysis of 2,928 studies on “economy”, 1,683 studies on “finance”, 9 studies on “Islamic economics” and 11 studies on “Islamic finance” written with key words including “machine learning” indexed in the Web of Science. The aim here is to identify and eliminate the gap in the field.

The study is a comprehensive literature review. In this study, the analysis was carried out using the VOSviewer (1.6.18) program, and outputs such as the author who has done the most work in the field, the author with the most citations, the most effective study in the field, the most effective journal and so forth will be obtained. In line with these outputs, content analysis of the studies obtained will be carried

out and an evaluation will be made on why the studies are a reference source.

In addition to the studies, those written on machine learning will be analyzed separately on "economy" and "finance." The existing literature shows that 103 studies meet all the constraints of "machine learning, economy and finance". In addition to these studies, only four studies (Yesilyaprak et al., 2023; Caraka et al., 2022; Hudaefi et al., 2022; Polyzos et al., 2022) that combine the topics of "Islamic economics" and "Islamic finance" were identified. The fact that there is no study performing bibliometric mapping analysis among these studies underscores the contribution of this study to the *Islāmic* economics literature.

While examining machine learning, it is important to evaluate the subject scope of five studies examining both "Islamic economics" and "Islamic finance" to know the focus point in this framework. When the review was carried out, one study found was Caraka et al. (2022) who evaluated credit cards from an *Islāmic* perspective. In the study, Indonesia was chosen as a sample, and the borrowing system of credit cards was examined on its *Islāmic* compatibility and the moral burden and elements of debt repayment. The machine learning technique called data mining was used in the study. Here, it is aimed at finding *Islāmic* reference sources by identifying the factors that will create a driving force in debt payment, and the study contributed to the literature.

Hudaefi et al. (2022) focused on the concept of "*zakāt*", which is of *Islāmic* importance and can be described as a religious duty and examined the compatibility of activities carried out on YouTube and Zoom with the concept of *zakāt* by using machine learning tools. As a result of the study, after determining the most frequently mentioned concepts and subject scopes in the relevant social media tools, contributing findings were obtained regarding *zakāt*.

Polyzos et al. (2022) examined in their study the understanding of *Islāmic* banking, which is frequently researched in terms of its differentiation from traditional banking from an *Islāmic* perspective and whose accuracy is questioned with religious outputs such as hadiths, verses, and so forth. In their study, the authors commented on the basis of the economy by evaluating the efficiency of the sector. In addition, the study was constructed using machine learning techniques, and the results show that the *Islāmic* banking approach negatively affects the economy on a numerical basis, and in addition has a positive effect on stability and happiness.

The last study to be examined was written by Yesilyaprak et al. (2023). This study also evaluated banking by combining economics and finance. This study also assessed banking by combining economics and finance. It evaluated profit rates by using machine learning and determined that the effectiveness of the banking approach in the field tends to increase.

In this direction, within the scope of the study, studies drawn from the Web of Science database will be analyzed and bibliometric mapping analysis of these studies will be carried out comparatively.

3. RESEARCH METHODOLOGY

The analysis method used in the study aims at qualitative output as a result of this data, taking into account the numerical data regarding the studies in literature. The database used to obtain the data in the study is called Web of Science (WOS). The data obtained will be analyzed using the VOSviewer (1.6.18) program, and this analysis is called bibliometric mapping analysis (Heberger, Christie, and Alkin, 2010). The analysis will include key idea analysis, author analysis, institution analysis, country analysis, and so on of academic studies received from the database, and the outputs will include information such as the trend and breadth of research in the area.

The acquired results will be presented in tables in the study's findings section. Each table in the findings section will present all works written on machine learning in the area of economics and finance in two different groups, both *Islāmic* studies and general studies, in a single table. This will enable data comparability.

When the studies in the literature were examined, it was observed that there were more than one study that applied bibliometric mapping analysis and was written within the scope of economics (Kumar et al., 2025; Bijos et al., 2022; Bircan, Akdağ Salah, and Haodong, 2023; Carrasco-Garrido, De-Pablos-Heredero, and Rodríguez-Sánchez, 2023; D'Amato et al., 2017; El Kattan et al., 2023; Espina-Romero and Guerrero Alcedo, 2022; Gundu et al., 2022; Jamwal et al., 2021; Li et al., 2023; Madzík et al., 2023; Walas Mateo and Redchuk, 2021; J. Wang et al., 2022; Xi et al., 2023).

In addition, it is observed that there are multiple bibliometric mapping analysis studies (Ahmed et al., 2022; Goodell et al., 2021; Maria, Ballini, and Souza, 2023; Muñoz and Castañeda, 2023; Nazareth and Ramana Reddy, 2023; Pattnaik et al., 2022; Zakaria et

al., 2023, et al.) written on finance and machine learning. Among the articles to be analyzed, no bibliometric mapping analysis research on machine learning and addressing *Islāmic* economics or *Islāmic* finance was found. Based on this, it is thought that the literature gap in the field of *Islāmic* economics and *Islāmic* finance will be identified, and the study will contribute by comparing the machine learning literature within the scope of economics and finance.

4. FINDINGS OF LITERATURE REVIEW

In this study, studies written on machine learning were evaluated in four separate groups. Relevant groups were obtained using data obtained from the Web of Science database. The first of the mentioned groups was determined as 2,928 studies covering the subject of "economy" and the second was determined as "1,683" studies covering the subject of "finance". In addition to these studies, bibliometric mapping analysis of nine studies on machine learning and 11 studies on "Islamic economy" and "Islamic finance" will be carried out.

VOSViewer (1.6.18) program was used to analyze these studies taken from the database. The output obtained as a result of the analysis carried out with the program will be expressed under subheadings in this section of the study.

4.1 KEYWORD ANALYSIS OF PUBLISHED RESEARCH

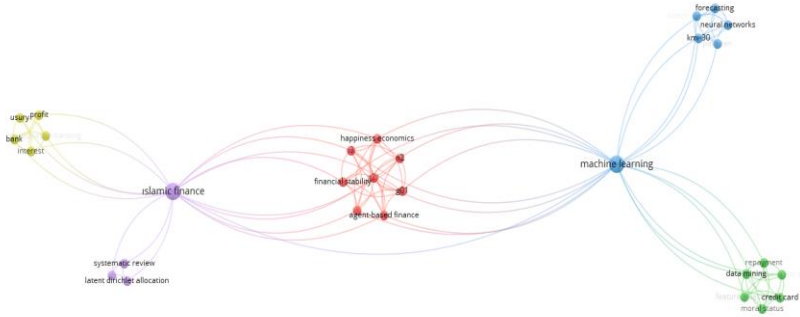
In this part of the analysis, key concept evaluation will be carried out for 4 separate data groups examined in the study. In Figures 1, 2, 3 and 4, mapping analysis outputs are expressed within visuals. In the table, mapping analysis outputs are expressed within visuals, and in Table 1, the relevant data will be expressed quantitatively.

When Figures 1 and 2 are examined, the key concept densities and concept connections of the studies written in the field of economics and covering the subject of machine learning can be observed on an *Islāmic* basis (1) and on a general basis (2). The higher number of studies explains why Figure 2 has a denser network map.

Analyzing both Figure 1 and Figure 2, as well as the data in Table 1, it was found that 'machine learning' was the keyword with the highest usage rate in machine learning and economics - both *Islāmic* economics and general economics. The fact that the word is the main subject of the studies explains this situation. When the term is examined within the figure, it can be seen that it is used more

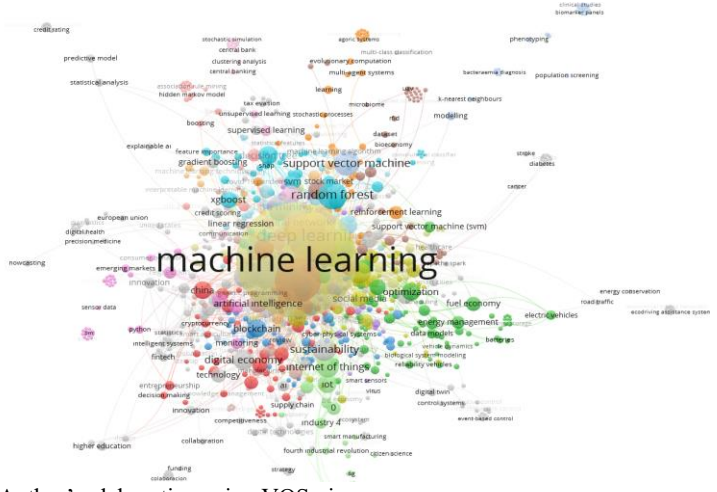
intensively in 2020-2021. When examining the studies written within the framework of *Islāmic* economics, a total of 9 studies were found. It was found that word machine learning was included in 3 of these studies and the link length of the word was determined to be 20.

FIGURE 1
Co-occurrence Keyword Mapping Analysis (*Islāmic* -Economy)



Source: Author's elaboration using VOS viewer

FIGURE 2
Co-occurrence Keyword Mapping Analysis (Economy)

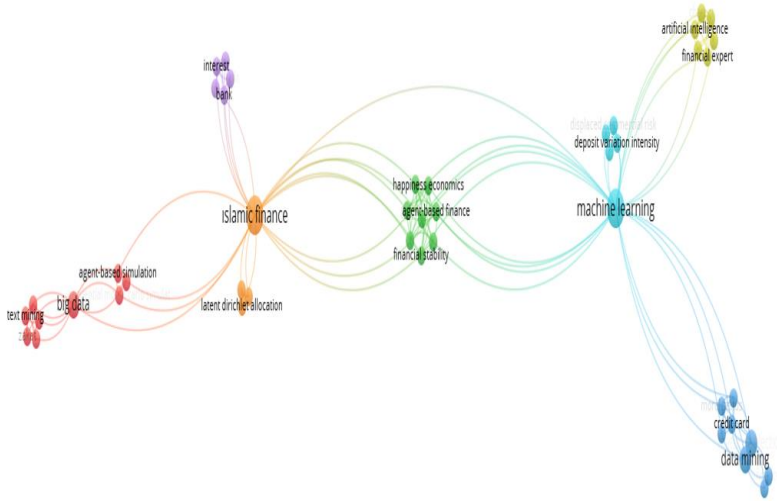


Source: Author's elaboration using VOS viewer

When the corresponding evaluation was carried out for the general economy, it was determined that there were a total of 2,928 studies and it is stated in Table 1 that the keyword machine learning was included 1,151 times in these studies. Other terms include "Islamic finance", which is used a total of three times, and "text mining", which is used two times in *Islāmic* economics studies. In general economics, 'deep learning' is used 195 times and 'artificial intelligence' 171 times. Table 1 gives information about the literature in terms of the ten most effective words.

When Figures 3 and 4 were examined, it was determined that there were 11 *Islāmic* finance studies in total for Figure 3 on machine learning and the most frequently used keywords were "machine learning" and "Islamic finance" and had a total of four uses. Other keywords were identified as "big data", "data mining" and "feature selection" with two uses.

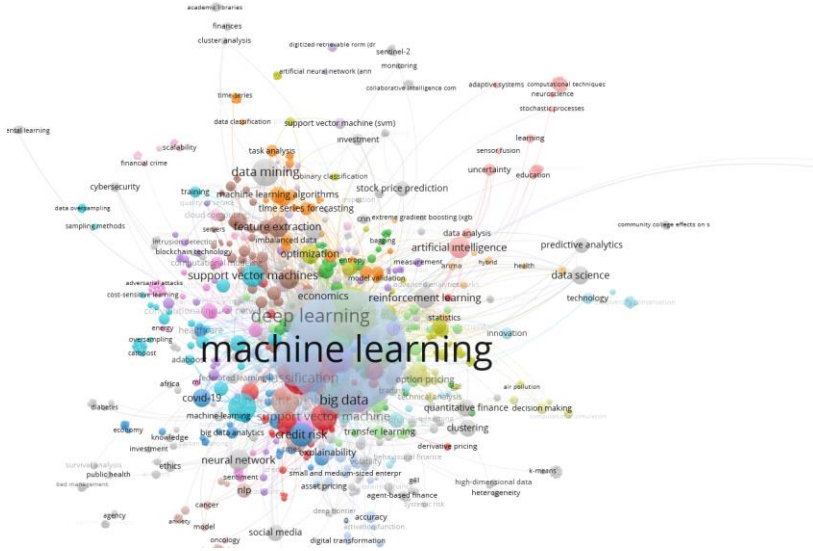
FIGURE 3
Co-occurrence Keyword Mapping Analysis (*Islāmic* -Finance)



Source: Author's elaboration using VOS viewer

When evaluated for Figure 4, "machine learning" ranks first with 697 uses, followed by "deep learning" with 130 uses, "finance" with 128 uses and "artificial intelligence" with 108 uses. Other concepts can be observed in detail in the table.

FIGURE 4
Co-occurrence Keyword Mapping Analysis (Finance)



Source**:** Author's elaboration using VOS viewer

4.2 PUBLICATIONS WITH THE MOST CITATIONS

Another analysis output shows the study with the highest citation among the studies examined. The publication information expressed in Table 2 has an important place in terms of expressing the scope of the subject of the studies in the field and knowing the subject guided by the literature.

Table 2 shows that the most cited study among the studies written on machine learning and structured within the framework of *Islāmic* economics was written by Hudaefi et al. (2022). The study is stated in the literature review section and is descriptive of *Islāmic* practices by including the concept of "*zakāt*" within the subject scope. In this respect, it has been made a reference source in literature. The second most cited study (Ghlamallah et al., 2021) included both economics and finance concepts and examined academic studies between 1979 and 2018. In this respect, the study serves as a guide for other fields of studies.

TABLE 1
Co-occurrence Keyword Analysis

Islāmic					
Economy			Finance		
Keywords	Occ.	TLS	Keywords	Occ.	TLS
Machine Learning	3	20	Machine Learning	4	25
Islāmic Finance	3	17	*Islāmic* Finance	4	21
Text Minning	2	9	Big Data	2	9
Agent-Based Finance	1	9	Data Minning	2	9
Happiness Economics	1	9	Feature Selection	2	9
Financial Stability	1	9	Agent-Based Finance	1	9
Credit Card	1	6	Financial Stability	1	9
Data Minning	1	6	Happiness Economics	1	9
Feature Selection	1	6	Accounting Research	1	7
Moral Status	1	6	Asia-Pacific	1	7
Economics					
Economy			Finance		
Keywords	Occ.	TLS	Keywords	Occ.	TLS
Machine Learning	1151	2527	Machine Learning	697	2032
Deep Learning	195	625	Deep Learning	130	517
Artificial Intelligence	171	534	Finance	128	588
Covid-19	125	362	Artificial Intelligence	108	442
Classification	75	187	Big Data	47	208
Circular Economy	71	204	Classification	45	124
Random Forest	66	216	Neural Networks	41	123
Support Vector Machine	55	111	Forecasting	39	131
Big Data	53	287	Sentiment Analysis	38	135
Forecasting	51	154	Prediction	37	146

Note: Total Link Strength (TLS), Occurrences (Occ.)
Source**:** Author's elaboration using VOS viewer

TABLE 2
Citation Analysis in Academic Articles

İslamic					
Economy			Finance		
Title	Article	Citation	Title	Article	Citation
Knowledge discovery of *zakāt* administration worldwide from YouTube and Zoom via text mining	(Hudaefi et al., 2022)	13	Machine Learning and Expert Judgement: Analyzing Emerging Topics in Accounting and Finance Research in the Asia–Pacific	(Cai et al., 2019)	21
The topics of *Islāmic* economics and finance research.	(Ghlamallah et al., 2021)	10	The topics of *Islāmic* economics and finance research.	(Ghlamallah et al., 2021)	10
Machine learning in the financial industry: A bibliometric approach to evidencing applications	(Zakaria et al., 2023)	6	Artificial Intelligence and NLP - Based Chatbot for *Islāmic* Banking and Finance	(Khan and Rabbani, 2021)	10
Indonesian *Islāmic* moral incentives in credit card debt repayment: A feature selection using various data mining	(Caraka et al., 2022)	4	Big data tools for *Islāmic* financial analysis	(Mnif et al., 2020)	8

TABLE 2 *(continued)*

Islāmic					
Economy			Finance		
Title	Article	Citation	Title	Article	Citation
Understanding the Middle East through the eyes of Japan's Newspapers: A topic modelling and sentiment analysis approach.	(Ghasiya and Okamura, 2021)	3	Screening of Murabaha business process through Quran and hadith: A text mining analysis.	(Tlemsani et al., 2020)	6
Knowledge discovery of *zakāt* administration worldwide from YouTube and Zoom via text mining	(Hudaefi et al., 2022)	2	Indonesian *Islāmic* moral incentives in credit card debt repayment: A feature selection using various data mining	(Caraka et al., 2022)	4
Forecasting *Islāmic* securities index using artificial neural networks: Performance evaluation of technical indicators.	(Aslam et al., 2020)	2	Management and monitoring of the displaced commercial risk: A prescriptive approach	(Touri et al., 2024)	2
Islāmic banking, efficiency and societal welfare: A machine-learning, agent-based study	(Polyzos et al., 2022)	0	Knowledge discovery of *zakāt* administration worldwide from YouTube and Zoom via text mining	(Hudaefi et al., 2022)	13
The Profit Rate-Interest Rate Nexus Evidence from Machine Learning Algorithms	(Yesilyaprak et al., 2023)	0	*Islāmic* banking, efficiency and societal welfare: A machine-learning, agent-based study	(Polyzos et al., 2022)	0

TABLE 2 *(continued)*

Economics					
Economy			Finance		
Title	Article	Citation	Title	Article	Citation
Accelerating the discovery of materials for clean energy in the era of smart automation	(Tabor et al., 2018)	397	Power of multifactor dimensionality reduction and penalized logistic regression for detecting gene-gene interaction in a case-control study	(He et al., 2009)	4151
CovidGAN: Data Augmentation using Auxiliary Classifier GAN for Improved Covid-19 Detection	(Waheed et al., 2020)	340	From local explanations to global understanding with explainable AI for trees	(Lundberg et al., 2020)	1846
Circular Economy and Sustainable Manufacturing: A Bibliometric Based Review	(Jain et al., 2022)	205	Discovering governing equations from data by sparse identification of nonlinear dynamical systems	(Brunton, Proctor, and Kutz, 2016)	1625
A machine learning approach on the relationship among solar and wind energy production, coal consumption, GDP, and CO2 emissions	(Magazzino, Alola, and N. Schneider, 2021)	183	Deep learning with long short-term memory networks for financial market predictions	(Fischer and Krauss, 2018)	794

TABLE 2 *(continued)*

Economics					
Economy			Finance		
Title	Article	Citation	Title	Article	Citation
Economic complexity theory and applications	(Hidalgo, 2021)	178	Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy	(Dwivedi et al., 2021)	645
CoroDet: A deep learning-based classification for COVID-19 detection using chest X-ray images	(Hussain et al., 2021)	171	Recent advances in robust optimization: An overview	(Gabrel, Murat, and Thiele, 2014)	520
An ensemble machine learning approach through effective feature extraction to classify fake news	(Gadekallu et al., 2021)	169	An Introduction to Deep Reinforcement Learning	(François-Lavet et al., 2018)	510

Source**:** Author's elaboration using VOS viewer

Among the studies written on machine learning and within the scope of general economics, the study with the highest number of citations was Tabor et al. (2018) with 397 citations. The author makes evaluations on the basis of economy, emphasizing the benefits of integrated research systems developed based on new smart technologies within the scope of machine learning, with the influence of technology. The fact that the smart technology applications included in the study save time and support cost minimization increases the importance of the study in literature.

Another study (Waheed et al., 2020) ranks second with 340 citations. The study was built based on the global pandemic crisis and is a machine learning study that concerns the field of health and economy together. In the study, smart technologies are integrated with the detection of disease symptoms and application-oriented outputs are presented to speed up disease detection. The study contributes to the field and offers a new method that explains its effectiveness in literature.

When evaluated within the scope of finance, it is observed that the most cited study (Cai et al., 2019) on *Islāmic* finance is evaluated for the Asia-Pacific region. This study aims at using machine learning for literature review. In line with this purpose, the development of the qualitative analysis method of the study increases its contribution to the literature. The study is categorized under finance because of the inclusion of accounting and finance research in the literature review.

In the analysis outputs of general economic studies analyzed on finance, the most cited study (He et al., 2009) also uses machine learning elements. The study is a case-control study in which 200 cases were examined. The study evaluates gene interaction. The study provides outputs that contribute to the finance literature.

4.3 JOURNALS WITH THE MOST PUBLICATIONS

Another analysis shows the journals that publish studies in the field. Identification of these journals enables the identification of sources that contribute to the field and the identification of leading studies in the field.

When the table is examined, among the studies written on machine learning on the basis of Islam, the journal that has contributed the most publications to the literature for those within the scope of economics is the “International Journal of Islamic and Middle Eastern Finance and Management”. While a total of 9 studies exist in the field,

3 of them are published in this journal. When the evaluation is made for 11 studies contributing to the literature in the field of finance within the same group, it is observed that two journals rank first with 2 publications. These journals were identified as "International Journal of Islamic and Middle Eastern Finance and Management" and "Journal of Islamic Accounting and Business Research."

The relevant evaluation was also carried out for studies within the framework of general economy. Among these studies, it was determined that there were 2928 studies within the scope of "economy" and it was determined that the journal in which 67 studies were published most was "Sustainability" and the studies published in the journal received a total of 429 citations in this journal. Following this journal is "IEEE Access" with 57 publications and 1147 citations, and "Energies" journal with 42 publications and 485 citations.

When the 1683 studies indexed in the Web of Science database within the scope of "finance" were examined, the journal that contributed the most publications to the literature was stated as "IEEE Access" with 58 publications and 626 citations. Following the relevant journal, there is the journal "Expert Systems with Applications" with 36 publications and 1138 citations, and the journal "Computational Economics" with 19 publications and 155 citations. The excess publication and citation numbers of the mentioned journals can be found in Table 3.

4.4 THE MOST ACTIVE WRITER IN THE FIELD

In this part of the study, it is also necessary to examine the author who is most active in the field under examination. The analysis output, based on the data obtained in the section, is expressed below in both tables and figures.

Figure 5 illustrates the collaboration between authors within the scope of *Islāmic* Economics studies. Figure 5 shows that clusters have formed among authors and that studies intensified in 2022, while the existence of new studies published in 2023 indicates that the subject is still being investigated.

Figure 6 shows author collaboration for studies in the economics category.

TABLE 3

Top Publications by Sources and Number of Citations

İslamic					
Economy			Finance		
Journal	Article	Citation	Journal	Article	Citation
International Journal of Islamic and Middle Eastern Finance and Management	3	17	International Journal of Islamic and Middle Eastern Finance and Management	2	4
Journal of Islamic Accounting and Business Research	1	2	Journal of Islamic Accounting and Business Research	2	8
International Review of Economics and Finance	1	10	International Journal of Emerging Markets	1	2
Turkish Journal of Islamic Economics-TUJISE	1	0	International Review of Economics and Finance	1	10
Digital Scholarship in the Humanities	1	3	Turkish Journal of Islamic Economics-TUJISE	1	0
Journal of Economic and Administrative Sciences	1	2	Abacus- A Journal of Accounting Finance and Business Studies	1	21
Intellectual Discourse	1	6	Intelligent Systems in Accounting Finance and Management	1	8

TABLE 3 *(continued)*

Economics					
Economy			Finance		
Journal	Article	Citation	Journal	Article	Citation
Sustainability	67	429	IEEE Access	58	626
IEEE Access	57	1147	Expert Systems with Applications	36	1138
Energies	42	485	Computational Economics	19	155
Journal of Cleaner Production	28	1093	Mathematics	18	120
Plos One	24	168	Neural Computing and Applications	17	258
Sensors	22	158	Frontiers in Artificial Intelligence	17	25
Remote Sensing	19	238	Applied Sciences-Basel	16	287
Expert Systems with Applications	19	375	European Journal of Operational Research	15	1774

Source**:** Author's elaboration using VOS viewer

FIGURE 5
Author Elaborating (*Islāmic* Economy)

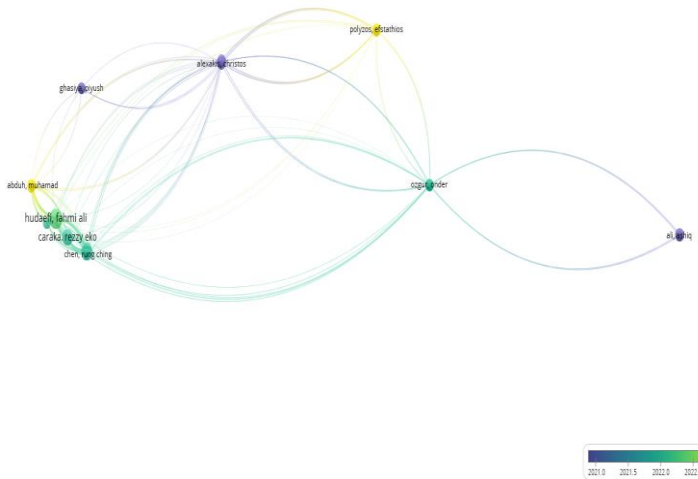
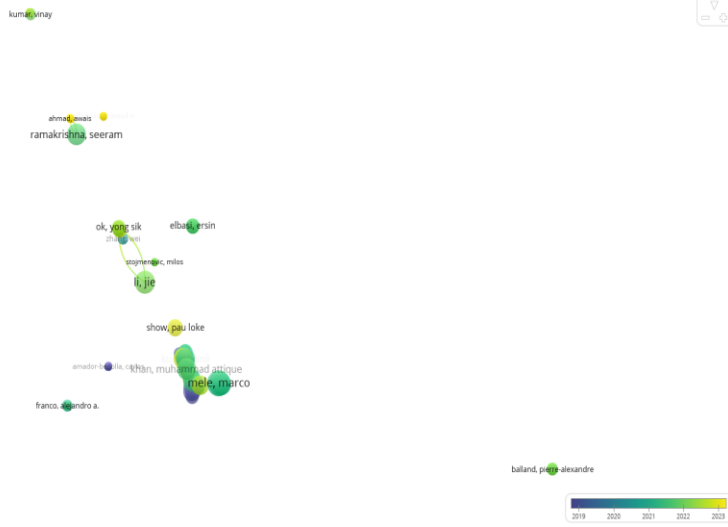


FIGURE 6
Author Elaborating (Economy)



Source**:** Author's elaboration using VOS viewer.

When the data obtained was examined, the author who published the most on studies in *Islāmic* economics within the scope of machine learning and economics was determined to be "Hudaefi, Fahmi A" with three publications. Following the author is "Caraka, Rezzy E" with two works.

When the authors who brought general economics studies to the literature were evaluated, it was determined that "Mele Marco" ranked first with nine studies, and "Magazzino, Cosimo" followed the author with eight studies. The identified authors remain leaders in the field.

Figure 7 evaluates author collaboration analysis for academic studies in the *Islāmic* finance category. The scaling shows that literature remains up-to-date in finance studies with high author network connectivity.

Figure 8 shows the finance category, and both tables must be considered when making an assessment.

When both tables are evaluated together, it can be seen that the number of authors working in the field of finance is higher than those working in the field of *Islāmic* finance. Although fewer authors are visible on the map in the field of *Islāmic* finance, it can be stated that the network connection between authors is higher.

In addition, the table shows that there is a weak network connection among authors working in the field of finance. This can be evaluated in the context of intensive work in both *Islāmic* finance and general finance.

When the table is examined, when the 11 studies examining the subject of *Islāmic* finance are evaluated, "Hudaefi, Fahmi A" has the highest number of publications, just like in *Islāmic* economics studies. The author contributed a total of 2 studies to the literature in this field and received 6 citations with these studies. The author is followed by "Hasan, M Kabir" with 2 publications and 10 citations. It is also observed within the mapping analysis that the works of "Hasan, M Kabir" are more up to date than the works of "Hudaefi, Fahmi A". Other studies are shown in detail in the table.

When other studies written in the field of finance and not *Islāmic* finance were examined, it was determined that 5 of the 1683 studies analyzed were written by "Creamer, German G", "Kumar, Satish", "Papadimitriou, Theophilos", "Garcia-Mendez, Silvia", "Hansen, Kristian B" and "Boyd, Stephen". In this regard, it can be stated that the authors ranked first in terms of the number of publications.

FIGURE 7
Author Elaborating (*Islāmic* Finance)

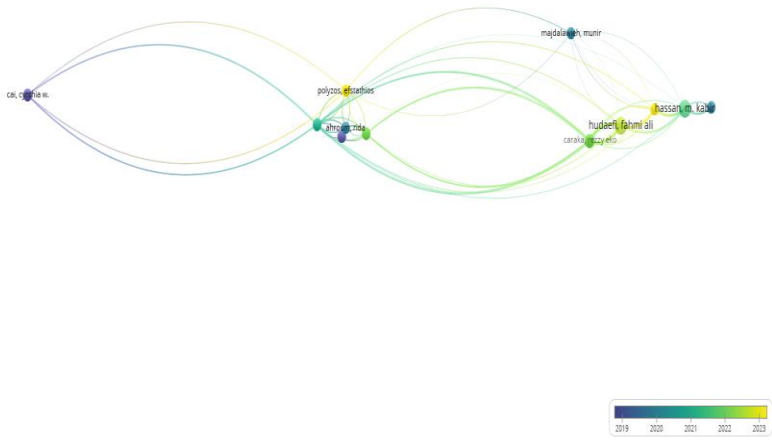
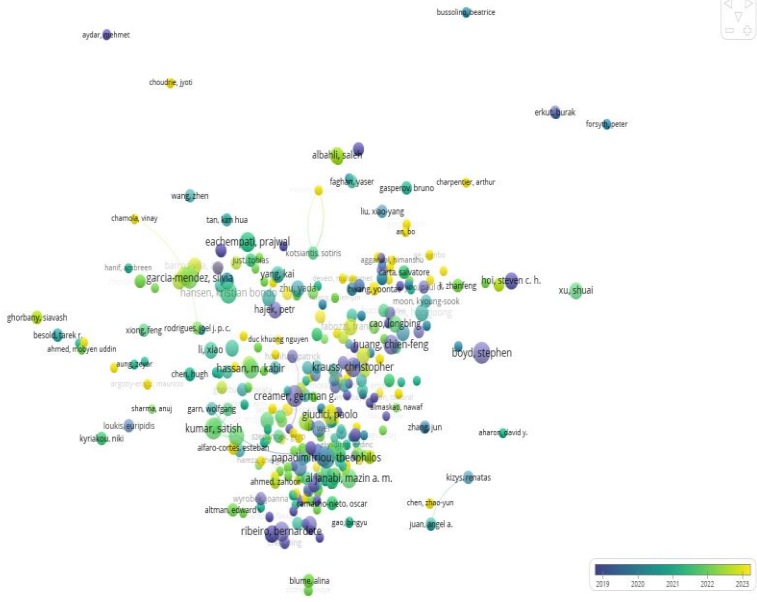


FIGURE 8
Author Elaborating (Finance)



Source**:** Author's elaboration using VOS viewer.

TABLE 4
Authors, Article(s), Citation, and Total Link Strength

İslamic					
Economy			Finance		
Author	Art.	Cite.	Author	Art.	Cite.
Hudaefi, Fahmi A.	3	19	Hudaefi, Fahmi A.	2	6
Caraka, Rezzy E.	2	17	Hasan, M. Kabir	2	10
Alexakis, Christos	1	10	Alexakis, Christos	1	10
Dowling, Michael	1	10	Dowling, Michael	1	10
Ghlamallah, Ezzedine	1	10	Ghlamallah, Ezzedine	1	10
Piepenbrink, Anke	1	10	Piepenbrink, Anke	1	10
Chen, Rung C.	1	4	Caraka, Rezzy E.	1	4
Goldameir, Norr E.	1	4	Chen, Rung C.	1	4
Toharudin, Toni	1	4	Goldameir, Norr E.	1	4
Tyasti, Avia E.	1	4	Toharudin, Toni	1	4
Ugiana, Prana	1	4	Tyasti, Avia E.	1	4
Economics					
Economy			Finance		
Author	Art.	Cite.	Author	Art.	Cite.
Mele, Marco	9	450	Creamer, German G.	5	188
Magazzino, Cosimo	8	447	Kumar, Satish	5	245
Li, Jie	7	83	Papadimitriou, Theophilos	5	65
Ramakrishna, Seeram	6	120	Garcia-Mendez, Silvia	5	21
Schneider, Nicolas	6	402	Hansen, Kristian B.	5	57
Kumar, Anil	6	199	Boyd, Stephen	5	441

TABLE 4 *(continued)*

Economics					
Economy			Finance		
Author	Art.	Cite.	Author	Art.	Cite.
Khan, Muhammad A.	6	46	Krauss, Christopher	4	1076
Zhang, Lei	6	8	Eachempati, Prajwal	4	42
Liu, Wei	5	60	Srivastava, Praveen R.	4	42
Xiao, Dong	5	68	Lim, Weng M	4	237
Fan, Shuangshuang	5	21	Samitas, Aristeidis	4	27

Note: Article (Art.), Citation (Cite)
Source**:** Author's elaboration using VOS viewer

4.5 INSTITUTIONS WITH MOST PUBLICATIONS

When the journals that published studies written on machine learning and based on *Islāmic* principles were examined, the institution contributing the highest number of publications to the literature in *Islāmic* economics was determined to be "University of Indonesia" with two publications and 17 citations. Following this institution, "BAZNAS Center of Strategic Studies", "Seoul National University", "University Kebangsaan Malaysia" and "University Brunei Darussalam" are observed with 13 citations and one publication each.

After studies in the field of *Islāmic* finance were examined, the institution that published two of the 11 studies analyzed were identified as "University of Indonesia", "University of New Orleans" and "Zayed University".

When studies within the framework of general economics were evaluated, 2928 studies in "machine learning" on the subject of "economy" were analyzed. The most effective institution in the field was determined to be the "Chinese Academy of Sciences" with 40 publications and 630 citations. The journal is followed by "Tsinghua University" with 23 publications and "University of the Chinese Academy of Sciences" with 21 publications.

TABLE 5

Top Publishing Institutions

Islāmic					
Economy			Finance		
Institution	Art.	Cite.	Institution	Art.	Cite.
University of Indonesia	2	17	University of Indonesia	2	4
BAZNAS Center of Strategic Studies	1	13	University of New Orleans	2	10
Seoul National University	1	13	Zayed University	2	6
Universiti Kebangsaan Malaysia	1	13	Chaoyang University of Technology	1	4
University Brunei Darussalam	1	13	Darussalam Institute of Islamic Studies	1	4
Chaoyang University of Technology	1	4	Padjadjaran State University	1	4
Padjadjaran State University	1	4	Polytechnic Application University	1	4
Polytechnic Application University	1	4	Riau University	1	4
Riau University	1	4	Universitas Sumatera Utara	1	4
Universitas Sumatera Utara	1	4	University of Brunei Darussalam	1	2
Darussalam Institute of Islamic Studies	1	4	IPB University	1	2

TABLE 5 *(continued)*

Economics					
Economy			Finance		
Institution	Art.	Cite.	Institution	Art.	Cite.
Chinese Academy of Sciences	40	630	Stanford University	21	1608
Tsinghua University	23	373	New York University	18	71
University of the Chinese Academy of Sciences	21	165	University of Illinois Urbana	15	196
University of Johannesburg	19	202	Massachusetts Institute of Technology	15	792
Zhejiang University	19	164	Chinese Academy of Sciences	14	404
King Abdulaziz University	19	389	Tsinghua University	14	153
Beijing Institute of Technology	18	319	Stevens Institute of Technology	14	4385
University College London	17	129	Nanyang Technological University	13	257
Tongji University	17	128	University of Boston	12	295
University of California, Berkeley	16	654	University of Washington	12	3873

Note: Article (Art.), Citation (Cite)
Source**:** Author's elaboration using VOS viewer

When studies in finance are evaluated, “Stanford University” ranks first with 21 publications and 1608 citations. Following the identified institutions are “New York University” with 18 publications, “University of Illinois Urbana” and “Massachusetts Institute of Technology” with 15 publications. Detailed information can be found on the table.

4.6 COUNTRIES WITH THE MOST PUBLICATIONS

The last restriction, in which the data obtained in the study will be analyzed using the VOS Viewer (1.6.18) program, is country analysis. The data obtained in this section provides a quantitative output based on the country where the journal publishing studies were brought to literature and the country where the authors are affiliated with the institutions.

When Table 6 is examined, it reveals a total of 9 studies in *Islāmic* economics, but it was determined that 3 of these studies were published in Indonesia and 2 of them were published in Malaysia. In this regard, it can be stated that these two countries are active in the field.

When economic studies on a general basis are evaluated in the study a total of 2,928 articles were examined. The People's Republic of China ranks first with 700 publications, followed by the USA with 492 publications, and India with 403 publications.

For studies in *Islāmic* finance, the two countries that came first were identified with 2 publications for “Indonesia” and “USA”. When the evaluation is made for general finance studies, USA ranks first with 392 publications. The country has received a total of 16150 citations with its published studies and is by far the most effective country in the field. Following USA are the Peoples Republic of China (352, 3850) and India (170, 1920) in terms of publication and citation numbers, respectively. Table 6 gives detailed information about the countries and their publication and citation numbers.

Figures 9 and 10 provide information about the countries that have contributed the most publications to literature. The countries listed in Figure 9 show the countries that are active in studies within the scope of *Islāmic* economics, and it can be seen that the most recent publications are from Brunei and the USA.

TABLE 6
Publications by Countries

İslamic					
Economy			Finance		
Country	Art.	Cite.	Country	Art.	Cite.
Indonesia	3	19	Indonesia	3	6
Malaysia	2	19	USA	2	10
South Korea	1	13	France	2	18
Brunei	1	2	United Arab Emirates	2	6
USA	1	2	Brunei	1	2
Taiwan	1	4	Tunisia	1	8
France	1	10	Taiwan	1	4
United Arab Emirates	1	0	Spain	1	6
Turkey	1	0	Malaysia	1	0
Japan	1	0	Morocco	1	2
Pakistan	1	2	Turkey	1	0
Economic					
Economy			Finance		
Country	Art.	Cite.	Country	Art.	Cite.
Peoples r China	700	6035	USA	392	16150
USA	492	8302	Peoples r China	352	3850
India	403	3920	India	170	1920
England	188	3987	England	130	3394
Spain	121	1655	Germany	88	2387
Germany	114	1736	Italy	78	1974
Saudi Arabia	107	1091	France	73	1720
Australia	103	1816	Canada	63	1630
Italy	103	1656	Spain	54	868
Canada	100	1825	Australia	52	579

Note: Article (Art.), Citation (Cite)
Source**:** Author's elaboration using VOS viewer

FIGURE 9
Top Publishing Countries (*Islāmic* Economy)

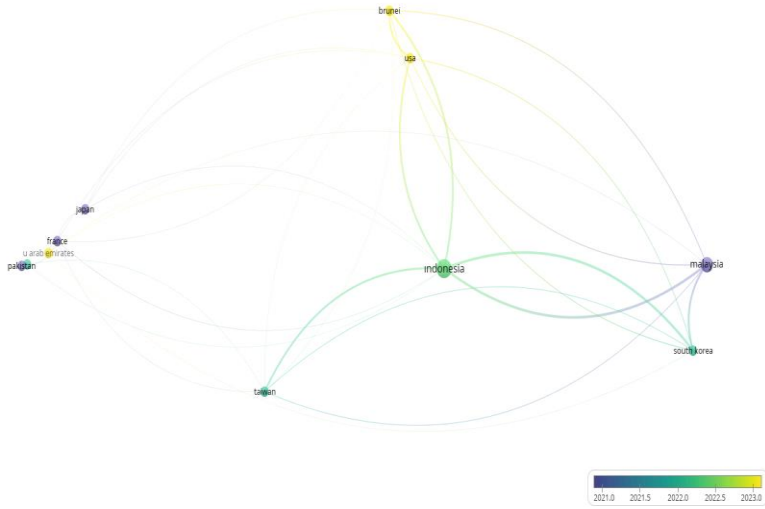


FIGURE 10
Top Publishing Countries (Economy)

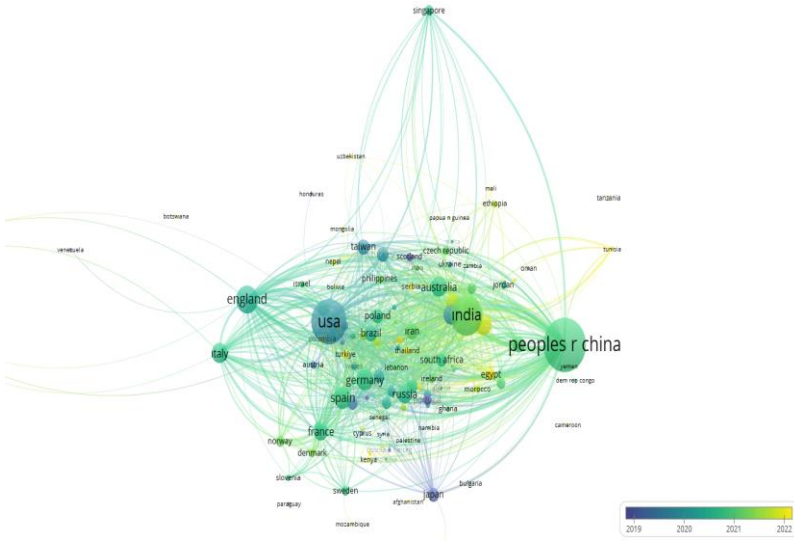
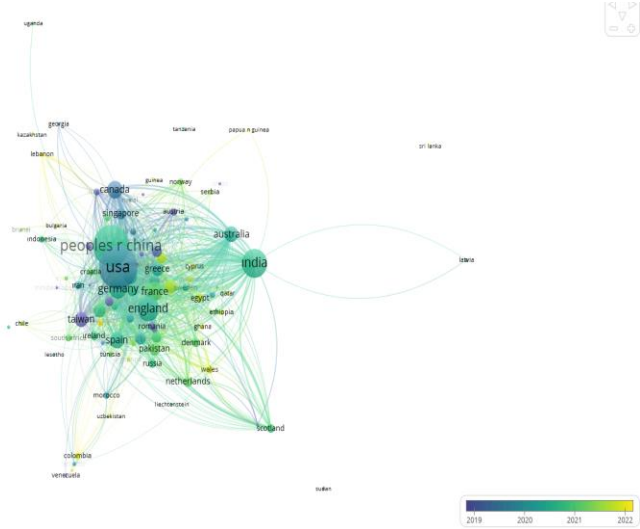


FIGURE 11
Top Publishing Countries (*Islāmic* Finance)

FIGURE 12
Top Publishing Countries (Finance)



Source**:** Author's elaboration using VOS viewer.

The countries shown in Figure 10 represent countries where research has been conducted in the field of general economics. This indicates that publication intensity is high and that 2021 is ahead in terms of publications. In addition to the high number of countries and publications, network connectivity is also high.

The countries operating in the *Islāmic* finance sector within the financial industry are Brunei, Indonesia, Malaysia, Taiwan, Morocco, Turkey, the United Arab Emirates, Spain, France and Tunisia. The countries contributing to the literature with the most recent publications are Brunei, Taiwan and Turkey. The highest number of publications has been identified in Indonesia.

When the figure is examined, it is determined that among the countries that have published studies on "*Islāmic* economy", the countries that have contributed the most up-to-date studies to the literature are Brunei and the USA. When the analysis is carried out for economic studies on a general basis, it is observed that the publications of "People's Republic of China", which brought the most studies in the field to the literature, were published on average in 2021, and the studies in "USA", which ranked second, were published mainly between 2019-2020.

The countries contributing the most up-to-date publications to the literature on studies in *Islāmic* finance were identified as Brunei, Taiwan and Turkey. Following the relevant countries, it is observed that the publication year of the USA, which has the highest publication for general finance studies, is mostly between 2019-2020, and for the Peoples' Republic of China and India, it is mostly between 2020-2021. It is observed that Lebanon, Guinea, Turkey, and Nigeria, are among the countries contributing the most up-to-date studies to the literature.

5. DISCUSSION AND CONCLUSION

This study was created to present quantitative outputs by processing the qualitative data obtained in the Web of Science database through the VOS Viewer (1.6.18) program. The data used in the study were obtained from the Web of Science database and were created as a result of examining four separate concepts on two separate bases. When the data groups used in the study were examined, nine studies on "Islamic economics and machine learning", 11 studies on "Islamic finance and machine learning", 2928 studies on "economy and machine learning" and 1683 studies on "finance and machine learning" were extracted from the database for analysis. A detailed literature review was conducted by examining the obtained studies.

When the analysis outputs were evaluated, it was determined that Indonesia carried out the most studies on *Islāmic* economics and *Islāmic* finance. In addition, on a general basis, the most effective countries in economic studies were the Peoples' Republic of China (PRC) and USA, respectively, and for studies in the field of finance, USA and PRC.

Another finding is that the most frequently used key concept was found to be 'machine learning' for all four review topics. When examining the most cited studies, it was found that Hudaefi et al. (2022), studies in the field of *Islāmic* economics, and Cai et al. (2019), studies in *Islāmic* finance, came first with 13 and 10 citations respectively. When evaluated on a general basis for economics and finance studies, the work of He et al. (2009) ranked first for finance studies and Tabor et al. (2018) ranked first for economics studies.

When the authoritative journal in the field is identified for studies on *Islāmic* basis, it can be stated that the International Journal of Islamic and Middle Eastern Finance and Management, Journal of Islamic Accounting and Business Research and International Review of Economics and Finance are important in both *Islāmic* economy and *Islāmic* finance, respectively. Sustainability ranked first in general economics studies and IEEE Access ranked first in general finance studies.

On an institutional basis, the leading institution for *Islāmic* studies is the University of Indonesia. For general economics, this institution includes the Chinese Academy of Sciences and Tsinghua University, and for general finance, Stanford University and New York University.

This study contributes to the literature by examining studies on machine learning and economics and *Islāmic* economics, as well as studies in finance and *Islāmic* finance. In addition, it is effective as it is the first study to carry out such a comprehensive literature review through “bibliometric mapping analysis”.

REFERENCES

Ahmed, S., M.M. Alshater, A.E. Ammari, and H. Hammami, “Artificial Intelligence and Machine Learning in Finance: A Bibliometric Review.” *Research in International Business and Finance* 61, (2022): 101646.

Aslam, F., K.S. Mughal, A. Ali, and Y.T. Mohmand, “Forecasting Islamic Securities Index Using Artificial Neural Networks: Performance Evaluation of Technical Indicators.” *Journal of*

Economic and Administrative Sciences 37, no. 2 (2020): 253–71.

Bijos, J.C.B.F., V.M. Zanta, J. Morató, L.M. Queiroz, and K.P.S.R. Oliveira-Esquerre. "Improving Circularity in Municipal Solid Waste Management Through Machine Learning in Latin America and the Caribbean." *Sustainable Chemistry and Pharmacy* 28 (2022): 100740.

Bircan, T., A. Akdağ Salah, and Q. Haodong, "A Bibliometric Analysis of Computational Social Science in Turkish Academia." *IEEE* (2023): 1–4.

Brunton, S.L., J.L. Proctor, and N. Kutz, "Discovering Governing Equations from Data by Sparse Identification of Nonlinear Dynamical Systems." *PNAS* 113, no. 15 (2016): 3932–937.

Cai, W.C., M.K. Linnenluecke, M. Marrone, and A.K. Singh, "Machine Learning and Expert Judgement: Analyzing Emerging Topics in Accounting and Finance Research in the Asia–Pacific." *Abacus* 55, no. 4 (2019): 709-33.

Caraka, R.E., F.A. Hudaefi, P. Ugiana, T. Toharudin, A.E. Tyasti, N.E. Goldameir, and R.C. Chen, "Indonesian Islamic Moral Incentives in Credit Card Debt Repayment: A Feature Selection Using Various Data Mining." *International Journal of Islamic and Middle Eastern Finance and Management* 15, no. 1 (2022): 100–24.

Carrasco-Garrido, C., C. De-Pablos-Heredero, and J.L. Rodríguez-Sánchez. "Exploring Hybrid Telework: A Bibliometric Analysis." *Heliyon* 9, no. 12 (2023): e22472.

D'Amato, D., N. Droste, B. Allen, M. Kettunen, K. Lähtinen, J. Korhonen, P. Leskinen, B. Matthies, and A. Toppinen, "Green, Circular, Bio Economy: A Comparative Analysis of Sustainability Concepts." *Journal of Cleaner Production* 168 (2017): 716-34.

Dwivedi, Y.K., L. Hughes, E. Ismagilova, G. Aarts, C. Coombs, T. Crick, Y. Duan et al. "Artificial Intelligence (AI): Multidisciplinary Perspectives on Emerging Challenges, Opportunities, and Agenda for Research, Practice and Policy." *International journal of information management* 57 (2021): 101994.

ElKattan, A., D. Gavilan, M. Elsharnouby, and A. Mahran. "Mapping Sharing Economy Themes: Science Mapping, Topic Modeling, and Research Agenda." *Journal of Marketing Analytics* (2023): 1–22.

Espina-Romero, L., and J. Guerrero Alcedo. "Fields Touched by Digitalization: Analysis of Scientific Activity in Scopus." *Sustainability* 14 (2022): 14425.

Fischer, T., and C. Krauss, "Deep Learning with Long Short-Term Memory Networks for Financial Market Predictions." *European Journal of Operational Research* 270, no. 2 (2018): 654–69.

François-Lavet, V., P. Henderson, R. Islam, M.G. Bellemare, and J. Pineau. "An Introduction to Deep Reinforcement Learning." *Foundations and Trends® in Machine Learning* 11, no. 3–4 (2018): 219–354.

Gabrel, V., C. Murat, and A. Thiele, "Recent Advances in Robust Optimization: An Overview." *European Journal of Operational Research* 235, no. 3 (2014): 471–83.

Ghasiya, P., and K. Okamura. "Understanding the Middle East through the Eyes of Japan's Newspapers: A Topic Modelling and Sentiment Analysis Approach." *Digital Scholarship in the Humanities* 36, no. 4 (2021): 871-85.

Ghlamallah, E., C. Alexakis, M. Dowling, and A. Piepenbrink. "The Topics of Islamic Economics and Finance Research." *International Review of Economics and Finance* 75 (2021): 145–60.

Goodell, J., S. Kumar, W.M. Lim, and D. Pattnaik. "Artificial Intelligence and Machine Learning in Finance: Identifying Foundations, Themes, and Research Clusters from Bibliometric Analysis." *Journal of Behavioral and Experimental Finance* 32 (2021): 100577.

Gundu, K., A. Jamwal, A. Yadav, R. Agrawal, J. Jain, and S. Kumar. "Circular Economy and Sustainable Manufacturing: A Bibliometric-Based Review" *Recent Advances in Industrial Production* (2022): 137-47.

Hakak, S., M. Alazab, S. Khan, T.R. Gadekallu, P.K.R. Maddikunta, and W.Z. Khan. "An Ensemble Machine Learning Approach Through Effective Feature Extraction to Classify Fake News." *Future Generation Computer Systems* 117 (2021): 47–58.

Mnif, E., M.K. Hassan, A. Jarboui, and K. Mouakhar. "Big Data Tools for ISLAMIC Financial Analysis." *Intelligent Systems in Accounting Finance & Management* 27, no. 1 (2020): 10-21.

He, H., W.S. Oetting, Brott, M.J., and S. Basu. "Power Of Multifactor Dimensionality Reduction and Penalized Logistic Regression

for Detecting Gene-Gene Interaction in a Case-Control Study." *BMC Medical Genetics* 10 (2009): 1-17.

Heberger, A.E., C.A. Christie, and M.C. Alkin. "A Bibliometric Analysis of the Academic Influences of and on Evaluation Theorists' Published Works." *American Journal of Evaluation* 31, no. 1 (2010): 24–44.

Hidalgo, C.A. "Economic Complexity Theory and Applications." *Nature Reviews Physics* 3, no. 2 (2021): 92–113.

Hudaefi, F.A., M.K. Hassan, M. Abduh, and I.S. Beik. "Knowledge Discovery of Zakat Administration Worldwide from YouTube and Zoom Via Text Mining." *Journal of Islamic Accounting and Business Research* 14, no. 1 (2022): 159–80.

Hussain, E., M. Hasan, M.A. Rahman, I. Lee, T. Tamanna, and M.Z. Parvez. "Corodet: A Deep Learning Based Classification for COVID-19 Detection Using Chest X-Ray Images." *Chaos, Solitons & Fractals* 142 (2021): 1-12.

Jamwal, A., R. Agrawal, M. Sharma, G.S. Dangayach, and S. Gupta. "Application of Optimization Techniques in Metal Cutting Operations: A Bibliometric Analysis." *Materials Today: Proceedings* 38 (2021): 365–70.

Kartiwi, M., T.S. Gunawan, T. Arundina, and M.A. Omar. "Feature Selection for Financial Data Classification: Islamic Finance Application." *2018 IEEE 5th International Conference on Smart Instrumentation, Measurement and Application (ICSIMA)* (2018): 1–4.

Khan, S., and M.R. Rabbani. "Artificial Intelligence and NLP -Based Chatbot for Islamic Banking and Finance." *International Journal of Information Retrieval Research (IJIRR)* 11, no. 3 (2021): 65–77.

Kumar, S., D. Sharma, S. Rao, W.M. Lim, and S. Mangla. "Past, Present, And Future of Sustainable Finance: Insights from Big Data Analytics Through Machine Learning of Scholarly Research." *Annals of Operations Research* 345 (2025): 1061-104.

Li, C., L. Bai, L. Yao, S.T. Waller, and W. Liu. "A Bibliometric Analysis and Review on Reinforcement Learning for Transportation Applications." *Transportmetrica B: Transport Dynamics* 11, no. 1 (2023): 1-40.

Lundberg, S.M., G. Erion, H. Chen, A. DeGrave, J.M. Prutkin, B. Nair, R. Katz, J. Himmelfarb, N. Bansal, and S.-I. Lee. "From Local Explanations to Global Understanding with Explainable

AI for Trees." *Nature Machine Intelligence* 2, no. 1 (2020): 56–67.

Madzík, P., L. Falát, L. Copuš, and M. Valeri. "Digital Transformation in Tourism: Bibliometric Literature Review Based on Machine Learning Approach." *European Journal of Innovation Management* 26, no. 7 (2023): 177–205.

Magazzino, C., A.S. Alola, and N. Schneider. "The Trilemma of Innovation, Logistics Performance, and Environmental Quality in 25 Topmost Logistics Countries: A Quantile Regression Evidence." *Journal of Cleaner Production* 322 (2021): 129050.

Maria, M. R., R. Ballini, and R.F. Souza. "Evolution of Green Finance: A Bibliometric Analysis Through Complex Networks and Machine Learning." *Sustainability* 15, no. 2 (2023): 1-27.

Muñoz, J., and R. Castañeda. "Use of Machine Learning in Volatility: A Review Using K-Means." *Revista Universidad y Empresa* 25 (2023): 1–28.

Nazareth, N., and Y.V. Ramana Reddy. "Financial Applications of Machine Learning: A Literature Review." *Expert Systems with Applications* 219, (2023): 119640.

Pattnaik, D., S. Kumar, B. Burton, and W.M. Lim. "Economic Modelling at Thirty-Five: A Retrospective Bibliometric Survey." *Economic Modelling* 107 (2022):105712.

Polyzos, E., A. Samitas, and K. Syriopoulos. "Islamic Banking, Efficiency and Societal Welfare: A Machine-Learning, Agent-Based Study." *International Journal of Islamic and Middle Eastern Finance and Management* 16, no. 4 (2022): 777–801.

Tabor, D.P., L.M. Roch, S.K. Saikin, C. Kreisbeck, D. Sheberla, J.H. Montoya, S. Dwaraknath et al. "Accelerating the Discovery of Materials for Clean Energy in the Era of Smart Automation." *Nature Reviews Materials* 3, no. 5 (2018): 5-20.

Tlemsani, I., F. Marir, and M. Majdalawieh. "Screening of Murabaha Business Process Through Quran and Hadith: A Text Mining Analysis." *Journal of Islamic Accounting and Business Research* 11, no. 9 (2020): 1889–905.

Touri, O., R. Ahroum, and B. Achchab. "Management and Monitoring of the Displaced Commercial Risk: A Prescriptive Approach." *International Journal of Emerging Markets* 19, no. 6 (2024): 1748-765.

Waheed, A., M. Goyal, D. Gupta, A. Khanna, F. Al-Turjman, and P. Pinheiro. "CovidGAN: Data Augmentation Using Auxiliary

Classifier GAN for Improved Covid-19 Detection." *IEEE Access* 8 (2020): 91916-23.

Walas Mateo, F., and A. Redchuk. "IIoT/IoT and Artificial Intelligence/Machine Learning as a Process Optimization Driver under Industry 4.0 Model." *Journal of Computer Science and Technology* 21 (2021): 170-76.

Wang, J., Y. Zhou, and F. Cooke. "Low-Carbon Economy and Policy Implications: A Systematic Review and Bibliometric Analysis." *Environmental Science and Pollution Research* 29 (2022): 1–20.

Wang, Q., R. Huang, and R. Li. "Towards Smart Energy Systems: A Survey About the Impact of COVID-19 Pandemic on Renewable Energy Research." *Energy Strategy Reviews* 41 (2022): 100845.

Xi, J., X. Liu, J. Wang, L. Yao, and C. Zhou. "A Systematic Review of COVID-19 Geographical Research: Machine Learning and Bibliometric Approach." *Annals of the American Association of Geographers* 113, no. 3 (2023): 581–98.

Yesilyaprak, M., A. Polat, Ö. Özgür, and S. Şahal. "The Profit Rate-Interest Rate Nexus Evidence from Machine Learning Algorithms." *Turkish Journal of Islamic Economics* 10, no. 1 (2023): 137-61.

Zakaria, N., A. Sulaiman, F.S. Min, and A. Feizollah. "Machine Learning in the Financial Industry: A Bibliometric Approach to Evidencing Applications." *Cogent Social Sciences* 9, no. 2 (2023): 2276609.