



The Bibliometric Analysis on The Worldwide Agricultural Financing Literature: The Mapping and Direction

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ABSTRACT: The financial support plays a role in the most stage of agricultural sector. There are many literatures in this field, unfortunately, none of these maps in order to give the direction for the impactful future studies. This study quantitatively analyses 224 articles on Agricultural Financing literature during ten years period. Our selected papers were gained from the indexed-Scopus database that represented by English-language articles. Using a bibliometric approach, we investigate the field's performance and evolution of the agricultural financing literature. A significant increase in the number of publications was seen in the last period of our observation. We find the most frequent author is Turvey, CG who comes from the most relevant country. We noted that the leader of author and country are not necessarily the impactful one. However, the Agricultural Finance Review occurs as the most frequent and impactful journal. We offer future research directions on agricultural financing, rice/maize, productivity, sustainability and smallholder farmer. This study gives the information that there is a rarely occurrence of Indonesian as the country's contributor. Therefore, there is a great opportunity for Indonesian scholars to bring a novel from Indonesia's agricultural wisdom. We encourage Indonesian Scholars to enhance the quantity and quality publications.

KEYWORDS: Agricultural Financing; Bibliometric Analysis; Future Directions; Mapping; Scopus

I. BACKGROUND

Financial support is one of the significant factors especially for agriculture as high-risk characteristic sector [1]. Regarding the impact to the national income, agricultural industry was consistently supporting as the second largest contributor to the GDP for last five years [2]. Agricultural sector become a prominent factor since it meets the need of consumption for entire population. However, current agricultural production and growth are insufficient to meet the needs of a rapidly growing country's population. If not managed properly, the world population may exacerbate food insecurity in the near future [3]. In line with that, Indonesia's historical data shows that the growth rate of population continuously increase while the growth of paddy production continuously decrease [4].

Agricultural productivity should be increased to meet local food and livelihood demands. It was found that credit support significantly affects the farmer's productivity [5]. Farmers who have easy access to agricultural financial services are more able to increase crop yields [6] and the efficiency [7] by implementing new technologies [8]. The credit support was saving the cost up to 25 percent [9] compared to farmers with no credit access. In Indonesia, credit support is prominently should be enhanced since Central Bureau Statistic report that the biggest problem faced by 49.47 percent Indonesian farmer is lack of capital [2]. We noted that farmer is the second highest level of labour absorption in Indonesia. In the same vein, farmer also become the highest composition in the poor group [2]. In particular, the credit support indirectly affects the farmer's income through the farming output.

Many of the literature has been studied on agricultural financing. For instance, the effect of financial support to the productivity [6], [10], [11], technical efficiency [7], [12], financial risk and uncertainty [13], the policy [14], the relationship of financial support to climate change [15], [16], economic growth [17], determinant factor of farmers' participation on agricultural credit [1], [17], the distinction between institutional and non-institutional credit [18] and so on.

However, there is no study mapping of the literature using bibliometric analysis. Therefore, this study filled the gap. The prior study uses the similar method in agricultural context involving food security [19], vegetable price [20] and sustainable agriculture [21]. Since the financing support is a prominent factor, it is essential for any researcher to have an exhaustive understanding of the current state of research in their field of interest [22]. Bibliometrics could be a useful tool for conducting future research directions and encouraging international collaboration for effective treatment. Therefore, in this study we utilized the

bibliometric analysis to encompass the current trend research and to find further theoretical developments in the scope of agricultural financing.

II. METHOD

Bibliometric method has become increasingly popular among scholars to investigate meta-data analysis. Meta- data analysis studied the distribution structure and quantitative relationships of the literature and intelligence by using statistical and other methods of measurement on existing literature [20]. The bibliometric quantitatively maps the distribution among documents, journals, authors and institutions. Bibliometric is used since it was the effective method and useful to improve the quality of research [23]. Our research design is depicted in the Figure.1:

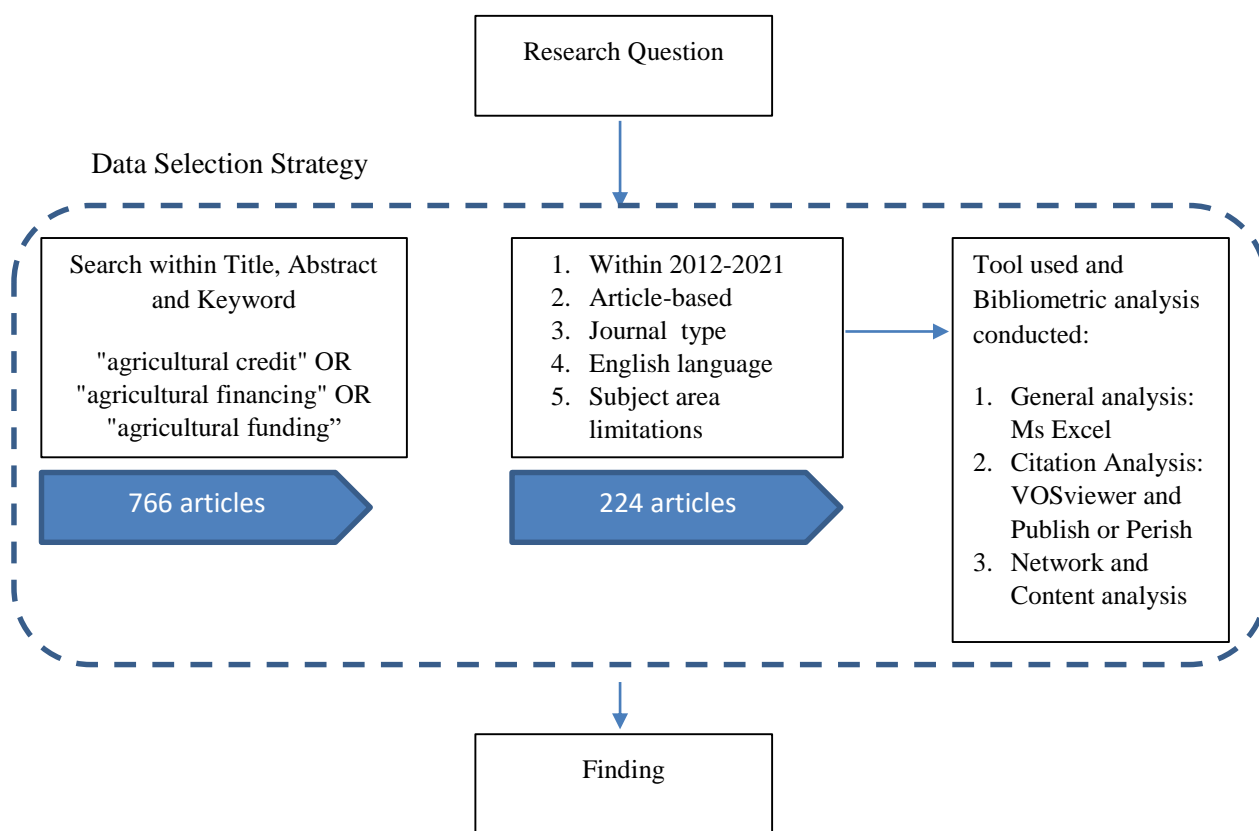


Figure 1. Research design

To identify the research structures and conduct the bibliometric analysis, the following step is defined. Firstly, we define the keywords as "agricultural financing" OR "agricultural credit" OR "agricultural funding" at indexed-Scopus database. The total population was 766 articles from 1914 until 2021. Secondly, we extract the data using inclusion and exclusion criteria such as year, form, type and language of publication. In addition, we limit our subject area in social science; agricultural and biological sciences; economic, econometrics and finance, environmental science; business, management and accounting; and multidisciplinary. Finally, our selected sample was 224 from 2012 until 2021.

We gathered data from Scopus database as a frequently used database for the rigorous development of social science research. We use the following software to answer our research questions: VOSviewer and Perish or Publish (PoP). VOSviewer allows users to generate and visualize bibliometric networks that depict relationships between authors, sources, nations, and keywords [24]. Using the tools, we can analyse the impact and the productivity of each variable in researcher’s own observation. Through the investigation of the interlink among above mention variables, it also can direct the future research based on current performance.



In this study, we analysis the most frequently following variables: author, journal, article and country. We also assess the impactful key-point by the citation analysis. The citation analysis is one form of an established bibliographical reference method [25] to determine the impact of a scholar's research [26] that captures the connection among documents [24]. Finally, we undertook a network analysis, evaluate the current trend and assign the future work.

III. RESULT AND DISCUSSION

Table. 1 provides a general overview data. There were 224 selected articles from 159 journals during ten years period. It represents that the low journal specialization and less productive in publishing this field's articles.

Table I. Citation metrics

Metrics	Data
Publication years	2012-2021
Citation years	10(2012-2021)
Papers	224
Journal	159
Citations	1496
Cites/year	149.6
Cites/paper	6.68
Authors/paper	3.04
h-index	21
g-index	30

Overall, the distribution of publications throughout the period is shown by the Figure. 2. The quantity of publication increases over the year where 2021 was the most productive year with 48 articles. However, it was not necessarily proportional to the citations. It was found that the most impactful year is 2018 with 263 citations. Furthermore, the authors assume that the low of 68 citations from 48 publications was affected by the short time lapse, since the current observation conducted in February 2022. In the following years, it might be increase.

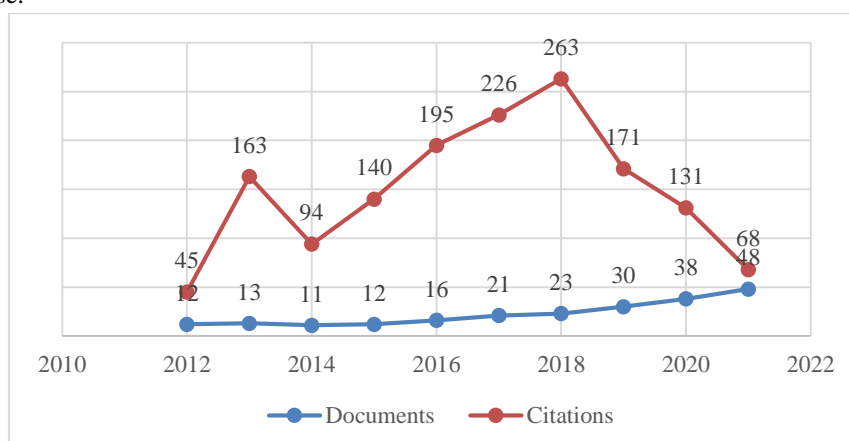


Figure 2. Annual distribution of agricultural financing papers

A. The Productive Authors

According to our analysis, the authors find that the most productive author lead by Turvey, CG from Cornell University. He composed 8 publications during last ten years either at first or second author. The distribution of the article as follows: one article in 2012, 2013, 2014 and 2019; and four articles in 2020. From the total of their publications, the most impactful Turvey's article

was “Risk rationing and the demand for agricultural credit: A comparative investigation of Mexico and China” with 22 citations. The reason behind is that this paper is the first to investigate risk rationing in China and Mexico, and it is one of the few empirical studies on the subject. A comparison of Mexico and China is instructive due to structural differences in the respective agricultural economies [27].

Table II. Most frequently authors in agricultural financing papers

No	Author	Country	TP	NCP	TC	C/P	C/CP	LS	h	g
1	Turvey, Calum Greig	United States	8	7	66	8.25	9.43	22	4	8
2	Jiang, Yuansheng	China	7	6	93	13.29	15.50	23	5	7
3	Chandio, Abbas Ali	China	5	5	92	18.40	18.40	13	5	5
4	Yilmaz, Hasan Ibrahim	Turkey	4	3	7	1.75	2.33	5	2	2
5	Adnan, Km Mehedi	China	3	2	11	3.67	5.50	15	2	3
6	Danso-Abbeam, Gideon	Ghana	3	3	44	14.67	14.67	10	3	3
7	Hartarska, Valentina M.	United States	3	2	39	13	19.5	5	2	3
8	Makate, Clifton	Norway	3	3	41	13.7	13.67	6	3	3
9	Musshoff, Olfier	Germany	3	3	18	6	6	4	3	3
10	Nadolnyak, Denis	United States	3	2	39	13	19.5	5	2	3

TP: Total Publications; NCP: Number of Cited Publications; TC: Total Citations; C/P: Average Citations per Publication; C/CP: Average Citations per Cited Publication; LS: Link Strength; h: h-index; and g: g-index.

However, the leader author not reflects the most cited article. Based on total citation among top ten authors, the most cited articles are Jiang, Y with 93 citations. However, not all of his publications have been cited. Therefore, it is not giving a significant impact on other Scopus articles except for a small number of articles shown by C/P value of (13.29). Consequently, the most influential author in the top ten are written by Chandio, AA. Although his total publication slightly lower than Jiang, Y, all of the Chandio’s articles have been cited therefore the C/P is higher than their counterpart as shown in the table 2.

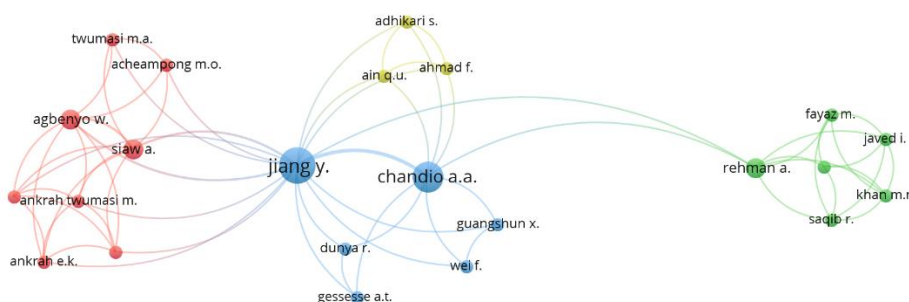


Figure 3. Co-authorship

We used co-authorship analysis to determine the collaborative relationship between authors that depicted by nodes. Based on the Figure.3, the strength of the collaborative relationship was reached by Jiang, Y with 23 link-strength (LS). Jiang, Y was connecting to all of the clusters. It means that he formed many relationships through co-authorship, which has indirectly influenced research on agricultural financing literature.



B. The Productive Journals

Our sample of 224 documents come from 159 journals. We highlight the top-ten journal to be analysed.

Table III. Most frequently journals in agricultural financing papers

No	Source	TP	TC	Publisher	Cite Score	SJR	SNIP
1	Agricultural Finance Review	46	339	Emerald	2.4	0.61	0.929
2	Sarhad Journal of Agriculture	7	11	ResearchersLinks Ltd	0.5	0.2	0.297
3	Heliyon	4	27	Elsevier Ltd	2.1	0.46	1.079
4	International Journal of Social Economics	4	15	Emerald	1.6	0.29	0.632
5	Journal of Agribusiness in Developing And Emerging Economies	4	12	Emerald	2.6	0.54	1.482
6	Journal of Agricultural Extension	4	4	Agricultural Extension Society of Nigeria	0.6	0.17	0.415
7	Land Use Policy	4	152	Elsevier Ltd	7.5	1.67	1.908
8	Agricultural Economics Czech Republic	3	25	Agricultural Economics	2.3	0.44	0.898
9	Agricultural Economics United Kingdom	3	39	Blackwell Publishing Ltd	3.8	1.29	1.442
10	Agriculture Switzerland	3	30	MDPI AG	2.5	0.53	1.327

Based on the Table. 3, the highest publication’s journal was reached by *Agricultural Finance Review (AFR)* with 46 documents. Based on the Figure. 4, AFR journal consistently produces the publication every year at above average of the other journals.

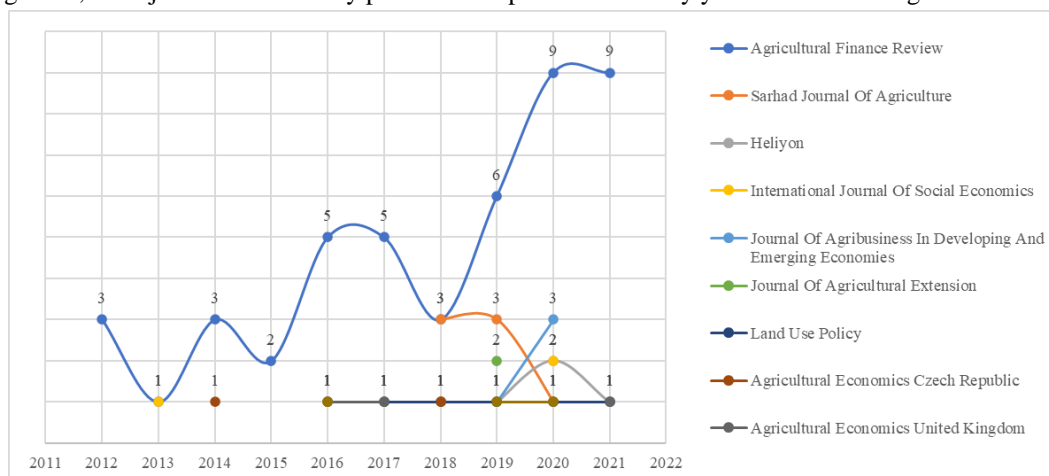


Figure 4. The distribution of the frequently journals

Not only as the most frequently journal, it was also be the most impactful journal with 339 of total citations. Moreover, the second highest cited journal was significantly different. Here the specific distribution of AFR journal during the time observation: 19 citations in 2012 and 2013; 48 citations in 2014; 41 citations in 2015; 58 citations in 2016; 55 citations in 2017; 42 citations in 2018; 29 citations in 2019; 22 citations in 2020 and 6 citations in 2021.

Scopus-indexed journals use two indicators to evaluate the impact of journal, SNIP (Source Normalized Impact per Paper) and SJR (Source Normalized Impact per Paper) (SCImago Journal Rank). SNIP considers the field in which a journal operates such as the number of citations per paper, the amount of indexed literature, and the speed of publication. Meanwhile, SJR considers the prestige of the citing journal; citations are weighted to reflect whether they come from a high or low-status journal. SJR (Hugget,2013). According to the table, the most quality journal based on cites score was *Land Use Policy* published by Elsevier Ltd with 7.5 score of citations.

To assess the network analysis, we utilize bibliographical coupling of source. Initially, we placing at five thresholds. As that criterion provided limited results, we reduced the threshold to minimum three citations. Therefore, we find five clusters as shown by figure. 5. By the nodes, AFR was obviously seems as the highest link strength (349 links) that linked to all the clusters. Therefore, AFR placed a significant position in the journal involving the most frequently, most productive and most relationship journal in our sample.

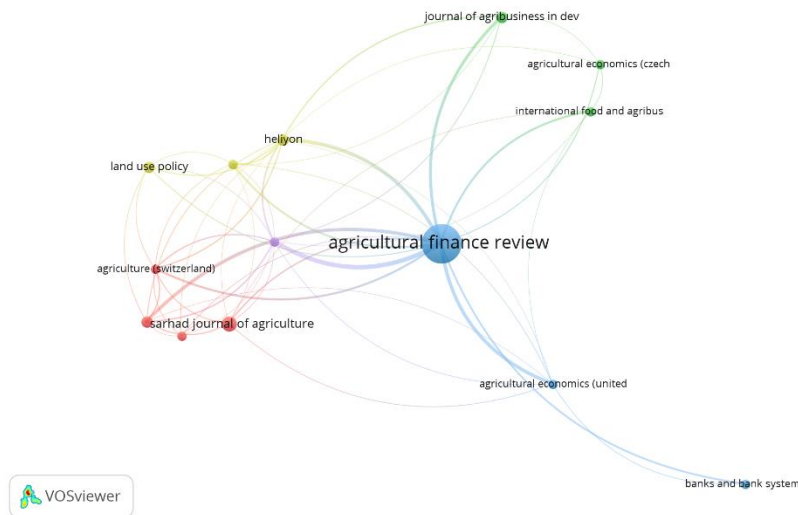


Figure 5. Bibliographical coupling of sources

C. The Productive Countries

There are 87 contributed countries to our selected agricultural financing literatures. However, we document the top ten countries. Based on the Table. 4, United States lead as the highest country’s publication with 41 articles. The distribution of the publication and citation as follows: 2 publications with 15 citations in 2012; 1 publication with 19 citations in 2013; 3 publications with 30 citations in 2014; 3 publications with 48 citations in 2015; 1 publication with 20 citations in 2016; 5 publications with 44 citations in 2017; 1 publication with 8 citations in 2018; 2 publications with 10 citations in 2019; 6 publications with 40 citations in 2020; 7 publications with 2 citations in 2021.

Table IV. Countries covered in agricultural financing studies

No	Country	TP	NCP	TC	C/P	C/CP	h	g
1	United States	41	31	251	6.12	8.1	9	14
2	India	29	20	127	4.38	6.35	5	10
3	Nigeria	28	19	116	4.14	6.11	5	9
4	China	21	17	234	11.14	13.8	7	15
5	Pakistan	21	17	247	11.7	14.5	7	15
6	Ghana	13	12	189	14.54	15.8	7	13
7	Germany	12	11	292	24.33	26.5	8	12
8	South Africa	10	8	75	7.5	9.38	4	8
9	Thailand	10	9	194	19.4	21.6	8	10
10	Turkey	9	7	22	2.44	3.14	3	3
41	Indonesia	1	0	0	0	0	0	0

TP: Total Publications; NCP: Number of Cited Publications; TC: Total Citations; C/P: Average Citations per Publication; C/CP: Average Citations per Cited Publication; LS: Link Strength; h: h-index; and g: g-index.



In general, the score of C/P and C/CP among the countries are different. It means that the published articles were not cited yet by the other Scopus-articles, in the other word, there is the publication with zero citation and have no impact yet in the literature. Besides, Indonesia was far apart from the top board. The rank of Indonesia was 41st place with one document and none of citation and index at all. This finding represent that the Indonesian’s researcher should enhance the quantity and quality of publication. The collaboration as well as co-authorship is needed to expand the publications from Indonesia.

D. The Impactful Articles

We analyse the impactful articles using citation analysis to determine the most influential articles. Table. 5 shows the top-ten of the impactful articles in our sample. We found that the article titled “Agricultural advisory and financial services; farm level access, outreach and impact in a mixed cropping district of Punjab, Pakistan” by Elahi., *et al* [28] as the most cited article. In that time, there is no consensus in the available empirical studies regarding the effectiveness of these services [29], particularly in Pakistan. Elahi., *et al* [28] fill the gap and bring many insightful findings. Consequently, the average citations (22 cited per year) reflect huge impact on the development literature. According to popularity definition by Ding and Cronin [26] that popularity can be defined as the total number of times an author is cited. Therefore, we categorized that Elahi *et al* [28] was the most popular author in our selected sample.

Table V. The impactful articles

No	Author	Title	Year	C	C/Y	LS
1	E. Elahi, M. Abid, L. Zhang, S. ul Haq, J.G.M. Sahito	Agricultural advisory and financial services; farm level access, outreach and impact in a mixed cropping district of Punjab, Pakistan	2018	88	22	26
2	T. Wossen, T. Berger	Climate variability, food security and poverty: Agent-based assessment of policy options for farm households in Northern Ghana	2015	54	7.71	21
3	M.J. Kabir, M. Alauddin, S. Crimp	Farm-level adaptation to climate change in Western Bangladesh: An analysis of adaptation dynamics, profitability and risks	2017	52	10.4	10
4	S. E. Saqib, J.K.M. Kuwornu, S. Panezia, U. Ali	Factors determining subsistence farmers’ access to agricultural credit in flood-prone areas of Pakistan	2018	42	10.5	85
5	A.-H. Abdallah	Agricultural credit and technical efficiency in Ghana: is there a nexus?	2016	41	6.83	24
6	R. Ullah, G.P. Shivakoti, F. Zulfiqar, M.A. Kamran	Farm risks and uncertainties: Sources, impacts and management	2016	37	6.17	20
7	S.M. Kumar	Does Access to Formal Agricultural Credit Depend on Caste?	2013	35	3.89	10
8	C. Asante-Addo, J. Mockshell, M. Zeller, K. Siddig, I.S. Egyir	Agricultural credit provision: what really determines farmers participation and credit rationing?	2017	35	7	52
9	T. Wossen, T. Berger, N. Swamikannu, T. Ramilan	Climate variability, consumption risk and poverty in semi-arid Northern Ghana: Adaptation options for poor farm household Northern Ghana: Adaptation options for poor farm households	2014	34	4.25	14
10	G. Danso-Abbeam, J.A. Bosiako, D.S. Ehiakpor, F.N. Mabe	Adoption of improved maize variety among farm households in the northern region of Ghana	2017	34	6.6	9

C: Citations; C/Y:Citation per year; LS: Link Strength

We use a bibliographic coupling analysis to discover core items in our dataset [30]. This widely used technique performs automatic clustering on large data sets and identifies cases where two documents in their publications cite the same third work. The color in Figure 4 depicted the cluster of the article that represent by the author. We limit five thresholds at minimum number of citations following Paltrinieri *et al.* [31]. Therefore, there are eight clusters from 78 documents meet the threshold. Our results show that the documents most often co-cited are articles by Elahi from cluster purple and T. Wossen from cluster blue. However, based on the link strength among the articles, the article entitled *Factors determining subsistence farmers' access to agricultural credit in flood-prone areas of Pakistan* by S. E. Saqib, J.K.M was the highest linked with 85 LS. It was connected to all of 8 clusters in the 78 documents.

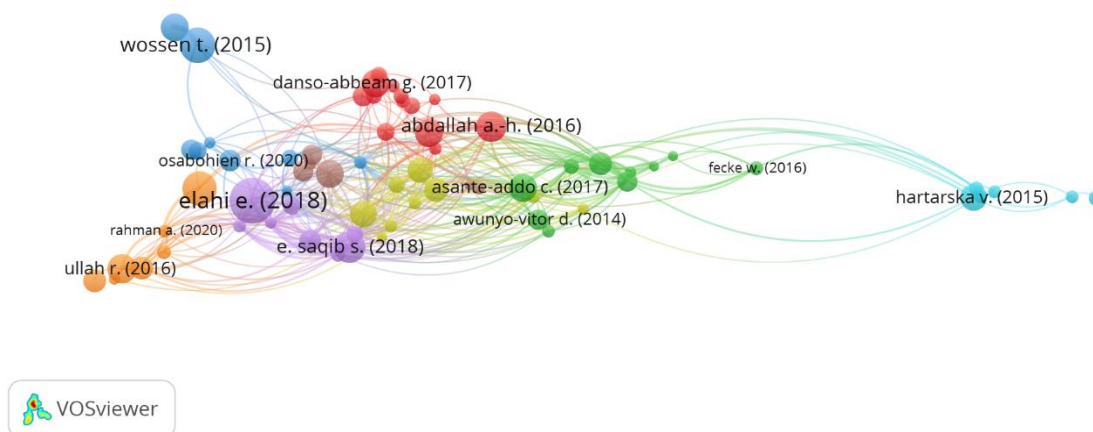


Figure 4. Bibliographical coupling of documents.

E. Top Frequent Author's Keywords: Mapping and direction

We use co-occurrence (co-word) analysis to examine the most prevalent keyword discussed in the agricultural credit literature. Co-occurrences occur when two keywords appear together in an article, indicating a connection between the two concepts [32]. We use five threshold as minimum number of occurrences. Therefore, we find four clusters from 51 keywords that meet the threshold from the total of 988 keywords as shown in the figure below.

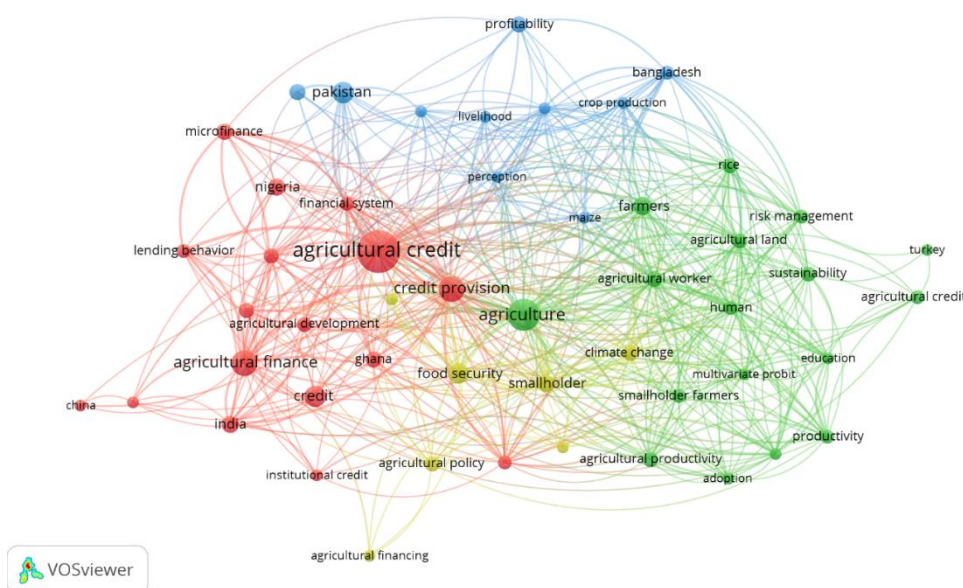


Figure 6. Co-occurrence of keyword



Based on the map, there are four clusters: red, blue, green and yellow. The red cluster (n=17) is the most used keyword (207 occurrences) involving agricultural credit, credit provision, agricultural finance and technical efficiency. Although the green cluster has the equal items (n=17), the total occurrences are below the red which is 135 occurrences. This cluster represent by the following keywords: agriculture, farmers, agricultural productivity and sustainability. The blue cluster (n=10) has 61 occurrences that are represented by profitability, crop production, livelihood and maize. Then, the yellow cluster (n=4 clusters) with 53 occurrences are represented by following keywords: food security, agricultural financing, agricultural policy and smallholders.

Co-occurrence is also used to understand the main research in the worldwide literature. Overall, the keyword of “agricultural credit” is the largest node on the network (57 occurrences) and follow by other nine keywords as shown by Table. 5. The largest node indicates that its occurrences were relatively large as well as these keywords were commonly used in the included articles [33]. The direction of future research is better to utilize the little node that still linked to the main research or to use the node that not directly linked yet in the network. We found some insights for future directions. There are an interlink from climate change, agricultural technology and sustainability to agricultural credit. Therefore, it can bring a novelty in the future agenda.

Table VI. The analysis of co-occurrence of keyword

No	Keyword	Occurrence	Total Link Strength
1	Agricultural credit	57	98
2	Agriculture	33	103
3	Credit provision	22	110
4	Agricultural finance	21	63
5	Pakistan	15	27
6	Credit	15	22
7	Food Security	13	37
8	Farmers	11	48
9	Smallholder	10	56

Beside our main keyword in the agricultural finance cluster (credit provision, agricultural financing, and credit), the map of the most frequent author keywords includes the names of the countries/regions such as Pakistan, Bangladesh, Nigeria, Turkey, Ghana, India and China. The map also included keywords such as profitability, productivity, livelihood, farmer and poverty. Among of keywords, maize and rice occur as the type of food.

We investigate the movement of agricultural financing literature during our time observation. Starting from the earliest period, literature studied in the broad theme such as lending behaviour, financial system, institutional credit and agricultural development. In the middle period, the literature enhance to the risk management, technical efficiency, credit provision, profitability, poverty and farmers. In the latter period, the directing literature expand to as food security and sustainability as world agenda of Sustainable Development Global (SDG) conducts. It is also focus to optimal the agriculture such as the productivity, policy and climate change.

The discussion in the literature moves from Nigeria, Ghana, China and India to Pakistan, Turkey, Bangladesh and Kenya. The object of agriculture also pursued at maize and rice. Farmer as the worker of agriculture is more focusing on small farmer. There is a huge challenge for Indonesian scholar to fill the gap literature follow current trend and novelty based on this analysis.

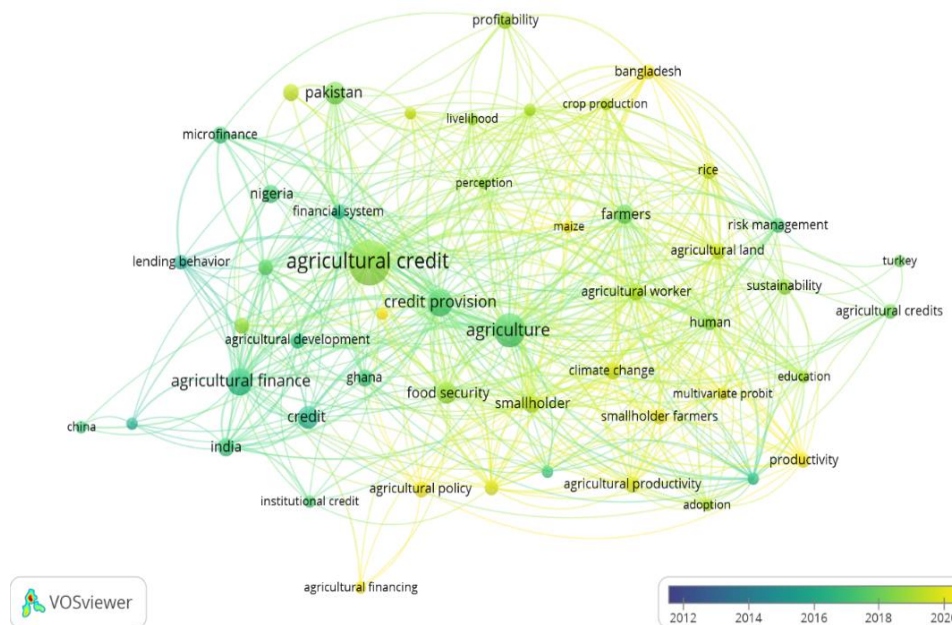


Figure 7. Overlay visualization of co-occurrence of keyword

IV. CONCLUSION

We utilized 224 worldwide articles that was restricted to “agricultural financing, agricultural funding and agricultural funding”. In particular, the keyword has moved from agricultural credit to agricultural financing. In this study, we find that the most frequently author not reflects the most impactful and not reflect the interlinked collaboration within authors. In contrast, the evidence of the journal shows that the frequent was similar to the impactful journal which is the Agriculture Finance Review published by Emerald. United States was actively involved articles in this area. Regarding the most impactful article, paper entitled *Agricultural advisory and financial services; farm level access, outreach and impact in a mixed cropping district of Punjab, Pakistan* by Elahi., et al was the high cited article.

The current study shows that agricultural credit, agriculture and credit provision were the main research themes in the existing literature. Therefore, it was better to conduct the research in the rare of keyword’s occurrences and for future research. Our overlay visualization supports our finding that the latest theme stands for the agricultural financing, productivity, rice and small farmer. Therefore, our suggestions for the further research trend literature are the productivity and profitability of small farmer related to the agricultural financing. As the profitability was closely related to the welfare, the authors consider that theme is relevant in the future. The relation of agricultural technology and policy are rarely studied in the network. In addition, the sustainability theme is relevant to study as well as the global agenda. The collaboration among above keywords might be the novelty in the forthcoming time laps.

V. RECOMMENDATION

We find that Indonesian scholar is less likely founded in our selected articles. It was the big chance to Indonesian scholar to contribute in this field. Indonesia as the agrarian country is certainly having a novel finding compared to the existing object research or frequent countries’ publication.

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