Exploring the research trends of entrepreneurship and innovation for agricultural competitiveness: a bibliometric analysis

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Abstract. Entrepreneurship and innovation have a positive impact on competitiveness, including in the agricultural sector. Since much research is conducted on entrepreneurship and innovation, it is challenging to map the research trends and obtain directions for future research, especially in agricultural competitiveness. This study aims to provide a systematic overview by analyzing the research trend and main topic of entrepreneurship and innovation studies related to agricultural competitiveness. Next, this study also analyzes the potential topic for future research. Data collected from the Scopus database and bibliometric analysis using the Biblioshiny (R package) and VOSviewer software. The results showed that the number of publications on research interest in this area increases over time. The increasing research on this topic can be seen in the trends of documents produced. This study focused on four main topics: agricultural development, agricultural sustainability, agricultural economy, and agricultural technology. The hot topic mainly discusses in the last three years related to agricultural robots, investment, agro-industrial complex, biotechnology, technology transfer, crops, international trade, alternative agriculture, agricultural trade, and supply chain management. Further, the keywords: agribusiness, financial resources, manufacture, agricultural enterprises, strategy, organizational framework, industry, economic competitiveness, development, and social entrepreneurship still need to explore and potentially discuss in the future.

1. Introduction
In the last years, increasing agricultural competitiveness is becoming increasingly urgent in line with globalization, trade liberalization, and changes in the business environment. It shifted the business paradigm from comparative advantage orientation to competitive advantage. The driving force in industrial development is innovation, and this requires entrepreneurship, which is the attitude, imagination, and ability to implement the innovation. Innovation and entrepreneurship are significant in sustainable agricultural development as well, where increased productivity and increased competitiveness are achieved through innovation [1]. Furthermore, entrepreneurship has a positive effect on innovation, which positively impacts the Global Competitive Index [2].
Research on agricultural entrepreneurship and innovation has become a topic of discussion among researchers. The number of research articles on agricultural entrepreneurs has increased in recent years [3]. It is due to the growing entrepreneurial literature and because agricultural challenges are increasing, both in rural and urban areas, with new business models and social entrepreneurship initiatives [4,5]. Discussions related to agricultural entrepreneurship are associated with the development of other businesses and the development of new products and innovations in business processes, distribution, and marketing [6].

Recently, much research has been conducted in entrepreneurship and innovation in agricultural competitiveness from many study areas. In addition, the topic has high citations that indicate the importance of published work in the research community. However, the study mapping on this area is still limited, directly linking entrepreneurship and innovation to increased competitiveness. This mapping study will help scholars to determine the research topic in this area in the future. Therefore, this study was applied bibliometric analysis to generate the mapping study. It is a method to provide progress and the development of knowledge on the topic of research.

Bibliometric analysis conducted based on data allows scientific studies and a comprehensive view of areas of scientific investigation. The accessibility of bibliographic data has increased bibliometric reviews in different research areas [7]. This study aims to provide a systematic overview by analyzing research trends and the current status of entrepreneurship and innovation topics in agricultural competitiveness during the 2001-2021 period. Then, analyzing the main topic in entrepreneurship and innovation research related to agricultural competitiveness and analyzing the potential topic for future research in entrepreneurship and innovation topics in the context of agricultural competitiveness.

2. Materials and method

This study was assessed using bibliometric analysis to answer the research question. The English documents were collected from Scopus database for entrepreneurship and innovation in agricultural competitiveness topics in the last twenty years, from 2001 to 2021. By applying Boolean logic model, the search strategy was run with keywords “Entrepreneurship” OR “Innovation” AND “Agricultural competitiveness” on article titles, abstracts, and keywords on April 27, 2021. Types of documents collection including Article, Conference Paper, Book Chapter, Review, and Book.

This study uses a five-step research workflow when performing thematic mapping [8]. Those are study design, data collection, data analysis, data visualization, and interpretation. The first phase of this study began by determining three research questions about entrepreneurial research trends and innovation for agricultural competitiveness. Next, the selection of documents from the Scopus database was conducted as the second phase by applying the search strategy. The search result was refined by limiting the subject area to Business, Management, Accounting; Economics, Econometrics, Finance; Agricultural and Biological Science, Social Science, and Environmental Science. Finally, after carefully selecting the documents found by reading the abstract, the selected files are exported to "csv", and "bibtext" formats for further analysis. The third phase is to choose the software to be used to analyze and process the data. VOSviewer version 1.6.16 and Biblioshiny R version 4.0.5 are used to generate a robust statistical analysis of data. Bibliometrix R package was used to perform a descriptive bibliometric analysis and create a matrix comprising all the documents.

Further, the keyword co-occurrence analysis technique of VOSviewer was conducted to analyze the main topic and investigate the potential research in this field. It extracted all keywords from document collection and counted the term by full counting methods. Then, the number of terms was adjusted where only words that appear at least three times will be counted. Afterward, relevant terms are selected by the program’s natural language processing algorithm. In the fourth and fifth phases, data analysis results are visualized automatically and interpreted to answer the research question.
3. Results and discussion

3.1. Publication trend of document collection

The analysis of document collection found 146 documents related to entrepreneurship and innovation for agricultural competitiveness from 2001 to 2021 that increased over time (Figure 1). They have an average citation of 9.95 that could be noticed as the significance and impact of this topic for the other research. Furthermore, the analysis of the document revealed the most cited document and the most relevant word as described as follows.

Figure 1. Annual Scientific Production

Figure 2 shows the most cited document in the blue bar chart. The dark blue color, the more citations. The number displayed in the total citation ranges from 0 to more than 200. The study found Srbinovska et al. [9] was an article with top quotes of more than 200 citations. Followed by Intarakumnerd et al. and Lahmar [10,11] in second and third position.

Those documents discussed how important innovation in improving agricultural competitiveness. The innovation of Wireless Sensor Network (WSN) applications for precision agriculture can improve crop production and quality and lower management costs from the environmental monitoring aspect [9]. The NIS study in countries such as Thailand should focus on the factors that contribute to the long-term viability of a weak and fragmented NIS because it will affect competitiveness [10]. Furthermore, Lahmar R [11] states that adopting agricultural conservation innovations significantly reduces production costs, including machinery costs, expert materials, and labor costs. The need to improve agricultural competitiveness, market globalization, and stable fuel costs are likely to increase European farmers’ interest in conservation agriculture as it cuts production costs significantly.

The study also counted relevant words used in documents. The top 10 words show a comparison of the number of occurrences of each word’s use and their relevance to the study topic. The top word with the highest number of occurrences and most relevant to the research topic is the innovation, with 28 occurrences. It illustrates that the topic of the study is closely related to the word innovation that often appears in research. Next in second place is agriculture with the number of occurrences 26 times. Then in third place is competitiveness with the appearance of 10 times.

3.2. Main topic cluster and hot topic research

The study extracted 587 keywords from titles and abstracts from 146 documents collected using VOSviewer. Next, 76 of the most relevant terms that appeared at least three times were selected in this stage. Figure 3 shows a co-occurrence map of keywords to show the main topic cluster of research
entrepreneurship and innovation to agricultural competitiveness. The VOSviewer analysis result identified four clusters illustrated in four different colours (red, green, blue, and yellow). Each cluster was manually labelled based on the most occurred word and link all terms in the cluster. For instance, in the red cluster, agricultural development-related keywords cooccurred, and consequently, this study labeled them as the agricultural development cluster. Similarly, the green cluster is agricultural sustainability, the blue cluster is an agricultural economy, and the yellow cluster is agricultural technology.

TLS represent the total link strength of two related terms [12] to predict trends and the main topic of research. Refer to Table 1, the red cluster contains the highest number of terms and has the highest total link strength value rather than blue, green, and yellow. It indicates that the primary research trends and research clusters in the past decade have focused on agricultural development and are supported by agricultural economy, agricultural sustainability, and agricultural technology.

| Table 1. The keyword cluster and total link strength value. |
|-----------------|-----------------|----------|
| Cluster          | Keyword                                    | TLS     |
| Agricultural Development (red points) | agricultural development, agricultural economics, agricultural policy, agricultural production, agricultural trade, alternative agriculture, Australia, Brazil, competitiveness, decision making, economic aspect, Eurasia, Europe, European union, export, farmers knowledge, farming system, food industry, food, production, income, innovation, investment, Italy, livestock farming, North Amerika, organic farming, organizational framework, policy, profitability, rural area, strategic approach, supply chain management, supply chains, sustainability, sustainable agriculture, technological development, Thailand, United States | 1286     |
| Agricultural Sustainability (green points) | agricultural enterprises, agricultural policies, agricultural productions, agricultural robots, agri-industrial complex, biotechnology, climate change, commerce, common agricultural policy, developed countries, developing countries, economic analysis, efficiency, entrepreneur, environmental management, environmental protection, environmental technology, food security, food supply, international trade, marketing, rural areas, social entrepreneurship, strategy, sustainable development | 854      |
| Agricultural Economy (blue points) | agricultural machinery, agricultural products, agricultural research, agricultural sector, agriculture, competition, costs, crops, economic and social effect, economic competitiveness, financial resources, information management, investments, manufacture, modernization, planning, productivity, regional planning agribusiness, agricultural engineering, agricultural technology, agroindustry, cluster, development, economics, engineering education, entrepreneurship, forestry, industry, innovations, rural development, technology, technology transfer | 998      |
| Agricultural Technology (yellow points) | | 372      |
Figure 3. The co-occurrence map of keyword.

Topics that appear in the analysis can be a hot topic to discuss through citation. This study tries to map hot topics in the last three years (2018-2021) and found that the topics agricultural robots, investment, agro-industrial complex, biotechnology, technology transfer, crops, international trade, alternative agriculture, agricultural trade, and supply chain management are the hottest in the document collection.

Table 2. The hot topic by cluster.

| Term               | Colour | Occurrence | Size  | Cluster                        |
|--------------------|--------|------------|-------|--------------------------------|
| Agricultural robots| Green  | 15         | medium| Agricultural sustainability    |
| Investment         | Blue   | 5          | small | Agricultural economy           |
| Agro-industrial complex | Green  | 9          | medium| Agricultural sustainability    |
| Biotechnology      | Green  | 6          | small | Agricultural sustainability    |
| Technology transfer| Yellow | 3          | small | Agricultural technology        |
| Crops              | Blue   | 6          | small | Agricultural economy           |
| International trade| Green  | 6          | small | Agricultural sustainability    |
| Alternative agriculture | Red    | 5          | small | Agricultural development      |
| Agricultural trade | Red    | 5          | small | Agricultural development      |
| Supply chain management | Red    | 3          | small | Agricultural development      |

According to Table 2, ten terms from four clusters became hot topics in document analysis with different compositions. Along with the challenge to further improve agricultural competitiveness, entrepreneurship and innovation became a hot topic of discussion among researchers. The development of agricultural entrepreneurship is one of the strategic directions for the greening of land use, organic production, and domestic market development for organic (ecological) products in the format of agro-eco zonal clusters [13]. Furthermore, the entrepreneurial competence of farmers influences the willingness to participate in the Short Food Supply Chains (SFSC) for the creation of food distribution networks that can bring many benefits to farmers and consumers [14].
In addition, agricultural innovation also contributes very significantly to the improvement of agricultural competitiveness. Innovation of WSN technology innovation for precision agriculture can increase production and quality [9], agricultural conservation innovation for a significant reduction of production costs [11]. Furthermore, the Life Cycle Sustainability Assessment approach for sustainable, innovative solutions in satisfying and retaining customers [15] and adopting new technologies for increased productivity and increased competitiveness throughout the supply chain of thriving aquaculture industries [16].

3.3. Potential topic for further research

Entrepreneurship and innovation are essential for the development of agricultural competitiveness. However, research on how entrepreneurship and innovation are applied to make agriculture competitive and sustainable is still rare. Therefore, identifying a potential topic is needed to enrich literature and build direction for the future, which will be helpful in the development of agricultural competitiveness.

The study conducts density visualizations to investigate potential topics in data collection. It is a kind of VOSviewer visualization, which indicates the weight of the item to investigate the most frequently appeared topics and rarely discusses document collection by determining the weight of an item and visualizing it in rainbow colours. The most significant number of items and the weightiest element were red, followed by yellow, green, and blue. The red area indicates that researchers use the terms many times. In comparison, the yellow area allows researchers to conduct further investigation. At the same time, the green and blue areas indicate that those terms are still widely discussed and have the potential to be explored in future studies.

Figure 4 reveals the highest density terms are "innovation", "agriculture", and "sustainable development". It suggests that the three terms are used in various research topics widely. Many other words lie in red, yellow, and green. In addition, the blue area indicates many potential topics for further research related to entrepreneurship and innovation for competitive agriculture. There are six terms located in the red area, 17 terms located in the yellow area, 43 in the green area, and 10 in the blue area. At least ten terms have the potential to be researched in the future. However, by considering previous findings on publication reviews and analysis of hot topics, the terms were filtered to determine the most potential research topics in this field of study. The study found ten terms with high potential for future research, namely, "agribusiness", "financial resources", "manufacture", "agricultural enterprises", "strategy", "organizational framework", "industry", "economic competitiveness", "development", and "social entrepreneurship".

Figure 4. The potential topic for future research.
Future research on entrepreneurship and innovation for agricultural competitiveness can be focused on these terms. For example, research on agri-science to agri-business: the dimension of technology transfer where the transfer of knowledge and technology from agricultural science serves as a driver of innovative entrepreneurship in agriculture and the food industry to improve industrial competitiveness and social welfare [17]. Research on technology transfer that can improve agribusiness performance and encourage rural development [18]. Other research such as the development of industrial and agricultural enterprises based on innovation management [19], towards a single innovation space in the agrarian sector [20], and integrative viewpoint for implementing sustainable management agricultural business excellence [21] can be an exciting topic for future research. Future research using these terms will further enrich the science and technology literature of entrepreneurship and innovation for agricultural competitiveness.

4. Conclusions
Research on entrepreneurship and innovation for agricultural competitiveness has been discussed among researchers shown by the increasing number of publication over twenty years. The analysis on the document collection, revealed that the most cited document talk about the importance of innovation in improving agricultural competitiveness. Furthermore, the primary research is grouped into four clusters: agricultural development, agricultural sustainability, agricultural economy, and agricultural technology. Analysis of hot topics in the current period revealed ten terms mostly derived from agricultural development and agricultural sustainability clusters. The keywords reflect the current hot topics in the last three years (2018-2021): agricultural robots, investment, agro-industrial complex, biotechnology, technology transfer, crops, international trade, alternative agriculture, agricultural trade, and supply chain management. In summary, the future research in this field could related to the terms "agribusiness", "financial resources", "manufacture", "agricultural enterprises", "strategy", "organizational framework", "industry", "economic competitiveness", "development", and "social entrepreneurship".

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