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Analysis of SDGS research: The relationship between climate change, poverty, inequality, and food security: The Indonesian context

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Abstract

Research aims: This study investigates the linkages between climate change, inequality, and food security. The study attempts to provide an understanding of the evolution of publications on the topic to identify key emerging themes and policy prescriptions.

Design/Methodology/Approach: Mixed methods, bibliometric analysis, and content analysis were employed to examine emerging themes in the literature on climate change, inequality and poverty, and food insecurity in Indonesia. The bibliometric data used were taken from the Gscholar database for 2018-2023.

Research findings: The study generated six research themes based on the analyzed literature: (1) Human resource management and wealth redistribution through zakat; (2) Agricultural adaptation to climate change and the concept of sustainable agriculture; (3) Policies or rules applied by the government to regulate the agricultural sector; (4) Limited access to resources, loss of employment, and income in food insecurity among households; (5) Poverty alleviation strategies in reducing inequality and improving the quality of human life; and (6) Comprehensive and sustainable planning to identify challenges, opportunities, policies, inclusive economy, and food security.

Theoretical contribution/Originality: This study analyzes and uncovers emerging topics in the field and their contributions to the literature, as well as persistent gaps, and provides future research directions based on emerging themes and policy prescriptions.

Practitioner/Policy implication: This study can be used by the government as a regulator and financial institutions as a means of financing and academics.

Research limitation/Implication: Future research is expected to examine: (1) The planning of government agencies in mobilizing local resources; (2) The role of zakat institutions in poverty alleviation programs; (3) Sustainable agriculture models; (4) CWLS & Green Sukuk financing models; (5) The role of microfinance institutions in poverty alleviation programs; and (6) Studies on cultural economy.

Keywords: Climate change; Food security; Inequality; Sustainable Development Goals (SDGs); Indonesia

Introduction

Over the past two decades, the global climate has changed in ways that affect lives in uncertain ways. Climate change has far-reaching impacts on the prospects of achieving the seventeen Sustainable Development

Goals (SDGs), both directly and indirectly. There is a direct link between food security and SDGs 1 (no poverty), 2 (no hunger), and 12 (responsible consumption and production). In Indonesia, the impacts of climate change have increased average air temperature, a decrease in average air humidity, increased rainfall in the wet season, and changes in the length of sunshine in the wet and dry seasons (Maryono et al., 2023). Climate change has also resulted in the food security level of cassava farming households being mostly categorized as insecure (Murniati et al., 2019).

In Indonesia (*UU No. 18 Tahun 2012 tentang Pangan*, 2012), food security is a condition of food fulfillment for the state for individuals, which is reflected in the availability of sufficient food quantity and quality, safe, diverse, nutritious, equitable and affordable, and there is no conflict. The focus of food security is so that every human being can consume food and nutrition in a balanced manner (obtained from various foods) for good nutritional status. Particularly food self-sufficiency is a strategy to achieve food security (Antara & Sumaniarsih, 2020). Based on Global Food Security Index (GFSI) data (Figure 1), Indonesia's food security index in 2022 was at the level of 60.2, below the global average index of 62.2 and lower than the Asia Pacific average index of 63.4 (Alaydrus, 2023).

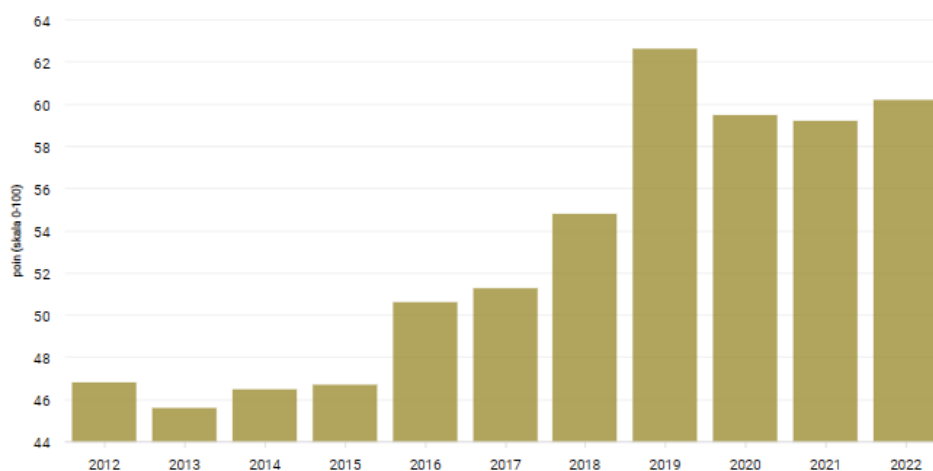


Figure 1 Indonesia's Food Security Index in 2022

Source: www.katadata.com

Referring to BPS (Central Bureau of Statistics) data, the value of the poverty line (GK) in September 2022 rose by 5.95%, from the original IDR 505,469 to IDR 535,547 per capita per month, and the number of poor people in Indonesia reached 26.36 million people as of September 2022. This figure increased by 0.20 million people. According to BPS, the primary cause of the increase in the poverty rate was the commodities of fuel oil (BBM) and rice, which had a positive effect on the purchasing power of the poor.

As of September 2022, the Gini Ratio level in Indonesia was 0.381; this ratio calculates the level of expenditure inequality of the Indonesian population. The Gini Ratio in urban areas in September 2022 was recorded at 0.402, down from the March 2022 Gini Ratio of 0.403 but up from the September 2021 Gini Ratio of 0.398. In rural areas, the Gini Ratio in

September 2022 was recorded at 0.313, down from the March 2022 and September 2021 Gini Ratio of 0.314 (BPS, 2023a).

Previous research states that while food security has a significant positive effect on economic growth, problematic financing has a significant negative effect on economic growth (Ariani et al., 2023). Interestingly, non-performing loans and agricultural sector financing are linked to food security, indirectly impacting economic growth. A study (Syamsuri et al., 2022) reviewing the role of zakat has proven to provide an alternative to poverty alleviation for the community, especially Muslims in Indonesia. One of the efforts that the Amil Zakat Institution can make is changing service recipients from *mustahik* to *muzakki* through empowerment. The relationship between zakat management and the achievement of SDGs is an idea where the approach that exists in the belief system/spirituality of the community will be accepted by the community with its values and beliefs.

Green waqf is highly recommended to support a green economy. Waqf, as a charitable institution in Islam, is expected to play an important role in environmental protection (Hasan & Syahrudin, 2022). In addition, waste management with carbonization technology can supply renewable energy and play an important role in preserving the environment, improving living standards, and accelerating economic strength.

Nevertheless, the linkages between inequality, climate change, and food security remain unclear and unexplored. Against the above background, this study aims to investigate the linkages between climate change, inequality, and food security. The study attempts to provide an understanding of the evolution of publications on the topic to identify key emerging themes and policy prescriptions. For that reason, this study adopted a bibliometric and content analysis approach regarding the linkages between climate change, inequality, and food security in Indonesia.

The contributions of this article are: first, the content analysis conducted revealed the emerging topics in the field and their contribution to the literature, as well as the gaps that continue to exist. Second, the authors proposed future research directions based on emerging themes and policy prescriptions.

Literature Review

Challenges of SDGs implementation in Indonesia include the following: (1) Alignment of SDGs with national and regional development planning by integrating SDGs into national and regional development plans; (2) Improved vertical and horizontal coordination by establishing institutional coordination mechanisms between various levels of government; and (3) Increased stakeholder participation by encouraging partnerships and coordination across levels of government (Amirya & Irianto, 2023). On the other hand, the realization of the SDGs program in Indonesia in the poverty alleviation program is carried out by fiscal policy, raising zakat and productive waqf, reducing unemployment,

and improving community welfare through direct assistance programs and business capital assistance (Wartoyo & Haida, 2023).

Moreover, income inequality is also influenced by the human development index factor, which has a positive and significant correlation, while the unemployment rate has no significant effect on the Gini index (Muhtar & W, 2021). For the percentage of poor people by province and region in Indonesia in 2022, Semester 2, the provinces with the highest level of poor people were Papua at 26.80%, West Papua at 21.43%, and East Nusa Tenggara at 20.23%, respectively (BPS, 2023b). Inter-island income distribution inequality in Indonesia was classified as medium and high inequality (Wahyuningsih et al., 2019). While the highest income distribution inequality was in Java, the lowest one was in Kalimantan.

In Indonesia, climate change is adversely affecting food security. Changing rainfall patterns, rising temperatures, and more extreme weather have far-reaching impacts, such as increased weather instability and extreme events, sea level rise, changes in the incidence of agricultural pests and diseases, and direct impacts on crop yields. Based on climate data from 1971 to 2006, Indonesia's agricultural production was more sensitive to increasing temperatures and decreasing rainfall, which will significantly impact Indonesia's food production and food balance by 2050 (Syaukat, 2011). It aligns with a study (Malau et al., 2021) that stated that rainfall levels and deforestation activities significantly affect food security.

When the production yields and patterns of various food products that contribute to people's nutritional needs are affected by climate change impacts and policies, the overall nutritional needs of the population also change. Affordability becomes a difficult issue when food prices increase. Based on indicators of economic growth, inequality and the interaction between economic growth and inequality have a significant effect on the incidence of poverty in Indonesia, whereas the agricultural sector has a negative impact on the number of poor people (Permadi, 2018). Other research revealed that the effects of economic inequality, both within regions and between regions, have a substantial upward impact on crime and criminality rates (Widyastaman & Hartono, 2022).

The connections between inequality, climate change, and food security, on the other hand, remain obscure and unexplored. As such, the study intends to look into the connections between climate change, inequality, and food security. The study aims to provide insight into the evolution of publications on the subject to identify major emerging themes and policy prescriptions. As a result, this study used a literature review and content analysis approach to investigate the relationships between climate change, inequality, and food security in Indonesia.

The following research questions (RQs) guided this study:

RQ₁: *What are the emerging themes in the literature on the interconnections between climate change, inequality, and food security?*

RQ₂: What are the key literature gaps and future research directions based on the emerging themes identified in RQ₁?

Research Method

Bibliometric and content analysis methods are critical analyses of existing research on a particular topic. It aims to synthesize existing knowledge, provide theoretical background, explore the depth of research, and answer practical questions about peer-reviewed literature related to climate change, food security, inequality, and poverty. To include only up-to-date information, a maximum time limit of five years is usually placed on the age of the work to be reviewed. On the other hand, content analysis allows scholars to extract key results from specific studies (Williamson et al., 2018).

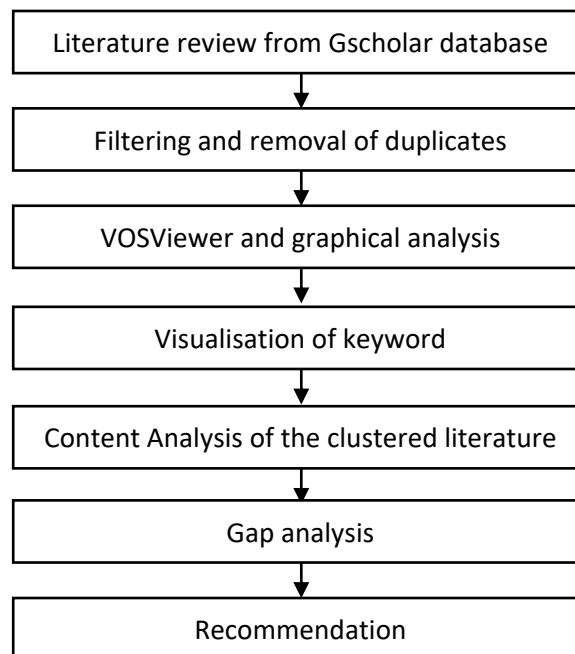


Figure 2 Flowchart of Bibliometric & Content Analysis Methodology

Figure 2 depicts a flowchart for the methodology used in this study, including the procedure of the methodology followed in selecting the articles used in the study, as well as the analysis and findings.

Furthermore, data collection and analysis in this study consisted of seven steps: (1) Retrieval of studies from the Google Scholar database: Collecting bibliometric data from the Google Scholar database was conducted. Search criteria were used when selecting the papers for this study. The authors defined the period of the study as 2018 to 2023. Moreover, the authors used the following keywords in the search strategy: "Poverty" OR "Inequality" AND "Climate Change" AND "Food Security" AND "Indonesia." It ensured that

the extracted articles were restricted to the selected keyword domain; (2) Filtering and removing duplicates: In the second step, assessing the extracted papers, checking for duplicate records, removing one duplicate copy, and keeping the other were carried out; (3) Screening documents based on inclusion and exclusion criteria: Review document titles, keywords, and abstracts of the selected articles to remove articles that are not relevant to this study field. After screening and removing irrelevant journal articles, the authors obtained a dataset of 110 articles; (4) Descriptive analysis: Conducting a descriptive analysis of the remaining set of documents to establish publication trends; (5) VOSviewer and graphical illustration: This stage generated a graphical illustration of the network from the co-occurrence of keywords, leading to cluster analysis. VOSviewer is a software package that facilitates the creation, analysis, and visualization of bibliometric networks. Networks can use authors, journals, countries, keywords, and countries as nodes. The nodes were then connected by lines that indicate co-occurrence in terms of keywords or collaboration in terms of authors, institutions, and countries (Williamson et al., 2018); (6) Literature content analysis: Based on the identified clusters, the main themes and content of the literature were analyzed; and (7) Policy recommendations: Content analysis of the literature guided policy recommendations drawn from the literature and highlighted key theoretical and practical contributions of interest to researchers and policymakers.

The document selection criteria used are illustrated in Table 1. It presents the logical statements, inclusion criteria, and exclusion criteria used to retrieve 110 documents.

Table 1 Criteria Used In The Selection Of Articles From The Gscholar Database

| Criteria | Dimension |
|-------------------|--|
| Logical Statement | TITLE-ABS-KEY (“poverty” OR “inequality” AND “climate change” AND “food security” AND “Indonesia” |
| Inclusion | The document is located in the Gscholar database. The document is an article. The document is in its final state. Published from 2018 to 2023. The document is written in the English language. The document is written in the Indonesian language. The document has the keywords “poverty,” “inequality,” “food security,” “Indonesia,” and “climate change.” |
| Exclusion | Non-peer-reviewed journals Lack of references, authorship, or full-text The document is not written in English. The document is not a journal article. The document does not relate to climate change, food security, or poverty and inequality in Indonesia. |

Result and Discussion

The results analysis consists of two parts: (1) Bibliometric analysis: In bibliometric analysis, trends for publications and citations over the years, co-occurrence of keywords, and bibliographic merging were studied. The authors created tables using Microsoft Excel and

performed network analysis with VOSviewer; (2) Content analysis: The authors performed content analysis in the second part of the analysis, which was based on the co-occurrence of keywords and generated clusters/main themes. Finally, the authors identified research recommendations and areas of future theoretical and practical research.

Bibliometric Analysis

Publication Trends per Journal

The keyword search and filtering resulted in a total of 110 articles obtained from the Gscholar database. As presented in Table 2, the highest number of publications was generated in 2020, and the lowest number of publications was from 2023. As Table 2 illustrates, approximately 17% (n=19) of the published papers were the work of a single author, while 57% (n=57) of the papers were the work of two or three authors. The number of papers produced by four or five authors was 26 (about 24%), six or seven authors produced about 5% of the papers (n=5), and eight or nine authors produced two papers (about 2%). Table 2 shows the full list of articles used in this bibliometric analysis.

Table 2 Summary Description

| Characteristic | Number | Percentage |
|-------------------------------------|------------|------------|
| Year of publication | | |
| 2018 | 21 | 19 |
| 2019 | 13 | 12 |
| 2020 | 25 | 23 |
| 2021 | 17 | 15 |
| 2022 | 22 | 20 |
| 2023 | 12 | 11 |
| Total number of publications | 110 | 100 |
| Number of authors | | |
| 1 | 19 | 17 |
| 2-3 | 57 | 52 |
| 4-5 | 26 | 24 |
| 6-7 | 5 | 5 |
| 8-9 | 2 | 2 |
| >10 | 1 | 1 |
| Total number of authors | 110 | 100 |

Bibliometric Coupling of Keywords

Keyword clustering was generated utilizing VOSviewer and resulted in six main clusters, as depicted in Figure 3. The font and size of each node depend on the weight of a particular keyword. The larger the node, the more frequently the keyword appears. In addition, the thickness of the line connecting the nodes also indicates the frequency with which the two keywords appear together.

The main keywords were grouped into six clusters (see Table 3) and discussed further in the content analysis section.

Content Analysis

In this study, the authors focused on analyzing bibliometric data on poverty, inequality, food security, and climate change in Indonesia over the period 2018-2023. Based on the descriptive and bibliometric analysis of keywords, as well as the co-occurrence of keywords, this study identified the following six themes.

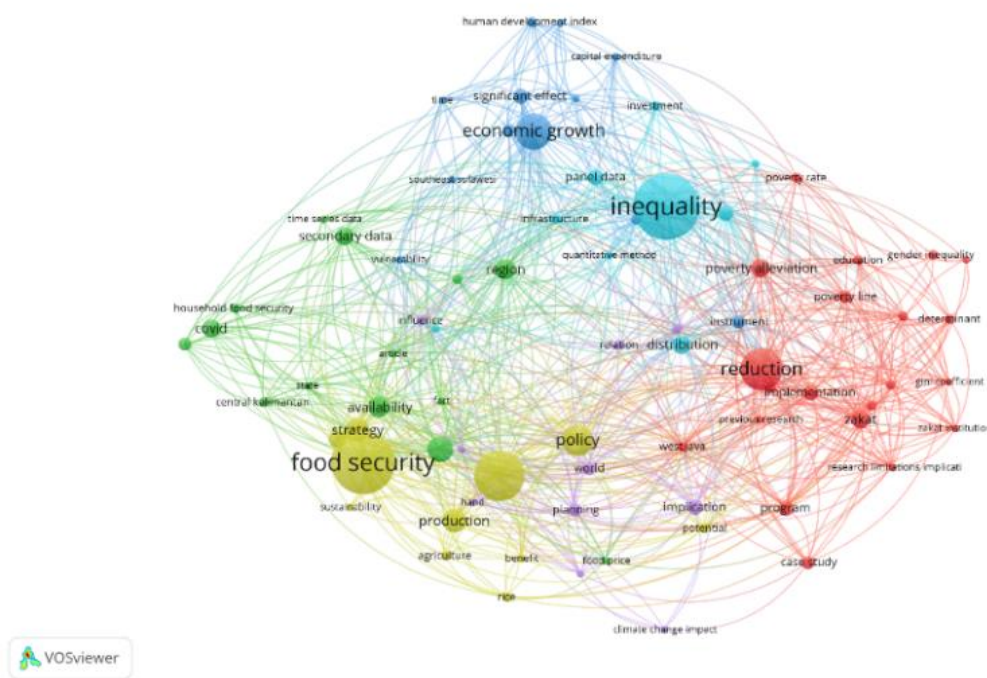


Figure 3 Image of simultaneous keyword occurrence on VOSviewer

First theme: Management of human resources and redistribution of wealth in achieving the goal of equitable social and economic development using the zakat method.

Studies on this theme seek to determine whether there is a relationship between poverty reduction, zakat, community welfare, and funds. The crowdfunding-zakat system provides convenience in collecting zakat funds from the broader community in several regions in Indonesia, showing the potential and positive impact on income distribution (Manara et al., 2018). Besides, the empowerment program carried out by zakat institutions in Indonesia is based on the priority scale and potential of *mustahik* by considering the level of productivity and long-term impact that improves the *mustahik* economy (Herianingrum et al., 2023).

Digitalization of the zakat program is conducted by BAZNAS. BAZNAS digital zakat program can reduce poverty due to *mustahik* empowerment through digital entrepreneurship and digital technology innovation in the form of rice (Utami et al., 2021). Other digital technologies in its implementation are the digitalization of zakat payment, application-

based digital information technology services for *muzzaki*, and blockchain (*izakat*) in digital zakat management as the development of digital entrepreneurship.

The zakat distribution program has been shown to have a positive impact on both female and male households. Based on the CIBEST model, the zakat distribution program had a better impact on male-headed households in terms of material (0.215) and absolute (0.037) poverty indices. In contrast, female-headed households had better performance on *falah* (0.438) and spiritual (0.022) poverty indices, with greater changes in the indices in female-headed households (Ayuniyyah et al., 2022). According to the Gini coefficient and Atkinson index, female-headed households had better income distribution one year after the zakat distribution program, while male-headed households had better performance in terms of welfare loss.

Table 3 Keywords For Research Topics And Clusters

| Cluster | Keywords | Emerging Theme |
|---------|---|--|
| n = 1 | Poverty Reduction, Zakat, Community Welfare, Fund | Management of human resources and redistribution of wealth in achieving the goal of equitable social and economic development using the zakat method |
| n = 2 | Climate Change, Sustainability, Farmer, Production, Food Security, Demand | Adaptation of agriculture to climate change, the concept of sustainable agriculture in maintaining long-term agricultural productivity without damaging the natural environment and sacrificing the quality of natural resources |
| n = 3 | Financing, Policy, Price, Agriculture, Subsidy | Policies or rules implemented by the government to regulate the agricultural sector. These policies may include subsidies, market regulations, investment incentives, farmer protection, import and export regulations, and natural resource management. |
| n = 4 | Covid, Life, Urban Area, Risk, Household Food Security | Limited access to resources, loss of employment and income, and disruptions in food supply chains lead to food insecurity among households. |
| n = 5 | Inequality, Poverty Alleviation, Strategy, Human Development Index | Poverty alleviation strategies to reduce inequality and improve the quality of human life |
| n = 6 | Economic Growth, Income Distribution, Food Security, Planning | Comprehensive and sustainable planning to identify challenges and opportunities and to develop policies and programs for inclusive economic growth and food security |

Additionally, the role of zakat in poverty alleviation is evidenced by the BAZNAS Welfare Index or IKB at the provincial level in Indonesia. A higher BAZNAS IKB, used as a sign of zakat impact, significantly reduces the poverty headcount but has no significant effect on the poverty gap index and poverty severity index (Choiriyah et al., 2020). Based on their study, zakat managers should emphasize the poorest part of the poor population to enable the improvement of poverty indicators through the utilization of zakat.

Finally, it is important to coordinate the planning of each regency and city to commit to each other in mobilizing all local resources, such as human resources, finance, investment, and infrastructure, to generate economic growth and reduce inequality between regions. BAZNAS's digital zakat program model can be a valuable reference for global zakat managers in improving digital entrepreneurship practices and zakat distribution innovations.

Second theme: Adaptation of agriculture to climate change, the concept of sustainable agriculture in maintaining long-term agricultural productivity without damaging the natural environment and sacrificing the quality of natural resources

Studies on this theme intend to determine if there is a relationship between climate change adaptation, sustainability, farmers, and productivity. Climate change has caused agricultural productivity to decline, making food security in the community problematic. The level of food security of farmer households is categorized as insecure; climate change adaptation strategies, land area, and rice prices affect the food security of farmer households (Murniati et al., 2019).

In addition, the effect of climate change increases the vulnerability of areas in agricultural land. There are 128,154 hectares of agricultural land vulnerable to natural disasters and 41,704 hectares vulnerable to drought. One policy to overcome these injuries is crop insurance with the help of government subsidies (Suryanto et al., 2020).

The impact of climate change on irrigation water demand for local rice cultivation was 56% and 25%, higher than current conditions in July, September, and October, respectively (Achyadi et al., 2019). Climate change also has a significant impact on fluctuations in agricultural production and food security. Adaptation policies due to climate change can be reduced by implementing planting calendar maps and farmer insurance (Massagony et al., 2022).

Adaptation strategies used by farmers to survive need to consider aspects: the use of manure, reducing the use of chemical inputs, increasing the intensity of weeding, planting at the beginning of the rainy season, using the recommended planting distance, scheduling the harvest period, changing the planting time, and being more disciplined in implementing crop rotation (Murniati et al., 2019).

Furthermore, the development strategy of climate change mitigation is through peatland optimization. Climate change mitigation in supporting sustainability is also through the construction of canal-blocking systems, revitalization of agricultural extension institutions, the formation of fire brigades, and training in soil and water management (Surahman et al., 2019). Effective coordination and synergy among all relevant ministries, regional administrative units, and stakeholders at the national and international levels are required.

Agricultural adaptation to climate change is very important to maintain agricultural productivity in the long term, such as how to use manure, reduce the use of chemical

inputs, increase the intensity of weeding, planting at the beginning of the rainy season, use the recommended planting distance, scheduling the harvest period, changing the planting time, and being more disciplined in implementing crop rotation. In addition, effective coordination and synergy are needed between all relevant ministries, regional administrative units, and stakeholders both nationally and internationally.

Third theme: Policies or rules implemented by the government to regulate the agricultural sector, including subsidies, market regulations, investment incentives, farmer protection, import and export regulations, and natural resource management

Studies on this theme are to determine if there is a relationship between strategy, policy, price, agriculture, and subsidy. The concept of agriculture in Indonesia is not centralized but decentralized. Indonesia's agricultural policy adheres to a decentralized system, which takes time in stages to be implemented properly according to the target (Rusliyadi & Libin, 2022). It requires participatory community empowerment and optimizing the use of resources in each region to encourage job creation and poverty reduction.

Climate change in Indonesia is also influenced by the El Nino and La Nina phenomena. The El Nino phenomenon has a significant impact on the increase in rice and soybean prices, as well as a decrease in corn prices, and then the La Nina phenomenon has a significant effect on the increase in rice prices (Fajri et al., 2019). ENSO (El Nino Southern Oscillation) plays an important role in climate variation and rainfall intensity, which can affect the food crop sub-sector, which is vulnerable to climate change.

In Indonesia, policies to improve the performance of the agricultural sector are through agricultural extension workers. The involvement of agricultural extension workers who provide education on agriculture is, in fact, very limited in terms of number (Rusliyadi et al., 2018). Agricultural extension workers greatly influence the implementation of education programs and the improvement of farmers' knowledge, attitudes, and skills, which can ultimately affect the implementation of community agricultural development, including the development of food security.

Moreover, the integration of Cash Waqf Linked Sukuk (CWLS) and Green Sukuk as green sector program financing has been studied. As a socially responsible investment instrument, CWLS and Green Sukuk can be adopted and developed as an innovative sustainable financing model in the future as a source of fiscal funding to combat climate change (Musari, 2022).

The problems of agricultural extension services, thus, must be addressed by the government to realize policy objectives and achieve the goals of agricultural development in Indonesia, i.e., the achievement of these objectives requires the effective implementation of decentralization policies where the pattern, form, and extension services must reach the community to the grassroots level. In addition, there needs to be an assessment of an agricultural concept that adheres to a centralized system in addition to being effective in terms of time. However, this system carries the risk that if there are

development imbalances between regions, it will impact agricultural development and national poverty.

The involvement of agricultural extension workers in providing education needs to be a special concern, namely as agents of change in education and increasing farmers' knowledge, attitudes, and skills. Finally, more research is needed on the future integration of Cash Waqf Linked Sukuk (CWLS) and Green Sukuk as an innovative sustainable financing model to combat climate change.

Fourth theme: Limited access to resources, loss of employment and income, and disruptions in food supply chains lead to food insecurity among households.

Research on this theme seeks to determine if there is a relationship between the COVID-19 pandemic, livelihood, urban area, risk, and household food security. Factors including availability, accessibility, and absorption statistically affect food security, and food security statistically affects people's well-being (Srnita, 2018). For income inequality and declining economic growth due to the COVID-19 pandemic, there is a need for a policy on easier accessibility for business actors in reaching conventional and sharia financial products and expansion of the capital market (Ridzuan et al., 2021). Apart from providing access to capital markets for low-income groups or underprivileged individuals by developing entrepreneurial skills and receiving better salaries, policymakers can design long-term economic plans that focus on technological innovation.

The resilience of households is affected by the COVID-19 pandemic. Food insecurity occurs both pre-pandemic and during a pandemic; the problem is exacerbated during a pandemic situation (Purnasari et al., 2020). Economic development is an obvious strategy to address food insecurity, requiring interventions to increase food availability and access to food in the community.

Urban agriculture is also a solution to the problem of food security. The combination of urban agriculture, such as vertical gardens and hydroponic and vertiminaponic cultivation systems, can support the improvement of food security in the community (Sutrisna, 2020). It is hoped that urban agriculture can support the three dimensions of food security, namely food availability, food access, and food utilization.

There were 65.0% of households with varying degrees of food insecurity during the COVID-19 pandemic. Households with low incomes had a four times higher risk of food insecurity than households with higher incomes. In addition, severely affected households (through reduced income and unemployment) had a three times higher risk of food insecurity than households with higher incomes (Syafiq et al., 2022).

In East OKU Regency, for strategies in the COVID-19 era, rice food security problems can be overcome with a concentration strategy through vertical integration through the SWOT Matrix, producing (SO): development of food granaries, food diversification, and the role of BULOG, (WO): training the younger generation about modern agriculture, subsidizing production facilities, and utilizing human resources to process natural

resources, (ST): government policies to set rice prices and production input prices, and (WT): managing rice supplies, using organic production inputs, and socializing rice entrepreneurship (Pusvita & Asroh, 2022).

Furthermore, the COVID-19 pandemic has had a significant impact on limited access to resources, loss of jobs and income, and disruption of food supply. Thus, there is a need for a policy on easier accessibility for business actors in reaching conventional and sharia financial products. In addition, in addressing food security stability, the government must provide interventions to increase food availability and access to food in the community. In the context of food security, urban farming is a solution to the problem of food security, as well as the implementation of concentration strategies through vertical integration of agriculture through training the younger generation on modern agriculture, subsidizing production facilities, utilizing human resources to process natural resources, and government policies to set prices and management of rice and production input prices.

Fifth theme: Poverty alleviation strategies to reduce inequality and improve the quality of human life

Research on this theme is to determine if there is a relationship between inequality, poverty alleviation, strategy, and human development index. The human development index (HDI) factor is a key aspect of success and a strong foundation for poverty reduction, while per capita income, government spending, GRDP, and investment are the main drivers of HDI improvement and poverty reduction. (Prasetyo & Thomas, 2021). The trend of the human development index from 2008-2018 in South Sulawesi (Indonesia) has been looked at. HDI had a significant effect on poverty, and the effect was 83.4%, with a negative relationship. This value is quite large, indicating that if the HDI increases by 1%, poverty will decrease by 83.4%, and likewise if the HDI decreases by 1%, poverty will increase by 83.4% (Fahraka et al., 2020).

A study of financial inclusion in poverty alleviation programs has also been conducted. Financial inclusion factors had a significant effect on poverty reduction in Indonesia (Fitriatinnisa & Khoirunurrofik, 2021). For financial inclusion as a tool to fight poverty and inequality, Indonesia needs to provide wider and greater access to finance, engage unbanked people to set up accounts and use financial services, especially for the poor. In addition, Indonesia also needs to make the usage dimension impact financial inclusion. Financial institutions should design the right products to meet people's needs.

Microfinance schemes in poverty alleviation have been investigated. The presence of microfinance had a significant role as a source of income for the poor or micro-entrepreneurs (Yasin, 2020). Conventional and Islamic schemes also have diversified opportunities for funding. However, the success of microfinance, whether high profit or high social goals, should be taken seriously. Due to microfinance's involvement with mostly inexperienced debtors, microfinance institutions as creditors should not only provide financial assistance to the poor but also offer non-financial assistance, such as training and good relationships.

A study has also examined the role of knowledge and culture in reducing inequality and alleviating poverty. Education, innovation, democratic political institutions, and cultural participation are effective in reducing income inequality, and tourism technology and culture increase income differences (Nizar et al., 2023). The largest source of income from the cultural tourism sector is still enjoyed by high capital owners rather than residents. Cultural participation has a two-sided significance, and when managed well, it will generate social capital, but it becomes a habit known as a culture of poverty where people are satisfied with their current position.

Equitable development should be a priority, and the results showed that all economic and cultural variables had a positive and significant effect on GRDP per capita. Increasing GRDP per capita tends to address inequality and poverty. Nonetheless, equity and the enhancement of knowledge and culture are key factors in successful development. There is also no backwash effect, where the community does not enjoy the results of development.

Ultimately, the strategy for poverty alleviation in reducing inequality and improving the quality of human life is the need for strong policies at the central and local levels; hence, equal distribution of knowledge and cultural economy must be implemented. Factors from the cultural economy should be researched from the perspective of trust, the spirit of cooperation, beliefs, values, and preferences of the community. In global-level research, it is possible to obtain larger data that includes time effects in the research model; thus, knowledge-based development has unlimited space because it is very dynamic. The role of financing through microfinance institutions can be used as a solution in poverty alleviation strategies, so further research is needed to explain and statistically prove the implications for the poor or micro-entrepreneurs to get out of the abyss of inequality and poverty.

Sixth theme: Comprehensive and sustainable planning to identify challenges and opportunities and develop policies and programs for inclusive economic growth and food security

Studies on this theme seek to determine if there is a relationship between economic growth, income distribution, food security, and planning. In the relationship between economic growth, poverty, and income inequality, economic growth had a positive and significant effect on income inequality in Indonesia, while poverty had a negative and significant effect on income inequality in Indonesia. At the same time, economic growth and poverty positively affected income inequality in Indonesia (Safrita et al., 2021).

The factors of local own-source revenue, education expenditure, government expenditure on health, investment, and infrastructure have a positive effect on economic growth and reducing income inequality between regions. Economic growth is also able to mediate the influence of variables on inequality (Sukmaadi & Marhaeni, 2021). Based on indicators of financial sector growth, i.e., money supply and the ratio of domestic credit to the private sector to GDP, there is a long-term relationship between the financial sector, economic growth, and poverty in Indonesia. At the same time, in the short term,

there is a two-way causal relationship between the financial sector and poverty (Majid et al., 2019). Based on these findings, there is a need for poverty reduction efforts, and the government should focus on facilitating the channeling of funds from the financial sector to certain segments of the population to ensure equitable credit accessibility, especially to low-income groups in Indonesia.

In a study, in the era of fiscal decentralization, the local government of Bone Regency seeks to alleviate poverty through the implementation of pro-poor budgeting policies. The pro-poor policy in the poverty alleviation program in Bone Regency is divided into three program groups: First, the social security and protection program; Second, the community empowerment program; and Third, the Micro and Small Business Empowerment Program (Nursini & Suhab, 2018). Pro-poor budget policies are those related to poverty alleviation through programs and activities that directly or indirectly benefit the poor.

The implementation of pro-poor budgeting in Bone Regency is already quite good, as reflected in three things. First, the number of programs and activities that have been formulated in relation to poverty reduction efforts, both directly and indirectly, is sufficient, but not all programs and activities have been implemented in the fiscal year. Second, the proportion of spending on poverty alleviation programs to total government spending in Bone is relatively small. Thirdly, some local innovations have been made, such as the mapping of the poor through a participatory approach of the community in the village, but not evenly distributed in all villages. Therefore, in the future, several action plans need to be considered: First, increasing the proportion of expenditure to finance all program plans and activities related to the poor based on priority programs; Second, increasing the proportion of expenditure received directly by the poor; Third, forms of innovation still need to be improved and evenly distributed in all villages, especially remote villages.

Moreover, comprehensive and sustainable planning is essential in facing challenges and identifying opportunities related to inclusive economic growth and food security. Therefore, further research is needed on the discussion: (1) Analysis of challenges and opportunities on inclusive economic growth and food security; (2) Policy and program development; (3) Inter-sectoral collaboration; (4) Cross-sectoral approach; and (5) Monitoring and evaluation.

Gap Analysis and Future Research

This systematic review has shown that, although there has been an increase in research output in the areas of climate change, food security, and inequality in the country, there are still some research gaps, The authors investigated the main themes and discussed them in the content analysis section and suggested the following research directions.

Management of human resources and redistribution of wealth in achieving the goal of equitable social and economic development using the zakat method

Government agencies must coordinate with each other in the planning of each regency and city to commit to mobilizing local resources, human resources, finance, investment, and infrastructure to generate economic growth and reduce inequality between regions. For the effectiveness of zakat distribution through poverty alleviation programs through digital zakat, BAZNAS serves as a global zakat manager in improving digital entrepreneurship practices and zakat distribution innovations.

Adaptation of agriculture to climate change, the concept of sustainable agriculture in maintaining long-term agricultural productivity without damaging the natural environment and sacrificing the quality of natural resources

Indonesia's agricultural development agenda is increasingly influenced by technological advances, such as the adoption of genetically modified crops. Unfortunately, technology is limited to smallholder farmers. Studies should focus on technology uptake by smallholder farmers. In addition, studies on agricultural adaptation to climate change through agricultural planting and maintenance strategies for increased productivity can be conducted.

Policies or rules implemented by the government to regulate the agricultural sector, including subsidies, market regulations, investment incentives, farmer protection, import and export regulations, and natural resource management

The study of agricultural decentralization policy where the pattern, form, and service of extension must reach the community at the grassroots level is required. In addition, there needs to be an assessment of an agricultural concept that adheres to a centralized system and the involvement of agricultural extension workers in providing education. Finally, there needs to be a study on the integration of Cash Waqf Linked Sukuk (CWLS) and Green Sukuk as a sustainable financing model in the future as a source of fiscal funding to combat climate change

Limited access to resources, loss of employment and income, and disruptions in food supply chains lead to food insecurity among households.

There is a need for easy accessibility for business actors in reaching conventional and sharia financial products. In addition, in overcoming the stability of food security, the government must provide interventions to increase food availability and access to food in the community through the concept of urban farming and the application of agricultural vertical integration concentration strategies consisting of training the younger generation on modern agriculture, subsidizing production facilities, utilizing human resources to process natural resources, and government policies to set prices and manage production input prices.

Poverty alleviation strategies to reduce inequality and improve the quality of human life

Further studies are needed on the cultural economy from the perspective of trust, the spirit of cooperation, beliefs, values, and preferences of the people. In global-level research, it is possible to obtain larger data that includes time effects in the research model. The role of financing through microfinance institutions can be used as a solution in poverty alleviation strategies, so further research is needed to statistically explain the implications for the poor or micro-entrepreneurs to get out of the abyss of inequality and poverty.

Comprehensive and sustainable planning to identify challenges and opportunities and develop policies and programs for inclusive economic growth and food security

For comprehensive and sustainable planning, further research is needed on the topics of analysis of challenges and opportunities on: (1) Inclusive economic growth and food security; (2) Policy and program development; (3) Inter-sectoral collaboration; (4) Cross-sectoral approach; and (5) Monitoring and evaluation.

Conclusion

The main objective of this study is to explore the literature on the interconnections between climate change, inequality, poverty, and food security in Indonesia. The study investigated publication trends in the field, key research interests based on frequently co-occurring keywords, emerging themes in the literature, and gaps and policy recommendations. The study adopted a combination of bibliometric analysis and content analysis. The bibliometric analysis looked at publication and citation trends over the years, co-occurrence of keywords, and bibliographic merging. The second step involved content analysis, which resulted in the emergence of key themes and gaps.

The study revealed an increase in publications on the interconnections between climate change, inequality, poverty, and food security with a period from 2018-2023. The findings of this study provide insights into current research on the impact of climate change on food security, poverty, and inequality in Indonesia and suggest areas for future research to address challenges in these areas. Four keyword clusters were determined consisting of (poverty, inequality, climate change, and Indonesia), and six themes were emerged from these keyword clusters: (1) Human resource management and wealth redistribution in achieving equitable social and economic development goals with zakat method; (2) The adaptation of agriculture to climate change, the concept of sustainable agriculture in maintaining long-term agricultural productivity, without damaging the natural environment and compromising the quality of natural resources; (3) Policies or rules applied by the government to regulate the agricultural sector; (4) Limited access to resources, loss of jobs and income, and disruptions in the food supply chain lead to food insecurity among households; (5) Poverty alleviation strategies in reducing inequality and improving the quality of human life; and (6) Comprehensive and sustainable planning to identify challenges and opportunities and develop policies, inclusive economic growth programs, and food security.

Based on the study findings, the following recommendations can be made to address the impact of climate change on food security, poverty, and inequality in Indonesia. First, for government agencies, planning for each regency and city to commit to each other in mobilizing all local resources, such as human resources, finance, investment, and infrastructure, can be done to generate economic growth and reduce inequality between regions. Second, it is suggested that the zakat institution conduct a poverty alleviation program through the digital zakat BAZNAS model as the global zakat manager in improving digital entrepreneurship practices and zakat distribution innovation. Third, regarding agriculture with technology, i.e., the adoption of genetically modified crops, studies should focus on technology uptake by smallholder farmers. Fourth, concerning agricultural adaptation, a study can be carried out on agricultural adaptation to climate change through agricultural planting and maintenance strategies to increase productivity. In addition, an in-depth study of the concept of decentralized agriculture, centralization of agriculture, and the involvement of agricultural extension workers in education and knowledge enhancement, as well as agricultural adaptation in urban areas, can be performed. Fifth, integration of Cash Waqf Linked Sukuk (CWLS) and Green Sukuk is an innovative future sustainable financing model suggested as a source of fiscal funding to combat climate change. Sixth, to promote innovative solutions, research should focus on developing innovative solutions to address the impacts of climate change on food security, poverty, and inequality in Indonesia by exploring new technologies, policies and practices. Seventh, in terms of cultural economy, the study of the perspectives of trust, the spirit of cooperation, beliefs, values, and preferences of the community on the micro and macro economy can also be conducted. At last, for microfinance institutions, further research is needed to explain and statistically prove the role of microfinance institutions in terms of poverty alleviation policies and programs that have implications for the poor or micro-entrepreneurs to get out of the abyss of inequality and poverty.

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Conflicts of Interest

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