Islamic Macroprudential Policy to Support Staple Agricultural Sector Financing

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Abstract

The study aims to recommend Islamic macroprudential policy instruments to support Indonesia's staple agricultural sector financing. Delphi-ANP analysis method is used to determine the optimal Islamic macroprudential instruments, which result is supported by meta-analysis and optimum method findings. The results show that Islamic Agricultural Lending to Sector (IALTS) is the optimal instrument to support agricultural sector financing. According to the ANP and optimum method findings, an Islamic macroprudential instrument should meet three criteria i.e., it should be able to increase financing for the agricultural sector, prevent speculative short-term transactions, and internalize systemic risk. Experts emphasized that IALTS have met the criteria to support sustainable growth and stability in the agricultural sector financing. Meta-analysis reveals a positive and significant correlation between agricultural financing and agricultural productivity across countries, which supports the instrument of macroprudential implementation. The government should adopt measures to boost agricultural production through macroprudential policy tools, financing for agriculture from Islamic banks, and policies that ensure inclusive agricultural financing for the benefit of all levels of farmers.

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Introduction

Indonesia's agricultural sector is crucial for economic development and growth, contributing about one-fifth of the country's GDP and employing over 30% of the workforce (ILO, 2021). However, the sector's growth rate has been inconsistent and significantly declined over the last ten years (OECD, 2020; Sudaryanto *et al.*, 2021) due to factors such as climate change (IPCC, 2022), limited agricultural infrastructure (Arizka *et al.*, 2022), land conversion (Azis *et al.*, 2022; Satria *et al.*, 2019), market access (Minten *et al.*, 2023), limited access to finance (Larasati *et al.*, 2017; Marita *et al.*, 2021), less favorable agricultural regulations, and suboptimal policies (Winoto & Siregar, 2008). Indonesia faces constraints in supporting agricultural production, ensuring food price stability, financial sector stability, access to financing, and environmental sustainability (Gumata & Ndou, 2021; Kahou & Lehar, 2017).

The intensification and commercialization of agriculture are crucial to guarantee food security due to the growing global population and urbanization (Kopittke *et al.*, 2019; Tilman *et al.*, 2011; Viana *et al.*, 2022). However, limited access to finance in the agricultural sector can hinder productivity, leading to a decrease in the supply of needed products. Imports can fill this gap, but they often result in higher prices for the public. Additionally, various constraints within the agricultural sector contribute to rising prices, and concerns about declining production have emerged due to worsening climate conditions and environmental degradation (Hiebert, 2022). Macroprudential policy plays a crucial role in supporting economic growth by providing sufficient and stable financing. Policymakers are prompted to formulate macroprudential policies and explore alternatives to support domestic food security, especially in the staple agricultural sector.

Macroprudential policy is also crucial for ensuring financial system stability and balanced financing in dual financial systems like Indonesia. It supports sustainable economic growth and maintains moral values. Since the global financial crisis, policymakers and academics have emphasized the importance of financial system regulation and supervision (Kahou & Lehar, 2017). Regulators focus on promoting stability and reducing imbalances, potentially leading to macroeconomic imbalances. On the other hand, the Islamic financial system has gained attention for its potential stability against crisis shocks, as it has been proven more resilient than conventional financial systems (Bilgin *et al.*, 2021; Syarifuddin, 2022).

The Islamic financial system is relatively stable because it applies intrinsic elements and moral values enshrined in Sharia principles (Galati & Moessner, 2012; Nachane & Islam, 2012). These elements include the prohibition of interest in lending and borrowing activities (*riba*), prohibition of excessive

debt (leverage), non-transparency in transactions (*gharar*), and excessive speculation (*maysir*) that trigger financial shocks. Islamic finance also promotes profit-loss sharing (PLS) tools, which are essential for the stability of the Islamic financial system (Adela, 2020). According to Chapra (2007), PLS contracts increase discipline by encouraging Islamic banks to be more cautious when making loans, while also raising depositors' awareness of the state of Islamic banks. In the end, this discipline increases the Islamic system's efficiency and stability.

Islamic finance, despite its moral values, still requires macroprudential regulation to achieve this goal (Hadian, 2016). Oseni (2015) advocates for using macroprudential policies in Islamic finance to prevent systemic risks. Zulkhibri *et al.* (2016) emphasize the need for Islamic macroprudential studies to develop a solid framework and effective instruments for such policies in a dual financial system. However, some groups doubt the use of macroprudential policies in the Islamic financial system due to its different structure and moral norms (Yoshida, 2016). Islamic finance is based on Islamic morality and social norms (Azmat *et al.*, 2021), but it is often seen as irrelevant due to its different structure and moral norms. Macroprudential regulation, which does not regulate greed and profit, aims to ensure stability in the system. However, due to constraints and challenges, Islamic finance is seen as not based on true Islamic principles (Maurer, 2001). The current financial structure may fail if the primary motivation to seek profit dominates, potentially leading to the failure of a financial system based on Islamic principles. Concerning stability, sustainable economic growth is a crucial component that must be supported to promote prosperity. Political stability and social progress are based on economic growth (Cao & Ren, 2016; Ip & Law, 2011). As the economy grows, the government can make money from taxes, giving it the ability and resources to provide its citizens with public goods and services like healthcare, education, social protection, and other essential services (Sen, 2021).

Outlining the issues facing the agricultural industry reveals a lack of funding as well as regulations and policies that are unfavorable to farmers. Financial institutions, both conventional and Sharia, including banks and non-bank financial institutions, are reluctant to finance the agriculture sector because of the high-risk nature of the industry. There are several macroprudential laws and policies that affect financing, but until this point, no macroprudential law or policy has specifically supported financing in Indonesia's agricultural sector. Inadequate macroprudential policies can lead to financial system instability in a number of industries, including the agricultural industry, which will have a significant impact on the nation's food security (Laeven *et al.*, 2022). A further implication of the problems in the agricultural sector is deagrarianization, where excessive modernization and

rapid development transform productive landscapes into unproductive ones such as real estate. According to Pujiriyani (2022), there are six key indicators which shows deagrarianization phenomenon in Indonesia, such as declining in: the agricultural sector's GDP, number of farming households, agricultural villages, rural population, agricultural labor participation, and agricultural area.

Since the global financial crisis, academics and policymakers have become increasingly interested in studying macroprudential policy. In general, conventional banking and financial institutions are primarily focus of the literature on macroprudential policy (Altunbas *et al.*, 2018; Bailliu *et al.*, 2015; Buncic & Melecky, 2013; Gauthier *et al.*, 2012; Kahou & Lehar, 2017). On the other hand, exploring macroprudential policy from an Islamic perspective has been attempted on numerous occasions (Wahyudi *et al.*, 2019; Zulkhibri, 2019). Nonetheless, limited research has been conducted to investigate the role of Islamic macroprudential policies in Islamic banking. There is a significant lack of Islamic macroprudential studies that endorse the provision of financing in the staple agricultural sector. Thus, this study aims to evaluate the most effective Islamic macroprudential policy instruments for bolstering financial support to the staple agricultural sector.

This study builds a conceptual framework to identify the most suitable Islamic macroprudential instrument to support Indonesia's agricultural sector financing by utilizing primary data. The Islamic macroprudential literature is extended by exploring Islamic macroprudential instruments for the agricultural sector through a systematic decision-making process, considering the perspectives of regulators, academics, and practitioners in Indonesia. To achieve this objective, the ANP method, which considers the interdependencies between the criteria, was utilized to determine the most suitable option. This model, which is designed based on the Delphi method, try to identify the most appropriate Islamic macroprudential instrument to support Indonesia's agricultural sector financing. To validates the findings; this study also conducted a meta-analysis as a form of robustness check. This paper also implements an optimal analysis approach by identifying criteria based on previous related literature.

This paper proceeds as follows. Section II discusses data and methodology. Discusses main findings and robustness check in Section III. Finally, Section IV concludes the paper.

1. Literature Review

1.1. *Key Aspects in Macroprudential Tools*

The key aspects of macroprudential refer to the various factors that affect overall financial stability. The main objective of macroprudential policy is to

prevent the occurence of financial crises that may harm the economy at the large. IMF (2013) underlines that macroprudential policy must aim at three objectives: (1) enhancing resilience, (2) limiting sectoral imbalances, and (3) limiting systemic liquidity risk.

To enhance resilience, the Basel Committee on Banking Supervision (2010) explains that it is important to increase banks' capital buffers during periods of elevated systemic risk. The additional capital raised during economic boom periods is expected to reduce banks' willingness to lend excessively (IMF, 2013). Conversely, during the downturns, macroprudential policies can avoid credit crunches by reducing the pressure on banks to deleverage to meet capital requirements. However, the extent to which macroprudential policy can effectively mitigate the fluctuations in credit, given the procyclical nature of credit, relies predominantly on the amount of capital maintained by banks beyond regulatory requirements. The issuance of new equity, which is relatively cheap during booms, may mitigate the impact of the demand for increased capital in the event of credit expansion (Adrian & Shin, 2010). Generally, the impact on overall credit and the real economy will depend on the extent to which non-financial firms can find substitute credit from unregulated financial intermediaries in the market.

In relation to limiting sectoral imbalances, instruments to address procyclical systemic risk can be selected and calibrated taking into account aggregate or sectoral variable conditions (International Monetary Fund, 2013). From a macroprudential viewpoint, aggregate instruments are meticulously calibrated to ensure adequate capital or liquidity in the entire financial system. On the other hand, sectoral instruments focus on assessing the relative risks associated with specific sectors, such as consumer loans, corporate exposures, or real estate markets. In situations where systemic risks are observed to accumulate within the financial system, employing aggregate instruments is deemed suitable. However, if risks permeate specific sectors individually, sectoral instruments are considered the apt mechanism to address such risks (Committee on the Global Financial System, 2012). Sectoral macroprudential instruments can affect either the demand side of credit (e.g., mortgage lending limits) or the supply side of credit (sectoral capital requirements). These instruments aim to restrain excessive credit growth in a sector, and may target specific types of loans, specific groups of borrowers, properties in high-potential regions, or loans denominated in specific currencies (Crowe *et al*., 2013). These two policies can be applied separately or together.

A strong liquidity profile that can withstand unexpected funding shocks is pivotal for ensuring the effective functioning of any bank, given its transformative role. Yet, the recent financial crisis has underscored the essentiality of having sufficient liquidity to uphold financial stability.

Financial market imperfections characterized by asymmetric information cause financial institutions to fail to internalize risk when lending, thus encouraging excessive credit expansion. Excessive credit expansion is often funded by short-term wholesale funding, as stable deposits tend to increase slower than credit demand. Banks in small open economies (SOEs) rely on short-term wholesale funding, which is often denominated in foreign currency, leading to maturity and currency mismatches. The occurrence of such mechanisms can give rise to a significant increase in the influx of capital, followed by an abrupt halt. This situation frequently culminates in a dual crisis, wherein both the banking sector and the currency experience a mutually reinforcing downturn (IMF, 2011).

Hiebert (2022) highlights that appropriate macroprudential policies are necessary, as the agricultural sector is exposed to various risks, including climate change risks. Macroprudential policies are crucial in managing systemic risks related to the financial implications of climate change. They constitute a vital component of a comprehensive policy approach aimed at mitigating the financial repercussions. These risks encompass both the financial vulnerabilities stemming from climate change and the financial vulnerabilities that can impact economic entities across various sectors, such as the agricultural sector.

In proposing macroprudential tools, it is crucial to address the three essential aspects. This becomes especially significant when considering the risks that may arise from the agricultural sector's development, specifically in the staple sector. Moreover, this sector tends to be riskier than other sectors (Syed *et al.*, 2022). Therefore, fulfilling these aspects should lead to macroprudential policies.

2. Research Methodology

This study can be considered as frontier research, as Islamic macroprudential policy has never been directly applied in any country including countries with dual banking system. This analysis adopts three different research methodologies i.e., Delphi-ANP, meta-analysis, and optimum analysis.

2.1. *Data*

This study consists of primary and secondary data. Primary data obtained from focus group discussions (FGD) and ANP questionnaires distributed to seven academicians in several regions, such as Yogyakarta, East Java, North

Sumatra, West Sumatra, and South Sulawesi. On the other hand, secondary data is obtained through literature reviews. In-depth interviews are conducted with regulators and practitioners to gather information about the development of the agricultural sector. According to Sakti *et al.* (2019), mastery and competence in the relevant fields are the most important factors to consider in selecting respondents for the Delphi-ANP method. Furthermore, Reza & Vassilis (1988) pointed out that the number of experts as interviewee should not be too much, and in general, 5-15 persons are best suited. This means that the respondent in this study is appropriate. The following is a list of respondents in this study.

Table 1 - List of Experts Profile

| No.	Job Title	Education	Institution	Expertise
1.	Academics	Master	Ahmad Dahlan University	Islamic economics
2.	Academics	PhD	North Sumatra State Islamic University, Medan	Islamic economics
3.	Academics	Master	Telkom University	Econometrics, monetary economics
4.	Academics	PhD	Alauddin Makassar State Islamic University	Macroeconomics
5.	Academics	PhD	Brawijaya University	Islamic economics
6.	Academics	Master	Sjech M. Djamil Djambek State Islamic University Bukittinggi	Islamic economics

Source: Author's own elaboration.

2.2. *Methods*

2.2.1. The Delphi-ANP Method

The Delphi-ANP method, as illustrated in Figure 1, is adopted to provide a decision-making framework to select the best Islamic macroprudential instruments to support the financing of the agricultural sector in a country. This study begins by reviewing literatures related to Islamic macroprudential instruments to identify the criteria of Islamic macroprudential instruments

that are suitable for the agricultural sector in Indonesia. The Delphi method is subsequently employed to examine the primary indicators for evaluating the impact of Islamic macroprudential instruments on the agricultural sector in Indonesia.

*Figure 1 - Stages of Delphi-ANP Methodology*
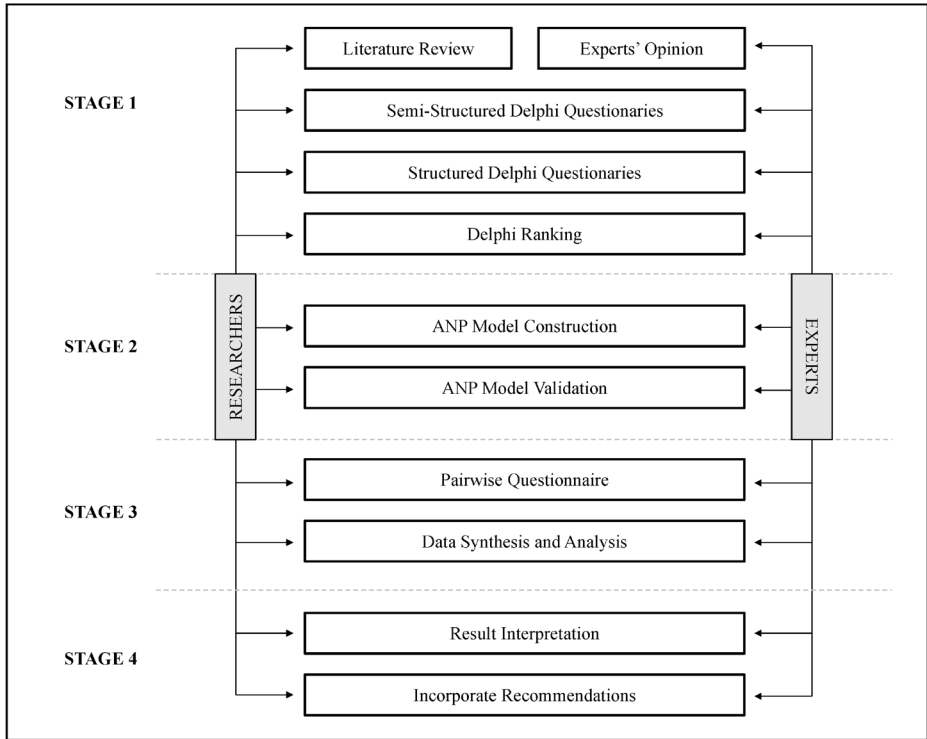
Source: Almashhour *et al.* (2023)

The Delphi procedure is a structured communication technique that relies on a panel of experts to solve complex problems (Landeta, 2006). Initially, Delphi was a decision-making approach to predict the impact of technology on warfare (Dalkey & Helmer, 1963), but now many studies use Delphi to decompose and structure ANP frameworks (Akhlagh *et al.*, 2013; García-Melón *et al.*, 2012; Kumar *et al.*, 2022; Sakti *et al.*, 2021). The Delphi method does not rely on statistical samples that aim to represent the population, but rather a group decision mechanism that requires competent

experts who have a deep understanding of the problem, hence the selection of experts is a fundamental aspect of this method (Okoli & Pawlowski, 2004). In this study, experts completed a questionnaire in more than one round, and the authors summarized their anonymous responses and justifications. To reduce disagreements and arrive at a consensus answer, experts were urged to modify their responses in response to those of others (Gamarra, 2009).

Following a comprehensive literature review and Delphi procedure, an analytic network process (ANP) model is constructed as presented in Figure 2. An ANP method is used to transform qualitative judgements from experts into quantitative data. ANP is a mathematical theory that examines the effects of using assumption-based techniques for problem solving (Saaty & Vargas, 2006). The integration of the Delphi into ANP method is expected to produce different assessments. By employing this approach allows the Delphi procedure to validate the evaluations provided by various respondents, unlike the conventional ANP method where the consensus among respondents may be less than optimal (García-Melón *et al.*, 2012). This enables a better understanding of the discussed topics and the expectations of each respondent. The integration of these two methods facilitates further consensus-building among respondents.

Figure 2 - Delphi-ANP Model
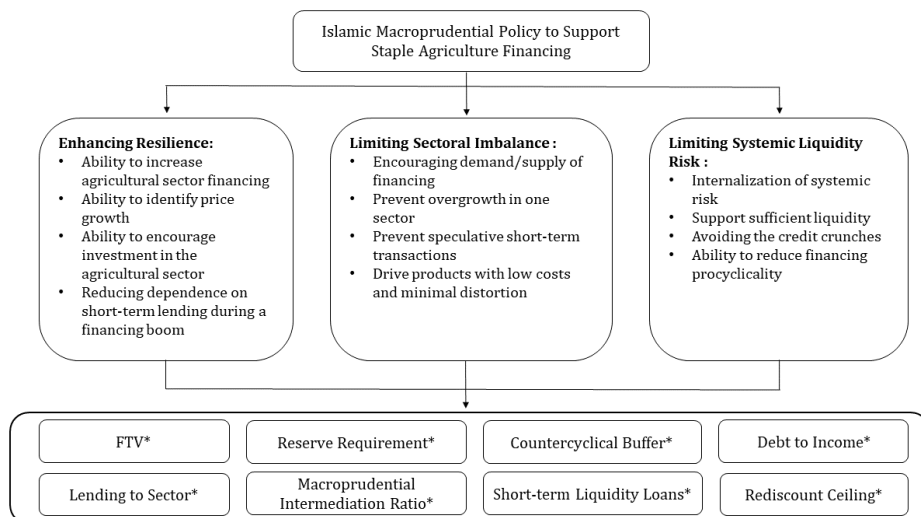
*All alternatives are adjusted to Islamic principle and directed to agricultural (staple) sector

Source: Author's originality.

The ANP model as in Figure 2 will be transformed into questionnaire in the form of pairwise (comparison). This questionnaire will be administered to multiple experts. Finally, the data derived from the questionnaire is analysed using Super Decision 2.10, Microsoft Excel, and SPSS software. The sensitivity analysis for the robustness test will not be conducted in this study as the Delphi procedure serves as an analysis of expert judgment's robustness (García-Melón *et al.*, 2012). The primary aim of sensitivity analysis is to ascertain the reliability of the ratings. Through the utilization of Delphi, it is possible to reinforce the accuracy of experts' evaluations, implying their confidence in the conclusions and obviating the need for sensitivity analysis.

2.2.2. Meta-analysi*s*

To enhance the credibility of the findings, a meta-analysis was performed concurrently to validate the outcomes. Meta-analysis is a statistical method that integrates several findings from individual studies (Glass, 1976). Meta-analysis aims to identify the facts of strong relationships from various literatures more accurately, although there may be bias in certain studies (Cook & Leviton, 1980). This can drive decision-making, both at the organizational and societal levels, as it is based on facts (Hunter *et al.*, 1986; Schmidt, 1984).

This analysis was conducted using the data obtained from related literature on Google Scholar as it is connected to various journal websites and indexing agencies. Google Scholar was employed with the aim of gathering an extensive pool of data to mitigate bias. The criteria of the studies collected for the meta-analysis were: 1) Articles using quantitative research methods; 2) The independent variable used relates to the agricultural financing by financial institution, while the dependent variable relates to agricultural productivity; 3) The article has a correlation coefficient. This method will be analyzed using JASP software.

The type of meta-analysis in this study is a correlation meta-analysis that shows the relationship between two variables by utilizing the results of previous correlation studies. The process consists of several stages (Berkhout *et al.*, 2024). First, transforming the r (correlation) value in each study into an effect size using a predetermined formula. Then, testing for heterogeneity and calculating summary effect. If there is no heterogeneity, the summary effect will be calculated using a Fixed Effect Model (FEM). However, if there is heterogeneity, the summary effect will be calculated using a Random Effect Model (REM). Finally, an evaluation of publication bias was conducted.

In this study, the scale proposed by Bhandari (2022) was utilized to interpret the effect size obtained from correlational studies. The classification of effect sizes is as follows:

Table 2 - Effect Size Classification

Effect Size	Pearson's r
Weak	.1 to .3 or –.1 to –.3
Moderate	.3 to .5 or –.3 to –.5
Strong	.5 or greater or –.5 or less

Source: Bhandari (2022).

The Pearson's r correlation coefficient provides insight into the magnitude of an effect size. Values nearing -1 or 1 suggest a significant effect, while values near 0 suggest a smaller effect. The positive or negative signs within the r Pearson coefficient indicate the direction of the relationship between variables. A positive sign indicates that both variables increase or decrease simultaneously, while a negative sign indicates that while one variable decreases, the other variable increases (and vice versa).

2.2.3. Optimum analysis

To fortify the results of this study and ensure greater validity, it becomes imperative to perform an evaluation that gauges the individual contribution or influence of each criterion outlined in the model. Optimum analysis is used to provide an assessment based on previous related literature. The assessment form can be seen in Table 3.

Table 3 - Optimum Analysis Score

	Increasing financing of the Staple agriculture sector	Limiting financing imbalances in the Staple agricultural sector	Limiting systemic liquidity risk in the staple agricultural sector
Yes	+1	+1	+1
Quasi Yes	+0.75	+0.75	+0.75
Depend	+0.5	+0.5	+0.5
Quasi No	+0.25	+0.25	+0.25
No	0	0	0

Source: Author's originality.

The scoring system utilizes a scale from –1 to +1, where positive values are assigned to statements that uphold the sub-criteria, and negative values are assigned to those that oppose it. A score of +1 or –1 signifies strong support for the optimum aspects based on the statements derived from existing literature. In contrast, a score of 0 indicates the absence of support for the optimum aspect.

In the initial phase, the first step entails describing the optimal aspects of each alternative of Islamic macroprudential policy instrument. If the criteria for these alternative instruments possess absolute attributes that are independent of other criteria, meaning they enhance the optimal aspects, they will receive a positive evaluation denoted by a "Yes". A "Quasi Yes" will be assigned if the alternative criteria for Islamic macroprudential policy instruments partially support the optimal aspects but have certain shortcomings in other aspects. Then, the "Depend" categorization will be obtained if the alternative criteria for Islamic macroprudential policy instruments support the optimal aspects but are highly dependent on other aspects. Moreover, a "Quasi No" will be assigned if the alternative criteria for Islamic macroprudential policy instruments fail to adequately align with the desired optimal aspects, albeit with minimal impact. Lastly, a "No" categorization will be warranted when the alternative criteria for Islamic macroprudential policy instruments fail to align with any of the optimal aspects.

3. Results

This section consists of three subsections. First, it discusses priority of criteria cluster, followed by the sub-criteria prioritization of each criterion in the second section. The third section discusses the prioritization of alternative optimal Islamic macroprudential instruments to support financing for staple agriculture sector. Then, it presents meta-analysis to strengthen the research findings as a robustness check. Lastly, the optimal analysis is employed to disseminate the author's perspective.

3.1. *Delphi-ANP Analysis*

3.1.1. Priority of Criteria Cluster

In this section, to determine the suitable Islamic macroprudential policy instruments to support the financing of Indonesia's staple agricultural sector,

three key aspects need to be taken into consideration, including increasing financing for the staple agricultural sector, limiting imbalances in financing for the staple agricultural sector, and limiting imbalances in systemic liquidity risk of financing for the staple agricultural sector. As illustrated in Figure 3, the criterion of increasing financing for the staple agricultural sector has the highest geometric mean value, meaning that this criterion is prioritized in determining Islamic macroprudential policy instruments to support the staple agricultural sector financing.

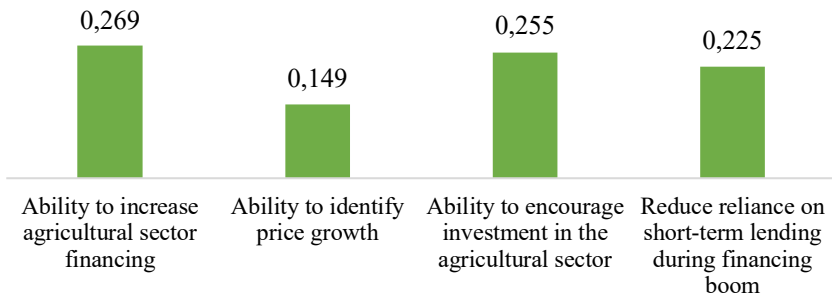*Figure 3 - Geometric Mean Value of Criteria*
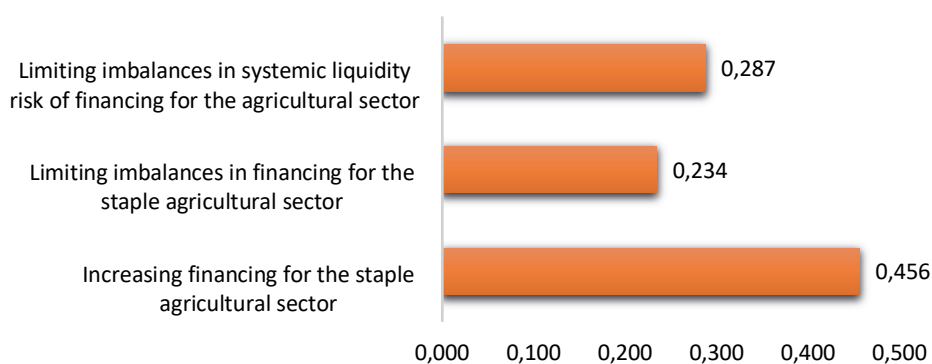
Source: Author's own elaboration based on Super Decisions software.

3.1.2. Priority of sub-criteria in each cluster criteria

Regarding the criteria for improving staple agriculture sector financing, the ability to increase the financing of the staple agriculture sector has the highest geometric mean value of 26.9%. This implied that the sub-criterion is the top priority in supporting the staple agricultural sector financing within the framework of Islamic macroprudential policy (Figure 4). It is followed by sub-criteria of ability to encourage the investment in the agricultural sector which has the second highest geometric mean value of 25.5% and to reduce reliance on short-term lending during financing boom with geometric mean value of 22.5%. The last priority in this criterion to support staple agricultural sector financing is the ability to identify price growth which has the lowest value of geometric mean of 14.9%.
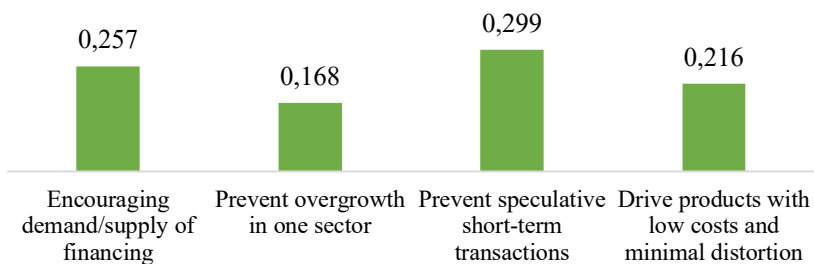
Figure 4 - Sub-criteria Geometric Mean Value of Increasing Staple Agricultural Sector Financing

Source: Author's own elaboration based on Super Decisions software.

The top priority of sub-criteria in limiting imbalances in financing the staple agricultural sector is preventing speculative short-term transactions with a geometric mean value of 29.9% (Figure 5). Speculative transactions can take many different forms in the context of agriculture, including commodity price speculation, futures and options trading, as well as investments in agricultural businesses. These have significant risks and the potential for large gains or losses. On the other hand, to prevent overgrowth in one sector is the least priority criterion to be used in encouraging financing in the food crop agriculture sector with geometric mean value of 26.8%.

Figure 5 - Sub-criteria Geometric Mean Value of Limiting Financing Imbalances in the Staple Agricultural Sector
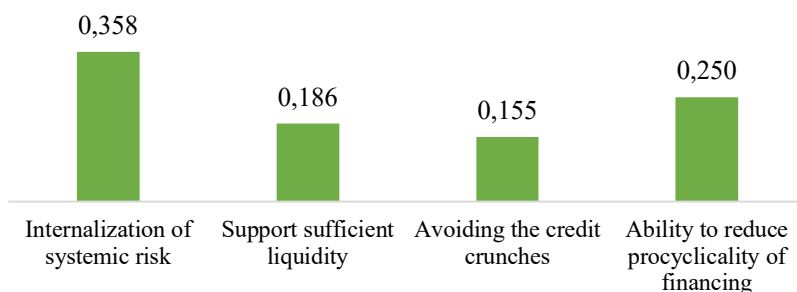

Source: Author's own elaboration based on Super Decisions software.

The sub-criterion of internalization of systemic risk is the most priority in the criteria of limiting liquidity risk in financing the staple agricultural sector.

The sub-criterion has the highest geometric mean value of 35.8% (Figure 6). It is followed by the ability to reduce the procyclicality of financing as the second priority sub-criterion with the geometric mean value of 25.0%. The least important sub-criterion is to avoid the credit crunches which have the lowest geometric mean value of 15.5%.

Figure 6 - Sub-criteria Geometric Mean Value of Limiting Liquidity Risk of Staple Agriculture Sector Financing

Source: Author's own elaboration based on Super Decisions software.

3.1.3. Prioritization of Alternative Instruments for Islamic Macroprudential Policy

Finally, the Delphi-ANP approach is employed to identify the most preferred Islamic macroprudential policy instruments for enhancing financing in the staple agricultural sector. According to the analysis results, the foremost instrument for stimulating financing in this sector is Islamic Agricultural Lending to Sector (IALTS), as indicated by the highest geometric mean value of 0.195. Islamic Agricultural Financing to Value (IAFTV) is ranked second with a geometric mean value of 0.182, followed by Islamic Agricultural Debt to Income (IADTI) at 0.112 geometric mean value, representing the third priority instrument (Figure 7).

Figure 7 - Geometric Mean Value of Alternative Instruments for Islamic Macroprudential Policy
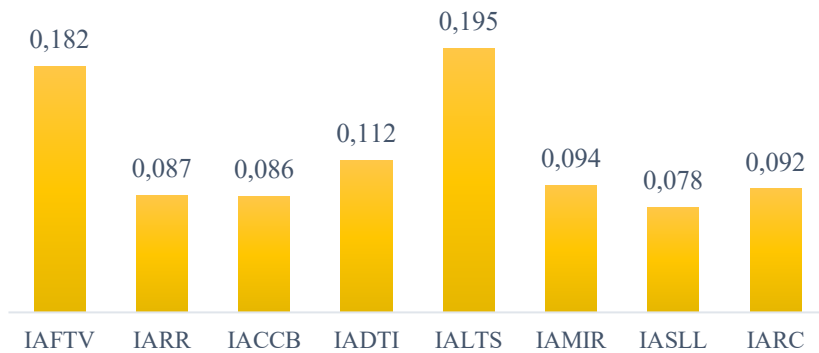
Source: Author's own elaboration based on Super Decisions software.

3.2. *Meta-analysis result*

As a means of affirming the previously attained analytical findings, this study further performed a meta-analysis to fortify the rationale behind the adoption of IALTS as the most prioritized instrument. This instrument, backed by the central bank and non-bank institutions, operates as a percentage-based incentive policy aimed at augmenting financing in the agricultural sector. To ensure that the implementation of this instrument can provide significant benefits, especially in terms of increasing agricultural financing, this analysis will show how much agricultural financing (Islamic and conventional) affects agricultural productivity. A total of nine studies meeting the predetermined criteria were identified. The sample size (N) and correlation coefficient (r) from those studies were utilized for further analysis. The distribution of publications is presented in Table 4.

Next, the correlation coefficient values as shown in Table 4, were transformed into an effect size, which is then used in heterogeneity testing. Heterogeneity was tested to determine the appropriate estimation model. The result is shown in Table 5.

The τ^2 value indicates the variance of the true effect size parameter across the study population, or the total amount of heterogeneity, whilst τ represents the estimated standard deviation of the true effect sizes distribution (Borenstein *et al.*, 2009). The I^2 value indicates the level of heterogeneity that is not caused by sampling error. The value of I^2 can range from 0 to 100 percent. If I^2 is less than or equal to 50 percent, the study is said to be homogeneous, hence fixed effect model will be used to calculate

Table 4 - Summary of Studies for Meta-analysis

Variable	No	Author	Year	N	r
Agricultural financing affects agricultural productivity	1	Fariduddin	2010	20	0.432
	2	Bolarinwa & Fakoya	2011	250	0.382
	3	Butler & Cornaggia	2011	6	0.021
	4	Allimi *et al.*	2019	45	0.295
	5	Ubi & Udah	2019	14	0.559
	6	Seven & Tumen	2020	2944	0.490
	7	Rashid	2021	1188	0.104
	8	Mladenović & Mladenović	2023	513	0.085
	9	Wang *et al.*	2023	330	0.084

Source: Author's own elaboration based on each each study used in meta-analysis.

Table 5 - Heterogeneity test

	Estimate
τ^2	0.035
τ	0.188
I^2 (%)	93.689
H^2	15.844

Source: Author's own elaboration based on JASP software

the summary effect. On the other hand, the I^2 value greater than 50 percent means the study has high heterogeneity, thus it is required to use a random effect model to calculate the summary effect (Hak *et al.*, 2016). The H^2 value represents the between-study variance (Goss-Sampson, 2020). This study employed a random effect model because τ^2 and τ is more than zero, the I^2 value greater 50 percent and the H^2 value is greater than one.

The next step is to calculate the summary effect using the Wald test, as shown in Table 6. A summary effect is calculated to determine the summary or overview of the effect size to be observed (Retnawati *et al.*, 2018).

The p-value of the estimated effect size on all variables in this study is less than 0.001. Thus, it is proven that there is a significant relationship between agricultural finance and agricultural productivity, which the estimated effect size is 0.276.

Table 6 - Summary effect calculation

	Estimate	Standard Error	z	p	95% Confidence Interval	
					Lower	Upper
Intercept	0.276	0.076	3.621	<.001	0.127	0.426

Source: Author's own elaboration based on JASP software.

The final step is to evaluate the publication bias. This step plays a pivotal role in establishing the significance of sources, attaining accurate conclusions of the study, and assessing the influence of different sample sizes on research findings with minimal bias (Agarwal *et al*., 2012; Chamdani *et al*., 2022). To detect the publication bias, Egger's test is employed. The results of Egger's test are presented in Table 7 with the *p*-value of 0.613, which is greater than 0.05. This indicates the absence of publication bias, which means the excluded studies yield similar results to the included studies in this meta-analysis.

Table 7 - Regression Test for Funnel Plot Asymmetry (Egger's Test)

	z	p
sei	0.505	0.613

Source: Author's own elaboration based on JASP software.

3.3. *Optimum Analysis*

The author provides his own insights through the valuation of each Islamic macroprudential instrument to strengthen the acquired research findings using the optimum analysis. In this case, this study assessed each instrument on each criterion based on the existing literature (attached in the Appendix). This study presents the matrix assessment form as described in Table 8.

The results of the optimum analysis show that IALTS has the highest scores. Hence, it is selected as the most optimal alternative instrument for supporting agricultural sector financing. The obtained optimal analysis outcome validates and enhances the conclusions drawn from the two other methodologies employed in this study.

Table 8 - Priority of Alternative Instruments for Islamic Macroprudential Policy

Characteristics	Islamic Macroprudential Policy Instruments							
	A: (IAFTV)	B: (IARR)	C: (IACCB)	D: (IADTI)	E: (IALTS)	F: (IAMIR)	G: (IASLL)	H: (IARC)
Increasing staple agriculture sector financing								
P1: Ability to increase agricultural sector financing	1	1	1	0,50	1	0,25	0,50	0,75
P2: Ability to identify price growth	0,50	0,75	0,50	0,50	0,75	0,50	0,25	0
P3: Ability to encourage investment in the agricultural sector	1	0,50	0,75	0,75	1	0,75	0,25	0,75
P4: Reduce reliance on short-term lending during financing boom	1	0,75	1	1	0,75	0,50	0,50	0,25
Total Score (P)	**3,5**	**3**	**3,25**	**2,8**	**3,5**	**2**	**1,5**	**1,8**
Limiting financing imbalances risk in the staple agricultural sector								
Q1: Encouraging demand/supply of financing	0,75	0,75	0,75	0,75	0,50	0,75	0,50	0,25
Q2: Prevent overgrowth in one sector	0,50	0,75	0,25	0,75	0,75	0,25	0,25	0,75
Q3: Prevent speculative short-term transactions	0,75	1	0,75	0,75	1	0,25	0,75	0,25
Q4: Drive products with low costs and minimal distortion	0,75	0,50	0,75	0,50	1	0	0,25	0
Total Score (Q)	**2,75**	**3**	**2,5**	**2,8**	**3**	**1,3**	**1,8**	**1,3**
Limiting systemic liquidity risk of the staple agriculture sector								
R1: Internalization of systemic risk	1	1	0,75	1	1	1	0,25	0,25
R2: Support sufficient liquidity	0,75	0,75	1	0,50	0,75	1	0,50	0,50
R3: Avoiding the credit crunches	0,75	0,75	0,75	0,50	1	0,75	0,50	0,75
R4: Ability to reduce procyclicality of financing	1	0,50	1	1	0,75	1	1	0
Total Score (R)	**3,5**	**3**	**3,5**	**3**	**3,5**	**3,8**	**2,3**	**1,5**
Total	**9,8**	**9**	**9,3**	**8,5**	**10**	**7**	**5,5**	**4,5**

Source: Author's own elaboration.

4. Discussion

Based on the outcome of Delphi-ANP method, it is essential to increase financing for the staple agricultural sector. For example, in Pakistan, the regulation of agricultural loans is an essential component of the central bank's functions as it aligns with the State Bank of Pakistan's policy for sectoral development financing. The policy is an equitable distribution of credit under the agricultural loan scheme where mandatory targets are given to commercial banks for agricultural loans. Until now, fifty-two institutions including five large banks, two specialized banks (ZTBL & PPCBL) for agriculture, 14 domestic private banks, 11 microfinance banks, five Islamic banks and 15 microfinance institutions directly provide financing to the agricultural community in the country (State Bank of Pakistan, 2021).

Based on the findings of meta-analysis, there is a positive and significant correlation between agricultural financing and agricultural productivity (effect size value 27.6% and p-value < .001). This is also in line with several studies in various countries that show agricultural credit or financing has a positive impact on productivity (Aguilar & Tovar, 2013; Ali *et al.*, 2014; Chandio *et al.*, 2018; Florence & Nathan, 2020; Manoharan & Varkey, 2021; Minten *et al.*, 2023; Okore & Nwadiubu, 2022; Yunusa & Ariyibi, 2022). Furthermore, Abubakar & Muhammad (2023) stated that commercial bank agricultural financing rates have a positive and substantial impact on agricultural output in the long run.

In line with this, numerous studies have demonstrated that lending policies to the agricultural sector have a favorable impact on bank disbursements (Sarker, 2016), productivity (Manoharan & Varkey, 2021) and GDP (Obioma *et al.*, 2021). Mohamed *et al.* (2021) also found that financing from Islamic banks has a long-term beneficial effect on agricultural output. The financing provided by Islamic banks not only positively impacts agricultural output in the long run but also contributes to the overall development of the agricultural sector. Furthermore, Islamic banks maintained stronger financing growth than conventional banks, with growth rates that were on average twice as high (Hasan & Dridi, 2010).

As indicated by the findings, it is crucial to prevent speculative short-term transactions to address the financing imbalances within the staple agricultural sector. The agricultural sector can avoid risks by utilizing the Islamic financial system in its policy rules. The Islamic financial system offers transactions which have to be based on the actual economic activity and to avoids elements of uncertainty as well as speculation to prevent speculative short-term transactions. Maulana (2020) stated that the Islamic financial system promotes business dealings based on legitimate economic activity, asset ownership, and risk sharing, all of which work to support

an equal and ethical financial system. By applying specific instruments tailored to the needs of the agricultural sector, such as flexible payment terms and profit-sharing arrangements, Islamic finance can further enhance their financing growth and contribute to the overall development of the sector. These benefits extend not only to the agricultural sector but also to strengthen the whole economy by increasing productivity, lending, and GDP (Mladenović & Mladenović, 2023).

The Islamic financial system, in principle, is considered to have less systemic risk than conventional finance due to the risk-sharing aspect and the prohibition of speculation (Kammer *et al.*, 2015; Rizwan *et al.*, 2022). Furthermore, procyclicality in Islamic banking is viewed favorably because it is consistent with the inherently stable features of Islamic finance and prevents the formation of bubbles that could lead to systemic risk (Albinali, 2023). Therefore, instruments with these criteria can support financing in the agricultural sector with the intermediation of Islamic financing institutions.

To enhance Indonesia's food crop productivity, an increase in Islamic financing to the agricultural sector is necessary as part of the implementation of Islamic macroprudential policy. Nevertheless, to access the financing needed by the agricultural sector, agricultural policy plays an important role (Okore & Nwadiubu, 2022). Therefore, access to financing for the agricultural sector must be supported by agricultural policy instruments from the government (Kirechev, 2021). These policy instruments can include providing subsidies or low-interest loans to farmers, establishing specialized financial institutions for the agricultural sector, and implementing regulations that encourage banks to provide loans to farmers. Furthermore, agricultural policies should also focus on improving farmers' financial literacy and provide them with training on how to effectively manage their finances and access credit. This supports the implementation of Islamic macroprudential policies to encourage agricultural financing through Islamic financial institutions.

Based on the collective findings of the three approaches used in this study, it can be deduced that Islamic Agriculture Lending to Sector (IALTS) serves as the most suitable Islamic macroprudential instrument for effectively promoting financing in the staple agricultural sector. IALTS instrument is a percentage-based incentive from the central bank for banks and non-banking institutions to lend more money to the staple agriculture sector. It aims to achieve development and food security goals by providing special treatment to sub-optimal sectors. According to several studies, agricultural financing policies from the authority can increase agricultural productivity (Manoharan & Varkey, 2021; Okore & Nwadiubu, 2022; Sarker, 2016). The implementation of such policies will lead to a positive relationship between bank financing and the development of the agricultural sector (Kirechev,

2021). Banks are essential for the development of the agricultural sector (Ngong *et al.*, 2023), as appropriate credit flows ensure farmers' needs and productivity.

In term of limiting financing imbalances in the staple agricultural financing risk, IALTS increase financing for the agricultural sector through Islamic principles, focusing on asset-based value and no interest rate (Aidah & Anugrah, 2021). In the context of the agricultural sector, this policy can help control liquidity and limit the risk of financing allocated to the sector. IALTS also allows a sector to access affordable and flexible financing options, enabling farmers to invest in modern technologies and improve productivity (ADB, 2019). Additionally, IALTS provides a transparent and efficient policy for lenders and borrowers to connect, fostering greater financial inclusion in the agricultural sector.

IALTS can also limits systemic liquidity risk of the staple agriculture sector. Islamic macroprudential policies encourage diversification of lenders and borrowers, using risk-sharing mechanisms like *mudaraba* and *musharaka*, instead of interest-based lending. This approach provides more equitable and stable financing arrangements, sharing risks and benefits between lenders and borrowers. LTS policy limits lending to high-risk sectors, reducing credit default risk and strengthening financial system resilience. Central banks and financial supervisory authorities play a crucial role in implementing LTS (Haniff *et al.*, 2019). IALTS policy promotes sustainable economic growth, but requires careful implementation and coordination with other policies for effective macroeconomic stabilization.

Using appropriate macroprudential instruments, the agricultural sector can experience sustainable growth, increase productivity, and better manage financial risks. This will have a positive impact on overall economic resilience, food security, as well as the welfare of people who depend on the agricultural sector. Despite the results of this study conclude that the most suitable Islamic macroprudential policy instruments to support staple agricultural sector financing is IALTS, its implementation is insufficient to address the complex financing issues in the agricultural sector. Hence, additional supporting measures are imperative for bolstering the financing of the agricultural sector (particularly in the staple agriculture sector). Other supporting policies include specialized financing institutions for the agricultural sector (such as agricultural banks), financial risk mitigation for farmers (agricultural insurance), and allocation of social funds for the agricultural sector. It is also necessary for policy instruments to be tailored to the smallholder farmers who dominate in Indonesia, so that the IALTS policy can support all layers in the agricultural sector.

Conclusions

Based on Delphi-ANP and Optimum Method approaches, they show that the most suitable Islamic macroprudential instruments considered to support staple agriculture sector financing in Indonesia are Islamic Agricultural Lending to Sector (IALTS). These instruments fulfill three criteria i.e., increasing financing for the staple agriculture sector, limiting imbalances in financing (preventing speculative short-term transactions), and limiting systemic liquidity risk (internalizing systemic risk) for the staple agricultural sector. IALTS suggests Sharia banks and other financial institutions to provide a greater percentage of financing to the agricultural sector. The existence of these policies is able to address the issues of financing in the agricultural sector, which is restricted by a lack of financing commitments from banks and non-banks for the agricultural sector, and to support the issue of collateral for farmers (especially small and medium farmers) when engaging in farming activities so that it can have an impact on boosting the productivity of food crops to realize national food security.

Furthermore, using meta-analysis this study supports Delphi-ANP premies indicated by the effect size of 9 publications which are proven to be heterogenous and have a positive value and significant correlation between agricultural finance and agricultural productivity. In this research, the publications bias does not exist, which means that the publication truly reflects the actual situation. Based on optimum analysis, IALTS come agricultural policy has an important role in accessing the financing needed by the agricultural sector. Therefore, access to financing for the agricultural sector must be supported by agricultural policy instruments from the government. These policy instruments can include providing subsidies or low-interest loans to farmers, establishing specialized financial institutions for the agricultural sector, and implementing regulations that encourage banks to provide loans to farmers.

Although extensive analysis has been conducted, this study is not without limitations. Time and cost constraints prevented use of number of respondents to participate in the study. Like the ANP method in general, the results of this study are somewhat influenced by the subjective assessments of the respondents. Moreover, there is a possibility that other indicators may have been disregarded due to the limitations of the indicator-based approach utilized in this study. Despite the limitations, this study opens new doors for research related to Islamic macroprudential in general in the future, specifically related to agricultural financing development.

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