INVESTIGATING FARMERS' PREFERENCES FOR CROP INSURANCE PRODUCT ATTRIBUTES IN INDONESIA USING THE BAYESIAN BEST-WORST METHOD

Muhammad Ibrahim Rachman*)1, Nunung Nuryartono), Bustanul Arifin***), Toni Bakhtiar****)**

*)School of Risk Management and Insurance
Jl. Perintis Kemerdekaan No 14-16, Pulo Gadung Jakarta Timur 13260, Indonesia
**)Department of Economics, Faculty of Economics and Management, IPB University
Jl. Agatis, Campus of IPB Darmaga Bogor 16680, Indonesia
***)Department of Agricultural Economics, Faculty of Agriculture, University of Lampung
Jl. Prof. Dr. Sumantri Brojonegoro No. 1 Bandar Lampung, 35145, Indonesia
****)Department of Mathematics, Faculty of Mathematics and Science, IPB University
Jl. Raya Dramaga, Kampus IPB Dramaga Bogor, 16680 West Java, Indonesia

Abstract

Background: In 2015, the government of Indonesia launched a crop insurance program to anticipate the economic impact of crop failure on farmers due to the climate crisis. Despite the government's high premium subsidy, farmers' participation rate in crop insurance remains very low. Therefore, a study is needed to determine which product attributes in an agricultural insurance product are important to farmers and can affect their participation rate.

Purpose: This study aims to investigate the factors that farmers consider when selecting a crop insurance product.

Design/methodology/approach: The study focuses on the features of the Rice Farm Insurance (AUTP) product: total sum insured, product type, premium, risk coverage, and claim. The research was conducted by sending questionnaires to 110 farmers in 15 villages in Sliyeg, Indramayu. The Bayesian Best-Worst Method was used to analyze the data. Using a scale from 1 to 9, the best and worst criteria are compared pairwise.

Findings/Result: The findings indicated that the total sum insured is the most crucial consideration for farmers when choosing a crop insurance product, followed by the premium, risk coverage, terms of claims, and product type. The top two positions of the product attributes are finance-related, indicating a need for improved understanding of agricultural risk management among farmers, extending beyond dollar amount, through continuous education. With the findings in this study, the government and other stakeholders need to develop effective strategies to increase farmers' awareness of the importance of insurance in managing their business risks. This study's added value comes from convincingly showing that farmers prioritize the amount of sum insured over premiums and other aspects. Other researchers can use this research as a springboard to learn more about the importance of product attributes in creating crop insurance products.

Conclusion: The top two positions of the product attributes are finance-related, indicating a need for improved understanding of agricultural risk management among farmers, extending beyond dollar amount, through continuous education. With the findings in this study, the government and other stakeholders need to develop effective strategies to increase farmers' awareness of the importance of insurance in managing their business risks.

Originality/value (State of the art): This study's added value comes from its convincingly showing that farmers prioritize the amount of sum insured over premiums and other aspects. Other researchers can use this research as a springboard to learn more about the importance of product attributes in creating crop insurance products.

Keywords: climate crisis, crop insurance, Bayesian best-worst method, multi-criteria decision making, farmer preference

1 Corresponding author:
  Email: greet.ibrahim@gmail.com

INTRODUCTION

Climate crisis is a major environmental risk that presents a challenge to the global community. It can lead to unpredictable weather patterns and threaten global food production. Additionally, floods, droughts, and pests caused by climate uncertainties can directly or indirectly impact crop failure rates (Ray et al. 2019). In Indonesia, as shown in Figure 1, rice crop failure due to the climate crisis impacts fluctuates annually. The highest point of rice crop failure due to the climate crisis impacts was observed in 2015, caused by a prolonged drought resulting from El Nino. However, when we consider the data collectively, we can see that over the past ten years since 2010, the average increase in rice crop failure due to climate crisis impacts has been 18%.

Crop failure can have a significant impact on farmers and even the wider economy. While the government has implemented policies and programs to support the agricultural sector, these measures have not been enough to address the various issues within the sector, including crop failure due to natural conditions or other factors (Wang et al. 2021). Looking at the developments that have occurred, crop insurance has become a widespread tool for agricultural risk management in both developed and developing countries and it is often used as a policy regulated by the government (Tsiboe & Turner, 2023). In line with Wang (2019), through Law No. 19 of 2013 on the protection and empowerment of farmers, the Government of Indonesia (GoI) mandates crop insurance to mitigate agricultural risks. The GoI then established the Rice Farm Insurance (AUTP) program in 2015 in order to fulfill the mission, and through the Ministry of State-Owned Enterprise, designated PT Asuransi Jasa Indonesia (Persero) as the program's administrator. The overview of the development of this regulation can be seen in Figure 2. The program is designed to protect rice farmers for one planting season with an insured value of IDR6 million per hectare and a premium of IDR180,000. However, the GoI subsidizes 80 percent of the premium to make the program more affordable for farmers. This means that farmers only need to pay IDR36,000 to participate in the program.
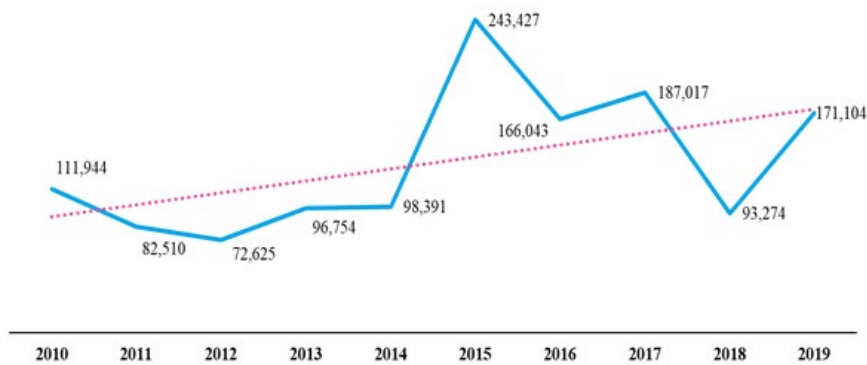

Figure 1. Crop failure due to climate crisis (ha), Ministry of Agriculture, processed

Figure 2. The development of AUTP regulations

Table 1. Land protected by AUTP and farmer participating, 2015 - 2021

Year	Land insured (ha)	Farmers participating	Growth	
			Land insured	Farmers participating
2015 (3 months)	233,499	401,408	-	-
2016	518,506	929,945	122%	132%
2017	997,960	1,550,389	92%	67%
2018	901,420	1,446,399	-10%	-7%
2019	971,218	1,380,357	8%	-5%
2020	1,000,001	1,367,678	3%	-1%
2021	400,000	627,601	-60%	-54%

Source: Indonesia Financial Services Authority Report (2015-2021), recalculated.

The GoI's policy subsidies crop insurance premiums, although these subsidies are sometimes the best tools to encourage farmer participation in many countries (Tsiboe & Turner, 2023). This policy has been in place since 2015. The GoI launched the crop insurance scheme and allocated a budget of IDR150 billion annually to subsidize the premiums. The policy aims to protect 1 million hectares of farmland. However, this target is low as it only covers around 6% of the total 15 million hectares of farmland, as shown in Table 1. The set target was only achieved 100% in 2020. However, even though the GoI has subsidized the premium enough to increase farmers' participation in AUTP, as seen in Table 1, the number of participating farmers has been decreasing since 2018, although the land covered by AUTP has increased. Therefore, it is necessary to increase the number of farmers participating in AUTP to reach all 29 million Indonesian farmers.

A study by Rachman et al. (2021) reveals that pull strategies, such as premium subsidy programs and encouraging or coercive initiatives, significantly shape farmer participation in AUTP. However, despite its classification under public policy, the issue of low participation rates among farmers in the AUTP demands a fresh perspective marketing lens. Identifying and optimizing the AUTP product attributes that can effectively boost farmers' participation rate is imperative. Previous research has mostly highlighted the characteristics of farmers and their willingness to pay for crop insurance (Aheeyar et al. 2023, Rachman et al. 2020, Kislingerová & ŠpiŇcka, 2022, Islam et al. 2021; Wodaju et al. 2023; Dahal et al. 2022; Ngango et al. 2022; Senapati, 2019; Wang et al. 2019). However, there is still a need to address farmers' preferences for attributes of insurance products. Few studies have explicitly used conjoint analysis (Sherrick et al. 2003) or choice experiments (Mensah et al. 2023, Mato-

Amboage et al. 2022, Ghosh et al. 2020, Jørgensen et al. 2020) to study crop insurance product attributes in order to investigate demand. Crop insurance product attributes are crucial when making decisions, even if the prior research mostly examined farmer characteristics as variables that may affect their participation (Syah et al. 2023). However, less focus has been on farmers' preferences for crop insurance attributes. Thus, the purpose of this study is to determine which attributes of crop insurance products are most important. This study is new in that it determined that, compared to premiums and other features, the amount of sum insured is the most crucial aspect of crop insurance for farmers.

This research aims to determine what farmers consider when choosing a crop insurance plan. The study looks at several characteristics of the existing AUTP product, including the sum insured, claim terms, product type, premium, and risk coverage. This study applies the Bayesian Best-Worst Method to make acceptable decisions through a mathematical technique. This research is expected to answer the following questions: What attributes do farmers prefer when adopting agricultural insurance products? The results can provide stakeholders with a strong foundation when developing the next agricultural insurance product.

METHODS

This study was conducted to determine the preferences of farmers in the Sliyeg subdistrict of the Indramayu regency in West Java province towards crop insurance product attributes. Sliyeg was selected as the research location because it is one of the top rice-producing sub-districts in West Java. West Java is Indonesia's third largest rice granary after Central Java and East Java, with a production of 5.21 million tons in 2019,

contributing to 16.64% of the national production. This selection ensures that the research results will be optimal. Additionally, farmers in Sliyeg are familiar with crop insurance, which was introduced in 2015. Sliyeg has been used for research on crop insurance on both national and international scales, indicating that farmers there have a strong understanding and knowledge of crop insurance products, especially AUTP. This study is of an exploratory nature, and as such, it does not formulate a hypothesis. The study used a descriptive approach to obtain primary data from 110 farmers in 15 villages through questionnaires. A purposive sampling method was used to select the samples, and respondents were determined using a simple random sampling method. The criteria for respondents are farmers who adopt AUTP or farmers who do not adopt AUTP products but already know and understand about the product.

This study uses a tried-and-true mathematical technique for choosing the best course of action: the Bayesian best-worst method. This approach, which Mohammadi & Rezaei (2019) developed, is a potent probabilistic multi-criteria group decision-making model. It involves pairing the best criterion with the remaining criteria (best-to-others) and the worst criterion with the other criteria (other-to-worst) on a nine-point rating system. This method will avoid bias, allowing more accurate identification of the most important attributes in crop insurance products.

The steps of this study are as follows (Moazzeni et al. 2023):
1. Determine a set of decision criterion;
2. Determine the best and the worst criteria and sub criteria;

3. Determine the reference comparison of best/worst criterion as:

$$A_B=(a_{B1},a_{B2},\ldots,a_{Bn})$$

$$A_W=(a_{1W},a_{2W},\ldots,a_{nW})$$

4. Determine the optimal weights of criteria using mathematical model to obtain criteria and sub criteria weights.

To gather data, a questionnaire was used to conduct in-person interviews between March 23, 2020, and April 6, 2020. Of the 110 surveys that were distributed, 103 were completed and returned. Based on the information obtained, the respondents chose the choice criteria the characteristics of the crop insurance policy displayed in Table 2. The collection of characteristics was selected to capture essential aspects of the crop insurance product's current design. The sample size was determined by examining the population of 7,817 farmers in Sliyeg. The minimum sample to be taken is 95 farmers, with a confidence level of 95% and an error rate of 10%, to ensure that the sample represents farmers in 14 villages in the Sliyeg sub-district.

In Table 2, respondents were tasked with choosing the best and the worst attributes, and then completing the subsequent questionnaire in Table 3 to ascertain the best and worst criteria and sub-criteria. Previous studies have used different product attributes depending on the product's country of origin. For a similar purpose, Mato-Amboage et al. (2022) did a study in Spain and found that farmers prefer schemes linking eligibility to ad hoc funds in case of catastrophic outbreaks over traditional insurance.

Table 2. Crop insurance product attributes

Attribute	Description
Premium	The farmer's premium payment amount
Risk Covered	The accessibility of risk-covered options:
	- Only insure against one kind of risk, such as pests or flooding..
	- Cover many risks.
Type of Product	The available product types are:
	- The product that will make up for lost production costs in the event of a crop failure.
	- The product that will make up for lost income in the same situation.
Sum Insured	The amount of money awarded in the case of a crop loss when a covered risk materializes.
Claim Terms	The minimum proportion of land damage required before receiving payment. 75% is the current proportion.

Table 3. Choosing the best and worst attributes

Choose the best	Best attribute name
Choose the worst	Worst attribute name

Source: Rezaei (2015)

In addition, respondents must specify which others-to-worst and best-to-others scores they prefer, as shown by the description of the following score (Rezaei, 2015):
1: Comparable significance
2: In the middle of equal and moderate
3: Slightly more significant than
4: In the middle of being powerful and modest
5: Significantly more significant than
6: In the range of strong to extremely strong
7: Far more crucial than
8: In between extreme strength and absolute
9: Far and away more significant than

The data must be entered into the template found in Tables 4 and Table 5. The data was analyzed using the Bayesian hierarchical model to determine the best weights for the criterion based on the preferences of respondents using the best-worst framework. A weighted directed graph was used to compute and display the corresponding credal ranking, and http://bestworstmethod.com/software/ provided the MATLAB implementation of the suggested model.

RESULTS

Table 6 shows the descriptive statistics gathered from the field data collection results. It reveals that most of the respondents are male, consistent with the national data indicating that 87% of the leading farmers in agricultural business households in Indonesia are male (BPS, 2018). The farmers' age range from the research results is between 40-49 years and 50-59 years, with an average age of 50. By looking at this age range, it can be concluded that the farmers in the research location belong to the productive but aging age group, which is also consistent with the national farmer population data from BPS (2018), showing that 88% of farmers are aged 35 years and above.

In addition, 42% of the respondents had graduated from high school, 41% had only completed elementary school, and 20% had graduated from junior high. Comparing this education data with the national data shows a difference in composition. The national data reveals that most (42%) farmers only have an elementary school

education, 25% did not finish elementary school, 16% finished junior high, 14% completed high school, and 3% graduated college (BPS, 2018). The latest education data from the field data collection results show that farmers in the research location have a relatively high level of education. Therefore, they have a good understanding of the concept of crop insurance in general.

Moreover, most of the respondents are married and have 2 to 4 dependents, and this aligns with the national data showing that 85% of agricultural business households have 2 to 5 family members (BPS, 2018). Finally, almost all respondents have more than five years of farming experience, and most are landowners with a land area of less than or equal to 1 hectare. This land size data aligns with national data from BPS (2018), which shows that 75% of farmers in Indonesia manage less than 1 hectare of land.

The Bayesian hierarchy model was used to examine the questionnaire data. Using the Best-Worst paradigm, this method assists in determining the ideal weights for various criteria based on the preferences of many respondents. Additionally, a weighted directed graph is used to display the ranking of importance. The results of this study will discuss the most significant attributes of crop insurance products perceived by farmers. Table 7 indicates that the respondents deemed the Total Sum Insured the most significant attribute, with 0.244 as the average weight. On the other hand, farmers believe that Product Type and Claim Terms are the least important features of crop insurance products, with an average weight of 0.180 and 0.181, respectively. Farmers claim that Premium an average weight of 0.202 and 0.193 is the second most crucial crop insurance product attribute, behind Total Sum Insured.

To ensure that the top and bottom-ranked answers from the respondents are consistent, we present the proportion of crop insurance product attributes considered as Best and Worst by the respondents, depicted in Figure 3. According to the weighted average, the Total Sum Insured is consistent with the answers of 44% of respondents who stated that it is the Best attribute. Additionally, only 6% of respondents said that the Total Sum Insured is the Worst attribute. On the other hand, the most selected crop insurance product attributed as Worst is the Claim Terms, chosen by 32% of respondents with a weighted average difference of 0.001. Lastly, according to the respondents, the least essential crop insurance product attribute is Product Type.

Table 4. Respondents' best-to-others preferences

Best-to-others	Premium	Risk Covered	Type of Product	Sum Insured	Claim Terms
Best attribute name	Respondents score using nine-point rating	Respondents score using nine-point rating	Respondents score using nine-point rating	Respondents score using nine-point rating	Respondents score using nine-point rating

Source: Rezaei (2015)

Table 5. Respondents' Others to the Worst Preferences

Others-to-worst	The worst attribute name
Premium	Respondents score using nine-point rating
Risk Covered	Respondents score using nine-point rating
Type of Product	Respondents score using nine-point rating
Total Sum Insured	Respondents score using nine-point rating
Claim Terms	Respondents score using nine-point rating

Source: Rezaei (2015)

Table 6. Descriptive statistics

Variable	Category	Total	Percentage	Variable	Category	Total	Percentage
Age	< 30	2	1.9		4	24	23.3
	30 – 39	10	9.7		5	7	6.8
	40 – 49	37	35.9		6	3	2.9
	50 – 59	37	35.9		7	2	1.9
	≥ 60	17	16.5	Land Ownership Status	Land Tenant	40	38.8
Sex	Male	99	3.9		Landowner	63	61.2
	Female	4	96.1				
Level of Education	Elementary	41	39.8	Farming Experience	1-5 years	7	6.8
	Junior High	20	19.4		>5 years	96	93.2
	High School	42	40.8	Land Area	≤ 5,000	45	43.7
Marital Status	Married	100	97.1		5,001 – 10,000	42	40.8
	Single	3	2.9		10,001 – 15,000	4	3.9
Number of Dependents	0	2	1.9		15,001 – 20,000	8	7.8
	1	11	10.7		> 20,000	2	1.9
	2	27	26.2				
	3	27	26.2				

Table 7. Credibility ranking

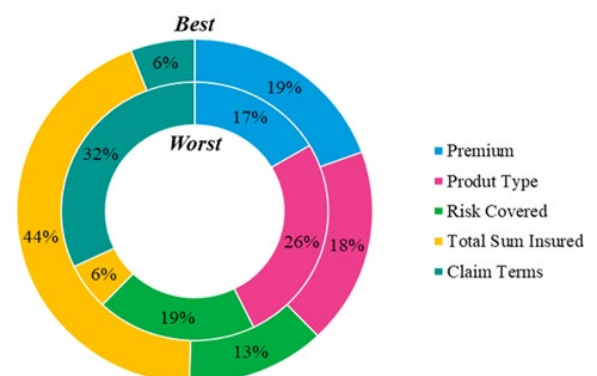| Rank	Attribute Name	Average Weight
1	Total Sum Insured	0.244
2	Premium	0.202
3	Risk Covered	0.193
4	Claim Terms	0.181
5	Product Type	0.180

Figure 3. Proportions of best and worst attributes

In comparison to Premium, Risk Covered, and Product Type, Figure 4 demonstrates that the Total Sum Insured is more critical than Claim Terms, with confidence intervals of 0.74 and 1.00, respectively. With confidence values of 0.74, 0.93, and 0.94 for Risk Covered, Claim Terms, and Product Type, respectively, Premium is the second most essential attribute. With confidence levels of 0.80 and 0.82 for claim terms and product type, respectively, risk covered is more significant. Finally, with a confidence level of 0.53, claim terms are preferred above product type.

Their preference for this attribute is mostly triggered by the discrepancy between the Total Sum Insured and the actual production cost that the farmers have paid. Currently, AUTP product stipulates a Total Sum Insured of IDR 6 million per hectare, which is lower than the actual production cost of up to IDR 13 million per hectare. This is in line with the results of the latest rice business cost structure survey, which shows that the production cost of the rice field was IDR13,559,300 in 2017. Even the current AUTP compensation value is lower than the production cost of the rice field in 2008, which was IDR10,830,000. Table 8 shows this clearly. Research by Olila et al. (2014) also lends credence to this conclusion. They found that farmers are willing to pay higher premiums if the value of crop insurance coverage can replace the production costs they incur. Regardless, premium subsidies play a very important role. According to Mavroutsikos et al. (2021), there is a strong and complementary relationship between the role of premium subsidies in several aspects, namely increasing farmer participation, inducing a desired separating equilibrium and transferring income to farmers.
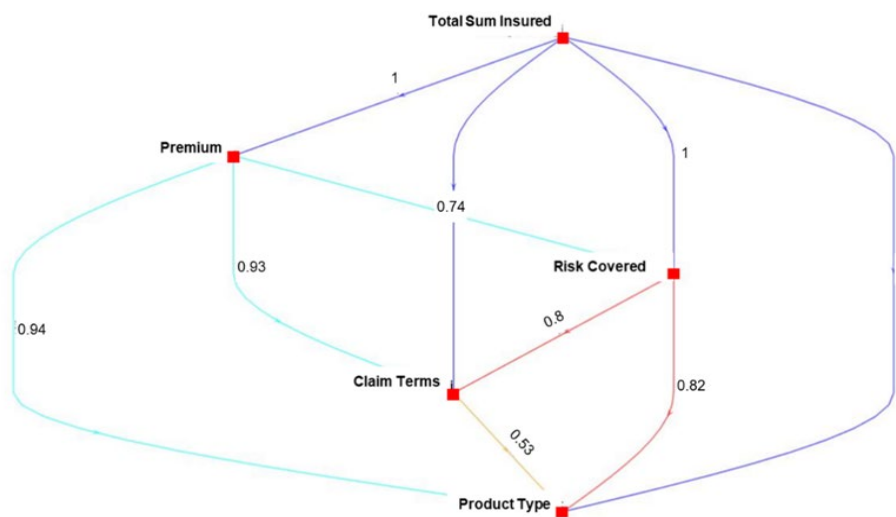

Figure 4. The credal ranking visualization

Table 8. Survey results of business cost structure of rice paddy crops

Survey Year	Production Cost (in IDR)
2008	10,830,000
2011	13,060,000
2014	12,700,000
2017	13,559,300

Source: BPS Data, various editions, processed.

Figure 5. The amount of AUTP premium that farmers are willing to pay

The farmers are hoping that the government will adjust the Total Sum Insured in the current AUTP product to be at least equal to the cost they spend producing their crops in the next planting period. According to the farmers, it is also important to consider the inflation rate each year and to accommodate differences in production costs between different plots of land. Some farmers choose not to use subsidized fertilizers for quality reasons, which can result in higher production costs than other land where they use them. Thus, the Total Sum Insured should be adjusted to account for these differences.

Farmers' preferences that place Premiums lower than the top rank differ from previous studies that place Premiums as the most important attribute of crop insurance products for farmers. A study by Sun (2019) in China indicates that farmers anticipate reduced crop insurance premiums, aligning with research by Kislingerová & Špička (2022) in the Czech Republic. Moreover, research conducted by Suryanto et al. (2020) found that nearly 95% of farmers are unwilling to purchase crop insurance due to the low willingness to pay for premium costs. Assuming that farmers consider Premiums the most important attribute, the government subsidizes premiums to increase farmer participation in crop insurance. This is in line with experience in many countries, which shows that agricultural insurance participation rates are generally low without significant premium subsidies (Dalhaus et al. 2020). The data obtained in the field shows that 14% of farmers are willing to pay crop insurance premiums of up to 1% of their production costs. However, when referring to the structure of rice business costs (BPS 2017), the cost of insurance premiums incurred by farmers is around 0.01% of total production costs. This percentage is lower compared to the study by Adjabui et al. (2019), who found that farmers are willing to pay crop insurance premiums of up to 12.5% of production costs. According to field research, farmers are generally willing to pay a crop insurance premium between IDR10,000 and IDR150,000 per hectare per planting season. Furthermore, based on Figure 5, it can be seen that 44% of respondents are only willing to pay the premium if it is lower than the current AUTP premium of IDR36,000 per hectare. 39% of the respondents are willing to pay the same amount as the current premium of IDR36,000 per hectare, and the remaining 17% are willing to pay a higher premium than the stipulated premium for the AUTP product. For additional reference, a study conducted by Aditya

et al. (2021) on 716 wheat farmers in Punjab found that farmers were willing to pay INR 297 per hectare (around IDR57,618) for crop insurance, which is lower than the premium based on existing rates.

Managerial Implications

The outcome of this study starkly illustrates that the top two product attributes of AUTP, as per the respondents, are sum insured and premium. It's alarming to note that these two attributes, which are directly linked to monetary value, are not fully understood by farmers, highlighting a significant gap in their comprehension of agricultural risk management. This underscores the immediate need for continuous and sustainable education and literacy efforts to increase farmers' awareness. The hope is that with increased awareness, farmers will shift their focus towards more essential attributes such as coverage or service quality, thereby enhancing their risk management practices.

CONCLUSION AND RECOMMENDATIONS

Conclusions

This research study explored the factors farmers consider when selecting crop insurance products. The research found that the sum insured is the most important consideration for farmers when choosing a crop insurance product. However, the current sum insured does not match the actual production costs incurred by farmers. The second most significant aspect is the premium, followed by the risk covered, claim terms, and product type in that order. The research results suggest that the two primary factors that farmers consider are related to financial considerations. This may indicate that farmers need more knowledge of the importance of agricultural risk management, as everything must be quantifiable in dollar amounts. However, further research is necessary to confirm this hypothesis. In addition, similar research needs to be duplicated for other regions to ensure that there are no differences, for example, due to cultural differences or farming methods.

Recommendations

The study's findings suggest that the GoI should strategically focus on enhancing the product features that are most valued by farmers. This proactive

approach is expected to yield significant results by increasing farmers' engagement with the AUTP product and ultimately enhancing the overall effectiveness of crop insurance policies.

REFERENCES

Aditya KS, Kishore A, Khan MT. 2021. Exploring farmers' willingness to pay for crop insurance products: A case of weather-based crop insurance in Punjab, India. *Agricultural Economics Research Review* 33(22):23–35. Https://doi.org/10.5958/0974-0279.2020.00027.0.

Adjabui JA, Tozer PR, Gray DI. 2019. Willingness to participate and pay for index-based crop insurance in Ghana. *Agricultural Finance Review* 79(4):491–507. https://doi.org/10.1108/AFR-01-2019-0001.

Aheeyar M, Amarasinghe U, Amarnath G, Alahacoon N. 2023. Factors affecting willingness to adopt climate insurance among smallholder farmers in Sri Lanka. *Climate Risk Management* 42. https://doi.org/ 10.1016/j.crm.2023.100575.

BPS. 2017. Hasil survei struktur ongkos usaha tanaman padi 2017. Jakarta. https://www.bps.go.id/id/publication/2017/12/26/07ca064175333cd9f796c183/hasil-survei-struktur-ongkos-usaha-tanaman-padi-2017.html. [6 April 2024].

BPS. 2018. Hasil Survei Pertanian Antar Sensus (SUTAS) 2018. Jakarta. https://www.bps.go.id/publication/2019/10/31/9567dfb39bd984aa45124b40/hasil-survei-pertanian-antar-sensus--sutas--2018-seri-a2.html. [6 April 2024].

Dahal BR, Adhikari S, Khanal AR. 2022. Willingness to pay for crop insurance: a case from citrus farmers in Nepal. *Journal of Agribusiness in Developing and Emerging Economies* 12(2): 247-261. Https://doi.org/ 10.1108/JADEE-12-2020-0298.

Dalhaus T, Barnett BJ, Finger R. 2020. Behavioral weather insurance: Applying cumulative prospect theory to agricultural insurance design under narrow framing. *PLoS One* 15(5): 1-26. Https://doi.org/10.1371/journal.pone.0232267.

Ghosh RK, Gupta S, Singh V, Ward PS. 2021. Demand for crop insurance in developing countries: New evidence from India. *Journal of Agricultural Economics* 72(1): 293-320. Https://doi.org/ 10.1111/1477-9552.12403.

Islam MDII, Rahman A, Sarker MSR, Luo J, Liang H. 2021. Factors affecting farmers' willingness to adopt crop insurance to manage disaster risk: evidence from Bangladesh. *International Food and Agribusiness Management Review* 24(3): 463-479. Https://doi.org/ 10.22434/IFAMR2019.0190.

Jørgensen SL, Termansen M, Pascual U. 2020. Natural insurance as condition for market insurance: Climate change adaptation in agriculture. *Ecological Economics* 169. Https://doi.org/ 10.1016/j.ecolecon.2019.106489.

Kislingerová S, Špička J. 2022. Factors influencing the take-up of agricultural insurance and the entry into the mutual fund: A case study of the Czech Republic. *Journal of Risk and Financial Management* 15 (366). Https://doi.org/ 10.3390/jrfm15080366.

Mato-Amboage R, Touza J, Soliño M. 2022. Understanding Farmers' Preferences Towards Insurance Schemes that Promote Biosecurity Best Management Practices. *International Journal of Disaster Risk Science* 13: 705–715. Https://doi.org/ 10.1007/s13753-022-00435-0.

Mavroutsikos C, Giannakas K, Walters C. 2021. The role of premium subsidies in crop insurance. *Plos One* 16(4). https://doi.org/10.1371/journal.pone.0250129.

Mensah NO, Owusu-Sekyere E, Adjei C. 2023. Revisiting preferences for agricultural insurance policies: Insights from cashew crop insurance development in Ghana. *Food Policy* 118. https://doi.org/10.1016/j.foodpol.2023.102496.

Moazzeni S, Darmian SM, Hvattum LM. 2023. Multiple criteria decision making and robust optimization to design a development plan for small and medium-sized enterprises in the east

of Iran. *Operational Research* 23(13). Https:// doi.org/ 10.1007/s12351-023-00761-1.

Mohammadi M, Rezaei J. 2019. Bayesian best-worst method: A probabilistic group decision making model. *Omega*. https://doi.org/10.1016/j. omega.2019.06.00.

Ngango J, Nkurunziza F, Ndagijimana J. 2022. Assessing rural farmers' willingness to pay for crop insurance scheme: Evidence from Rwanda. *Cogent Economics & Finance* 10(1): 1-14. Https:// doi.org/ 10.1080/23322039.2022.2104780.

Olila DO, Adhiambo NR, Jakinda OD. 2014. An assessment of maize farmers' preferences for crop insurance features in Trans-Nzoia County, Kenya; Thesis brief prepared for the AERC Workshop held in Egerton University, June 2014.

Rachman MI, Nuryartono N, Arifin B, Bakhtiar T. 2020. Factors influencing farmers' intention to participate in crop insurance. *Russian Journal of Agricultural and Socio-Economic Sciences*. 9(105): 46-53. https://doi.org/10.18551/ rjoas.2020-09.05.

Rachman MI, Nuryartono N, Arifin B, Bakhtiar T. 2021. Effect of the government intervention program to the crop insurance participation level. *Jurnal Manajemen & Agribisnis* 18(1): 1-9. Https://doi. org/ 10.17358/jma.18.1.1.

Ray DK, West PC, Clark M, Gerber JS, Prishchepov AV, Chatterjee S. 2019. Climate change has likely already affected global food production. *Plos One* 14(5). https://doi.org/10.1371/journal. pone.0217148.

Rezaei J. 2015. Best-worst multi-criteria decision-making method. *Omega* 53: 49-57. http://dx.doi. org/10.1016/j.omega.2014.11.009.

Senapati AK. 2019. Insuring against climatic shocks: Evidence on farm households' willingness to pay for rainfall insurance product in rural India. *International Journal of Disaster Risk Reduction* 42. https://doi.org/10.1016/j.ijdrr.2019.101351.

Sherrick BJ, Barry PJ, Schnitkey GD, Ellinger PN, Wansink B. 2003. Farmers' preferences for crop insurance attributes. *Review of Agricultural Economics* 25(2): 415-429. https://doi.org/ 10.2307/1349846.

Sun M. 2019. Heterogeneous choice in the demand for crop insurance in China: Results from in-the-field choice experiment. [Master's thesis, Cornell University]. Https://doi.org/ 10.7298/ fkw7-9k79.

Suryanto, Gravitiani E, Daerobi A, Susilowati F. 2020. Crop insurance as farmers adaptation for climate change risk on agriculture in Surakarta residency-Indonesia. *International Journal of Trade and Global Markets* 13(2): 251-266. Https://doi.org/ 10.1504/IJTGM.2020.10025689.

Syah MA, Prastiwi WD, Santoso W, Mukson. 2023. The attributes of insurance product as determinant factors of coffee farmers' participation in agricultural insurance. *Proceedings of the 3rd International Conference on Agriculture (ICA 2022)*. https://doi.org/10.2991/978-94-6463-168-5_16.

Tsiboe F, Turner D. 2023. The crop insurance demand response to premium subsidies: Evidence from U.S. Agriculture. *Food Policy* 119. https://doi. org/ 10.1016/j.foodpol.2023.102505.

Wang D, Jenkins K, Forstenhäusler A. Lei T, Price J, Warren R, Jenkins R, Guan D. 2021. Economic impacts of climate-induced crop yield changes: evidence from agri-food industries in six countries. *Climatic Change* 166(30). https://doi. org/10.1007/s10584-021-03062-8.

Wang HH, Liu L, Ortega DL, Jiang Y, Zheng Q. 2019. Are smallholder farmers willing to pay for different types of crop insurance? An application of labeled choice experiments to Chinese corn growers. *The Geneva Papers on Risk and Insurance* 45(1): 86-110. Https://doi.org/ 10.1057/s41288-019-00153-7.

Wodaju A, Nigussie Z, Yitayew A. Tegegne B, Wubalem A, Abele S. 2023. Factors influencing farmers' willingness to pay for weather-indexed crop insurance policies in rural Ethiopia. *Environment, Development, and Sustainability*. Https://doi.org/ 10.1007/s10668-023-04262-1.