Optimizing crop insurance strategy as a protection tool from crop failure, due to climate change through private sector involvement

M I Rachman¹, N Nuryartono², B Arifin³ and T Bakhtiar⁴

¹School of Business, IPB University, Bogor, Indonesia
²Department of Economics, Faculty of Economics and Management, IPB University, Bogor, Indonesia
³Department of Agricultural Economics, Faculty of Agriculture, University of Lampung, Bandar Lampung, Indonesia
⁴Faculty of Mathematics and Science, Department of Mathematics, IPB University, Bogor, Indonesia

E-mail: muhammad.ibrahim@sbm-itb.ac.id

Abstract. The global food production process is being threatened due to the uncertainty experienced in the weather pattern, especially the agricultural sector being placed at the risk of unpredictable climatic conditions. Moreover, climate uncertainties, such as floods and drought, directly and indirectly, impact the level of crop failure. Therefore, Indonesia’s Government has launched a program known as the Rice Farm Insurance (AUTP) in 2015, using a state-owned enterprise as the single administrator to manage these challenges. However, several other problems have been discovered using this program, such as the low level of farmer participation, unprofitable portfolio management, and a limited number of farm areas. Therefore, this research aims to formulate an AUTP optimization strategy through the private sector's involvement to mitigate these problems. The private sector's inclusion in managing crop insurance is due to the US and some Asian countries' success concerning its more comprehensive access to innovation, technology, and resources. The Analytical Hierarchical Process approach is a decision-making technique developed for cases with multiple analysis levels and used with the primary data obtained through questionnaires distributed to 5 experts representing the government, the general insurance industry, researchers, and farmers. The results showed that the influential actor was the government; the most successful factor was a collaboration among stakeholders. The prioritized objective was to increase farmer participation. The selected strategy was to form a consortium of public and private sector enterprises.

1. Introduction
Rice is one of the most widely consumed grains globally, with Indonesia being the fourth-highest consumer after China, India, and Bangladesh. Unlike the other top three countries, Indonesia has a lower production than national consumption. As of August 2020, 34.9 million rice was produced, which is 1% lower than the national consumption [1]. The estimate was projected to be more damaging in 2020, with the experience of erratic rain, delayed planting, and lower output below the forecasted level [2]. Generally, Indonesia is expected to experience the highest import rate. Therefore, more significant market intervention is needed by the government to curtail this effect. In the context
of the COVID-19 outbreak, successive production contractions have sway officials into importing to reconstitute reserves. Environmental risk, especially climate change, is one of the current biggest challenges because it causes a shift in weather patterns and consistently threatens food production.

Moreover, climate change affects crop yields by decreasing productivity[3][4]. The current national rice production system is vulnerable to the events of climate change, with rice production predicted to decrease by 20%-30% in 2030 [5]. Climate uncertainties, such as floods and drought, both directly or indirectly impact the level of crop failure [6]. As shown in Figure 1, paddy crop failure occurs due to climatic change impact, increasing at an average of 19% in the last ten years.

![Figure 1](image)

**Figure 1.** Paddy crop failure due to climate change impact 2010 – 2019 (ha)

Source: Ministry of Agriculture

One of the methods in managing agricultural the risk is through the implementation of crop insurance [7]. This has been widely applied in many countries favourable to small farmers. In response to that condition, the government implemented crop insurance, as part of the programs mandated by Law Number 19 of 2013, regarding Farmer Protection and Empowerment. To carry out this mandate, the government launched a program known as, Rice Farmers Business Insurance (AUTP) in 2015. In the implementation, the government appointed PT Asuransi Jasa Indonesia (Persero), a state-owned enterprise, as the administrator. The benefit of this program was to provide protection to paddy farmers, for one planting season, with a sum insured of IDR6 million per hectare, and a premium of IDR180,000. Considering the fact that the premium paid by farmers does seem too expensive, the government then provided premium subsidies of 80%, for farmers to only pay IDR36,000.

Even though the government provided a substantial premium subsidy to increase participation in AUTP, farmers’ interest was still very low. Till the year 2019, the target of 1 million land, set by the government each year, and protected by the AUTP, had not been achieved. Within the period of 2015 to May 2020, 99.8% of the target set by the government, was achieved in 2017, with the achievement in other years still below this figure. Therefore, this condition confirms the low interest of farmers to participate in AUTP.

Crop insurance is a complex line of business, that requires highly technical expertise. In a lot of countries, private insurance markets have proved to be efficient, as a consequence of better insurance principles implementation, such as, sound underwriting procedures and better risk pricing, lower administrative costs, and greater financial discipline, with purely commercial insurance not viable for systemic uncertainties or smaller farmers [8]. Public-private partnerships (PPP) are deemed as the best mode, to help improve the efficiency and sustainability of the crop insurance system [9]. Under this mode, the main role of the government is to address market and regulatory imperfections, to encourage the participation of private insurance and reinsurance industry [8]. However, to avoid the significant damage that the agriculture catastrophe risk has brought to capitals, the government also associated with the private insurance companies, to initiate the reinsurance pool, and collect reserve fund, to mitigate catastrophic losses [10]. Public support in the PPP are in the form of, coinsurance pools, communal reinsurance, subsidies on administrative and operational expenses, loss adjustment supports, or additional premium assistance, for small and marginal farmers [11][8].
Looking at the challenges encountered and learned in the implementation of crop insurance in Indonesia and other countries, the aim of this research is to formulate the crop insurance optimization strategy, through private sector involvement, by identifying the most important form of actor, factor, objective, and alternative plan. The study on crop insurance and private sector involvement is still scarce. Some studies on the subject, were conducted in the context of discussing the evidence of PPP implementation, from several countries [12][11][8][10]. Therefore, this research is expected to make good contributions, to enrich the literature on crop insurance.

2. Research Methods

The AHP questionnaires were distributed to 5 crop insurance expert informants, coming from private sector, farmer, government, and researcher elements. Experts representing each element are those directly involved in the process of policy making, operations, supervision, and research, which are related to crop insurance. However, the process of filling out the questionnaire was carried out from September to October 2020, by using the online survey platform. Figure 2 shows the structure model used in the questionnaire, to build the pairwise comparison.

![Figure 2. AHP Hierarchical Structure Model](image)

Data were analyzed, using the Analytical Hierarchy Process (AHP), formulated by Saaty [13]. In the questionnaire, a pairwise comparison method was used, to determine the weight of each indicator. Furthermore, the weight determination was carried out by submitting a questionnaire that is open to the informants.

3. Result and Discussion

According to the survey, the result obtained were processed in advance for each informant, by using the AHP framework to describe the criteria for objectives, actors, factors and alternatives. According to the opinions of each informant, the data processed, produced two matrices, which are responsible for the priority order of the criteria and right alternatives. The total number of returned and completed questionnaires were 5, representing the private sector (representative from AAUI – Indonesia General Insurance Association), farmer, government (representatives from OJK – Financial Services
Authority, Ministry of Agriculture and PT Asuransi Jasa Indonesia (Persero)), and researcher. All informants are expert in their fields, having extensive knowledge and experience in crop insurance. The results obtained from 5 experts are grouped into four clusters, namely, objectives, actors, factors, and alternative priorities for crop insurance strategy, through private sector involvement.

3.1. Actor Priority
In this discussion, the first research question is answered, with regards to the criteria of the most important actors, related to crop insurance optimization strategy, and private sector involvement. Based on the results of the data processed, the priority of each criterion is obtained, according to the combined opinion of each expert.

![Figure 3. Geometric Mean of Actor Cluster]

Based on the diagram above, there are four aspects to the actor cluster, namely, private sector, farmer, government, and researcher. Among these four aspects, the government is the main actor priority, playing the most important role in optimizing crop insurance management, with a weight value of 0.304. The farmer aspect is the second actor priority, with a weight value of 0.223, followed by the private sector (0.165), and the researcher (0.121). The rater agreement value of this actor cluster is 0.175 (w = 0.175), which is on a weak to moderate scale, while indicating that, experts have very varied answers in determining the actors that play the most important role, in the management of crop insurance optimization.

The selection of the government as an important actor in this study is comprehensible, considering the fact that the regulation, only allows one operator to manage crop insurance. Experts stated that the government needs to improve this regulation, to open opportunities for the private sector, by enabling participation in managing crop insurance. Also, the importance of the government role had been largely confirmed by previous studies. The most common form of government role, apart from preparing policies, is financial support, by providing premium subsidies [14][15][16]. In the application of crop insurance to increase farmer participation rates, the government used other methods, such as, awareness creation about agricultural insurance benefits, credit programs linked with insurance, insurance integration with input supply services (seeds, fertilizers, irrigation), premium subsidies, reinsurance facilities provision, and technical assistance [17].

3.2. Objective Cluster
Furthermore, research questions is answered, with regards to the most important objectives, related to crop insurance optimization strategy and private sector involvement. Based on the results of data processed, the priority of each objective is obtained, according to the criterion of each expert, and their combined opinions. Several important objectives in this study are divided into three factors, namely, increasing participation, efficient and profitable management, with increased area of protected land.
As presented in Figure 4, increase in farmer participation, was the main objective in optimizing crop insurance management, with a weighted value of 0.582, followed by efficient and profitable management (0.174) in second place, and increase in total land area protected (0.168) as the last. The rater agreement value of this cluster is 0.4375 (w = 0.4375), which is on a moderate to strong scale, indicating that experts have the same answer in determining the most prioritized goals, in the optimization of crop insurance management.

Based on the results of this study, all experts have the same opinion that, for the main objective of the strategy to be formulated, there has to be an increase in farmers’ participation rates. The problem of low farmer participation is not only encountered by Indonesia, as it also occur in all countries involved in the application of crop insurance. Previous research on low participation rate had been conducted, with emphasis on farmer’s characteristics [18][19][20] and willingness to pay [21][22][23].

3.3. Factor Cluster
There are four aspects to the factor cluster, namely, marketing and service accessibility, infrastructural facilities and supporting technology, stakeholder collaboration, with regulation and policy.

From the four aspects shown in Figure 5, stakeholder collaboration is the main factor in optimizing crop insurance management, with a weighted value of 0.270, followed by marketing and service accessibility (0.219), regulation and policy (0.172), with the infrastructural facilities and supporting technology (0.162) occurring as the last priority factor. The rater agreement value of this cluster was 0.1 (w = 0.1), which is a weak scale, indicating that experts have very varied answers in determining the most prioritized factors, in optimizing crop insurance management.

Observing at a more detailed analysis, the data showed that, experts representing insurance companies (private and Jasindo), noticed stakeholders’ collaboration as a very important role. However, experts representing farmers and researchers noticed marketing and services accessibility to
be the most important factor, while experts representing regulators viewed regulation and policy as their top priority. This diversity of opinion is understood, observing that each expert has a different perspective. Therefore, the result of the geometric mean is a determinant of the factor that is to be prioritized.

3.4. Alternative Cluster

Finally, question is answered, as regards to the most important strategies in optimizing crop insurance management, through strengthening the role of the private sector. Based on the results of data processed, the priority of each alternative is obtained according to the criterion of each expert and their combined opinion. Several strategies in this study are divided into three alternatives, namely, the formation of a state-owned consortium and private insurance, establishment of crop reinsurance pool by government, and free market mechanism.

![Figure 6. Geometric Mean of Alternative Cluster](image)

Based on Figure 6, the formation of a state-owned consortium and private insurance companies is an alternative priority in optimizing crop insurance management, with a weighting value of 0.302, followed by the establishment of a government crop reinsurance pool (0.281) in second place, with free-market mechanism (0.205) occurring last. This cluster's rater agreement value is 0.0625 (w = 0.0625), which is on a weak scale, indicating that experts have very varied answers to determine the most prioritized alternatives in optimizing crop insurance management.

Generally, the formation of a consortium is a quick win strategy, given the current regulations' limitations. The diversity of responses from experts showed the different perspectives they possess, with the formation of a consortium being a strategy agreed upon by experts representing the private sector and agriculture ministry. According to Jasindo and OJK, the formation of pooling is the best strategy, while the farmers and researchers observed that agricultural insurance management should be for the free market mechanism, with the government still providing premium subsidies.

4. Conclusions

This study showed that the influential actor for crop insurance optimization strategy is the government. The government is expected to play an important role in promoting and enabling a legal-regulatory framework. Furthermore, the most successful factor was a collaboration among stakeholders, which should be based on clear rules and a long-term vision. The prioritized objective in optimizing crop insurance strategy was to increase farmer participation, as the rate was very low. However, the selected alternative method in optimizing crop insurance was to form a state-owned consortium with a private-sector enterprise.

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