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Stakeholders and Farmers' Preferences Towards Contract Attributes: Evidence from Hybrid Maize Production in Indonesia

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Abstract

The availability of quality seeds is critical to supporting the sustainability of agriculture, which is further reinforced by the success of contract farming between seed companies and partner farmers. To foster a mutually beneficial partnership, it is essential to align the needs of farmers with the facilities and services provided by the company through well-defined contract terms and conditions. This study aims to explore the contract attribute preferences and their importance levels among farmers, growth leaders, and companies using a quantitative approach. A discrete choice experiment utilizing the conditional logit model was employed to investigate the preferences of 170 farmers, while a descriptive analysis was used to outline the preferences of other stakeholders. The findings indicate that farmers prefer written agreements over informal ones, favor shorter contract durations, and demand higher prices. Additionally, farmers showed a marked preference for receiving inputs, incentives, and credits. The preference patterns of stakeholders align with those of farmers regarding agreement form, inputs, price, incentives, and credit, although stakeholders tend to favor contracts with longer durations. Based on the rank-based quotient method, both growth leaders and farmers identified price, input subsidies, incentives, credits, agreement form, and duration as the most important attributes in maize seed partnership contracts, in descending order of importance. Contrarily, the company prioritizes input subsidies over other attributes, including price, duration, credit, incentive, and agreement form. These insights can inform the design of more suitable and effective contracts, thereby fostering sustainable partnership relationships in the future.

Keywords: choice experiment; conditional logit; contract farming; preference behavior; seeds

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INTRODUCTION

For sustainable agriculture, quality seeds are the most fundamental and essential input. Other inputs can be optimized depending on the quality of the seeds used. Agriculture needs to be supported by seed improvement programs involving both the public and private sectors (Ali, 2016). The seed industry plays a crucial role in agricultural growth. Through a partnership approach and long-term commitment, seed companies can contribute to improving welfare and supporting sustainable agriculture (Manish Lad et al., 2022). Seed companies not only directly benefit farmers but also contribute to food security, economic development at local and global levels, and environmental sustainability (Chellattan et al., 2021). Contract farming, which

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involves pre-harvest agreements between farmers and buyers, has been suggested as a potential means to support sustainable agricultural practices. This arrangement has the potential to address a range of sustainability issues in agriculture, including environmental sustainability, economic stability, and social equity (De Salvo et al., 2018; Hoang, 2021; Ren et al., 2021; Li and Wang, 2024).

Contract farming for cereal products has potential to support and incentivize the adoption of the sustainable farming (Ciliberti et al., 2020; Rossi et al., 2023; Weituschat et al., 2023). Contract farming has been shown to increase the adoption of environmentally friendly practices, such as the use of organic fertilizers and environmentally friendly pest control technologies. This suggests that contract farming can lead to more sustainable agricultural practices by improving the green technological efficiency of farmers and providing the necessary resources and incentives (Ciliberti et al., 2020; Ren et al., 2021; Ciliberti et al., 2023; Li and Wang, 2024). Contract farming provides substantial benefits to cereal product farmers (Anderson and Monjardino, 2019; Bezabeh et al., 2020; Khanal et al., 2020; Frascarelli et al., 2021; Sendhil et al., 2021; Ganewo et al., 2022; Viganò et al., 2022; Ciliberti et al., 2023; Hailu and Mezgebo, 2024).

Various studies have demonstrated that contract farming can increase incomes, improve the welfare of smallholder farmers (Minot and Sawyer, 2014; Champika and Abeywickrama, 2015; Arouna and Zossou, 2017; Khan et al., 2019; Bezabeh et al., 2020; Meemken and Bellemare, 2020; Ganewo et al., 2022; Liang et al., 2023), increase farmer household assets (Sendhil et al., 2021), enhance the quality of agricultural products (Ton et al., 2018) and quality of cereal products (Anderson and Monjardino, 2019; Frascarelli et al., 2021; Viganò et al., 2022; Ciliberti et al., 2023), reduce production risk, and increase market access (Adnan et al., 2021; Sendhil et al., 2021; Nduwimana, 2022). Transaction costs increase farmer participation in contract farming (Dogeje et al., 2023; Xue et al., 2024). Contract farming ensures a stable supply of agricultural products with quality requirements, reducing marketing risks and transaction costs (Pultrone, 2012; Bijman et al., 2020; Khanal et al., 2020) and helping small-scale farmers manage production risks through better access to inputs and technical assistance (Meti et al., 2017).

Seed companies also play a role in improving productivity, nutrition, and resilience among smallholder farmers (Mcguire et al., 2016; Bezabeh et al., 2020; Hailu and Mezgebo, 2024). Through contract farming schemes, companies provide production support in the form of input supply, production technology, and technical assistance (Eaton and Shepherd, 2001; Abebe et al., 2013; Otsuka et al., 2016; Maertens and Vande Velde, 2017; Arouna et al., 2021; Dogeje and Ngaruko, 2023; Neme et al., 2024). Farmers will only participate in contract farming if they can minimize production costs (Cariappa et al., 2023) and transaction costs (Dogeje et al., 2023). Firms will choose contract farming when the expected benefits of contracting outweigh the alternatives, such as buying inputs from the market or producing on their own farms (Bellemare, 2012).

Success in contract farming is determined by cooperation and trust between farmers and companies. Aligning the needs of farmers with the facilities and services provided by the company through the terms and conditions of the contract is essential. Contract attributes can influence a farmer's decision to participate in contract farming by affecting the level of expected utility (Abebe et al., 2013). Contract farming has an important role in the ecological transition of the agri-food sector by promoting sustainable agricultural practices and improving environmental outcomes (Ren et al., 2021; Mi and Ok, 2022; Li and Wang, 2024). The sustainability of contract farming depends on factors such as equitable relationships between farmers and partners, timely provision of inputs, and effective conflict resolution mechanisms (Prasetyo et al., 2022).

Understanding farmers' preferences for contract attributes is critical to developing effective and sustainable partnership agreements. These preferences influence their willingness to participate and remain in the partnership. Junaidi et al. (2023) assessed preferences, which include high live chicken prices, written contracts, short harvest periods, high-quality inputs, prompt payment after harvest, and technical assistance. Trust, risk, and time preference significantly influenced the choice of contract (Fischer and Wollni, 2018). Farmers prefer contracts where buyers provide seeds, inputs, and technical assistance (Abebe et al., 2013; Ruml and Qaim, 2020; Junaidi et al., 2023). They also favor contracts with lower transaction costs (Ochieng

et al., 2017; Chazovachii et al., 2021; Sendhil et al., 2021; Widadie et al., 2021; Dogeje et al., 2023; Xue et al., 2024) and those with transparent quality assessment (Ochieng et al., 2017). Important contract attributes include pricing options, payment terms, delivery arrangements, input provision, and quality standards (Kozhaya, 2020; Rokhani et al., 2020; Tuyen et al., 2022). Smallholders prefer spot markets over contracts with modern retailers due to negative perceptions of contract attributes, particularly regarding quality requirements and involvement of producer organizations (Widadie et al., 2021).

Many studies have examined contract attributes such as contract form, duration, provision of credit inputs, price, payment type, and mentoring across various commodities using quantitative methods, such as broiler chickens (Junaidi et al., 2023), coffee (Laksono et al., 2021), vegetables (Ochieng et al., 2017), pineapple (Fischer and Wollni, 2018), industrial crops (Sauthoff et al., 2016; Bergtold et al., 2017) and potatoes (Abebe et al., 2013). Meanwhile, research has been carried out on cereal commodities (Ciliberti et al., 2023), sorghum (Bergtold et al., 2017), durum wheat (Oliveira et al., 2021), wheat (Weituschat et al., 2023) and rice (Van den Broeck et al., 2017; Tuyen et al., 2022). A discussion on preferences for contract attributes involving farmers, contract buyers, and government through ranking has been conducted in Thailand (Tuyen et al., 2022). However, no study has been conducted on the preferences of maize farmers and seed companies regarding contract attributes as a basis for implementing contract farming.

This study goes further by discussing attribute levels and ranking contract attributes to provide an overview of the importance level of each attribute for each actor in contract farming. Although many studies focus on farmers' preferences, few consider the perspectives of stakeholders, such as growth leaders and companies. The objective of this study is to explore attribute preferences and importance levels among farmers, growth leaders, and companies using a quantitative approach. This research can be used to evaluate existing contracts and develop contract farming governance in maize seed, aiming to maximize profits and farmers' welfare through contract farming schemes, as well as create stability and availability of maize to support sustainability in agriculture.

MATERIALS AND METHOD

Data collection

This study was conducted from February to April 2024 in the Special Region of Yogyakarta, focusing on five sub-regencies: Jetis, Kasihan, and Bambanglipuro in Bantul Regency and Berbah and Pakem in Sleman Regency (Figure 1). These sub-regencies were selected because they represent the development areas of PT XYZ's seed maize producer-farmer partnership, housing the largest population of partnership farmers. This selection provided a representative sample for the study, as maize is the primary crop grown by farmers in this area during the dry season.

Respondents involved in this study include maize farmers, growth leaders, and a representative of the seed company. Regarding the maize farmers, the respondent criteria included both non-partner maize farmers and those in partnership with PT XYZ. Population data were obtained from records of maize farmers in five central sub-regencies, totaling 440 farmers. The sample size was calculated using the formula by Isaac and Michael (1995), resulting in a requirement of 170 farmer samples. A simple random sampling technique was employed to select these samples.

Meanwhile, growth leaders serve as external parties connecting farmers with the seed company. Growth leaders play a crucial role in the partnership's continuity, handling administration and records related to farmers, ensuring the smooth distribution of farming needs such as seeds, pesticides, and credits for purchasing fertilizers, as well as managing harvest sacks, incentives payments, and harvest results. The minimum sample size of growth leaders was determined to be 50% of the total number of growth leaders in the Special Region of Yogyakarta. Based on this criterion, the sample included five growth leaders. One representative from the operational division of PT XYZ seed company was also interviewed. This approach allowed this study to effectively capture the perspectives and roles of growth leaders in the partnership framework, as well as the views from within the seed company, which contribute valuable insights to the study.

Stated choice experiment

The experiment was designed to assess farmers' preferences for contract attributes measured by a discrete choice experiment (DCE). Attribute determination was based on literature

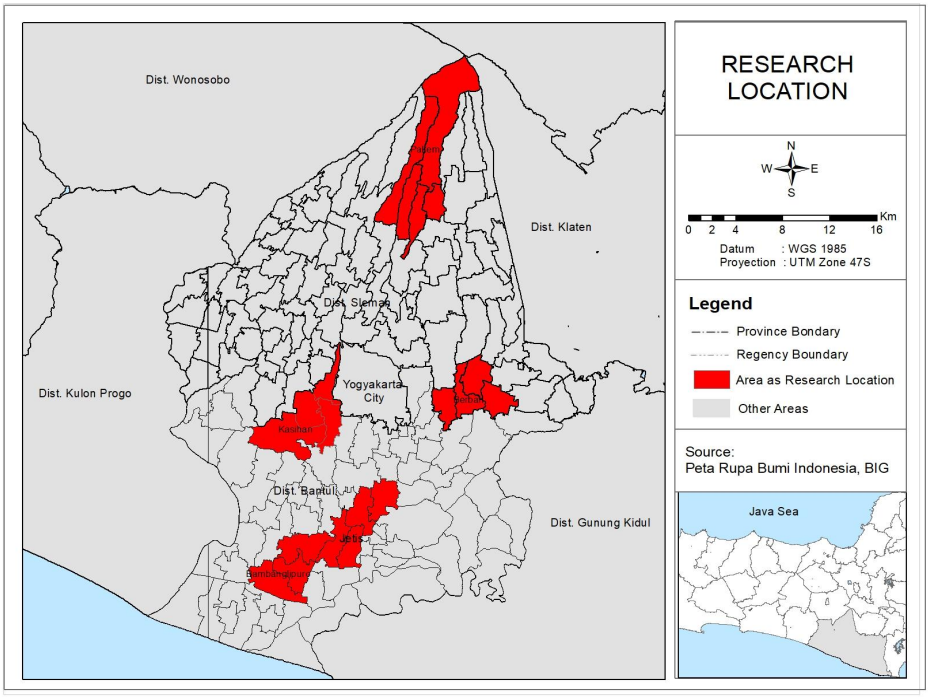

Figure 1. Map of research location

study and interviews with PT XYZ. The attributes consist of (1) form of agreement, (2) contract duration, (3) price, (4) subsidies, (5) incentives, and (6) credit.

The form of agreement refers to a memorandum of cooperation outlining the rights and obligations of both parties (Schipmann and Qaim, 2011; Abebe et al., 2013; Laksono et al., 2021; Junaidi et al., 2023). This attribute has two levels: written and unwritten contracts. A written contract is a formal agreement documented in writing, detailing all terms, conditions, and responsibilities, offering stronger legal protection and minimizing potential disputes. In contrast, an unwritten contract is an oral agreement, not formally regulated in a written document, providing flexibility to adapt to changing situations. However, an unwritten contract can lead to ambiguity or differing interpretations between the parties involved.

Contract duration defines the length of time the cooperation between farmers and stakeholders will last (Sauthoff et al., 2016; Fischer and Wollni, 2018; Tuyen et al., 2022). Contract duration is typically calculated based on the growing season. While existing contracts often last for only one growing season, this model tests three levels of contract duration: 1, 2, and > 2 growing seasons.

The price attribute, commonly used in designing agricultural contract attributes, refers to the market price or premium price with certain adjustments (Schipmann and Qaim, 2011; Abebe et al., 2013; Gelaw et al., 2016; Van den Broeck et al., 2017; Fischer and Wollni, 2018; Laksono et al., 2021; Tuyen et al., 2022; Junaidi et al., 2023). This attribute determines the price that farmers will receive for each kilogram of dried maize with stalks produced. The price attribute includes five levels: 4,500; 4,700; 4,900; 5,100; and 5,300 IDR kg^{-1}.

Input subsidies refer to any assistance provided to farmers to improve and maintain the quality of their produce following established standards (Schipmann and Qaim, 2011; Abebe et al., 2013; Tuyen et al., 2022). Effective input management is crucial for the success of maize seed partnership programs. This study examined four levels of seed and pesticide input attributes, including 100% goods, 100% money, 50% money and 50% goods, and no inputs were provided.

Incentives are given to maize farmers as rewards for achieving desired production or quality targets (Tuyen et al., 2022; Junaidi et al., 2023). These incentives or bonuses are provided as additional payments per kilogram of maize produced. The levels of incentive attributes are: none, 100, 300, and 400 IDR kg^{-1}.

Credit refers to the availability of financial support, which can play a crucial role in facilitating farmers' access to inputs (Schipmann and Qaim, 2011; Tuyen et al., 2022). Credit can be used to finance the purchase of inputs, such as fertilizers, with interest-free payments

made after the harvest. This experiment includes two levels of the credit attribute: no available and available.

The attribute levels are set to achieve a realistic range of possibilities based on the variety of conditions that may occur in the partnership. Each attribute level is given a weight starting from 0. The greater the weight, the more important or desirable the attribute level is. Weighting was done to find out how much each attribute contributes to respondents' preferences. The experimental design was implemented using R Studio software to determine the choice sets referring to Aizaki and Nishimura (2008). The process involved several stages: creating a full factorial design, creating a factorial design, creating a copy of the factorial design, creating choice sets using random selection without replacement, and translating the code.

Based on seven attributes and 20 attribute levels, a full factorial design was created (2^2 x 3 x 4^2 x 5), resulting in 960 combinations of choice sets. Then fractional factorial design was conducted by determining the number of choice sets of at least 16 choice sets. The result is an experimental design using R Studio software, an alternative of choices submitted to farmer respondents. The results of the experimental design were transformed into questions presented on cards (Table 2). Each choice card contained information and pictures to help farmers better understand the contract attributes and make informed choices. Each card presented two alternative hypotheses and one opt-out option (status quo). Respondents might choose the opt-out option if they disagreed with either alternative option 1 or alternative 2.

Model specification

The analysis to determine farmers' preferences for contract attributes was conducted using a conditional logit model, with the maximum likelihood estimation (MLE) method to estimate the coefficient values of the attribute levels with the Stata statistical software. The conditional logit model is an equation with respondent variables of more than two categories or alternative choices. The general form of the conditional logit model is presented as Equation 1. Where, V_{ij} represents the observable component of utility, X_{ij} denotes the various predictors, β is the estimated parameter that indicates the effect of a particular factor on the respondent's propensity to accept the contract, and ε_{ij} is the error term.

Equation 2 is the conditional logit model in this study. Where, n is the respondent-specific identifier, j is the alternative-specific identifier, t is the choice set, V_{njt} is the probability of selecting a specific attribute and level combination from the total profile simultaneously in a given choice set, and β is the preference weight for the attribute level defined as the value of the choice set from the estimation process that minimizes the difference between the observations in the data and the estimated model. The opt-out or status quo option in the model is represented by the alternative specific constant (ASC). ASC is a dummy variable where 0 indicates the status quo option and 1 represents the alternative contract option (Junaidi et al., 2023). The details of the variables are outlined in Table 1.

Stakeholders' preferences

Stakeholder preferences were analyzed using descriptive analysis. Growth leader farmers and company representatives selected options from 16 cards, using the same cards as the growth leader farmers. Each selected attribute was worth one, so the total score for growth leaders was 80, and the score for companies was 16. The score for each attribute was calculated and presented in a frequency distribution table. The results were interpreted, and the attribute with the highest score indicated the stakeholders' preferences for the contract attribute.

Contract attribute rating

Ranking the importance of contract attributes was conducted using rank-based quotient (RBQ)

$$V_{ij} = \beta X_{ij} + \varepsilon_{ij} \quad (1)$$

$$\begin{aligned} V_{njt} = {} & \beta_0 ASC + + \beta_1 CONT_{1njt} + \beta_2 CONT_{2njt} + \beta_3 DUR_{1njt} + \beta_4 DUR_{2njt} \\ & + \beta_5 DUR_{3njt} + \beta_6 PRI_{1njt} + \beta_7 PRI_{2njt} + \beta_8 PRI_{3njt} + \beta_9 PRI_{4njt} + \beta_{10} PRI_{5njt} \\ & + \beta_{11} INP_{1njt} + \beta_{12} INP_{2njt} + \beta_{13} INP_{3njt} + \beta_{14} INP_{4njt} + \beta_{15} INC_{1njt} \\ & + \beta_{16} INC_{2njt} + \beta_{17} INC_{3njt} + \beta_{18} INC_{4njt} + \beta_{19} CRE_{1njt} + \beta_{20} CRE_{2njt} + \varepsilon inj \end{aligned} \quad (2)$$

Table 1. Description of scheme attributes and levels

Attribute	Description	Symbol	Attribute Level
Form of agreement (CONT)	Written agreements for farmers made before production begins	$\beta_1 CONT_{1njt}$ $\beta_2 CONT_{2njt}$	Written Not written
Contract duration (DUR) (Season)	Length of time over which contract farming agreement is to be implemented	$\beta_3 DUR_{1njt}$ $\beta_4 DUR_{2njt}$ $\beta_5 DUR_{3njt}$	1 2 > 2
Price (PRI) (IDR kg^{-1})	Selling price of maize produced by farmers	$\beta_6 PRI_{1njt}$ $\beta_7 PRI_{2njt}$ $\beta_8 PRI_{3njt}$ $\beta_9 PRI_{4njt}$ $\beta_{10} PRI_{5njt}$	4,500 4,700 4,900 5,100 5,300
Subsidies (INP)	Assistance provided to farmers in the form of production inputs, consisting of seeds and pesticides	$\beta_{11} INP_{1njt}$ $\beta_{12} INP_{2njt}$ $\beta_{13} INP_{3njt}$ $\beta_{14} INP_{4njt}$	Not available Goods 100% 50% money, 50% goods 100% money
Incentives (INC) (IDR kg^{-1})	Rewards provided to farmers for achieving production targets	$\beta_{15} INC_{1njt}$ $\beta_{16} INC_{2njt}$ $\beta_{17} INC_{3njt}$ $\beta_{18} INC_{4njt}$	Not available 100 200 300
Credit (CRE)	Credit provided to farmers for the purchase of fertilizer, tailored to the size of cultivated land area	$\beta_{19} CRE_{1njt}$ $\beta_{20} CRE_{2nj}$	Not available Available

Table 2. Example of choice card for farmer respondents

Attributes	Option 1	Option 2	Option 3
Form of agreement	 Not written	 Not written	Did not choose options 1 and 2
Contract duration	 2 growing seasons	 1 growing season	
Price (IDR kg^{-1})	5,100	4,700	
Subsidies	 100% money	 100% goods	
Incentives (IDR kg^{-1})	200	No Available	
Credit	Available	Available	
Farmer's choice	Option 1 ☐	Option 2 ☐	Status quo ☐

analysis. This analysis was used to explore the most important contract attributes according to the actors in the maize seed partnership. This method has been used in similar research (Tuyen et al., 2022) and applied to examine the rank order (Selvanayaki and Selvi, 2015; Chiem et al., 2022). The RBQ score was calculated by adopting the formula from Garret and Woodworth (1969) (Equation 3).

$$RBQ = \frac{\sum f_{ri}\,(n+1-ri)}{N \times n} \times 100 \qquad (3)$$

Where, r_i is the r^{th} rank order of the i^{th} attribute (or attribute level), N is the total number of

respondents, n is the total number of attributes identified, f_{ri} is the frequency of respondents assigning the r^{th} rank order to the i^{th} attribute. The RBQ calculation results are sorted in descending order, with the highest RBQ value getting the 1st rank.

RESULTS AND DISCUSSION

Respondent characteristics

According to Table 3, the demographic profile shows that the majority of farmers are in the productive age group. In terms of education, most farmers have completed primary school (38.2%). In terms of gender, farming is dominated by men, with men accounting for 90% of the workforce. Most farmers have more than 10 years of farming experience, reflecting a considerable depth of practical knowledge. Farmers consider farming their main occupation, with more than half of them managing land areas exceeding 1,000 m^2. Interestingly, a high percentage of farmers participate in extension programs, indicating their openness to further education and innovations in farming practices.

Maize seed contract farming involves three main actors: companies, growth leaders, and farmers. Growth leaders are private business entities run by individuals to establish partnerships with companies and farmers. The company establishes agreements with the growth leaders regarding the commodities to be produced, the number of facilities, and quality standards. Farmers produce commodities according to the instructions and contractual agreements. The growth leaders act as liaisons between the farmers and the company. The company provides agricultural inputs including seeds, pesticides, credit, and additional agricultural equipment if needed. The growth leaders distribute these resources to farmers assisted by the company's field officers. In addition, they are responsible for contracting farmers, keeping administrative records, scheduling harvests, and distributing payments on time. To maintain production quality, the company employs field officers who conduct regular monitoring from planting to harvesting, ensuring that farmers adhere to the prescribed procedures and standards. This integrated approach facilitates effective maize seed production under the contract farming framework.

Farmer preferences

Farmers were asked to select their preferred option on 16 cards, with each card containing two options for a combination of contract attributes and a status quo option if the farmer did not select either option 1 or 2. Based on the calculations, 831 (10.13%) out of 8,203 observations chose the status quo. This illustrates that the majority of maize farmers tended to accept the partnership contract offered by the company rather than continue maize farming without a contract. The results of the conditional logit model estimation, used to determine farmers' preferences for maize seed partnership contract attributes, are presented in Table 4. The pseudo-R^2 values for the model are 0.5282 (partnership farmers), 0.5183 (independent farmers), and 0.5199 (partnership and independent farmers), respectively. These values indicate that the independent variables, namely the contract attributes, explain 52.82, 51.83, and 51.99% of the farmers' preferences, while the remaining variation is due to factors outside the model. A McFadden pseudo-R^2 value of 0.5 suggests that, overall, the model provides a good fit to the data (Mcfadden, 1974). The results of the Prob>chi^2 test on each model have a value of 0.000, indicating that all models estimated together have a statistically significant effect.

ASC is defined as the respondent's choice not to choose between alternatives 1 and 2 (status quo). This shows that farmers prefer to cultivate maize outside the contract. The ASC values

Table 3. Sample characteristics

Farmer characteristics	Farmer respondent		
	Farmer partnership (n = 80)	Non-partnership farmers (n = 90)	Overall (n = 170)
Age (years)	59	60	60
Education (years)	9	10	9
Gender (% male)	88.75	91.11	90.00
Farming experience (% > 10 years)	31.25	44.44	53.00
Specialization (% main job)	81.25	58.88	78.23
Land area (% > 1,000 m^2)	48.75	57.77	54.11
Counseling (% join)	98.75	51.11	73.25

estimated in the partnership and overall farmer models are significant and positive, indicating the tendency of farmers not to have a maize seed partnership contract scheme. A positive ASC value indicates farmers' underlying preference to opt out of contract farming in the future (Schipmann and Qaim, 2011; Permadi et al., 2018; Laksono et al., 2021; Nong et al., 2021). The ASC value in the independent model is positive but insignificant, meaning that farmers are neutral between choosing to produce maize independently or under a partnership scheme (Laksono et al., 2021).

Each contract attribute was tested to see the influence on farmers' preferences with a significance test. The results of the partial test of the attributes show that in each estimation model the price, subsidy, incentives, and credit attributes had a significant effect on farmers' preferences in choosing maize partnership contracts. Meanwhile, the form of agreement attribute is significant in the model of partnership farmers and joint farmers (partnership and non-partnership). The contract duration attribute is significant in the models for independent and joint farmers (partnership and independent). Attributes that were found to be insignificant suggest that they were not considered by farmers when choosing the maize seed partnership scheme. Many significant contract attributes mean that farmers care about the design features of the contract offered (Haile et al., 2019).

When establishing a maize seed partnership, both independent farmers and all farmers prefer written contracts, as indicated by the negative and significant coefficient. This finding aligns with research on chicken farmers' preferences for written contracts, where farmers favor the written form (Abebe et al., 2013; Junaidi et al., 2023). However, some partnership farmers do not prioritize written contracts because they trust the head of the farmer group, who serves as a representative. In certain research areas, farmers do not feel the need for a cooperation contract because of the closeness and trust they have in the farmer group leader. Most farmers who have participated in maize partnerships multiple times do not consider written contracts essential. Other studies, such as those on coffee farmer partnerships, indicate that farmers prefer unwritten contracts (Laksono et al., 2021). Similarly, in a study of Italian wheat farmers, the sample farmers ignored written contracts in favor of long-term relationships based on mutual trust (Solazzo et al., 2020). Nevertheless, written contracts offer more clarity for both parties in executing operational activities compared to oral or informal agreements. Another study reported that farmers in Ghana regretted accepting oral contracts from agribusiness companies (Barrett et al., 2012).

Farmers are more likely to accept long contract durations if they receive additional compensation. However, other research suggests that farmers generally prefer shorter contract durations because they offer greater flexibility in managing their farming businesses (Bergtold et al., 2017). The number of maize crop seasons varies by region in the study area. In some areas, farmers can plant maize for a maximum of two growing seasons per year, while in other regions, farmers are concerned about long contract durations. These concerns arise because farmers' decisions regarding cultivation contracts are influenced by the production results from previous periods. Farmers prefer shorter contract durations, a preference that can be influenced by various factors such as education level, age, land size,

Table 4. Results of the conditional logit estimation model of farmers' preferences for attributes

Attributes	Farmer partnership			Farmer non-partnership			Overall		
	P>|z|	Coefficient	Odds ratio	P>|z|	Coefficient	Odds ratio	P>|z|	Coefficient	Odds ratio
ASC	0.000	7.052***	1155	0.963	21.548^{ns}	2.280	0.000	7.870***	2618
Agreement	0.650	-0.060^{ns}	0.941	0.014	-0.313**	0.730	0.032	-0.196**	0.821
Duration	0.054	-0.171*	0.842	0.514	0.052^{ns}	1.053	0.444	-0.044^{ns}	0.955
Price	0.000	0.421***	1.524	0.000	0.446***	1.562	0.000	0.431***	1.539
Subsidies	0.000	0.336***	1.400	0.000	0.312***	1.367	0.000	0.321***	1.379
Incentives	0.000	0.264***	1.303	0.000	0.384***	1.469	0.000	0.329***	1.390
Credit	0.000	1.261***	3.532	0.000	1.232***	3.429	0.000	1.243***	3.447
Log-likelihood		-662.72			-767.43			-1439.37	
Pseudo R^2		0.5282			0.5183			0.5199	
Prob>chi^2		0.0000			0.0000			0.0000	

Note: Significance levels are *** = $p < 0.01$, ** = $p < 0.05$ and * = $p < 0.1$

participation in institutions, and farmers' preference for risk (Broch and Vedel, 2012). In other conditions, farmers' income regarding contract duration is still debatable. On one hand, long-term contracts can facilitate planning and provide income security. On the other hand, many farmers are hesitant to invest in cultivating contract crops for extended periods due to the lack of flexibility (Schulze et al., 2024).

All farmers prefer a high maize selling price, as indicated by the positive and significant coefficient value. This finding is consistent with research showing that the higher the price offered in the contract scheme, the more farmers are likely to enter into a partnership (Gelaw et al., 2016; Haile et al., 2019; Laksono et al., 2021; Oliveira et al., 2021). Although the selling price of partnership maize remains below the market price, farmers are still interested in joining the partnership because of the benefits provided, such as subsidized seeds and pesticides, which help reduce maize production costs. Higher contract payments are necessary to increase farmers' willingness to adopt new practices, as they must sacrifice long-standing habits and adhere to the systems and rules outlined in the contract. Increased payments can be seen as compensation for the additional efforts required by farmers, such as conservation (Tanaka et al., 2022). In contrast to these findings, farmers in Taiwan are willing to accept lower payments in contract farming in exchange for an eco-label. This suggests that economic incentives are not always the primary motivation for farmers to enter into a partnership because non-monetary incentives, such as eco-labels, can offer farmers the opportunity to earn a better income (Chang et al., 2017). Partner companies provide facilities that can assist farmers in maize farming, including the provision of seeds and pesticides based on the land area planted. Farmers prefer input subsidies in maize seed partnerships. This result is consistent with several studies showing that farmers prefer the provision of inputs by the partner company to provide qualified yields and risk-sharing (Schipmann and Qaim, 2011; Abebe et al., 2013; Van den Broeck et al., 2017).

Incentives or bonus payments are given to farmers if production results match the production target. The positive significance value for farmers' preference for maize seed partnership contracts in all models indicates that for every one-unit increase in the incentive attribute, the likelihood of farmers accepting the partnership scheme increases, as reflected by the odds ratio. This finding aligns with research by Bergtold et al. (2017). The provision of incentives is a way for the company to show appreciation for meeting production targets. These incentives make the partnership scheme more attractive to farmers, encouraging them to choose it over producing commercial maize. Farmer participation in partnerships is likely to increase if farmers have a positive preference for incentives, with the expectation that incentives will enhance their income (Vaissière et al., 2018). In another study, the individual incentive attribute showed lower significance compared to the collective incentive, suggesting that collective incentives are more effective in motivating farmers to join the contract scheme (Thiermann et al., 2023). Contracting schemes require coordination and collectivity to be efficient for companies. As a result, companies often target farmer groups within a block area. In many cases, landscape-level coordination is necessary to ensure sufficient participation and coverage of the land. Collective incentives play a crucial role to encourage farmer participation in such schemes (Sumrada and Erjavec, 2022).

The company provides credit in the form of cash for purchasing fertilizers, with loan repayments made after harvest. Loans are an important attribute for most farmers, as they help reduce the production costs of farming. Credit has two attribute levels: availability of credit and no credit. All estimated models indicate that farmers prefer contracts with credit. The high coefficient on this attribute reflects that the availability of credit is the most attractive factor for farmers to join a production contract, consistent with the findings of Schipmann and Qaim (2011). Credit is a tradeoff to help farmers implement standardized farming practices (Tesfaye and Brouwer, 2012) or an attraction for farmers to adopt more environmentally favorable farming practices (Cranford and Mourato, 2014).

Stakeholders' preferences of contract attributes

A company's preference when establishing an association contract may include several aspects outlined to ensure effective and mutually beneficial collaboration between all parties involved in the partnership. The contract should align with the company's goals and outline the details of the operation, including the obligations and duties of each party, standard operating procedures, and timelines. The company will build up the item or benefit quality guidelines it anticipates from its accomplices. This includes

technical specifications, regulatory compliance, and quality control procedures that must be followed by both growth leaders and farmer companies will set reasonable and competitive costs for items or administration given by their partners. The results of the study on growth leaders' and company's preferences are presented in Table 5. This section includes responses from 80 growth leaders and 14 responses from the company, derived from a total of 16 card responses provided by five growth leaders and one operational division of PT XYZ.

Written agreements are made by the growth leader after consultations are conducted and farmers agree to engage in contract farming. Farmers have more confidence in a written agreement. The study shows that companies tend to prioritize written contracts in partnerships, as these agreements provide clarity and legal certainty for both parties. In addition, companies tend to prefer contracts with a longer duration than the current two-growing-season arrangement, as these provide stability and sustainability in the supply of raw materials, ensuring the quality of maize parts for seed production. However, the company prefers two-growing-season contracts over longer ones because the agricultural sector is also vulnerable to risks such as failure and price fluctuations. Therefore, contracts that are too long may be detrimental to both the company and farmers due to the lack of flexibility to adjust to changing conditions. The existence of contractual agreements with short terms allows for a greater expenditure of transaction costs (Bijman et al., 2020). Longer contract terms, however, require more penances from the company, as farmers expect compensation for the increased contract duration (Msawil et al., 2022). This can pose a limitation for the company.

Competitive pricing is highly prioritized by companies so that they can maintain competitiveness and optimal profits in a competitive market. This study shows that pricing is important among the contract attributes. This result is in line with the outcome of the previous research (Abebe et al., 2013). A fair distribution means the company can adjust the price, which benefits farmers and serves as a motivation for them to join the partnership. Input subsidies in the form of seeds and pesticides are a very important attribute for companies. Companies prefer input subsidies in the form of 100% goods. By supplying production inputs to farmers, they can control the quality of the raw materials they receive. The provision of inputs is the most important attribute of the six attributes, which is in line with the prior studies (Abebe et al., 2013; Widadie et al., 2021). High-quality inputs will result in better agricultural output, which is important to meet the quality standards desired by the company. Providing the right production inputs can help reduce the risks associated with crop failure or low yield quality. This helps companies to secure input supply and reduce losses due to production fluctuations. Subsidies increase yields and motivate farmers to grow contract crops, reducing the burden of production costs (Li et al., 2022).

In addition, incentives and credit are also desirable for the company, as these can provide additional motivation for the partner farmers and support the sustainable development of

Table 5. The company and growth leader preference distribution of contract attributes

Contract attributes	Frequency		Contract attributes	Frequency	
	Company	Growth leader		Company	Growth leader
Status quo	0	50	Subsidies		
Form of agreement			No available	1	1
Written	9	20	100% goods	6	9
Not written	7	10	50% goods, 50% money	4	12
Contract duration			100% money	5	8
1 growing season	3	8	Incentives (IDR kg^{-1})		
2 growing seasons	8	10	None	6	10
>2 growing seasons	5	12	100	3	11
Price (IDR kg^{-1})			200	4	7
4,500	2	5	300	3	2
4,700	2	3	Credit		
4,900	5	5	No available	8	25
5,100	4	3	Available	8	5
5,300	3	14			

their businesses. By providing an interest-free credit facility, the company can help farmers gain easier access to the capital required for fertilizer purchases. This is important as many farmers may not have sufficient capital to purchase fertilizer. Credit for fertilizer purchases can help reduce the risks associated with fertilizer shortages or insufficient application, ultimately contributing to better crop yields and quality. By having access to sufficient fertilizer, farmers have less risk associated with production disruptions or reduced yields due to fertilizer shortages. Overall, credit facilities for fertilizer purchases in partnerships are an important strategy for companies to support partner farmers, increase agricultural productivity, and build sustainable relationships in the agricultural supply chain. This fact is in line with the results of research where credits can increase the adoption of contract farming and increase the number and quality of farms (Bellemare and Bloem, 2018; Girma, 2022; Gelata and Han, 2024).

The attribute preferences of growth leaders align closely with those of companies, including preferring written contracts, long contract duration, high prices, input subsidies, and incentives. However, growth leaders differ from companies in their preference for the credit attribute. Growth leaders tend to deprioritize credit, indicating that they place greater importance on other attributes, such as competitive pricing and input subsidies, over the provision of credit. Based on interviews with growth leaders, credit is not mandatory and is only provided to farmers who specifically need it for purchasing fertilizer. Consequently, some farmers may not prioritize credit compared to other facilities offered in the partnership. The growth leader serves as the link between the company and the farmers, playing a pivotal role in facilitating the distribution of input needs, making contract agreements, making payments, and gathering feedback or aspirations from farmers. This central position underscores the significance of growth leaders in contract farming. The company employs field officers who conduct direct monitoring of farmers throughout the production process to ensure the required quantity and quality are achieved and to address any issues farmers face until harvest. Although the company determines the price, the amount of input, and the provision of credits, the growth leaders hold the authority to negotiate and channel the aspirations and needs of the farmers. Therefore, harmonizing the preferences of the company, growth leaders, and farmers is essential to fostering mutually beneficial cooperation.

Importance level of contract attributes

The study results presented in Table 6 show that farmers and growth leaders have similar preferences for the importance of attributes. The six most important attributes are price, input subsidy, incentive, credit, contract form, and contract duration. However, there is heterogeneity in how the attributes are ranked from the company's perspective. According to the company, the input subsidy is the most important attribute of the contract, followed by the selling price, contract duration, credit, incentive, and contract form. This study shows the selling price option to be the most important for farmers and growth leaders, which is consistent with various studies. Both farmers and growth leaders prefer higher prices (Abebe et al., 2013; Ochieng et al., 2017; Van den Broeck et al., 2017; Tuyen et al., 2022). The selling price determines the income that farmers get from the harvest. A competitive selling price can improve farmers' welfare. A fair and profitable selling price is an important factor in maintaining the sustainability of partnership farming. Farmers need to earn a sufficient profit to continue developing their farming businesses. The second most important attribute is input subsidies. This shows that farmers and growth leaders favor the provision of inputs from the company. Inputs such as improved seeds and pesticides

Table 6. Results of rank-based quotient analysis of contract attributes

Contract attributes	Company		Farmer		Growth leader	
	RBQ	Rank	RBQ	Rank	RBQ	Rank
Form of agreement	16.66	6	33.33	5	33.33	5
Contract duration	66.66	3	16.66	6	16.66	6
Price	83.33	2	100.00	1	100.00	1
Subsidies	100.00	1	83.33	2	83.33	2
Incentives	33.33	5	66.66	3	66.66	3
Credit	50.00	4	50.00	4	50.00	4

can increase the agricultural productivity of partnership farmers. Through the provision of quality and adequate inputs, companies can help farmers produce larger and higher-quality crops.

According to the company, the most important attribute of the contract is the input subsidy in the form of seeds and pesticides. Through the provision of the right inputs, the company can help ensure that the products produced by the partnership farmers meet the set quality standards. Providing sufficient and timely inputs can help reduce the risk of losses due to agricultural disruptions, such as pests or plant diseases. Adequate inputs can also help reduce the risk of crop failure or reduced yields due to unfavorable weather conditions. Providing inputs is one way for companies to demonstrate their commitment to the success of partnership farmers. By helping farmers improve their yields and welfare, companies can build strong and mutually beneficial partnership relationships in the long run.

CONCLUSIONS

This study reveals varying preferences and levels of importance assigned by different stakeholders to the attributes of maize seed production contracts. Farmers exhibit a preference for written agreements over informal ones, favoring short contract durations, high prices, subsidies, incentives, and credits. Stakeholders' preferences align closely with those of farmers regarding the attributes of agreement form, inputs, price, incentives, and credits. However, stakeholders demonstrate a preference for contracts with longer durations. Results indicate that farmers and growth leaders similarly rank the importance of these attributes. The order of importance for the six key attributes in maize seed partnership contracts is as follows: price, input subsidy, incentive, credit, contract form, and duration. In contrast, the company prioritizes the input subsidy attribute as the most important, followed by price, duration, credit, incentive, and contract form, respectively. The findings emphasize the importance of competitive pricing, input subsidies, trust-building, and transparent communication in developing sustainable maize seed partnership agreements. Companies are encouraged to establish forums with growth leaders and farmers, conduct regular evaluations, and adapt to environmental changes to ensure alignment and effectiveness. Further research on satisfaction, willingness to accept (WTA)/ willingness to pay (WTP) analysis, and comparative studies between contracted and non-contracted farmers can provide deeper insights into improving partnership mechanisms.

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