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Institutional Interventions to Reduce Risks of Shallot Farmers in Bima Regency

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ABSTRACT

Abstract: The theory of market institutions emphasizes the Government's role in creating a healthy and competitive market structure, such as through policies that encourage market access diversification for farmers, strengthening farmers' bargaining position, and oversight of monopolistic or oligopolistic practices. However, most of the falling prices faced by shallot farmers in Bima Regency, one of the shallot production centers in West Nusa Tenggara Province, Indonesia, stems from the pull and push forces between supply and demand at the national level. The weak Government intervention in market institutions exacerbates this problem. The laboratory experiment results showed that the probability of market failure risk faced by shallot farmers reaches 86% when no institutional intervention exists. This finding emphasized the urgency of the role of institutional intervention in reducing the risks faced by shallot farmers in Bima Regency. The lessons from this laboratory experiment also emphasized that institutional interventions through Regional-Owned Enterprises (BUMD) and the formation of distributor clusters effectively reduce the risk of market failure farmer face. Meanwhile, the collective community power among farmers can be social capital to support the success of institutional interventions.

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A. INTRODUCTION

Bima Regency is one of the shallot production centers in West Nusa Tenggara (NTB), Indonesia. The Government has designated it as a shallot development area regulated by the Minister of Agriculture Number 14 Decree of 2015 (Abbott & McCalla, 2002). It is recorded that around 70% of the shallot supply in NTB Province comes from Bima Regency (Altmejd et al., 2019). According to previous research, competition at the national level primarily determined the fluctuation in shallot prices (BPS, 2021; Haryati et al., 2022; Hasan et al., 2017). The Government has provided guidance and technical support to shallot farmers through the relevant ministries. The aim is to guide the suitable planting and harvesting time based on weather and environmental conditions in each region. This is done to prevent production surpluses in one area that can cause shallot prices to plummet in other areas (Mamahit et al., 2022). However, the final decision on when to plant and harvest remains in the hands of the farmers as the main actors in the field. So, the Government cannot intervene too far in the farmers' planting decisions (Abbott & McCalla, 2002; Quisumbing & Doss, 2021).

Farmers are the backbone of the agricultural supply chain, yet they are also the most vulnerable to various risks. Farmers are in a weaker position when facing market

fluctuations and natural challenges Abbott & McCalla (2002); Mullen et al. (2000); Nurjumiyati et al. (2018) than distributors, wholesalers, or retailers. Research conducted Nurjumiyati et al. (2018) indicates that the profit margin for farmers exceeds the difference in marketing costs, which are the expenses incurred by actors to perform marketing functions. Table 1 shows that the profit margin for Chain I is recorded at IDR 276,000 per quintal of shallots. This figure is lower than the profit margin in Chain II, which is IDR 305,000. The field observations during the period of January-February 2024 found similar facts. The profit margin for Chain I exceeded the marketing cost difference in Chain II, where the profit margin for Chain I was recorded at IDR 400,000 per quintal of shallots. This figure is lower than the marketing margin in Chain II, which reached IDR 507,000. January - February is when the price of shallots in Bima Regency plummeted compared to the previous period (September 2023). Although the profit margin in the study Nurjumiyati et al. (2018) increased from IDR 276,000 to IDR 400,000 in this observation, the difference in margins between the two periods is quite significant, whereas the margin difference in the previous study was only Rp 29,000, and in this observations, the difference increased to IDR 170,000.

Recognizing this condition, the Government has rolled out various assistance programs to protect and empower farmers. Various initiatives have been launched, ranging from forming shallot production clusters, fertilizer subsidies, provision of superior seeds, and pest and disease control to technology assistance and infrastructure improvements (Hasan et al., 2017; Nursan & Wathoni, 2021; Van De Klundert, 1999). These efforts have yielded positive results (Audretsch et al., 2012; Barham et al., 2015; Nitzan, 2014). Shallot productivity as a whole has continued to experience significant increases from 2017 to 2021. This indicates that Government programs have had a tangible impact on the welfare of farmers and the growth of the national shallot industry (Haryati et al., 2022; Nitzan, 2014; Setiani et al., 2019). However, like other leading agricultural commodities in Indonesia, the fluctuation in shallot prices remains a specter that often haunts the industry.

At website of Panel *Harga Badan Pangan*, in February 28, 2023, the price of shallots in West Nusa Tenggara was IDR 26,270 per kg, decreasing to IDR 18,170 per kg on February 29, 2024. In the same month, the highest national price was recorded in South Sulawesi at IDR 30,000 per kg, while the lowest was in Jambi at IDR 16,350 per kg, with a national average of IDR 20,910 per kg. On May 30, 2023, the price of shallots was IDR 23,760 per kg, increasing to IDR 28,980 per kg on May 31, 2024. The highest price in May 2023 was found in Banten at IDR 34,000 per kg, and the lowest in Jambi at IDR 13,610 per kg, with a national average of IDR 21,240 per kg. In May 2024, the highest price reached IDR 37,500 per kg in East Nusa Tenggara, while the lowest was IDR 22,800 per kg in South Sulawesi, with a national average of IDR 29,870 per kg. In February 2022, the price difference was only 1.11%. However, a year later, in February 2023, this disparity increased to 8.8% (Nursan & Wathoni, 2021; Setiani et al., 2019; Triyono & Sulistyaningsih, 2021a). This phenomenon indicates that although the average price at the national level has experienced an increase, the price gap between regions has become higher. This indicates that the suboptimal role of market institutions has caused the loss

of control from non-market institutions (Campbell & Klaes, 2005), such as the role of the Government in maintaining price stability (B. P. T. P. N. B. L. P. N. T. Barat, 2019; G. N. T. Barat, 2019; B. Indonesia, 2022). The role of market institutions, particularly those played by the Government at the local level, is crucial in reducing the price fluctuations of shallots. Theoretically, market institutions function as regulators that create stability within the economic system by providing a framework that facilitates interaction between producers and consumers. In the context of shallots, local governments can build efficient market infrastructure and establish mechanisms and regulations for a distribution system that allows farmers better access (Luckyardi et al., 2022; Priya et al., 2018).

We interviewed shallot farmers from five sub-districts, the Agriculture Office of Bima Regency, and the Regional Development Planning Agency (BAPPEDA) of Bima Regency (24,25). From this investigation, we found that although playing an important role, shallot farmers in Bima Regency have feeble bargaining power in the distribution chain. The distribution chain, which distributors, collectors, or retailers fully control, causes farmers to have insufficient bargaining power. This is because farmers have almost no alternative market access other than to private distributors. In conditions of a shallot surplus in Bima Regency, distributors are only willing to buy the farmers' harvest at the lowest price (Setiani et al., 2019). Distributors have much stronger bargaining power than farmers because they control the supply chain. By exploiting the farmers' limited market access, distributors are in an oligopolistic position in the shallot commodity market. The absence of Government intervention in market institutions exacerbates this problem (Nitzan, 2014; Van Der Burg, 2000). Market institutional theory emphasizes the Government's role in creating a healthy and competitive market structure, such as through policies that encourage market access diversification for farmers, strengthening farmers' bargaining position, and monitoring monopolistic or oligopolistic practices. Almost all the negative impacts faced by shallot farmers in Bima Regency originate from the tug-of-war between supply and demand at the national level. In contrast, some negative impacts originate from lousy weather, pest attacks, and high production costs (Nursan & Wathoni, 2021).

Previous research related to efforts to reduce risks for farmers in the agricultural sector has elaborated on general aspects, such as diversifying food sources to anticipate global climate change (Kunimitsu et al., 2020; Kurniawan et al., 2019), utilizing modern agricultural technology, using quality seeds, downstream processing of agricultural products (Hasan et al., 2017; Luckyardi et al., 2022; Nugroho, 2021), supply chain coordination, quality of packaging, as well as improving global competitiveness, branding the agricultural sector, and utilizing distribution networks (Putsenteilo et al., 2020). However, the problems faced by farmers are not only related to production aspects but also institutional aspects. Some previous studies have explained that almost every problem, from the production to the marketing level in the agricultural sector, occurs due to poor market institutions (Kementerian Menteri Pertanian Republik Indonesia, 2015; Sulistiowati et al., 2021). Although previous research has identified that many problems

occur from the production to the marketing level, there has not yet been a study that explicitly explores the types of institutional interventions that effectively address these issues. Therefore, this research aimed to fill that gap by formulating appropriate and applicable patterns of institutional intervention.

Additionally, by utilizing laboratory experiment results, this study provides empirical evidence to support more measurable policy recommendations. Therefore, this research sought to provide appropriate implications in two ways. First, the implementation of Government intervention in the shallot agricultural sector should be reconstructed in the form of assistance and incentives and the aspect of market institutions. Second, the appropriate pattern of institutional intervention should be found to reduce the risks shallot farmers face in Bima Regency.

B. METHODS

1. Research Design

The researchers intended to conduct a quasi-experimental laboratory study to assess the effects of specific independent variables/treatments on a dependent variable under controlled conditions. This design aimed to generate data by converting input variables into output variables called experimental responses. Other influencing factors must be controlled to minimize experimental error and strengthen causal conclusions (Triyono & Sulistyaningsih, 2021a; Webster & Sell, 2014). The experimental group is selected based on specific criteria, divided into treatment and non-treatment groups. Each group consists of four actors: (1) shallot farmers, (2) distributors, (3) Regional-Owned Enterprises (BUMD), and (4) Farmer Groups (Gapoktan). The Gapoktan actor represents the farmers' association and is selected from the shallot farmer participants. Criteria for the farmer role include: (1) students from the University of Muhammadiyah Bima who are shallot farmers, (2) students assisting their parents/family in shallot farming, and (3) students working part-time as shallot farmers. Distributors are selected based on the criterion of being students from the University of Muhammadiyah Bima engaged in distribution. Recruiting participants from this university is feasible, as many students and their families are involved in agriculture, particularly shallots, which significantly contributes to the economy of Bima Regency. For BUMD actors, the criteria include lecturers from the Department of Entrepreneurship at the University of Muhammadiyah Bima, who have conducted research and community service related to BUMD activities and similar enterprises.

2. Experiment Design

The treatment design whose effects on the experimental response observed in this experiment consists of six treatment combinations formed from the combination of three institutional arrangement factors, which were (1) Arrangement of the distributor area (warehouse for absorbing shallot commodities), denoted as (DP); (2) Regional-Owned Enterprises (*Badan Usaha Milik Daerah/BUMD*) functioning as the absorber of shallot commodities, denoted as (bu); and (3) Farmer group association (*Gabungan Kelompok*

Tani/ Gapoktan) as the determinant of prices through centralized agricultural contracts, symbolized as (kp).

The experimental design in this research is a randomized block design, utilizing six treatment combinations to minimize bias, with each experiment repeated five times for a total of 30 trials. Each trial involves one group of participants under the following (1) Four randomly selected distributors and 12 qualified shallot farmers conduct experimental simulations with treatment (denoted as p-dp); (2) Four randomly selected distributors and 12 qualified shallot farmers conduct simulations without treatment (denoted as t-dp); (3) Three randomly selected distributors, one BUMD participant, and 12 qualified shallot farmers conduct simulations with treatment (denoted as p-bu); (4) Three randomly selected distributors, one BUMD participant, and 12 qualified shallot farmers conduct simulations without treatment (denoted as t-bu); (5) Three randomly selected distributors, one Gapoktan participant, and 12 qualified shallot farmers conduct simulations with treatment (denoted as p-kp); and (6) Three randomly selected distributors, one Gapoktan participant, and 12 qualified shallot farmers conduct simulations without treatment (denoted as t-kp).

Thus, the total number of experimental participants was 96. However, for efficiency reasons, only half of the total participants are used, 48 experimental participants, where each person performs 2 treatment combinations. The experimental design in the laboratory research used a randomized block design, with four institutional arrangement factors that can be symbolized as follows:

$$Y_{ijkn} = \pi + \beta_i + \delta_j + \theta_k + (\beta\gamma)_i + (\delta\gamma)_k + (\theta\gamma)_k + (\beta\sigma)_i + (\delta\sigma)_k + (\theta\sigma)_k + \varepsilon_{ijkn}$$

Where, (1) $Y\ i\ j\ k$ n is The risk of shallot farmers at the (i-th dp), (j-th bu), and (k-th kp) for the (n) replication, where, dp = treatment factor, bu = block factor, kp = institutional arrangement factor, n = replication $Y = \sum_x \int_0^1 b$ with b is all independent variable, and $\int_0^1 b$ shows the criteria between 0 – 1 (very high risk – nothing risk); (2) π is The general average of Y (if the slope coefficient = 0); (3) β_i is The coefficient of the dp to-i (i=1 for p=dp; i=0 for tp-dp); (4) δ_j is The coefficient of the bu to-j (j=1 for p-bu; j=0 for tp-bu); (5) θ_k is The coefficient of the kp ke-k (k=1 for p-kp; k=0 for tp-kp); (6) γ is The coefficient of farmer literacy that determines the decision on dp, bu, and kp (i,j,k=1 for farmers with good agricultural literacy; i,j,k=0 for farmers with poor agricultural literacy); (7) σ is The coefficient of other farmers' success that determines the decision on dp, bu, and kp (,j,k=1 for farmers who make decisions not based on the success of other farmers; i,j,k=0 for farmers who make decisions based on the success of other farmers); and (8) $\varepsilon\ i\ j\ k$ n is The error for the risk of shallot farmers at the (i-th dp), (j-th bu), and (k-th kp) for the nth replication.

3. Tools Analysis

Data processing in this study utilized R-Studio software version 4.4.1, with analysis of covariance (ANCOVA) as the analytical tool to test the statistical significance of institutional intervention effects on the risk faced by shallot farmers. If the F-test statistic showed a significant effect (p < 1%, 5%, 10%), the Information Theory (Infortheo) approach was employed. Infortheo used entropy to measure uncertainty in data distribution, which was crucial since all variables in this study were binary factors, violating the assumption of data normality (Frank & Witten, 2000; Priya et al., 2018). We formulate the ANCOVA model into infortheo as follows:

$$E(x) = -\sum p(x)\ log(p(x))$$

where $E(x)$ denotes the entropy for the predictor, $p(x)$ is the probability of the occurrence of the sample value x from the population X (Meyer, 2022; Priya et al., 2018). Therefore, the mutual information can be written as follows:

$$I(x;y) = E(x)\ -\ E(x \mid y)\ =\ E(y)\ -\ E(y \mid x)$$

where $I(x;y)$ represents the mutual information between variable x and y, $E(x)$ is entropy variable x, $E(x \mid y)$ is the entropy of variable x conditional on y, $E(y)$ is entropy y variable, dan $E(y \mid x)$ is entropy conditional y variabel y to x. The measurement of entropy through infortheo plays an important role in ensuring that the ANCOVA model can accurately depict the actual state of the predictor variables. Additionally, infortheo can be used to measure mutual information, which is the amount of information that can be obtained about one variable by knowing the value of another variable. This mutual information metric helps to reveal the relationships and interconnections among the variables in the dataset (Armstrong, 2016; Meyer, 2022).

C. RESULT AND DISCUSSION

1. Laboratory Experiment and Result

The range of the residuals indicates that the linear regression model cannot perfectly predict the Risiko_petani_num (Farmer's Risk) value. This is due to the difference (residual) between the observed value and the value predicted by the model. The use of binary factor variables in the model is suspected to cause the violation of the normality assumption and the presence of multicollinearity. The minimum residual value is -0.34234, and the maximum is 0.38656. These findings indicate that the model has not fully captured all the variation in the dependent variable.

Nevertheless, the distribution of the residuals shows that most residuals are centered around the median value and the first quartile (1Q) of -0.01826, indicating a reasonably concentrated dispersion. Furthermore, the symmetry of the residuals, where the median (-0.01826) and the first quartile (1Q) (-0.01826) are the same, suggests that the residual distribution tends to be symmetric. A large negative residual (-0.34234) indicates that the

model often underestimates the risks faced by farmers. This can lead to results that do not align with reality on the ground, where farmers may be facing greater risks than predicted by the model. If the model underestimates the risk, the policies implemented may not be sufficient to protect farmers from larger fluctuations in income or crop yields. However, despite this variation, the residuals are centered around the median and the first quartile (1Q). This suggests that the model can capture some patterns in the data. Therefore, future model development is still possible, such as by incorporating macroeconomic variables that influence farmers' risk. This means that there is no significant bias in the residuals, as shown in Table 1.

Table 1. Residual Indicators from the ANCOVA Model

Residual	Value	Information
Min	-0.34234	The smallest residual value (minimum)
1Q	-0.01826	The residual value at the first quartile (25th percentile)
Median	-0.01826	The median value (50th percentile) of the residuals
3Q	-0.01826	The residual value at the third quartile (75th percentile)
Max	0.38656	The largest residual value (maximum)

The estimated regression coefficient results show that several independent variables significantly affect Farmer Risk at a 95% confidence level. First, variable (δ_j), the coefficient is valued at a positive (0.40482) and is significant at a 1% error level. This means that when there is a market price intervention treatment by the Regional-Owned Enterprises (*BUMD*) as an absorber of shallot commodities, the probability of farmers not having market failure risk increases by 0.4 times compared to when there is no institutional intervention. Second, variable ($(\beta\gamma)_i$, is valued at a positive (0.37519) and is significant at a 1% error level, as shown in Table 2.

Table 2. ANCOVA Estimation with Naïve Bayes Model on Shallot Farmer Risk Experiment

Variabel	Coeficient	Std. Error	Pr(>| t |)
π	0.86772	0.23701	0.000606 ***
β_i	0.03822	0.06436	0.555319
δ_j	0.40482	0.08346	0.0000005***
θ_k	0.16656	0.11152	0.141590
$(\beta\gamma)_i$	0.37519	0.07663	0.0000005***
$(\delta\gamma)_k$	0.01826	0.12205	0.881683
$(\theta\gamma)_k$	0.01826	0.12205	0.881683
$(\beta\sigma)_i$	-0.16934	0.09498	0.080677*
$(\theta\sigma)_k$	0.03607	0.08669	0.679144
$(\theta\sigma)_k$	0.26251	0.07965	0.001810 ***

Y is dependent variable (Risiko_petani_num)
Signif. codes: 0.001 '***' 0.05 '**' 0.1 '*.'
Residual standard error: 0.1207 on 50 degrees of freedom.
Multiple R-squared: 0.7442, Adjusted R-squared: 0.6982.
F-statistic: 16.17 on 9 and 50 DF, p-value: 5.297e-12*** (Pr < 0.0001).
Mutual information score: 0,2337917.
Confusion Matrix Result for Naïve Bayes Model:
Accuracy: 1

95% CI: (0.7354.1)
No Information Rate: 1
P-Value (Acc > NIR): 1
Specificity: 1

This means that farmers with a good level of agricultural literacy have a probability of solid bargaining power to minimize market failure by 0.38 times compared to farmers with a poor level of agricultural literacy. Third, variable ($(\beta\sigma)_i$) is valued at a negative (-0.16934) and is significant at a 10% error level. This means that the farmer's independent decision to sell their shallots to a clustered distributor has a probability that is 0.16 times lower compared to farmers who decide due to the influence of other farmers. Fourth, variable ($(\theta\sigma)_k$) is valued at a positive (0.26251) and is significant at a 1% error level. This means that the farmer's independent decision to determine the price has a probability that is 0.26 times higher compared to following the price contract with the distributor represented by the Farmer Group Association (*Gapoktan*). However, the intercept variable (π) is valued at a positive (0.86772) and is significant at a 1% error level. When the independent variable (significant at the tolerated error level) is valued at 0, or there is no institutional intervention, the probability of farmers experiencing market failure risk is 86%. In other words, without institutional intervention, the market failure risk faced by shallot farmers in Bima Regency has a probability that is 0.86 times higher compared to when there is institutional intervention.

The Residual standard error value of 0.1207 indicates the model's accuracy in predicting Risiko_petani_num. Meanwhile, the Multiple R-squared value of 0.7442 indicates that the independent variables in the model can explain 74.42% of the variation in Risiko_petani_num. The Adjusted R-squared value of 0.6982 also shows that the model maintains good predictive power after accounting for the number of predictors. The F-statistic test with a p-value < 0.0001 further proves the overall significance of the model.

The Naïve Bayes model used shows excellent performance on the test data. The accuracy reaches 100%, meaning the model can predict perfectly. The 95% confidence interval for accuracy is within the range of 73.54% to 100%, indicating that we can be 95% confident that the model's accuracy is within this range. Furthermore, the No Information Rate (NIR) value is also 100%, meaning that all test data is actually in the "not at risk" class. A p-value [Acc > NIR] of 1 indicates that the model's perfect accuracy (100%) is not significantly different from the NIR (100%). In terms of specificity, the model also shows remarkable performance, which is 100%. This means the model can predict the "not at risk" class perfectly. However, it should be noted that this model can only predict the "not at risk" class well but cannot correctly predict the "at risk" class. This is due to the relatively small sample size of 60 observations. The tendency of the experiment to take a similar experimental path with a small sample accumulation has caused the Naïve Bayes model to be unable to predict the "at risk" class. Overall, the results of this evaluation indicate that the Naïve Bayes model used has excellent predictive capability, especially for the "not at risk" class, although it still has limitations in predicting the "at risk" class.

Although the model has limitations in predicting the "at risk" class, its strong performance in identifying the "not at risk" class is crucial. This identification can enhance resource allocation and interventions, reducing overall market risk. Naïve Bayes is notably robust against imbalanced data, common in agriculture. While it may struggle with the "at risk" class, its accuracy with the "not at risk" class offers valuable insights, especially when data on the "at risk" class is scarce. The Naïve Bayes model is effective for small sample sizes, performing well with only 60 observations, making it a good starting point for further analysis. (Frank & Witten, 2000; Priya et al., 2018; Resa et al., 2021). Naïve Bayes assumes that the features in the dataset are independent of one another. This allows the model to perform well even when the amount of data is limited, as it does not rely on complex interactions between features. Naïve Bayes outputs probabilities, which provide a better understanding of uncertainty in predictions, making it useful in situations with limited data (Frank & Witten, 2000; Priya et al., 2018). The use of the Naïve Bayes model in this research is due to the limited sample size. Using methods such as Ordinary Least Square (OLS), Feasible Generalized Least Square (FGLS), Maximum Likelihood (ML), and similar techniques would yield biased parameter estimates. If future research utilizes a larger sample size, then the Naïve Bayes model should no longer be used.

2. Discussion

This research provides several important implications for institutional interventions to reduce the risks faced by shallot farmers in Bima Regency. First, in the case of Bima Regency, one of the significant shallot production centers, prices are highly dependent on an unstable market mechanism. Although the Government has established National Food Agency Regulation No. 17 of 2023 (38), which sets a minimum price for agricultural commodities, the field often fluctuates outside the established regulations. This occurs because corporate cartels control the distribution chain. As upstream business actors, farmers do not have strong bargaining power in determining prices when facing profit-oriented distributors. As a result, when shallot prices decline, farmers are weak due to the absence of an institutionally based market price control system (Ian Wills, 1987; Nitzan, 2014).

a. Regional state-owned enterprises (BUMD) as a safety net for shallot farmers
   The laboratory experimental learning shows that *BUMD* intervention effectively increases the probability that farmers will not experience market failure risks. With the presence of an absorbing institution that guarantees prices, farmers will have market certainty, thereby reducing the risk of crop failure due to unstable prices. The presence of *BUMD* in institutional market intervention practices serves as a safety net for farmers, where *BUMD* acts as an economic actor with a combination of profit-seeking motives and public service functions. Thus, farmers gain the necessary market certainty. *BUMD*'s intervention as a price guarantor creates a domino effect that strengthens farmers' bargaining power. Farmers who have access to guaranteed minimum prices not only feel safer but can also

negotiate with distributors more confidently. They can reject low offers from distributors, which they may have previously accepted due to market pressures. With this mechanism, farmers feel more protected from the risks they face, allowing them to focus on improving productivity and the quality of their agricultural outputs.

b. Distributor clusters: limiting power for protection

Determining shallot distributors or warehouses based on clusters reveals exciting findings from the laboratory experimental results. The policy design that divides distributors by region aims to limit the bargaining power of distributors when shallot prices decline (Campbell & Klaes, 2005; Quisumbing & Doss, 2021). With rules prohibiting distributors from absorbing shallots from clusters that do not belong to them, farmers are given a more significant opportunity to choose their distributors. This provides farmers with more options and creates competition among distributors. By establishing clusters, farmers can reject unfavorable offers from distributors, enhancing their bargaining position in the market. This is a crucial step toward creating a fairer market environment. Additionally, when farmers have more distributor options, they can negotiate better prices, potentially increasing their income and reducing losses caused by price fluctuations.

However, the experimental results indicate that the success of this institutional design heavily relies on the literacy level and understanding of the farmers. Farmers may not be able to leverage this cluster system effectively without sufficient knowledge about their rights and how to negotiate. Many farmers in this region face challenges in adapting to this complex system, particularly given that many belong to the unproductive age group and have low education levels (3). The uncertainties farmers face, especially regarding their understanding of market mechanisms and their rights in the negotiation process, can hinder them from capitalizing on available opportunities. Farmers lacking adequate education may feel alienated from this policy, necessitating more significant support to help them understand their rights and obligations within the system. Therefore, institutional interventions using the distributor cluster method should include outreach, training, and mentoring to enhance farmers' knowledge of the regulations in place. Indeed, regulations limiting distributors' absorption areas significantly impact the market dynamics of supply and demand for shallots. By establishing clear boundaries, these regulations create price stability. Price stability allows farmers to plan their production more effectively and potentially diversify their products. Thus, the regulation restricting distributors strengthens farmers' bargaining positions, indirectly encouraging increases in sustainable production. On the demand side, guaranteeing a more stable supply provides confidence to consumers and distributors to purchase larger quantities. When the supply of shallots increases and prices stabilize, consumers are more likely to buy, fostering a positive cycle that supports overall market growth. This way, the distributor clusters limit the power and build a protective ecosystem for economic stability.

c. Effect of farmers' decisions on other farmers: important notes for BUMD intervention

This study's results showed that the farmers' decision to entrust the Regional-Owned Enterprise (*BUMD*) as a market intervention institution is supported by other farmers. In other words, the probability of farmers selling their shallots to the *BUMD* when prices plummet is determined by the domino effect of other farmers who also choose to sell to the *BUMD*. This indicates a collective communal power among the farmers, enabling them to move together to strengthen their bargaining position. These experiments showed that when most farmers decide to sell their shallots to the *BUMD*, other farmers follow suit. This creates a sense of solidarity and trust among fellow farmers (Barham et al., 2015; Kurniawan et al., 2019), making them feel more secure and confident in entrusting the *BUMD* as the distributor of their shallot commodities. As a result, the *BUMD* can play a more effective role in stabilizing shallot prices at the farmer level, especially when prices plummet.

d. Not Gapoktan: farmers' communal institutions in shaping bargaining power

The results of the experiments showed that the communal institutions of farmers are more preferred than Farmer Groups (*Gapoktan*). The communal institutions among farmers are a form of collectivity woven among fellow farmers, which can encourage the formation of a stronger bargaining position towards the market. The institutional design that encourages farmers to make sales decisions independently and autonomously, without being too dependent on collective decisions through *Gapoktan*, is more effective in reducing the risk of market failure. This suggests that empowering farmers as individuals can lead to a more significant positive impact than depending on Gapoktan's role as a coordination platform. In Bima Regency, it must be acknowledged that the strength of *Gapoktan* as a platform for strengthening farmers' bargaining position has not been optimal (G. N. T. Barat, 2019). This is because Gapoktan has a limited function, serving only as a data-organizing platform and not acting as a strategic partner of the Government in controlling agricultural policies in the region. As a result, farmers do not consider Gapoktan an essential entity in their operations. Farmers tend to rely more on the communal institutions among themselves, which are considered more effective in increasing their bargaining position and reducing the risk of market failure.

Finally, the experiments' results showed that the probability of market failure risk faced by shallot farmers reaches 86% when no institutional intervention exists. This finding emphasizes the urgency of the role of institutional intervention in reducing the risks farmers face. Without institutional market intervention, the market failure risk farmers face is 8.6 times greater than the condition where there is institutional market intervention. This shows that the existence of institutional intervention is an essential factor in mitigating the risks faced by shallot farmers (Campbell & Klaes, 2005; Ian Wills, 1987; Quisumbing & Doss, 2021). In this

context, the role of the Government becomes crucial in creating a healthy and non-oligopolistic competitive environment. The neo-institutional economic theory emphasizes the importance of institutions in regulating market mechanisms to prevent them from being trapped in non-competitive market structures. This is in line with empirical findings showing that without institutional intervention, shallot farmers are vulnerable to the dominance of oligopolistic power from corporations or distributors in the supply chain (Putsenteilo et al., 2020; Triyono & Sulistyaningsih, 2021b; Klundert, 1999). The Government's efforts to strengthen the role of institutions in the agricultural sector can be carried out through several strategic steps. First, encouraging the establishment of Regional-Owned Enterprises (*BUMD*) as the absorber of shallot agricultural commodities. The existence of *BUMD* can be an alternative market for farmers and prevent harmful price-setting practices by distributors. Second, the formation of distributor clusters or warehouses directly connected to farmers should be regulated. This can reduce price distortions due to oligopoly at the distributor level. Third, agricultural literacy should be improved for shallot farmers so that they have a stronger bargaining position in price negotiations. Comprehensive and integrated institutional interventions are expected to minimize the market failure faced by shallot farmers in Bima Regency. Government policies supporting the strengthening of agricultural market institutions will improve the welfare of shallot farmers.

D. CONCLUSIONS AND SUGGESTIONS

This study concluded several essential points regarding institutional interventions to reduce the risks faced by shallot farmers in Bima Regency. Data observations indicated that shallot prices depend highly on unstable market mechanisms, where price gaps between regions occur, particularly during simultaneous harvest periods. This condition leads to production surpluses and ultimately creates price instability. Distributors and similar corporate cartels play a crucial role in the shallot market by controlling the supply chain from procurement to distribution. They can set prices and regulate supply, often to the detriment of farmers. By dominating this process, cartels create a weak bargaining position for farmers, as their access to the market becomes limited. Therefore, the role of regional-owned enterprises (*BUMD*) as absorbers of shallot commodities is vital in balancing prices and providing market guarantees for farmers. Then, the distribution of distributor clusters based on region is considered quite effective in enhancing farmers' bargaining power. However, its success heavily depends on the level of operational literacy related to the distributor clusters. Farmers' decisions to entrust *BUMD* as a market intervention institution are also influenced by the domino effect of other farmers who sell to *BUMD*. This indicates communal collective strength among the farmers, which can serve as social capital to support the success of institutional interventions.

From these conclusions, we need to offer policy implications as solutions to reduce the risks faced by shallot farmers in Bima Regency: (1) Strengthen the role of regional-owned enterprises (*BUMD*) as absorbers of shallot commodities to balance prices and

provide market guarantees for farmers. This can be achieved through strengthening cross-sectoral regulations among the Regional Development Planning Agency of Bima Regency (*Badan Perencanaan dan Pembangunan Daerah/BAPPEDA*) as the strategic implementer, the Agriculture Department (*Dinas Pertanian*), and the Trade Department (*Dinas Perdagangan*) Bima Regency as technical control functions, with *BUMD* as the operational executor. For this purpose, a legal basis, such as a regional regulation for the protection of farmers, is needed, which includes provisions for distributor clusters, the involvement of *BUMD*, and other relevant agencies. Strategic regulations are also necessary, such as the Agricultural Industry Development Plan for Bima Regency (*Rencana Pengembangan Industri Pertanian Bima)*, which is a derivative of the Bima Regency Industrial Development Plan (*Rencana Pengembangan Industri Kabupaten/RPIK Bima*); (2) Implement a distributor cluster system based on the region, accompanied by efforts to enhance farmers' knowledge regarding operational and technical aspects related to regulations through intensive extension, training, and mentoring programs. These activities can be collaboratively organized across sectors with the Village Empowerment Office (*Dinas Pemberdayaan Desa*) and Agricultural Extension Workers (*pendulum Pertanian*); (3) Facilitate regular farmer meetings at the community level. Farmers can share information through these forums, discuss common challenges, and formulate collective strategies to address them. Additionally, the involvement of local governments in these activities is crucial to creating solid collaboration between farmers and policymakers.

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