

Decision Making in Inventory Policy Determination for Each Echelon to Stabilize Capsicum Frutescens Price and Increase Farmers Share Value Using Discrete Event Simulation

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Abstract. Capsicum frutescens is one of the vegetable commodities that can affect the dynamics of the national economy. The dynamics of the national economy is due to significant fluctuations in chili prices in Indonesia at all times. Price fluctuations occur due to lack of information either in the form of demand information or Chilean price information about consumers received by farmers for marketing red pepper. Besides, the length of the distribution of red pepper (farmer- the middleman- wholesaler- retailer- consumer) results in significant price changes from farmers to consumers at each echelon or distribution level. Such price changes result in a decline in the farmer's share. Farmer's share has a negative relationship with marketing margins. the negative relationship is the higher the marketing margin, the lower the share received by the farmer. from the explanation, the concept shows that the victims of the length of the distribution channel are farmers and consumers. Where farmers will bear a high business risk, and consumers will get high chili prices. The research will discuss how to stabilize the price of red pepper and improve farmer's share by making the best decision using discrete simulation using Monte Carlo, so it can determine the supply policy by the distribution at each level aimed at reducing the operational cost. Besides, this can also reduce the hoarding activities undertaken by the relevant distribution. The hoarding can disrupt the stability of the existing chili price.

1. Introduction

Chili red pepper is a vegetable commodity that is often used as a flavouring food. Therefore, the needs of chili in large cities are about 800,000 tons / month or 66 tons / month. From these data can be known, that chili is one of vegetable commodities that strategic enough to affect the dynamics of the national economy. Chili prices in Indonesia fluctuate every year. Such price fluctuations occur quite significantly, especially when it comes to the celebration of the big day. This is due to the demand for red chilies that increased by about 10% to 20% of normal needs. [1]

The fluctuation in the price of red pepper causes uncertainty of income earned by the farmers. The uncertainty of the revenue is caused by the lack of cooperation between the farmers and other distributors. Lack of cooperation resulted in a lack of information received by farmers on the marketing of red pepper. So, farmers cannot determine the bargaining position in price formation. From this problem indicates that the occurrence of dependence between farmers with other distribution parties. The inadequacy and transparency of communication and information received by these farmers resulted in significant price changes from farmers to consumers. Not only that, if farmers directly distribute chili to consumers, farmers do not have a transportation infrastructure, pricing information system, and adequate market facilities. This is where third parties arise. The appearance of these third parties is what



causes the length of the distribution flow of chili pepper. These third parties are often referred to as middleman (perpetrators of distribution). The number of perpetrators of this distribution is uncertain, depending on the region of each. In the present study, the perpetrator of this distribution consists of three parties (the middleman - wholesalers - retailers). So, if the written flow distribution is as follows.



Fig 1 Perpetrators in Red Rice Chilli Distribution

If the ineffectiveness and transparency of an information, the price changes will result in a decrease in the farmer's share. has a negative relationship with the marketing margin means that the higher the marketing margin, the share received by the farmers is lower. The concept shows that the victims of the distribution channel are farmers and consumers, where farmers will bear a high business risk, and consumers will get a high price of chili. In Figure 2 below shows a comparison of farmer's selling price and buying price by consumers in 1983 - 2014. The graph shows a very significant difference.

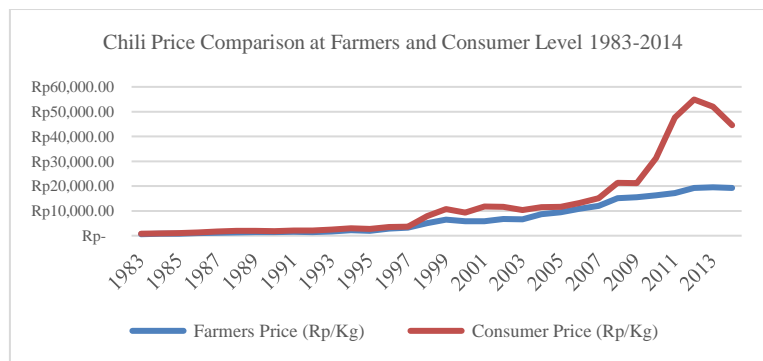


Fig 2 Chili Price Comparison at Farmers and Consumer Level 1983-2014

In the previous study, entitled "Marketing System of Red Rice (*Capsicum Frutescens*) in Cigedug Village, Cigedug Sub-district, Garut Regency" [2] discusses the analysis of marketing channels, marketing function, market structure, and market behaviour of red chilli in Cigedug Village District Cigedug Garut regency and marketing margin analysis, farmer's share, profit and cost ratio, and cohesiveness of vertical market of red pepper between market at farmer level in Cigedug Village with Kramat Jati Parent Market.

The differences in the research made now are very significant, the differences that occur include differences in different viewpoints in analysing the chili distribution channel chain. In this research will discuss how to stabilize the price of red pepper and improve farmer's share by making the best decision using Monte Carlo simulation so that it can determine the supply policy by the distribution at each level aimed at reducing the operational cost. The operational costs will be computed with the profit margin on each echelon, so it will obtain the stability of the selling price of chilli on each echelon. In addition, the research undertaken can reduce the stockpiling activities performed by the related distribution. This is done because the government is vigorous-incessant to reduce this activity. The hoarding can disrupt the stability of existing chili prices, because the chili that has been stored will be sold when the price begins to rise. As a result of the hoarding, chili will have a poor quality caused by the duration of hoarding.

2. Research Methodology

2.1 Analysis of Performers and Distribution Patterns of Marketing

According to [3] the marketing channel is a series of commercial institutions that pass the goods in their distribution from producers to consumers in which they engage several marketing institutions. In this study, the actors involved include: Farmers (suppliers), medicines (the middleman - wholesalers - retailers), Consumers. Each of these actors has their own marketing distribution pattern. The pattern of red pepper distribution in Figure 3.

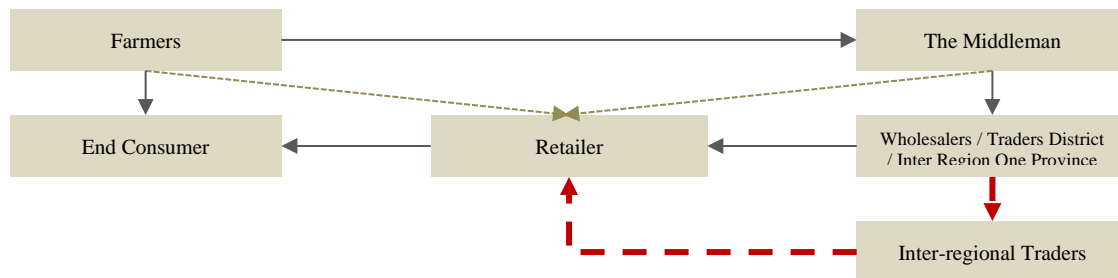
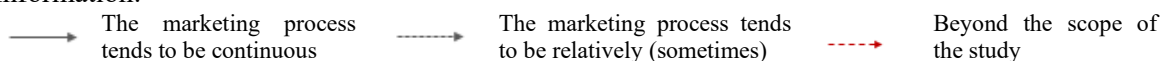


Fig 3 Distribution Channel Level of Red Chili

Information:



The picture shows the distribution of the chili can actually be done from farmers directly to consumers, but it is rare. What happens is that the distribution of this chili has been trapped in the circle mafioso, the syndicates who seek maximum profit at the expense of the farmers and final cosmos. The trading mafia was deliberately created with various tendencies surrounding it, so the high margin of red pepper is only enjoyed by the traders involved, but the price at the farm level is very cheap. Then the next victim is the end consumer who usually consumes this chili in sufficient quantities, but now becomes a very limited quantity of consumption with weakening purchasing power. Another victim is a good retailer trader in the market, peddler which originally per day can sell at least 20 kg, currently only maximum 5 kg / day. This condition indicates that the morals and ethics of traders experience the process of degradation [3]

2.2 Operational Cost Analysis

The main purpose of this study was to stabilize the price of chili and increase farmer's share by reducing operational costs. The variables included in the operational costs have been mentioned previously. These variables influence the perpetrators of the distribution of chili. For example, the cost of harvesting is an operational cost that is only found in farmers. For more details can be seen in the table below.

Table 1 Variable of Operational Costs

| Variable Cost | Cost of Harvest | Freight Charges | Packing Cost | Cost of Middleman | Levy Fees | Cost of depreciation | Cost of Loading & Unloading | Sorting Fee | Rental Rental Cost | Cost Disadvantages | Margin Cost |
|---------------|-----------------|-----------------|--------------|-------------------|-----------|----------------------|-----------------------------|-------------|--------------------|--------------------|-------------|
| Farmers | v | v | v | | | v | | | | v | v |
| Middleman | | v | v | | v | v | v | v | | v | v |
| Wholesaler | | v | v | v | v | v | v | v | v | v | v |
| Retailers | | v | v | v | v | v | | | | v | v |

2.3 Farmer' Share Analysis

Farmer's share has a negative relationship with marketing margin, which means that the higher the marketing margin, the share received by the lower farmers. F_s is percentage received by farmers, P_f is prices at farm level, and P_r is prices at the consumer level, the mathematically farmer's share can be formulated as follows:

$$Fs = \frac{Pf}{Pr} \times 100\%$$

2.4 Inventory Management

Inventory management is used to perform inventory levels at each red chili supply chain level. The continuous review inventory system is used at the retailer level. This is because the demand that comes at this level comes from the end customer. While we can not regulate people's habits in determining when to buy red chili. Continuous review allows the fulfillment of requests at any time, because it does not pay attention to the demand fulfillment period. While at the level of wholesalers and middlemen, we use simulated inventory system periodic review. Retailers may only purchase to wholesalers within a period of seven days and wholesalers may only buy into a middleman within a seven day period as well.

2.5 Monte Carlo Simulation

Simulation is a technique in making a model of a real system or proposed system so that the behaviour of the system can be learned [4]. The simulation used is Monte Carlo simulation using Crystal Ball module. Monte Carlo simulation is one method that can be used to analyse business planning dynamically by building random scenarios according to the business risk analysis [5]. The risk analysis used can be from historical data and expert estimation data in the form of probability distribution. One example of a Monte Carlo simulation application that uses data estimation was developed by [6] using Monte Carlo simulations to predict the level of human resource performance within a company. Given these characteristics, Monte Carlo simulations are quite appropriate to be used in quantitative analysis of organizational change risk, where available data are based on expert estimates.

3. Discussion and Problem Solution

In the discussion and problem-solving section, the first step is to analyses the inventory of red chili. The inventory data of red chili is divided into four inventory scenarios. These four scenarios are obtained through trial and error method. The purpose of finding this inventory scenario to find out the minimum and maximum supply of red chili per day. So, in Table 2 it explains the minimum inventory and maximum inventory, for example retailers with a minimum inventory of 190,000 kg and a maximum supply of 220,000 kg, as well as for wholesalers and middlemen. From the inventory data combined with the cost of red chili each level. After that both data are solving using the simulation as much as 10,000 times (trial), resulting in the data in Table 3.

After knowing inventory levels and red chili cost/kg of each scenario, then the next step is to arrange alternatives based on the cheapest to highest cost scenario. Alternatives taken as many as 4 alternatives are shown in Table 4. The results of alternative calculations 1, 2, 3, 4 are shown in Table 5 and Table 6. The calculation of these alternatives compares the selling price of red chili and red chili each level. Then will be obtained margin, that is percentage comparison of pepper cost per kg divided by selling price. For example, in alternative 1, the selling price of chili at retailers is Rp 374.256.01, - while the cost is Rp 271.300.53,00 so that the margin of 34.38% is obtained. the next step is to calculate the farmer share's by comparing the purchase price of the consumer level with the price of the farmer. In the same alternative that is alternative 1, can know the value of farmer share's equal to 29,47%. And so, on alternatives 2 to 4.

Table 2 Red Chili Supplies/Stock

| | Chili stock (kg/days) | | | |
|------------|-----------------------|---------|---------|---------|
| Retailers | 190000 | 200000 | 210000 | 220000 |
| Wholesaler | 1505000 | 1510000 | 1515000 | 1520000 |
| Middleman | 1506000 | 1507000 | 1509000 | 1510000 |

Table 3 Result of Chili Simulation (Cost/Kg Red) (10.000 Trials)

| | Results of Chili Simulation (Cost / Kg) (10,000 Trials) | | | | | | | |
|------------|---|----------------|--------------------|--------------|--------------------|---------------|--------------------|---------------|
| | Scenario 1 | | Scenario 2 | | Scenario 3 | | Scenario 4 | |
| | Minimum Inv. Level | Cost /Kg | Minimum Inv. Level | Cost /Kg | Minimum Inv. Level | Cost /Kg | Minimum Inv. Level | Cost /Kg |
| Retailers | 190,000 | Rp 341,168.211 | 200,000 | Rp 4,156.547 | 210,000 | Rp 22,682.616 | 220,000 | Rp 27,169.952 |
| Wholesaler | 1,505,000 | Rp 147.700 | 1,510,000 | Rp 170.292 | 1,515,000 | Rp 232.826 | 1,520,000 | Rp 324.542 |
| Middleman | 1,506,000 | Rp 33.363 | 1,507,000 | Rp 23.461 | 1,509,000 | Rp 23.653 | 1,510,000 | Rp 33.802 |

Table 4 Alternatives Arrangement based on Cheapest Cost – Most Expensive Cost Scenario

| | Compilation of Alternatives Based on the Cheapest Charge Scenario sd. Highest | | | |
|------------|---|---------------|---------------|---------------|
| | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
| Retailers | Skenario 2 | Skenario 3 | Skenario 4 | Skenario 1 |
| Wholesaler | Skenario 1 | Skenario 2 | Skenario 3 | Skenario 4 |
| Middleman | Skenario 2 | Skenario 3 | Skenario 1 | Skenario 4 |
| Farmers | - | - | - | - |

Table 5 The Calculation of Alternatives 1 And 2

| | Alternative 1 | | | | Alternative 2 | | | |
|----------------------|-----------------|-----------|--------|---------------|-----------------|-----------|--------|---------------|
| | Inventory Level | Cost / Kg | Margin | Selling Price | Inventory Level | Cost / Kg | Margin | Selling Price |
| Retailers | 200,000 | Rp 4,157 | 34% | Rp 15,272 | 210,000 | Rp 22,683 | 34.38% | Rp 40,203 |
| Wholesaler | 1,505,000 | Rp 148 | 18% | Rp 7,208 | 1,510,000 | Rp 170 | 18.00% | Rp 7,235 |
| Middleman | 1,507,000 | Rp 23 | 32% | Rp 5,961 | 1,509,000 | Rp 24 | 31.78% | Rp 5,961 |
| Farmers | | Rp 1,406 | 69% | Rp 4,500 | | Rp 1,406 | 68.77% | Rp 4,500 |
| Farmer's Share Index | 29.47% | | | | 11.19% | | | |

Table 6 The Calculation of Alternatives 3 And 4

| Alternative 3 | | | | Alternative 4 | | | |
|-----------------|-----------|--------|---------------|-----------------|------------|--------|---------------|
| Inventory Level | Cost / Kg | Margin | Selling Price | Inventory Level | Cost / Kg | Margin | Selling Price |
| 220,000 | Rp 27,170 | 34.38% | Rp 46,352 | 190,000 | Rp 341,168 | 34.38% | Rp 468,443 |
| 1,515,000 | Rp 233 | 18.00% | Rp 7,324 | 1,520,000 | Rp 325 | 18.00% | Rp 7,433 |
| 1,506,000 | Rp 33 | 31.78% | Rp 5,974 | 1,510,000 | Rp 34 | 31.78% | Rp 5,974 |
| | Rp 1,406 | 68.77% | Rp 4,500 | | Rp 1,406 | 68.77% | Rp 4,500 |
| 9.71% | | | | 0.96% | | | |

After performing the calculation of the margin, the share farmer 's on each alternative, it is known that the highest value of the farmer's share in alternative 1 is equal to 29.47%. While alternative 2 is 11,19%, alternative 3 that is 9,71%, and alternative 4 that is 0,96%. So, the proposed selling price on alternative 1, with a comparison of farmer 'share of 4.97%. Can be seen in Table 7.

Table 7. Comparison of Existing and Proposed on the chosen alternative

| | Comparison of Existing and Proposed | |
|----------------------|-------------------------------------|-------------------------|
| | Existing Selling Price | Proposing Selling Price |
| Retailer | Rp 18,000 | Rp 15,272 |
| Wholesalers | Rp 10,000 | Rp 7,208 |
| Middleman | Rp 7,500 | Rp 5,961 |
| Farmers | Rp 4500 | Rp 4,500 |
| Farmer's Share Index | 25.00% | 29.47% |

4. Conclusion

This study was conducted, because there is a gap of red chili prices at the level of the farmer to the consumer level each period. These price fluctuations caused by price increases that occur at each level of the distribution supply chain. Therefore, to reduce the significant price increase then the authors do

research on the distribution of red chili. This study will discuss how to stabilize the price of red chili and improve farmer's share by making the best decision using Monte Carlo simulation in order to determine the inventory policy by the distribution at each level aimed at reducing the operational cost. The operational costs will be computed with the profit margin on each echelon, so it will obtain the stability of the selling price of red chili on each echelon. From the simulation, the best result is to use alternative 1, using scenario 2 at retailer level, scenario 1 at the merchant level, and scenario 2 at the middleman level. Thus, obtained value of the farmer's share of 29.47%. These results are the highest results of other alternatives. By using these alternatives, the proposed price at retailers amounts to Rp 15,272, -, at large traders of Rp 7.208, -, at the middleman level of Rp 5.961, -, and at the farmer level of Rp 4,500, -. So, when compared to the previous farmer's share amounted to 4.97%.

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