MARKETING ANALYSIS OF AGRICULTURAL PRODUCT SWEET POTATOES USING MARKOV CHAIN

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ABSTRACT

Agricultural is one of major livelihood of Indonesians. The economic aspects of it has also developed and noticed. In marketing its products farmers usually accept any prices determined by the buyer. Markov Chain Analysis is a method that studies the nature of variable in the present based on its nature in the past in order to estimate the variables' nature in the future. Markov Analysis is a mathematical technique to forecast changes on certain variables based on its knowledge of previous changes.

Initial matter for farmer is the middleman, who buys in lower price than the market price community. The next problem is almost all farmer in the village still do not have ability to process their agricultural products, so that the selling price of its raw products is very cheap. By analyzing using Markov Chain a simulation of shifting and raising selling price to the market can be made to depress prodution cost. Eventually it will be able to raise living standard of farmers of the sweet potatoes commodity, With the result of these research, farmers can save so much expenses from maintenance cost until the balance of production, because from the beginning all can be predicted by 5% of error rate.

Keywords: Analisis, Pemasaran Hasil Pertanian, Markov Chain

INTRODUCTION

Agricultural is one of major livelihood of Indonesia people. Its economic aspect is started to bloom and noticed. As a developed country, Indonesia has character and potential resources development which depend on agricultural sector. Meanwhile, agricultural sector has contributed a lot on foreign exchange, especially from main export commodity. It is confirmed by Nainggolan (1998), that agricultural sector has strategic role, which is as main source of life and income of the farmer, food producer for the community, raw and basic material for 2 processing industries, employment provider and workplace for the community, source of foreign exchange earners and one of the resources preservation life. As source of foreign exchange earners, position of agricultural commodity becomes more important and strategic in Indonesia non-oil export, especially since the drop of oil and gas price (migas) on international

marketing 1992. Since then Indonesia export commodity in form of agriculture products keep showing improving significant role. It is achieved by the increase improvement of product quality in accordance with the provisions and qualification set up by international market. The importance role of agricultural sector on Indonesia economics will not be decreasing.

In marketing their products, farmers usually accept the price determined by the buyer. On good marketing which is profitable for production farmer and consumer, it has to involve minimal trading institution. Short marketing chain will be more profitable or the farmer because selling price will be higher and offered price to the consumer will be lower. Then increasing consumer purchasing power and accelerate marketing result process. Every trading institution formed in marketing will gain some different shares or profit due to management cost that has been issued. The amount of marketing cost depends on marketing distance and management during the process of marketing.

But during marketing conducts by farmer it is often faced by problems which are fluctuative trends on price of sweet potatoes (unstable), so the earning results accepted by farmer are tend to be lower than expense cost they have paid. It is showing that sweet potatoes marketing is less than optimal and profit share the farmer receives are relatively low. Price of agricultural products are always fluctuative depends on occured changes on short terms which is monthly, weekly or even daily, or it can be happening on long terms. The condition is causing difficulties for farmer to plan production, buyer will also have difficulties on predicting demands. Because seen from its nature and use, sweet potatoes commodity is easily damaged / rotten (perishable) so that it need to be marketed directly to avoid large loss for farmers and marketing network is limited. So farmer is forced to sell sweet potatoes at offered price by collectors / middleman which is relatively minimal. In this case farmer is in difficult condition to bargain because they can not wait for sweet potato prices to go up due to its nature. So they are forced to sell them on relatively low price.

Weak producer (farmer) do bargaining to get good price. Their ability in bargaining products is still limited because of limited capital owned, there is tendency to sell their product in low prices. Then the one who won a great advantage usually is the buyer. Of course market price will be fluctuative, maybe higher or lower, both side will gain profit or loss based on contract price rather than market price. Nevertheless predetermined price on contract will be considered profit or loss only theoritically, which is linked to a lost opportunity. Another marketing problem faced by farmer is poor market information. Market information is factor which determine what to produce, where, why, how and for whom it is sold to for the best profit gain. Those conditions causes farming performs without proper planning, especially in macro condition

RESEARCH METHODS
Markov Chain
Markov Chain Analysis is a method that study natures of variables on present time based on its natures in the past in order to predicting its nature in the future.

Markov Analysis is a mathematical technique to predict changes on certain variables based on knowledge of its previous changes.

Considering a very significant generated impacts, marketing aspect of this farming products is one of the main subject on the modelling. Many approach model has been served on review of literature, one of them is Markov Chain. Markov Chain method is one of the oldest model and has been applied by various researches. Muller and Middleton (1994) use this technique in study the dynamics of land change in Ontario, Canada. Other researcher, Vandeveer and Drummond (1976) use it to examine a construction impact on a reservoir. Although it showed less significant impact on forecasting level, Markov Chain concepts has often served as base concept which is use on advance development, such as CA-Markov model (Ye and Bai 2008; Poska et al.

2008). The Markov Chain equation is build on using the distribution of field use at the beginning and end of observation which is presented in a vector (one column matrix) and a transition matrix.

Markov Analysis is vvery often use to help determining business and industrial decision, such as brand change, debt credit problems, operational machine problems, supervision analysis and other problems. Generated information is not absolute becoming a decision, because its nature is only to assist on decision making process.

Markov Analysis Characteristic

Markov Analysis can be use to analyze several different decision making situation. For example analysis of brand changes conducting by customer. Markov analysis give informations on brand changes probabilities from one brand to another or more other brands.

A small community has two gas stations. Machine A and Machine B. Members of the community buy gasoline from those gas stations monthly. Marketer of Machine A conducts survey to several people and find out that customer is not totally loyal to any gas station. They will move to any gas station due to advertisement, service and other factors. Marketing find out that when a customer buy gasoline from Machine A on any month, there is only 0,6 probability that he/she will still buy from Machine A on the next month, and 0,4 probability that they will buy from Machine B on the next month. Likewise when a customer holds transaction with Machine B on a month, there is 0,8 probability that he will buy from Machine B on the next month and 0,2 that he will buy form Machine A. Those probabilites are concluded at Table 1.

Table 1. Customer Movement Probabilities each Month

This month	Next Month	
	Machine A	Machine B
Machine A	0.6	0.4
Machine B	0.2	0.8

These examples are containing several important asumptions :

1. Notice that on table 1, the number of probability on each row is equal to 1.0. It means when a customer holds transaction with Machine A in a month, he will **definitely** hold transaction either with Machine A or Machine B on the next month.
2. Probabilities on table 1 applies to every customers who buy gasoline.
3. Everytime a customer buy gasoline, his probability to hold transaction on one of the gas station on the next month is stated on table 1.

The happening events are independent event all the time.

RESULT
Markov Chain Methods Trial

Tabel 2. Data Pemetaan 1 Komoditas

Dates	Wide Production (Ha)	Production Result (Ton/Ha)	Production Value (Rp./Ton)	Selling Price from Middlemen (Rp./Kg)	Harga Jual Pasar (Rp./Kg)
18/07/2017	3	36	34,200,000	3,500	7,200
20/10/2016	3	27	22,200,000	3,500	7,000

30/10/2015	3	31	28,000,200	3,000	6,500

On table 2 above, It can be seen that mechanism of price determination on marketing a product is one of key indicator of market behavior because it will ended up at number of earnings that will be received by market players. Many factors can affect mechanism process of determining price, such as level of competition between existing market players, regulation or rules from governments and preference form buyers or consumers. The most common problems faced by sweet potatoes commodity farmers is their helplessness on negotiating selling price of their about to sold products. The current agricultural system has patterned with marketing network structure which is tended to adverse farmers. The farmers' helplessness toward access to products market has caused increasingly difficult position in accepting some provisions which are offered by market. Based on current phenomenon, one of the main components to determine selling price of sweet potatoes commodity from farmers to collector buyer is the percentage of water content. The higher percentage of water content of the product than price received by the farmer will be lower. Meanwhile nature of farming management is still traditional. It is causing the quality of product always below quality standard desired and set by the market. This infirmity often becomes based for collector buyer to gain higher profits. Besides that, a long marketing chain that has to be passed is causing certain problem of its own. Therefore it led to inefficiency business as implication. Sweet potatoes commodity is marketable widely, on domestic level until international ones. Thus, each fluctuation happens on both markets will effects directly to determine price of sweet potatoes commodity. But the phenomenon that is always happens is the farmers' incapability to access each occurred changes. In other words, price of sweet potatoes commodity at research location is always set by information belonged by buyers. Development of price of sweet potatoes commodity cannot be accessed by farmers, unless it is a based info that is given by those buyers.

Other factor that is influencing price determination mechanism is regulation or rules by the government as regulator. Government regulation becomes determinants factor which have power to make market players to obey them. However for sweet potatoes commodity, government has not have regulation to set up mechanism for price determination as have been applied on rice commodity (Sudaryanto and Kasryno, 1999) and for several kind of vegetable oil (Suryana, 1999). Therefor development of price of sweet potatoes commodity only set up by the strenght of farmers as producer on consumers at the market.

The production in the field on 2017 is 36 Tons,-
Sweet Potatoes Price per Kg = Rp 3.200,- (Middlemen)
Market Selling Price = Rp 7.500,-
Production Cost = Rp 30,- x 36.000 Kg x 30 days = Rp 1.080.000,- = 0,43%
Depreciation Cost = 0,90% +
Total Storage Cost = 2,13%
Product Storage Cost each Months = 2,13% x 36.000 kg x Rp 2.100,- x state i
Cost of shortage of supplies = Rp 530.000 + (Rp 2.100 x 36000 kg)

Based on Table 2, those datas will be uploaded statistically into data class groups, which are :

Range = Largest Data – Smallest Data = 3750 – 150 = 3600
Number of Classes = 1 + 3,3 log n = 1 + 3,3 log 24 = 5,54 = 6
Interval = 3600 / 6 = 600

Assumpted that Early Data = 0, 600, 1200, 1800, 2400, 3000

Based on Markov Chain provisions, that decision making x, a state of system have transition from state i to state j = I +x-d with probability Pij(x) = P(d)

Order cost = Rp 530.000
Storage cost = production number x price = 3600 X Rp 2.100 = Rp 7.560.000
Number of material taken is number of quantity that occured mostly on the table (modus).
Then Markov Chain calculation begins fot each state row, which are :
For i = 0 ;
x = 520;
if j = 0
Then j = i + x – d 0 = 0 + 100 – d d = 520 Probability Pij = P0,0(520) = P(d >= 100) = 1
For other probablity = 0 Shortage Cost = Order Cost + Storage Cost
$[\sum (d – i – x)$
P(d)] = Rp 530.000 + Rp 7.560.000[(36000-520)0.42 + (1800 - 520)0.17 + (2400- 520)0.13 + (3000 - 520)0.08 + (3600 - 520)0.04] = Rp 39.820.000,-

Table 3 Calculation Result of Markov Chain Analysis

Dates	Wide Production (Ha)	Production Result (Ton/Ha)	N Production Value (Rp. /Ton)	Selling Price from Middlemen (Rp. /Kg)	Selling Price on market (Rp. /Kg)
18/07/2017	3	36	39,820,000	4,500	6,500
Sumber : Data Olahan Probabilitas Analisis Markov Chain					

CONCLUSION

Early problem of farmers is a middleman, who buy in lower price than public market price. Next problem is almost all farmers in the village have no ability to process their farming products. So then its raw materials' selling price is very cheap. Analyzing with this Markov Chain will create a shifting simulation and raise its selling price to the market by depressing cost production. So later it can raise standard living of farmers of sweet potatoes commodity. In this case farmer or in larger scope groups of farmers can count on production cost calculation with market selling price using Markov Chain Methods. Considering its result can reflects total supply by connecting cost must be paid by the company, for example total current production is 36000 Kg, then minimal cost production target is Rp.39.820.000,-. With this research result, farmers can save so much from maintenance cost until production balance, because from the beginning it can be predicted with 5% error rate.

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