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FACTORS AFFECTING FARMERS' DECISIONS TO APPLY HYDROPONIC SYSTEMS IN TARAKAN CITY

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Abstract Tarakan City has limited agricultural land potential and is less productive so that most of the consumption needs for vegetables are imported from outside the island of Tarakan. It is hoped that with the development of hydroponic technology, the community can meet the needs of vegetables independently. The purpose of this study was to determine the factors that influence the decision of farmers to implement a hydroponic system. The research is located in Tarakan City with the research period from April to October 2021. The method of determining respondents was carried out intentionally to 40 respondents with the consideration that the community had obtained information about hydroponic system, either through direct agricultural extension workers, from friends or through other electronic media. such as television, YouTube, Facebook and other social media. To find out the factors that affect farmers' opportunities to apply hydroponic system, an analysis is carried out using the logit function approach. Analysis of the factors that influence farmers' decisions to apply hydroponic system using logit regression function analysis obtained a Nagelkerke R^2 value of 0.494 meaning that the variation of the independent variables included in the model was able to explain 49.4% of the existing phenomena and the remaining 50.6% was explained by other variables. The variable hydroponic planting experience (X4) has a significant and significant effect at the 5 %, meaning that the more often people cultivate hydroponic plants, the greater the opportunity to apply hydroponic system, while age (X1), formal education (X2), Membership Dummy in the farmer group (X3), and Dummy nutrient costs (X5) are not significant. One of the obstacles for farmers in applying hydroponic system is the cost of purchasing nutrients.

Keywords: *hydroponic system, logit regression*

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INTRODUCTION

Tarakan City is a city in North Kalimantan province which has an area of 250.80 km2 and a population of 270,894 people (BPS, 2019). The density of settlements, especially in urban areas, causes limited land for farming. The government strongly supports the development of Urban Farming. Urban farming is a key component of developing a sustainable community food system and if properly designed it will be able to alleviate the problem of food insecurity (Pynanjung, Septiyarini, & Rianti, 2021).

Urban Farming is an activity that utilizes both land and space to produce agricultural products in urban areas. Urban faming can create a green, healthy, beautiful environment and add aesthetics (Fauzi, Ichniarsyah, & Agustin, 2016),(Pynanjung et al., 2021).

One form of urban farming activity is planting with a hydroponic system. The city of Tarakan is one of the targets of the hydroponic technology development program by the Province of North Kalimantan. Tarakan City has limited agricultural land potential and is less productive so that most of

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the people's need for vegetable consumption is imported from outside the island of Tarakan. It is hoped that with the development of hydroponic technology, the community can meet the needs of vegetables independently and can further be used as an alternative business to restore and strengthen the community's economy (Pynanjung et al., 2021). Hydroponic business can be done by anyone, not just farmers, private employees, civil servants and builders can also do hydroponics. The management of hydroponic plants is very easy, because it only maintains water content, nutrients and sunlight whether it is enough or not (Kaunang, Memah , & Kumaat, 2016). Based on the description of the background, the purpose of this study is to analyze the factors that influence the decision of farmers to implement a hydroponic system.

RESEARCH METHODS

The research is located in Tarakan City with the research period from April to October 2021. The location selection was carried out purposively. The city of Tarakan is one of the targets of the hydroponic technology development program by the Province of North Kalimantan. The method of determining respondents was carried out intentionally with the consideration that the community had obtained information about hydroponic technology, either through agricultural extension workers directly, from friends or through other electronic media such as television, YouTube, Facebook and other social media. The number of respondents who were selected purposively were 40 respondents and were considered representative of answering the research objectives. To find out the factors that affect farmers' opportunities to apply hydroponic technology, an analysis is carried out using the logit function approach. Where the parameter estimation is carried out using the Maximum Likelyhood Estimation (MLE) method. These functions are:

$$\text{Ln}(\frac{Pi}{1-Pi}) = \alpha + \beta 1X1 + \beta 2X2 + \beta 3X3 + \\ + \beta 4X4 + + \beta 5X5 + ei \ldots\ldots..(1)$$

Dimana :

Pi = opportunity for farmers to adopt hydroponic technology

X1 = age (years)

X2 = formal education (years)

X3 = *dummy* membership in the farmer group (1 = member; 0 = no member)

X4 = frequency of hydroponic planting experience (times)

X5 = *dummy* cost of using nutrients (1 = buying nutrients; 0 = not buying)

βi = Parameter variable Xi

Expected parameter sign: β_1, β_2, β_3, β_4 >0; β_5<0. The variables of age (X1), formal education (X2), *dummy* membership in farmer groups (X3), frequency of hydroponic growing experience (X4), *dummy* cost of nutrient use (X5) in the above logit equation with the consideration that the independent variables associated with the process of applying a technology (Roger and Shoemaker, 1971 in Yuliarmi 2006) is influenced by the personality variable and socio-economic status of the farmer who will apply a technology in his farming.

The steps of data analysis carried out in the study are as follows:

a. Conduct simultaneous testing of all predictor variables that have been significant to the response variable.
b. Get the results of all predictor variables on response variables that have been significant

RESULTS AND DISCUSSION

The characteristics of the respondents described in this case consist of the age of the respondent, the respondent's formal education, the number of family members and occupation. One of the factors that influence the application of a technology is the characteristics of an individual (Nurulia H, Clara Ajeng A, 2019). A brief description of the individual characteristics of the respondents is described in Table 1.

The average age of respondents is 100 percent in the productive age (15 to 64 years). Productive age is a marker that respondents have physical abilities, potential in business development, have curiosity, and are actively trying to find information. Productive age (15-64 years) will have relatively better productivity compared to the elderly (Ishak & Afrizon, 2011). The higher the level of education, it will be able to form a more advanced mindset, including in the application of a new technology (Ishak & Afrizon, 2011);(Nurulia H, Clara Ajeng A, 2019). The number of main family members covered has an influence on the family economy, where the greater the number of guaranteed members, the higher the family needs (Maryani, Suparta, Ap, & Regency, 2014).

Table 1. Characteristics of Respondents

Characteristics of Respondents	**Category**	**Frequency**	**Percentage**
Gender	Man	13	33.3
	Woman	27	66.7
Age	0-14 years old	0	0
	15-64 years old	40	100
	>64 years old	0	0
Formal education	Primary school	0	0
	Junior High School	2	5.0
	Senior High School	27	67.5
	Bachelor degree	10	25.0
	Master Degree	1	2.5
Number of Family Members	1-2	5	12.5
	3-4	14	45
	> 4	21	52.5
Respondent's occupation	Farmer	13	32.5
	Non farmer	27	67.5
Membership in the Farmer's Group	Farmer's Group	17	42.5
	Not a member of a farmer group	23	57.5
frequency of hydroponic planting experience	0 times	8	20
	1 times	0	0
	2 times	11	27.5
	3 times	11	27.5
	≥ 4 times	10	25

Source: Primary Data processed in 2021

People who are members of farmer groups will get information about the latest innovations in agriculture through counseling held. A total of 42.5% of respondents interviewed were members of farmer groups. They have received information and socialization about hydroponic technology from extension workers an average of 2 times. A total of 57.5 percent of respondents who are not a member of a farmer group get information about hydroponic technology through television and social media such as facebook and youtube.

Based on information from various sources regarding the application of hydroponic technology, based on the results of interviews with 40 respondents, as many as 85.0 percent of respondents directly applied and as many as 15.0 percent did not directly apply. Average experience of cultivating hydroponic plants The types of plants they grow hydroponically such as vegetables include lettuce, pakcoy, spinach, kale, mustard greens, celery, and tomatoes. Most of those who apply are members of farmer groups. This is due to an invitation or follow what is done by other members.

To determine the factors that influence farmers' decisions to apply hydroponic technology, logit regression function is used.

Table 2. Estimation Results of Factors Affecting the Application of Hydroponic Technology

No	Independent Variable	Coefficient	Wald Test	Sig.	Exp(B)
1	Age (X_1)	-3.054	1.102	0.294	0.047
2	formal education (X_2)	3.820	0.758	0.384	45.610
3	*dummy* membership in the farmer group (X_3)	-2.780	1.009	0.315	0.062
4	frequency of hydroponic planting experience (times) (X_4)	3.860	5.504	0.019*	47.466
5	*dummy* cost of using nutrients (X_5)	-0.566	0.143	0.705	0.568
	Constant	1.372	0.19	0.890	3.944
	Model Eligibility				
	Hosmer and Lemeshow Test	0.832 > 0.05			
	(Nagelkerke R^2)	0.494			

Source: Primary Data processed in 2021

This model includes variables that are thought to have an effect on people's decisions to apply hydroponic technology. These variables include age, community formal education, dummy membership in farmer groups, experience in growing hydroponics, and dummy nutrient costs. The estimation results of the function in logit regression can be seen in Table 2.

Table 2 shows that the logit model as a whole can explain the factors that influence the application of hydroponic technology by the Hosmer and Lemeshow test value, which is 0.832 > sig 0.05, which means that the model formed matches the observations or the model is feasible to use. By looking at the Nagelkerke R^2 value of 0.494, it means that the variation of the independent variables included in the model is able to explain 49.4% of the existing phenomena and the remaining 50.6% is explained by other variables.

The significance test is used to test which variables/factors have a significant effect on the application of hydroponic technology from the coefficient parameters partially through the Wald test statistic. From the results of data processing (Table 3), it is known that only the frequency of hydroponic planting experience (X4) has a real and significant effect at the 5 percent level on the application of hydroponic hydroponic technology, while age (X1), formal education (X2), Dummy Membership in farmer groups (X3), and Dummy nutrient costs (X5) are not significant.

The frequency of hydroponic planting experience (X4) has a significant positive effect at the 5 percent level, meaning that the more experienced or often people cultivate hydroponic plants, the greater the opportunity to apply hydroponic technology. This is because people who have implemented a hydroponic system and have enjoyed their harvests perceive that the yield of vegetables grown hydroponically is healthy, quality of the result is maintained, hydroponic care is practical, and it has a high selling price compared to those grown conventionally (Machmuddin N, et al 2021). The value of Exp (B) indicates that the community's opportunity to apply hydroponic technology is 47,466 times.

Motivation of Farmers in the Application of Hydroponic Systems

Figure 1 shows that there are 14 things that motivate farmers to apply the hydroponic system including : increasing productivity and profits, due to invitations from farmer groups, guidance from extension workers, high hydroponic vegetable prices, healthy hydroponic vegetables, limited agricultural land, because there is capital assistance, hydroponics as decoration to beautify the garden, fill the time, environmentally friendly because it saves water, and plant growth is faster.

The quality of crop yields can be maintained, maintenance is more practical, The quality of crop yields can be maintained, maintenance is more practical, Ease of obtaining planting media facilities. Among the 14 motivations, based on the results of interviews, the motivation of respondents to apply a hydroponic system is because hydroponic vegetables are healthy (65.2%), because farmers want to fill their spare time (63%), and hydroponic care is more practical (58.7%). is the thing that most motivates people to implement a hydroponic system.

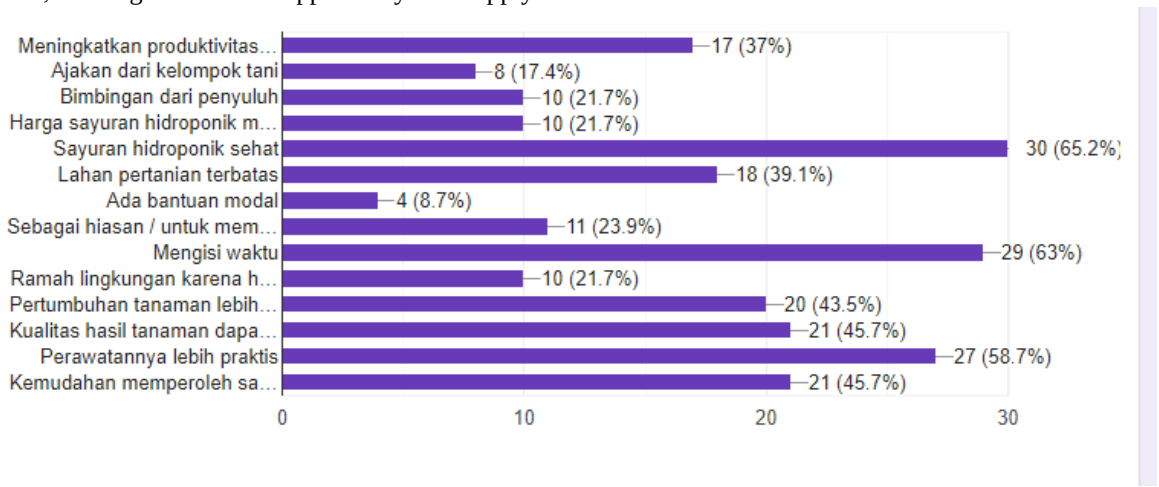

Figure 1. Motivation of farmers in the application of hydroponic systems
Source: Primary data, 202

There are constraint for respondents in implementing a hydroponic system, namely that the community lacks capital in the procurement of hydroponic equipment/media, some of which must be purchased including the cost of purchasing nutrients which require more costs and are the main things in the application of the hydroponic system. In Table 3 it can be seen that the nutrient cost dummy (X5) has a negative sign coefficient which means that the higher the cost of nutrient procurement, the smaller the opportunity for the community to apply hydroponic technology. In addition, another obstacle obtained from the results of interviews with respondents is that if you use electric power in its application, then what is a concern is the condition of electricity, especially in the city of Tarakan, where the blackouts are uncertain. If the electricity is blocked, then the flow of water will be hampered so that it will have an impact on the growth and development of plants where the plants will wither and quickly become damaged.

CONCLUSION

The conclusions of this study are:

1. Characteristics of research respondents spread over four sub-districts consisting of an average age of 30 years, formal education of respondents having an average of high school graduation, with a family of 4 people with the main occupation being non-farmers.
2. Analysis of factors that influence farmers' decisions to apply hydroponic technology using logit regression function analysis. The Nagelkerke R2 value of 0.494 means that the variation of the independent variables included in the model is able to explain 49.4% of the existing phenomena. The variable frequency of hydroponic planting experience (X4) has a real and significant effect at the 5 percent level on the application of hydroponic hydroponic technology, while age (X1), formal education (X2), Dummy membership in farmer groups (X3), and Dummy nutrient costs (X5) is not significant. The frequency of hydroponic planting experience (X4) has a significant positive effect at the 5 percent level, meaning that the more experienced or often people cultivate hydroponic plants, the greater the opportunity to apply hydroponic technology.

Suggestions that can be given in this study are: One of the obstacles for farmers in applying hydroponic technology is the cost of purchasing nutrients, where nutrients are the main component in hydroponic technology, the community is assisted by other parties such as the government and extension workers looking for alternative nutrient-making alternatives that are cheap, efficient, and can be produced by the community themselves. . Thus the cost of procuring hydroponic technology can be minimized.

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