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Analysis of Paranet Techniques in Fulfilling National Food Diversification as a Solution to the Highland Water Crisis

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Abstrak

The need for food in the industrial world tends to increase every time, this is due to the increasing rate of population growth in Indonesia. SMEs XYZ is a social entrepreneur that was formed together, with the aim of collecting various harvests carried out by farmers, which are then processed into processed food products, so as to increase the cost of added value income. The purpose of this research is to evaluate the different levels of irrigation systems with paranet tools, in supporting the production of agricultural commodities, as an added value for food diversification. The research method used in this study is a qualitative descriptive method to analyze secondary data. The results of the production value of the harvest value deposited into XYZ SMEs in the three-month period, show a better increase compared to the initial data period. These results showed positive in sufficient and support the national food diversification program. The high value of the quantity of water from the paranet netting technique must be adjusted to the conditions of the slopes and the steepness of the agricultural land, so as not to pose a risk of landslides or excessive abrasion which is detrimental to farmers.

Keywords: irrigation; nets; paranet; SMEs

Analisis Teknik Paranet Dalam Memenuhi Diversifikasi Pangan Nasional Sebagai Solusi Krisis Air Dataran Tinggi

Abstrak

Kebutuhan pangan pada dunia industri cenderung meningkat setiap saat, hal ini disebabkan oleh semakin meningkatnya laju pertumbuhan penduduk di Indonesia. UKM XYZ merupakan wirausaha sosial yang dibentuk bersama-sama, dengan tujuan mengumpulkan berbagai hasil panen yang dilakukan petani, untuk kemudian diolah menjadi produk pangan olahan, sehingga dapat meningkatkan biaya nilai tambah pendapatan. Tujuan penelitian ini adalah untuk mengevaluasi perbedaan tingkat sistem irigasi dengan alat paranet, dalam menunjang produksi komoditas pertanian, sebagai nilai tambah diversifikasi pangan. Metode penelitian yang digunakan dalam penelitian ini adalah metode deskriptif kualitatif untuk menganalisis data sekunder. Hasil nilai produksi nilai panen yang disetorkan ke UKM XYZ pada periode tiga bulan menunjukkan peningkatan yang lebih baik dibandingkan periode data awal. Hasil tersebut menunjukkan positif dalam mencukupi dan mendukung program diversifikasi pangan nasional. Tingginya nilai kuantitas air hasil teknik jaring paranet ini harus disesuaikan dengan kondisi lereng dan kecuraman lahan pertanian, agar tidak menimbulkan resiko terjadinya longsor atau abrasi berlebihan yang merugikan petani.

Kata kunci: *irigasi; jaring; paranet; UKM*

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INTRODUCTION

The need for food in the industrial world tends to increase every time, this is due to Indonesia's population growth rate continues to increase. This prospect is said to be positive, because it also absorbs the level of sales of local agricultural commodities, so that the level of welfare also increases. The dynamics of the level of needs, gave rise to the process of food diversification programs. Food diversification is an act of increasing the allocation of food diversity consumption with the principles of varied, nutritious, balanced. This is because the food diversification program needs support for the availability of relatively easy and inexpensive processing technology to be implemented in the community. In addition, the availability of processing technology for various food products from local ingredients, such as cassava, will provide opportunities for the growth and development of agro-industry, especially in areas of production centers (Ikhram & Chotimah, 2022). Analysis of the program in field conditions, namely the need for food land is not increasing but decreasing, because it has turned into non-agricultural infrastructure such as housing/residential settlements. This causes a decrease in agricultural productivity and results in a decrease in the availability of food (Tranggono et al., 2023). The unsupported condition of national food diversification also extends to the condition of irrigation supply, especially during the long dry season. The structural condition of the transition of land into a residential area also causes the condition of the irrigation system with a focus on the irrigation system, which must share the needs of water for food and housing for the population.

Previous research highlights that water demand for paddy cultivation is often calculated without considering specific plot dimensions. Furthermore, irrigation efficiency is frequently compromised by aging infrastructure, significant sediment accumulation within canals, and unaddressed structural damage (Kurnianto & Sutopo, 2020). These constraints have prompted an evaluation of how farmers might optimize commodity production amidst water scarcity, particularly during the dry season. Such interventions are critical to maintaining the economic stability of both the farmers and their institutional partners, specifically SMEs XYZ.

SMEs XYZ is a social enterprise that was formed together, with the aim of collecting various harvests carried out by farmers, which are then processed into processed food products, so as to increase the cost of added value income. The process of collecting agricultural commodities, initially tends to increase, because the agricultural land used is rich in nutrients. However, in dry conditions, crop yields began to decline, so that XYZ SMEs could not meet market demand, and this boosted the national food diversification growth rate. The form of solution applied by researchers is by applying the paranet technique, in the schematic title of the research analysis of paranet techniques in fulfilling national food diversification as a solution to the highland water crisis. This study considers the aspect of rainfall that falls on the fields of XYZ partner farmers' fields, and relates to the water balance (water balance) that exists in that area. The water balance is a balance of input and output of water in a place for a certain period, so that it can be used to determine the amount of water in excess (surplus) or deficiency (deficit). The water balance can be used as a monitoring of water needs for agricultural irrigation which will later be useful for preventing or overcoming drought in an area, by analyzing the results of the water balance it can be used as a way to mitigate drought (Mediani et al., 2019). It is hoped that this technique can provide an alternative to irrigation quickly, cheaply, in uncertain conditions.

RESEARCH METHODS

This study employs a qualitative descriptive methodology to analyze secondary data derived from institutional records. As defined by Martina and Praza (2021), this approach utilizes qualitative data to provide a descriptive account of agricultural extension methods. The research primarily focuses on the processing of secondary data, supplemented by field observations to contextualize the study area.

Specifically, the treatment and application data were sourced from SMEs XYZ, located in the highlands of the Bogor region. The research was conducted according to the following stages:

a) Setting Formulation and Research Objectives
   This stage contains all elements of questions that must be answered and then discussed at the data processing stage. The formulation of the problem also contains the rules for research objectives, so that research limitations emerge, so that they can be discussed specifically without being general.
b) SMEs XYZ Data Collection
   The type of data collection carried out was in the form of quantity data collected from deposits made by farmers, from the commodities of mustard greens, lettuce, kale, and radishes. These four commodities are considered sufficient as a form of supply to support the food diversification program.
c) Paranet Net Design
   This stage is a form of simple initial design in making paranet nets. This design will also be used as a guide for farmers, when this research has been completed, and it is hoped that it can be carried out independently.
d) Application of Paranet Techniques
   This stage is the most important stage, because the source of the data obtained comes from application activities to farmers. The results of this implementation will be carried out in early January 2023 until the end of March. The data process is based on the application of paranet, with an orientation towards production results, as well as a comparative treatment analysis for data from October to December 2022.
e) Data processing
   This stage contains processing, calculations, and comparisons based on the type of data variation collected.
f) Data Comparison
   This stage contains a comparison scheme before and after implementation. Comparison of data is also intended to see whether there are progress or setbacks from this irrigation technique.
g) Conclusion Drawing
   This stage contains the results of the final idea of a study, which contains several premises with inference rules.

The stages - these stages can be seen in Figure 1, which as a whole must be carried out by researchers.

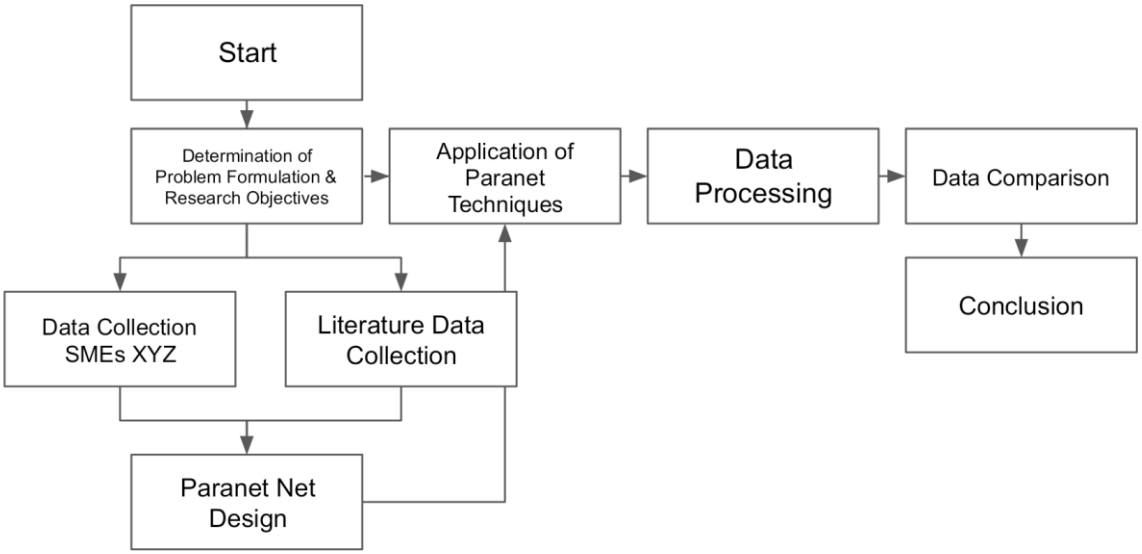

Figure 1: Research Framework

RESULT AND ANALYSIS

Determination of the formulation in this study is whether the paranet technique is capable of causing efficient sprinkling of water, and whether the technique is able to produce higher quality agricultural commodities. As support for answering these two questions, researchers obtained data on the contribution of farmer partners to SMEs XYZ, sourced from the local cooperative and agricultural office, which can be seen in Table 1.

Table 1 Total Production Results on a land area of 1 Hectare/ Tonne October - December 2022

No	Mustard Greens	Lettuce	Spinach	Turnip
October	0,5	2	9	1
November	0,51	3	11	1,1
December	0,52	3,1	12	1,1
Total	1,53	8,1	32	3,2

Source: Data processed by the author (2023)

Paranet Net Design

The design of paranet nets, basically adopts the Mist Catcher Building Technique which is an innovative technology based on collecting water collected from fog under certain climatic conditions (Irnawan, 2022)**.** And has developed in the process of watering and simultaneously increasing crop production, where drip irrigation can be controlled remotely using the Internet of Things (IoT) (Jamal et al., 2021)**.** However, the technique in this activity is done manually, with the form of nets used that must cover the plantation area as a whole, without any gaps, so that the irrigation process using dew can be carried out perfectly. The land area per commodity is 1 hectare or the equivalent of 10,000 m^2. therefore the process of designing 1 net is to form a triangle, with a height of 200 m and a base length of 10 m. As for the total, in order to adjust the land area, there are 5 triangular paranet nets counted. Overall, the shape of the paranet network can be modeled as shown in Figure 2.

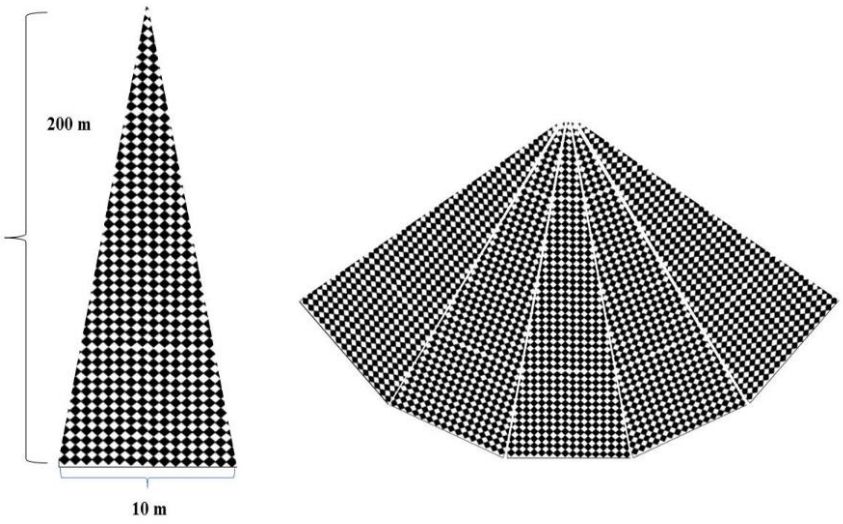

Figure 2: Paranet Design

Application and Data Processing of Paranet Net Techniques

The implementation of the paranet net stages is carried out for three months, and is processed at the end of the month to see the progress made. The data processing technique was carried out using the drip irrigation formula as follows :

$$EDR = \frac{\underline{q}}{s \, x \, l}$$

EDR : Emitter drip rate (mm/hour)
$\underline{q}$: Emitter Debit Average (m^3/hour)
s : Emitter Hole Spacing (m)
l : Emitter Lateral Distance (m)

Table 2 Calculation of the Results of Paranet Technique Drops as of January 2023

No	**Commodity**	$\underline{q}$ (m^3/hour)	**S** (m)	**L** (m)	**EDR** (mm/hour)
1	Mustard Greens	2	0.1	0.1	200
2	Lettuce	2	0.1	0.1	200
3	Spinach	3	0.1	0.2	150
4	Turnip	3	0.1	0.4	75

Source: Data processed by the author (2023)

Calculation analysis using the droplet formula, that the field numbers of mustard greens and lettuce, produce the highest level of EDR value. Because the system is definitely intentional by researchers, because of the minimal slope factor compared to kale and radish. In contrast to radishes, with a sloping soil structure, arrangements are made so that the level of each drop of dew received is not high so as to minimize the risk of landslides, but still pay attention to the aspect of water irrigation needs. The treatment is supported by study previously, which revealed that landslide events consisted of rainfall, rock type, slope, huma cover, & soil type. The parameter that most influences the level of landslide hazard is rainfall, because the percentage of rainfall weight (Prasetyo et al., 2022)**.**

The analysis of Table 3 demonstrates that paranet-facilitated rainwater harvesting can effectively supplement or replace natural rainfall allocations. This represents a viable alternative for irrigation systems, enabling partner farmers of SMEs XYZ to maintain field operations while mitigating the risks associated with irrigation scarcity. These findings align with Saputra et al. (2022), who observed that controlled drip irrigation significantly enhances the growth and yield of mustard greens (Brassica juncea L.), specifically at a discharge rate of 100 ml/day. Furthermore, this approach offers potential in alleviating water competition exacerbated by climate change. As noted by Hamzah et al. (2023),

diminishing water resources and environmental degradation have intensified competition for agricultural water, such fluctuations in water availability often impede optimal crop growth and productivity.

Table 3 Total Production Results on a land area of 1 Hectare/ Tonne October - December 2022

No	Month	Commodity	Mainstay Rain (mm)	Paranet Rain (mm)
1	January	Mustard Greens	70	200
		Lettuce		200
		Spinach		150
		Turnip		75
2	February	Mustard Greens	50	190
		Lettuce		280
		Spinach		112
		Turnip		300
3	March	Mustard Greens	67	200
		Lettuce		167
		Spinach		120
		Turnip		91

Source: Data processed by the author (2023)

Table 4 Total Production Yields on a land area of 1 Hectare/ Tonne January - March 2023

No	Mustard Greens	Lettuce	Spinach	Turnip
January	1	2,5	9,8	1,9
February	1,2	3,4	11,5	2,1
March	1,2	3,7	12,4	1,9
Total	3,4	9,6	33,7	5,9

Source: Data processed by the author (2023)

The results of the analysis in Table 4 show an increase in the amount of production with the help of paranet irrigation, which is higher than the previous data period. The level of efficiency based on the time value applied in the irrigation process is said to be faster, practical, because it is based on the movement of dewdrops, resulting in more abundant production values. The level of production and deposit to SMEs XYZ, is expected to be the foundation for, support for productivity agriculture and directly support the national food diversification program.

CONCLUSION

The research results obtained for three months (January – March 2023), show the role and positive developments. The result of the quantity value of water from the paranet netting technique is greater than the expected rainfall quantity value. This makes it an alternative technique that can be adopted by farmers in dealing with climate change or prolonged climate crises such as drought. The results of the production value of the harvest value deposited to SMEs XYZ in the three-month period (January – March 2023), show a better increase than the initial data period (October – December 2022). High water quantity value of technique paranet nets, must be adapted to the conditions of the slopes or the steepness of agricultural land, so that they do not pose a risk of landslides or excessive abrasion, causing losses to farmers.

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