The Potential for Development of Urban Farming in Supporting Agriculture Sustainability

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Abstract. In realizing sustainable and environmentally sound urban development, urban farming deserves to be used as part of sustainable urban development. Urban farming can indirectly overcome social problems in urban areas. The role of urban farming can have a positive impact on several aspects, such as the economy, ecology, society, aesthetics, education and tourism. Urban agriculture has considerable potential to be developed. This study aims to determine the potential for developing urban farming in Yogyakarta. Analysis was carried out through quantitative descriptive supported by primary and secondary data. The results showed that urban farming activities were carried out through the cultivation of vegetables, fruit plants, medicinal plants, ornamental plants, fish cultivation, product processing and marketing. Efforts to develop urban farming in the city of Yogyakarta have good potential. Urban farming activities have the potential to be developed into agricultural, educational and tourism activities.

1 Introduction

Urban farming is a series of activities carried out by individuals and groups to utilize limited land in urban areas [1]. The activities involved in urban farming can include livestock farming (breeding and raising animals), cultivation (beekeeping and fish cultivation), aquaponics (simultaneous fish farming and farming), and non-food production activities such as seed production, seedling propagation, and cultivating ornamental plants [2]. Urban farming plays an important role in ensuring food security in urban areas, facilitating access to high-quality farming products in densely populated regions, and reducing dependency on external food sources. In addition to its economic benefits, urban farming also contributes to environmental and social sustainability [3][4] .

The role of urban farming can have positive impacts on various aspects such as economics, ecology, social interactions, aesthetics, education, and tourism [5]. Based on this, urban farming indirectly addresses specific social issues, creates employment opportunities, provides educational resources, and contributes to a more vibrant and pleasant urban environment [6].

The concept of urban farming development carried out through farmer groups in Yogyakarta has also managed to become a reference for learning and attracting attention from

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areas outside Yogyakarta for benchmarking[7]. The achievements that have been made could present new opportunities for existing farmer groups in Yogyakarta. The urban farming activities managed by these farmer groups have the potential to evolve into new tourist destinations that can be integrated into farming education sites [8].

Yogyakarta Special Region is one of the provinces that attracts many tourists each year. The high number of tourists in Yogyakarta City could be leveraged to develop urban farming tourism destinations. A significant number of tourists in an area significantly impacts its economy, and a high potential of tourists represents a substantial opportunity for tourist sites, including farming, education and tourism.

The high tourist numbers in Yogyakarta City provide a foundation for the development of farming tourism concepts. The current tourism development in Yogyakarta City largely centers around historical buildings and has almost no natural or agro-educational tourism sites. Developing urban farming as a part of natural or agro-educational tourism represents a novel approach that deserves introduction and establishment as a new tourism option for Yogyakarta City. Considering that urban farming in Yogyakarta City has flourished and spread throughout the urban areas, effectively managed by farmer groups in all sub-districts.

The availability of agricultural land that is not commensurate with food needs in a city causes the city to depend on other areas around it [9]. A city is a 'nutrient absorber' when the city takes more resources than it gives, this is because cities consume a lot of resources such as land, food and energy from various places but are unable to return them [10]. However, a city will become more stable if the urban environment is able to provide resources for the city's needs by carrying out urban agricultural activities. It is hoped that the development of urban agriculture in the city of Yogyakarta can be a solution to efforts to ensure the availability of food for its population. Urban agriculture is the process of growing, developing and distributing various agricultural products using human resources, land and air, products and services found around urban areas (Food and Agriculture Organization of the United Nations, n.d.). Apart from that, the development of urban agricultural activities also has many other benefits (co-benefits), in the sense that it is not focused on food availability alone. However, the development of urban agricultural activities in Yogyakarta City needs to be directed at utilizing other aspects so that the benefits are more optimal. Much research has been carried out on urban agriculture (urban farming), both related to the concept of performance, models and desires of urban agriculture. However, research on the potential for developing urban agriculture (Urban Farming) is still very limited, especially in the city of Yogyakarta.

Given the potential of continuously evolving urban farming activities supported by the Yogyakarta City government, the true potential lies in creating a foundation for urban farming activities based on farming, education, and tourism in Yogyakarta City. The objective of this research is to describe the urban farming activities carried out in Yogyakarta City and depict the potential for urban farming development to support sustainable farming.

2 Research Method

This study utilizes a quantitative descriptive analysis method, examining the potential of urban farming in relation to farming, educational, and tourism activities. The collected research data was subjected to descriptive analysis. Subsequently, the outcomes of this data analysis were thoroughly discussed and interpreted, grounded in the presented data. The study was carried out in Yogyakarta City, involving 80 members of farmer groups selected at random. Primary data was collected through structured interviews using questionnaires. The potential for urban farming development is assessed based on farming potential, educational potential, and tourism potential, which are measured using a Likert scale ranging from 1 to 5. The scale includes the following options: "not at all potential," "low potential,"

"moderate potential," "high potential," and "very high potential." Below is the item statement of each indicator.

Table 1. Indicators of Urban Agricultural Development Potential

Agricultural Potential	Code	Educational Potential	Code	Tourism Potential	Code
Able to implement the vegetable village program	A1	As an educational medium for residents around the location	E1	As a tourist destination	T1
Able to implement the vegetable aisle program	A2	As an educational medium for people outside the sub-district	E2	As a tourist spot	T2
In carrying out activities to provide planting media	A3	As a medium for educating people from outside the city	E3	As a photo tour (selfie)	T3
In cultivating vegetable crops	A4	As an educational medium for foreign citizens	E4	As an educational tour of plant cultivation techniques	T4
In cultivating ornamental plants	A5	As an educational medium for children	E5	As a vegetable and fruit picking tour	T5
In cultivating medicinal plants	A6	As an educational medium in cultivating vegetable crops	E6	As a tourist destination for processing agricultural products	T6
In cultivating fruit plants	A7	As an educational medium in cultivating fruit plants	E7	As a tourism site for buying and selling plants and processed food	T7
In cultivating consumption fish	A8	As an educational medium in the cultivation of medicinal plants	E8	Empowering local communities as tourism managers	T8
In carrying out poultry farming activities	A9	As an educational medium in fisheries cultivation	E9	Structuring urban agricultural programs and activities as a tourist destination	T19
In carrying out plant nurseries	A10	As an educational medium in cultivating ornamental plants	E10	Involvement in managing tourism in the future	T10
When carrying out maintenance activities	A11	As an educational medium in poultry farming	E11	Addition of public facilities to support tourism activities	T11
In carrying out agricultural product processing activities	A12	As an educational medium for online cultivation	E12	Establishment of institutions that specifically handle tourism	T12

3 Result and Discussion

3.1 Demographic of Respondents

The identity of farmers is an explanation of the characteristics of members of farmer groups, which include age, gender, education level, income, land area, and farming experience. The number of farmer group members sampled in this study is 80 individuals, each of whom is part of their respective farmer groups located in the city of Yogyakarta. According to Table 3, it is evident that members of farmer groups in the city of Yogyakarta have an age range from 14 to 77 years. The age category is predominantly represented by farmer group members aged between 46 and 53 years. This age range encompasses both adults and the elderly. However, it can be observed that age is not a barrier or obstacle for farmer group members in the city of Yogyakarta to continue participating in urban farming activities. In the implementation of urban farming in Yogyakarta, it is rare to find young adolescent individuals joining farmer groups."

Table 2. Demographic of Respondents

	Frequency	Percent		Frequency	Percent
Age (year)			Farming Experience (year)		
14 - 19	1	1.25	<10	60	75
30 – 45	20	25	10 – 15	12	15
46 – 61	43	53.75	15.1 – 20	5	6.25
62 - 77	16	20	>20	3	3.75
Total	80	100	Total	80	100
Education			Land Area (m^2)		
Elementary School	5	6.25	470 – 704	69	86.25
Primary School	3	3.75	705 – 939	9	11.25
Senior High School	43	53. 75	940 - 1176	1	1.25
University	29	36.25	1647 - 1882	1	1.25
Total	80	100	Total	80	100
Income (IDR)			Job		
<1,000,000	27	33.75	Employee	13	16.25
1,100,000 – 2,000,000	38	47.50	Self-employed	25	31.25
2,100,000 – 4,000,000	10	12.50	Dealer	7	8.75
Total	80	100	Housewife	35	43.75
			Total	80	100

Nearly all members of the farmer groups have pursued education ranging from primary school, junior high school, high school, up to university level. The categories of high school and university are the most commonly achieved education levels among farmer group members in the city of Yogyakarta.

From Table 1, it is evident that members of urban farming groups in the city of Yogyakarta have diverse occupations. In terms of occupation, the majority of farmer group members are dominated by housewives. The urban farming occupation in Yogyakarta is also dominated by informal workers with varying income levels. From the table above, it is also noted that the income of group members is predominantly within the range of less than Rp 1,000,000 to Rp 2,000,000 per month. Based on their occupation and income levels, it can be discerned that urban farming activities in Yogyakarta are carried out by individuals with informal jobs and leisure time.

Land used in urban farming includes yards and demonstration gardens. Yards are plots of land directly surrounding residential houses with clear boundaries. Due to their proximity to homes, yards are easily cultivated by all family members, utilizing available leisure time (Ashari, Saptana & Purwantini, 2016). Based on data from Table 1, it is known that the land area used for urban farming in Yogyakarta ranges from 0 to 1882m². It is also evident that 68 farmers accounting for 85% of the total. The size of farmers' yard areas influences their cultivation patterns, which impacts the adoption of new innovations and improvements in productivity. A larger yard area is expected to contribute to more active efforts in finding effective and efficient patterns of urban farming management. In the implementation of urban farming in Yogyakarta, not all farmers possess yards for urban farming. Farmer group members without yard space collectively work on land in demonstration gardens.

Farming experience refers to the duration a farmer has been involved in farming throughout their life. Farmers' experience plays a crucial role in the sustainability of their farming endeavors. More experience translates to more useful insights for sustainable farming. The greater the experience, the more skills and expertise a farmer accumulates for successful farming. Based on Table 1, farming experience is dominated by farmers with a range of 1-5 years of experience, accounting for 66.25%.

3.2 Urban Farming Development Potential

Farmers' opinions on the potential for urban farming development can be defined as someone's idea or opinion in giving a value to an object. Farmers' opinions on potential can be seen by summarizing the opinions of members of urban farming farmer groups in the implementation of urban farming on the potential for farming activities, educational potential, and tourism potential[11][12][13].

3.2.1 Urban Farming as Potential Farming Activities

Farming potential is the potential for urban farming cultivation related to the opinion of members of farmer groups regarding the use of yards for preparing seeds, planting media, and processing farming products. Utilization of the yard in question is the activity of utilizing the yard as a vegetable village, vegetable alley, farming various types of plants, and carrying out activities of raising poultry and fish for consumption. Figure 1 is the opinion of members of farmer groups on urban farming activities as potential farming activities.

Based on the diagram above, it can be seen that the opinion of members of farmer groups in the City of Yogyakarta regarding urban farming as farming potential is included in the potential category with an average score of 4.14. Most people feel that land use as urban farming can have a good impact on members of farmer groups and the community around the urban farming environment. This can be seen from the existence of a vegetable alley program that utilizes walls and fences from the general public non-members of farmer groups as vertical land for cultivating horticultural crops. The Vegetable Village and Vegetable Alley Program is a city government program to strengthen household food security in the city of Yogyakarta [14]. This program can be a forum for farming cultivation and strengthen

community relations. At present, the vegetable village and vegetable alley programs exist in all villages in the city of Yogyakarta.

In the development of urban farming, Yogyakarta has emerged as a pioneering region that has successfully implemented the concept of urban farming on vacant or underutilized lands. The "Vegetable Alley" and "Vegetable Village" programs are initiatives that have been promoted in recent years by the Department of Farming and Food of Yogyakarta City. These programs are part of efforts to establish urban farming, serving as a means to utilize urban lands, generate additional income for the community, and enhance food security within the city[15][15]. The programs aim to transform neighborhoods into verdant and productive areas, foster a sense of community cooperation, and create a fresh identity for the city of Yogyakarta. Various types of vegetables are cultivated in this program, including chili peppers, lettuce, scallions, tomatoes, mustard greens, water spinach, spinach, celery, eggplant, and peanuts. Urban farming activities conducted by groups of farmers encompass seedling cultivation, plant care, harvesting, and post-harvest processing[16]. Moreover, in specific neighborhoods, this program has successfully yielded high-quality vegetables on a daily basis, which are considered suitable for the market due to the minimal use of chemicals.

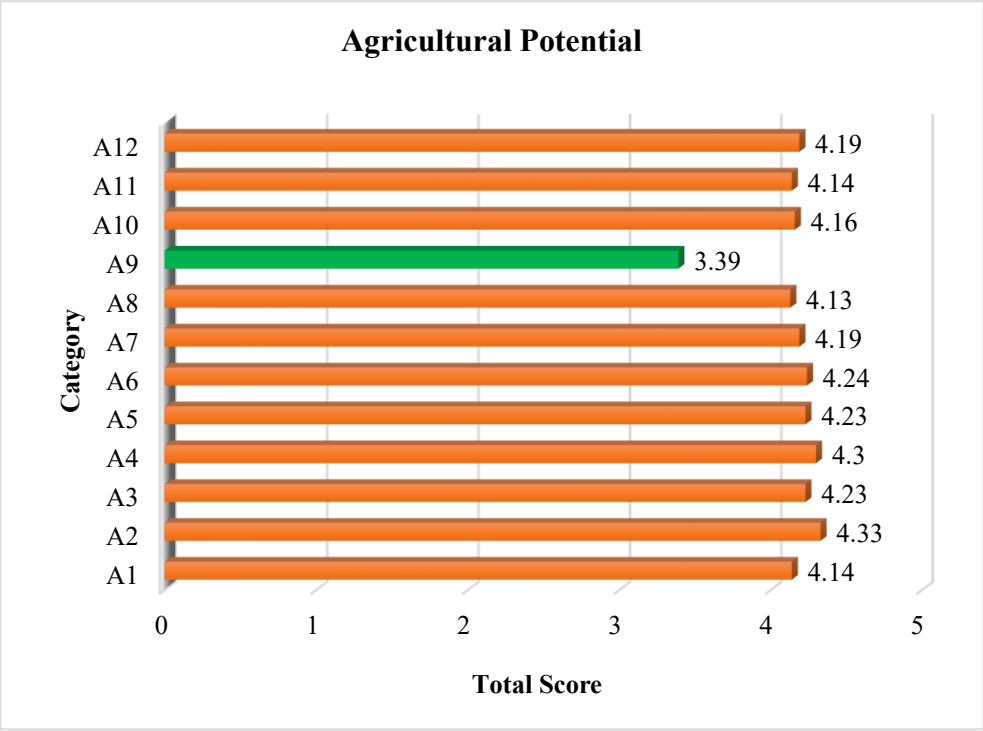

Fig. 1. Urban Farming as Potential Agricultural Activities

Score category:
Not Potential: 1 – 2.33
Less Potential: 2.34 – 3.66
Potential: 3.67 – 5

Farming cultivation activities are divided into land-use activities such as preparation of planting media, plant nurseries, plant maintenance, processing of farming products, vegetable farming, ornamental plant farming, fruit farming, medicinal plant farming, fish farming for consumption, and poultry farming[17]. The activities of utilizing farming land, from the

process of preparing the land, planting, caring for, cultivating various types of plants, raising fish for consumption, and utilizing the land as a place for processing farming products, have been accepted by the people of Yogyakarta City. This can be seen from Figure 1 that the community agrees with the activity indicators, with the average score of each indicator being more than 4 score. Every farming activity in the City of Yogyakarta is carried out on the principle of mutual cooperation and is scheduled. The ability of urban farmers to carry out the process of preparing planting media, seeding, caring for, and processing farming products in general has been carried out well by farmer groups in the City of Yogyakarta.

The farming cultivation agenda in the city of Yogyakarta has developed by applying various cultivation techniques. Currently, urban farmers in the city of Yogyakarta have used several techniques ranging from hydroponics, wall planters, pots, polybags, used bottle verticulture, and directly in the ground, while fish farming usually uses the cultivating catfish in a bucket technique, cement ponds, and tarpaulin ponds. In poultry farming activities, usually, solitary cages are made for the birds, which can limit the movement of the birds located in the demonstration plot. This is intended so that the poultry does not eat the plants around the demonstration plot garden and so that the environment in the demonstration plot garden is kept clean from poultry droppings. However, the poultry farming activities in urban areas did not receive a good response; some people disagreed, and most others chose the opinion that they quite agreed. The opinions of members of farmer groups regarding poultry raising activities in urban areas received unfavorable responses on the grounds that farming land in the City of Yogyakarta has a relatively narrow farming land area, the factor is the density of population settlements, and the opinion that raising poultry can disturb the comfort of residents because it can cause an unpleasant smell.

3.2.2 Urban Farming as Educational Potential

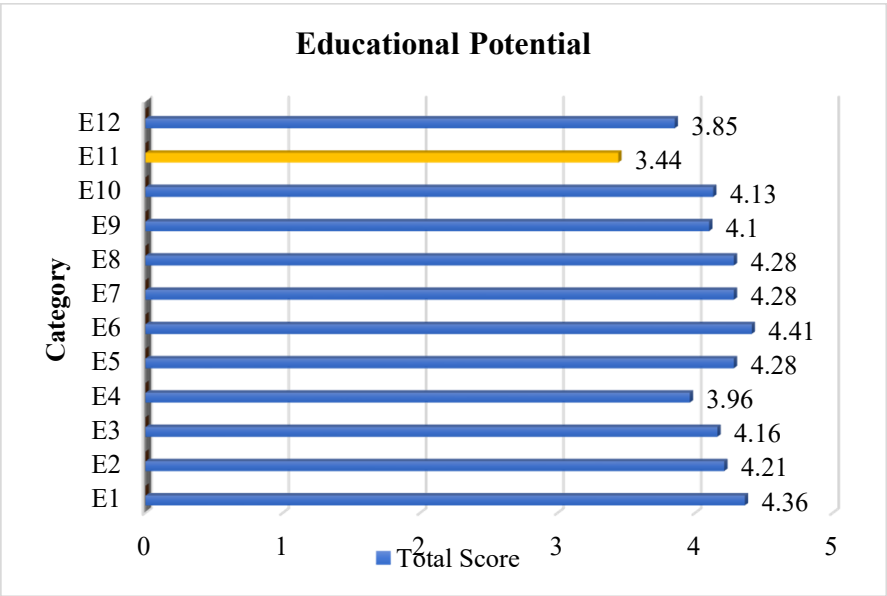

Fig. 2. Urban Farming as Educational Potential

Score category:
Not Potential: 1 – 2.33
Less Potential: 2.34 – 3.66
Potential: : 3.67 – 5

Educational potential is the potential of urban farming related to the opinion of members of farmer groups regarding the use and development of urban farming as various types of community education activities and the development of online education based on urban farming. In the educational potential variable, farmers' opinions on educational potential include the use of urban farming as an educational medium for communities around urban farming locations, educational media for people outside the sub-district, educational media for people outside the city of Yogyakarta, educational media for foreign nationals, educational media for educational media for children, educational media for vegetable cultivation activities, fruit plant cultivation, medicinal plant cultivation, ornamental plant cultivation, fishery cultivation, and ornamental plant cultivation, poultry farming cultivation, and online farming and animal husbandry cultivation[18]. The following is a frequency figure regarding the opinions of farmer group members regarding urban farming as an educational potential.

3.2.3 Urban Farming as Tourism Potential

Tourism potential is the potential of urban farming related to the opinion of members of farmer groups regarding the use of urban farming as a tourist area and community involvement in the management of urban farming tourism[19]. In the tourism potential variable, farmers' opinions on tourism potential include urban farming land development activities as tourist destinations, urban farming land arrangement as tourist attractions, urban farming development as photo tourism, urban farming development as farming cultivation tourism, urban farming development as cultivation tourism. crops, development of urban farming as a joint harvest tour, development of urban farming as a tour of picking vegetables and fruit, development of urban farming as a tourism of processing farming products, empowerment of surrounding communities as tourism managers, structuring programs and activities of urban farming as a tourist destination, involvement in managing tourism in the future, the addition of public facilities to support tourism activities, and the formation of special institutions that handle tourism[20][6]. The following is a frequency table regarding the opinions of farmer group members regarding urban farming as a tourism potential[21].

In the Figure 3, it shows that the level of opinion of farmer group members in the City of Yogyakarta in tourism potential results in a score of 4.28 in the potential category. Urban farmers in the city of Yogyakarta in developing their yards have a high desire to turn their land into farming cultivation, educational sites, and tourist attractions. Support from extension workers and the city government through its policies and programs makes farmers have the enthusiasm and willingness to continue to develop urban farming land.

The integrated food system program (Family Farming Integrated System) regulated in the Decree of the Mayor of Yogyakarta in 2020 has the aim of making urban farming function as education, agro-tourism, and environmental beauty. According to the mayor's decree, in building an integrated food system through urban farming, there must be four aspects to consider, namely aesthetic, educational, conservation, and economic aspects. The economic aspect is an aspect that emphasizes farming as a vehicle for developing the family economy. Making urban farming a tourist spot is one way to increase family income directly or indirectly[22][23].

The development of urban farming as a tourist destination shows that almost all members of the farmer group agree that their urban farming is developed as a tourist destination with a score of 4.34. The statement of urban farmers is also in line with the opinion of farmers who agree with a score of 4.30 that it is necessary to rearrange urban farming land as a tourist destination. Urban farming land owned by farmer groups currently still prioritizes yard space as an area that has the full function of growing crops and has not maximized yard space from

an aesthetic point of view. Based on this, the members of the farmer group agree with a score of > 4 that it is necessary to develop public facilities, develop land for photographs, and organize programs and group activities.

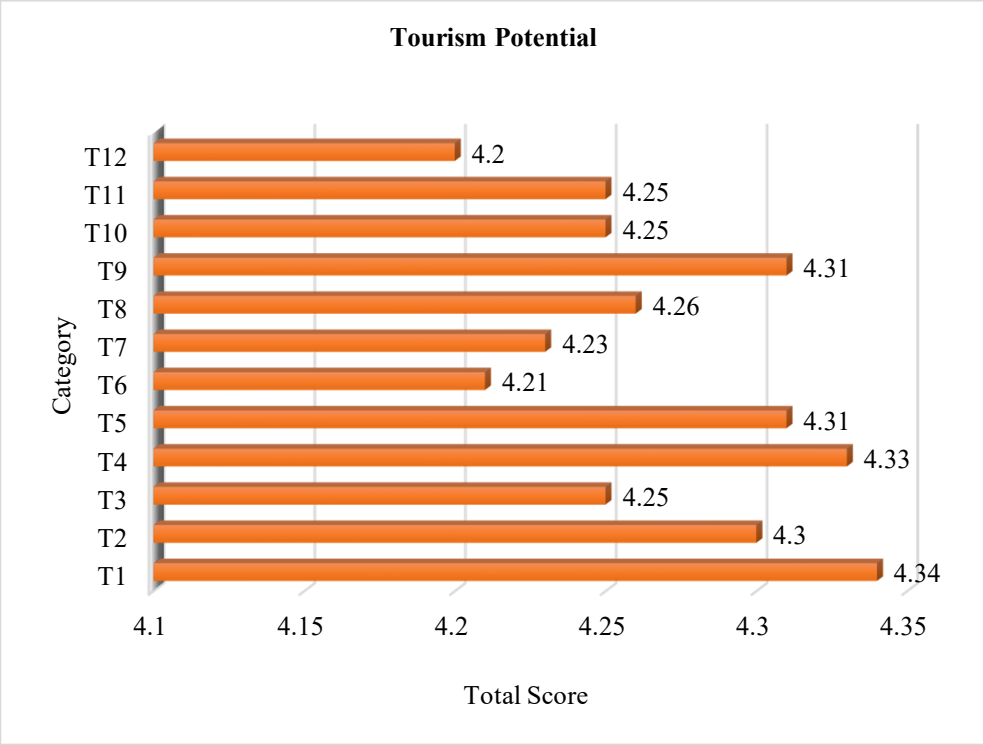

Fig. 3. Urban Farming as Educational Potential

Score category: Not Potential = 1 – 2.33; Less Potential= 2.34 – 3.66; Potential= 3.67 – 5

In the development of urban farming to attract tourists, a program is needed that can become the main attraction and characteristic of farming tourism. Some of the programs approved by members of the farmer groups as tourist attractions are the addition of educational programs on plant cultivation techniques, vegetable, and fruit picking tourism programs, farming product processing tourism programs, as well as plant buying and selling tourism programs and processed food.

Meanwhile, in the management of a tour, there needs to be an institution involved in designing and managing tourism activities. In this case, the majority of members of farmer groups in the city of Yogyakarta agree with a score of 4.20 if there is an institutional formation outside of farmer groups that deal with farming tourism activities and empower the surrounding community to be able to join as tourism managers.

The majority of farmer group members also agreed with a score of 4.25 to be directly involved in becoming farming tourism managers. Farmer group members want a new institution outside the farmer group to manage tourism activities; with the new institution, it is hoped that it can involve the community outside the farmer group. In addition, the formation of new institutions is intended so that the activities of farmer groups are not mixed up with tourism management institutions.

The opinion of members of farmer groups in the City of Yogyakarta regarding the use of their yards for urban farming on the potential for agriculture, education, and tourism is the opinion or statement of members' approval of the use of land for urban farming cultivation

activities, educational activities for the community, and farming tourism activities. The level of opinion of group members regarding the use of the yard can be grouped into several potentials, namely farming potential, educational potential, and tourism potential. So, the following is a table regarding the conclusions of the overall opinion of members of farmer groups in the use of yards in the City of Yogyakarta on the potential for agriculture, education, and tourism.

Table 3. Potential of Urban Farming Activities

Kriteria Potensi	**Rata-Rata**	**Kategori**
Urban farming as agricultural Potential	4.14	Potential
Urban farming as educational Potential	4.12	Potential
Urban farming as a tourism potential	4.28	Potential
Total	12.54	Potential
Average	**4.18**	Potential

Score category:
Not Potential : 1 – 2.33
Less Potential: 2.34 – 3.66
Potential : : 3.67 – 5

Based on Table 2, it can be seen that the opinion category of farmer group members regarding the potential of agriculture, education, and tourism is potential, with an average score of 4.18. Farmers' opinions on farming potential, educational potential, and tourism potential received a good response from farmers. Urban farmers in the city of Yogyakarta, which are dominated by housewives and informal workers, make farming activities in great demand for sideline activities. High expectations regarding their approval of the potential for agriculture, education, and tourism based urban farming activities can be seen from the farming activities carried out by farmer groups. Farming activities carried out by farmer groups have developed well; this can be seen from the various types of plants cultivated by farmers, group activities that have been programmed from seeding to harvest, and the variety of techniques applied in the use of yards. Urban farming in the city of Yogyakarta cultivates horticultural crops with several superior horticultural commodities such as ornamental plants, vegetable plants, fruit in pots, mushrooms, and processed farming products.

In the development of urban farming, the government has a role that can have a large influence on the development of urban farming. The main role of the city government, based on literature studies, is as a regulator (policy maker). City governments also play a role in providing facilities and infrastructure, assisting with funding, and increasing urban farming human resources. In supporting farming development in the City of Yogyakarta, the Yogyakarta City government helps farmer groups to receive guidance from the local government, for example, in the form of counseling, outreach activities, distribution of seeds, and technical guidance activities.

Urban farming activities in maximizing yard land in the City of Yogyakarta have great potential. Farming potential, which is supported by the development of the government, is intended to meet the food needs and nutritional needs of families as well as being a source of family income. With encouragement from the government, urban farmers in the city of Yogyakarta were able to have nursery houses, demonstration plot gardens, and vegetable alleys. Access to the facilities provided by the city government, as well as training and assistance from Farming Field Extension, can increase the knowledge, awareness, and skills of farmer groups in cultivating vegetables, fruit, tubers, raising fish, and raising poultry[24].

Based on Table 2, it can be seen that members of farmer groups in the City of Yogyakarta agree that urban farming is developed into agriculture, education, and tourism areas. In developing farming areas such as agriculture, education, and tourism, the community

believes that there is a need for development and renewal such as land arrangement, the addition of public facilities, arrangement of educational programs and farming tourism, development of online-based farming education, formation of special groups for agro-agriculture, education, and tourism, and addition of photo facilities to support the concept of agriculture, education, and tourism [5].

4 Conclusion and Recommendation

4.1 Conclusion

Based on the analysis discussed in the research that has been conducted regarding the potential of agricultural, educational, and tourism. Based on Urban Farming Activities in the City of Yogyakarta, the conclusions are as follows:

1. The implementation of urban farming in the city of Yogyakarta has been able to develop well when viewed from the three programs of using yards that have been carried out by farmer groups, the three programs are using yards as seed houses, using yards as demonstration plots, and using yards as vegetable aisle. The implementation of urban farming has developed well when viewed from the cultivation process; this can be seen from the various types of plants that have been cultivated by farmer groups, the development of several cultivation techniques, and the well-implemented process of caring for and harvesting by farmer groups.
2. The results of this study stated that the farmers' opinions on the implementation and development of farming potential, educational potential, and tourism potential showed a score of potential, meaning that most members of the farmer group agreed that the use of their yards and road alleys for farming cultivation activities, educational activities were carried out farming, and farming tourism activities.

4.2 Recommendations

1. The implementation of urban farming in the city of Yogyakarta, which farmer groups carry out, requires intensive assistance from field farming extension officers without discriminating between group levels. With the condition that the Covid-19, pandemic has subsided, it is hoped that PPL can hold regular meetings and help design return activity programs with farmer groups, bearing in mind that during the pandemic, several farmer groups postponed the implementation of meeting activities and programs that had been planned. PPL is also expected to be able to help prepare and arrange the layout of the cultivation location by prioritizing aesthetic, educational, conservation, and economic aspects.
2. The implementation of urban farming requires strengthening communication and collaboration between the government at the village levels in terms of collecting data on farmer group profiles and moral or material support to jointly realize urban farming, which can be a source of food and can increase family income.
3. The implementation of farming activities by farmer groups in Yogyakarta City needs to involve the younger generation, where so far, many of the younger generation have not joined farmer groups. The role of younger generation can assist farmer groups in carrying out digital marketing to facilitate the marketing of farming products or processed farming products and can help farmer groups to maximize social media such as YouTube as an introduction to activities and promotion of urban farming cultivation.

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