Contribution of home-garden farming to household income and its sustainability in Yogyakarta City, Indonesia

Irham1,*, D S Gusfarina2, A W Widada1 and A Nurhayati1

1 Department of Agricultural Socioeconomics, Universitas Gadjah Mada, Jl. Flora, Bulaksumur, Yogyakarta 55281, Indonesia
2 Agricultural Technology Research Agency, Jambi Province, Jl. Samarinda Paal V Kotabaru 36128 Jambi, Indonesia

* E-mail: irham@ugm.ac.id

Abstract. Farming is nowadays intensively developed in urban areas. Home-garden has excellent potential in supporting household food sufficiency and providing aesthetic value for the household economy. This study's objectives are: (1) to estimate home-garden farming's contribution to household income and (2) to determine the Sustainability of home-garden farming in Yogyakarta City. The research was carried out in the city center and fringe area covering seven districts of Yogyakarta City. The sample was 113 households that utilized their home-garden for farming as the members of farmer groups. Data were analyzed using a simple statistical calculation to determine the contribution of home-garden farming income. Farming sustainability data were categorized into ecological, economic, and social dimensions using a Likert scale. The results of the study showed that the contribution of home-garden farming to household income was 0.81%. This value is relatively small because the land is very narrow. Also, the primary purpose is not for sale. Home-garden farming, both in the city centre and in the suburbs, has a high level of Sustainability, which is indicated by the economic dimension (79.11%), the ecological dimension (78.71%), and the social dimension (84.12%).

1. Introduction
The need for food in an urban area tends to rise, in line with the increase in population number. Simultaneously, however, urban sprawl around the city of Yogyakarta has reduced the area of fertile agricultural land that reduced substantially [1][2]. Therefore, preserving agricultural land in urban areas, including homegarden, is vital to provide a food supply for urban communities by themselves [3]. To cope with such a phenomenon, the government is currently encouraging urban agriculture development [4][5]. Agriculture in urban areas can be carried out in cities and suburban areas, with residential, housing complex, or open areas [6]. Management also varies, such as gardens on public land assigned to individuals or households, gardens on abandoned vacant lands as community gardens, or individual gardens on homegardens, balconies, or even on roofs of buildings [7]. It is expected in the future; each household is encouraged to optimize its resources, including homegarden, in providing food for households [8][9]. Homegarden has a great potential in supporting ecosystem services [10], household food production [11], providing aesthetic value, and sustainable household economy [12]. Although the size of homegarden is generally small, both in urban and rural areas [13], the utilization of that small size land has great benefit and value for households, including fulfilling household nutrition improvement, ensuring quality, and hygienic foodstuffs, reducing expenditure and increasing household
income. The problem is that the household’s attention to the use of their homegarden is still limited. The study's objectives are: 1) to estimate home-garden farming's contribution to household income; and 2) to determine the Sustainability of home-garden farming in Yogyakarta City.

2. Literature review

2.1. Farming contributions

The concept of household refers to the economic meaning of the household unit. This activity includes how the household manages its economic activities, division of labour and functions, how much income is earned or spent, and the types of products and services produced [14]. The contribution of income from a kind of activity to the household depends on the productivity of the production factors. Household income stability tends to be influenced by primary income sources. The types of income generated from outside the agricultural sector are generally not dependent on the season and can be done at any time of the year [15]. Farming in the homegarden contributes to income in the form of commodities that are sold and commodities consumed by themselves.

2.2. Farming sustainability

Research has described the homegarden as traditional farming that is ecologically, socially, and economically sustainable [16]. The primary ecological processes that occur are a competition between plants, plants’ consumption by humans, livestock, and pets, and predation of pests by their natural enemies. However, the current ecological process is governed by the farming process in fertilizers, water control, pests and diseases, and harvest regulation. In turn, economic and social decisions manage agricultural operations. General indicators regarding the socio-economic Sustainability of homegarden by looking at the fact that homegarden farming contributes to nutritional security and energy needs contributes to household income even under high population density conditions. Besides, from a socio-economic perspective, adapting to significant transformations from rural to urban development is required.

2.3. Urban homegarden

In the city, there is currently a conversion of land to a settlement. Housing development will be provided with a specific area for homegarden. The homegarden as the land around the house with clear boundaries and ownership is an important landscape that supports the beauty of housing, supplies healthy food for households, and supports the household economy. Plants in the homegarden consist of a mixture of cultivated plants such as vegetables, fruit, plantations, spices, and medicinal plants [17]. The functions of horticultural crops as productive urban landscapes can be grouped into four parts [18] namely:
1. Providing food is related to vitamins, minerals, fibre, and other compounds in fulfilling nutrition.
2. Economic function, horticultural commodities have a high enough economic value to be a source of income for farmers, traders, industrial circles, etc.
3. Health functions, especially the benefits of biopharma commodities to prevent and the threat of various diseases.
4. Socio-cultural functions, the role of horticultural commodities as an element of the beauty or environmental comfort, and their role in various ceremonies, tourism, etc.

3. Methods

3.1. Data collection

The sampling technique for the research location was carried out using a purposive sampling technique. The research took place in 7 districts of the 11 districts in the city of Yogyakarta. This district is divided into 2 locations, namely the city centre and the suburbs. To make it easier to find respondents who use the homegarden for vegetable and/or fruit farming, each sub-district with a farmer group that operates the homegarden for agriculture is part of several farmer groups. The seven sub-districts were sampled because they have many farmer groups working on homegardens for horticultural agriculture. In contrast,
for selecting the village's location by looking at the diversity of superior horticultural commodities, it is hoped that the sample will meet diversity. The sampling method of respondents was done by using *purposive random sampling*. Respondents in this study were households that had used their homegardens for vegetable and/or fruit farming. In this study, Respondents were 113 respondents (77 respondents were taken from the city centre and 36 respondents from the suburbs).

### 3.2. Measures

#### 3.2.1 Contribution of home farming to household income

This study's data analysis is a quantitative analysis by calculating the average revenue, income, and contribution. To find out the amount of income obtained by subtracting the total revenue from the total cost, with the equation [15]:

$$ I_f = TR - TC $$

Where: $I_f$ = income from farming; $TR$ = Total Revenue; $TC$ = Total Cost

The total household income by using homegardens for farming in urban areas is calculated by summing up the income of all household members, namely:

$$ I = I_f + I_{nf} $$

Where: $I$ = Total Income of Household; $I_f$ = Income from Farming; $I_{nf}$ = Income from Non-Farming (salaries, wages, etc.)

The contribution of income from the homegardens to total household income is calculated as follow:

$$ P = \frac{I_f}{I} \times 100\% $$

Where : $P$ = contribution of home garden income to total household income (%); $I_f$= income from using the homegarden for agriculture; $I$ = Total household income

The amount of contribution of income from each economic activity to total household income is used by the following criteria: a) If the revenue contribution is <25%, then the contribution is small; b) If the contribution of income is (25-49)%, then the contribution is moderate; c) If the revenue contribution is (50-75)%, then the contribution will be large; and d) If the income contribution is >75%, then the contribution is immense.

#### 3.2.2 Sustainability of farming in urban homegarden

The Sustainability of farming in the homegarden was measured by employing a qualitative method, namely by looking at the sustainability indicators of farming using a Likert scale. The dimensions on the Likert scale are translated into measurable indicators. This indicator is then used as a starting point for making instruments in the form of statements that respondents need to answer by selecting the answers provided. The answers provided are SL = Always, SR = Often, KK = Sometimes, JR = Rarely, and TP = Never. The score is categorized 1-5 for each statement. This answer is presented with scale intervals to be a high, medium, and low reference category. The indicators used include ecological dimensions, economic dimensions, and social dimensions. Details on each dimension can be seen in Table 1.

| Dimensions | Indicator | Sub indicator |
|------------|-----------|---------------|
| Ecology    | Use of input | Use of organic fertilizers |
|            |            | Long time using organic fertilizers |
|            |            | Use of inorganic fertilizers |
|            |            | Long time using inorganic fertilizers |
|            |            | Use of biological pesticides |
|            |            | Duration of using biological pesticides |
|            |            | Use of chemical pesticides |
|            |            | Duration of use of chemical pesticide |
| Dimensions | Indicator | Sub indicator                                      |
|------------|-----------|---------------------------------------------------|
| Biodiversity (biodiversity) | The number of commodities cultivated | Number of commodity types cultivated |
| Economy   | Household income | Increase in income                        | Reducing expenses |
|           |             | Reducing transportation costs                  | Reducing cooling costs |
|           |             | Increase space use value                       | Employment Opportunity |
|           | Food security | Increase household food security                | Food diversification |
| Social    | Togetherness | Increase interaction between communities        | A sense of community among residents |
|           | Comfort     | Extension intensity                            | Access to information |
|           |             | Increase physical activity                     | Improve health |
|           |             | Improving aesthetics                           |                        |

To determine the sustainability index, the following formula is used.
Sustainability index = \( \frac{\text{total score}}{\text{maximum score}} \times 100\% \) \hspace{1cm} (4)

By using the above formula, the level of farming sustainability of the homegarden is categorized as follow [19]: (a) Index value 00.00-25.00 (poor/unsustainable); (b) Index value 25.01-50.00 (less/less sustainable); (c) Index value 50.01-75.00 (sufficient/sufficiently sustainable); and (d) Index value 75.01-100.00 (good/highly sustainable).

4. Results and discussion
4.1. Respondent characteristics

Most of the respondents in this study were women both in the city centre and the suburban. The condition means that the use of homegarden is indeed an area of work for mothers, especially housewives at home. The percentage of respondents in the city centre location for male respondents is lower than the suburban respondents, which means that men in the suburb are more active in utilizing a homegarden than men in the city centre. This could be because men in suburban locations have more flexibility in using their homegardens to do business.

The lowest age of respondents is 25 years, and the highest is 77 years divided into three scales so that the interval is 17. Respondents aged 25-42 years in the city centre are very few compared to respondents in the suburbs; however, those aged 61-78 years are more in the city centre than in the suburbs. Respondents aged 25-42 years were less in the city centre because people at this age did not use their homegardens to grow vegetables and/or fruit much. There were many other side jobs available in the city centre for people of this age than in the suburbs. The age of the respondents in the city centre are relatively older than in the suburbs. Some elderly respondents in the city centre are retirees, civil servants, and private employees who are used to working productive hours. Farming in the homegarden is one of the productive jobs that can be done for the elderly; besides filling their spare time, it also provides psychological and physical benefits. For the elderly, this city centre is also a place to gather and socialize, and self-actualize. In the suburbs, there may be informal jobs that do not have age and education requirements. In general, more than half of Yogyakarta City respondents are between 43-60 years old. At that age, most of the respondents already have independent children or retired, so that they used the free time to take care of the plants in the home garden.
Respondents in Yogyakarta City have relatively high education. Only 7.79% of respondents have an elementary education in the city centre only, and half of the respondents have a high school education/equivalent. Likewise, with suburban locations, the smallest percentage is an elementary school, and the highest is SMA/equivalent. The level of education will affect motivation with the general consideration that education level reflects the level of understanding of the power of reason and knowledge of the society in assessing the right and threatening environment. This high level of education also reflects a reasonably high income. Some respondents are civil servants / retired civil servants and private employees who receive pension funds every month; other jobs are traders, laundry workers, social workers, homemakers, and sell services.

Respondents' experience in farming vegetables and/or fruit in Yogyakarta's homegarden tends to be low, with an average age of 53 years and an average experience of 11 years. It means that the average respondent starts working in the homegarden at the age of 43 years, at which time it is estimated that they have begun to have a lot of free time, for homemakers they have children who are no longer toddlers. Experience in general will affect motivation; the more experience, the more benefits we get from farming in the homegarden, the higher the motivation.

Suburban locations grow more vegetables alone than in suburban areas. Respondents in the suburbs tend to choose vegetables because they can be enjoyed quickly; for example, leaf vegetables, spinach, and kale can be harvested within a month, or fruit vegetables such as chilies can be harvested every day. Respondents who cultivated fruit trees in the city centre were more than those of the suburbs, which mostly cultivated here are potted fruit plants. City centre respondents thought potted fruit plants were more comfortable to maintain than growing vegetables. More than half of the respondents in the city centre and suburban locations cultivate vegetable and fruit crops in their homegardens; this reflects the respondents' desire to give different colors to their homegardens.

A house in the suburbs is wider than a house in the city centre, with a wider homegarden area. The homegarden's utilization in the city centre is 53.86% of the area of the homegarden, while in the suburbs, it is 48.49%. This explains that the urban community uses the homegarden more than the suburban community; this can be because the city center community values land more than the suburban community. After all, the economic value of land in the city center is much greater than that of the suburbs. The average house in Yogyakarta City is very large [8], namely 152.37 m² and the area of the homegarden in the city of Yogyakarta (53.58 m²). About half have been used to cultivate vegetables and/or fruit of the homegardens' total area.

4.2. Home-garden farming's contribution to household income
Farming income in this study results from farming in the homegarden, whether it is consumed or sold. In general, in Yogyakarta, the homegarden's produce is not sold but rather for household consumption. For this reason, the analysis of farming in this study is to calculate the total production for one year of farming in the homegarden multiplied by the price prevailing in the market. Farming analysis can be seen in Table 2. Farming in the homegarden is a positive activity for urban communities; besides getting health benefits, the environment also gets economic benefits. The yield from the homegarden done optimally can meet household consumption needs, reducing the burden of spending on daily vegetable shopping. The total average income per respondent from farming in the homegarden is Rp. 400,000.00/year. The contribution is the amount of contribution given from an activity or job to household income. Table 3 showed that homegarden farming's contribution to household income in urban areas, especially the city of Yogyakarta is very small, which is only about 0.81 percent.

### Table 2. Average income, costs, and income from farming in the homegarden per household

| Location  | Revenue (IDR / year) | Cost (IDR / year) | Income (IDR / year) |
|-----------|----------------------|-------------------|---------------------|
| City center | 582,200.00 | 211,100.00 | 371,200.00 |
| Suburbs    | 683,900.00 | 222,200.00 | 461,700.00 |
The average total income per respondent in the suburbs is greater than that of the city center respondents; this is because homegardens on the city's outskirts are indeed wider than homegardens in the city center. The commodity is grown in the city center and the suburbs are not much different namely vegetables. Vegetables widely grown in Yogyakarta are mustard greens, lettuce, spinach and kale, eggplant vegetables, cayenne pepper, curly chilies, and tomatoes. Some leafy vegetables such as lettuce and kale are also grown using a hydroponic system.

Fruit plants seen from the planting medium in Yogyakarta City are planted in pots such as; Crystal guava, lime, sapodilla, and star fruit. The plants planted directly include mango, rambutan, banana, guava, papaya, and durian. The income of farming in this study is also obtained from fruit trees planted directly, although more is distributed to neighbours than from selling.

### Table 3. Contribution of homegarden farming to household income per year

| Location      | Farm income (IDR) | Household Income (IDR) | Contribution (%) |
|---------------|-------------------|------------------------|-----------------|
| City center   | 371,200.00        | 51,334,545.00          | 0.72            |
| Suburbs       | 461,700.00        | 45,301,388.00          | 1.02            |
| Yogyakarta City | 400,000.00      | 49,412,389.00          | 0.81            |

The contribution of homegarden farming to household income in urban areas, especially Yogyakarta City, is very small, which is only 0.81 percent. In another study by Putri [19] in rural DIY, home farming contributes slightly more than urban areas, due to the large income of urban people compared to rural communities. In town, homegarden farming is a side business, only for entertainment and filling spare time. Several other studies conducted in rural areas contributed around 3.45% to 20.37%. The fact is caused by the location of homegardens in rural areas, which tend to be wider than in urban areas.

We cannot deny the potential of urban agriculture for low-income urban communities. It's just that overcoming food insecurity should not be overemphasized because the contribution of income from the utilization of homegardens is minimal (tiny) [20].

### 4.3. Sustainability of homegarden farming in Yogyakarta City

4.3.1. Sustainability of homegarden farming based on ecological dimension. The index of Sustainability for homegarden agriculture (Table 4) based on the ecology dimension in the city centre is higher than that of in the suburbs in preventing pests and diseases by making biological pesticides but both are remained in the same category of sustainable enough.

### Table 4. The average score of homegarden farming sustainability from the ecological dimension

| Ecological dimension                                      | City Center | Suburbs | Yogyakarta City |
|-----------------------------------------------------------|-------------|---------|-----------------|
| Make your own organic fertilizer                          | 3.61        | 3.69    | 3.64            |
| Using biological pesticides for pest control              | 3.70        | 3.67    | 3.69            |
| Do not use chemical pesticides                            | 3.83        | 3.94    | 3.87            |
| Make use of every possible location for growing vegetables or fruit | 4.48        | 4.36    | 4.44            |
| Can take the time to clean the homegarden                 | 4.40        | 4.22    | 4.35            |
Ecological dimension | City Center | Suburbs | Yogyakarta City
--- | --- | --- | ---
Always look for ways to maximize the growth of vegetable and/or fruit crops | Score: 4.29 | Index: 85.8 | Score: 4.03 | Index: 80.6 | Score: 4.20 | Index: 84.4
Planning what commodities to plant | Score: 3.75 | Index: 75.0 | Score: 3.36 | Index: 67.2 | Score: 3.36 | Index: 67.2
The average number of scores | 28.06 | 27.27 | 27.55
The highest total score | 35.00 | 35.00 | 35.00
Ecological dimension sustainability index (%) | 80.17 | 77.91 | 78.71

Agricultural Sustainability in Yogyakarta City must be given an understanding of the ecosystem because people's behavior must be ecologically oriented. The use of homegardens is beneficial for humans and a habitat for fauna such as butterflies, birds, worms, and even ants, so you must be careful in using pesticides, which will also disturb the survival of the existing fauna. Besides, the preservation of fruit trees planted directly in Yogyakarta's homegarden is preserved by providing counseling for the urban community on the importance of these trees as a producer of fruit and the habitat for other living things. In the field, it was found that cutting down fruit trees was not the house owner's wish but was caused by complaints from neighbours who were disturbed by the tree. This is in line with Soemarwoto and Conway's research in 1992 [21], where the homegarden's role as a genetic resource has not been widely recognized until now.

4.3.2. The Sustainability of homegarden farming based on the economic dimension. Based on the homegarden farming sustainability index (Table 5), in the future, suburban respondents are more willing to sell their homegarden products than city-centre respondents. There is enough market for homegarden farming in the suburbs to the city centre. This is still in a fairly sustainable category.

| Economic dimension | City Center | Suburbs | Yogyakarta City |
|---|---|---|---|
| Selling the homegarden | Score: 2.79 | Index: 55.8 | Score: 3.36 | Index: 67.2 | Score: 2.97 | Index: 59.4 |
| Can save money to get vegetables/fruit from the homegarden | Score: 4.27 | Index: 85.4 | Score: 4.14 | Index: 82.8 | Score: 4.23 | Index: 84.6 |
| The frequency of buying from the shop/supermarket will be reduced | Score: 4.14 | Index: 82.8 | Score: 4.14 | Index: 82.8 | Score: 4.14 | Index: 82.8 |
| The cost for farming in the homegarden is not proportional to the benefits obtained | Score: 3.66 | Index: 73.2 | Score: 3.50 | Index: 70.0 | Score: 3.61 | Index: 72.2 |
| It is very easy to get input for farming | Score: 4.10 | Index: 82.0 | Score: 4.00 | Index: 80.0 | Score: 4.07 | Index: 81.4 |
| Free time will be more useful for maintaining plants in the homegarden | Score: 4.40 | Index: 88.0 | Score: 4.33 | Index: 86.6 | Score: 4.38 | Index: 87.6 |
| Will always harvest vegetables for the household from the homegarden | Score: 4.44 | Index: 88.8 | Score: 4.31 | Index: 86.2 | Score: 4.40 | Index: 88.0 |
| Households will eat various vegetables from the homegarden | Score: 4.21 | Index: 84.2 | Score: 4.11 | Index: 82.2 | Score: 4.18 | Index: 83.6 |
| The market for home crops is always available | Score: 3.53 | Index: 70.6 | Score: 3.81 | Index: 76.2 | Score: 3.62 | Index: 72.4 |
| The average number of scores | 35.54 | 35.70 | 35.60 |
| The highest total score | 45.00 | 45.00 | 45.00 |
| Economic dimension sustainability rate (%) | 78.98 | 79.33 | 79.11 |

City centre respondents hope to save money on vegetables and/or fruit, reducing the frequency of buying at stalls/supermarkets and suburban respondents, in the highly sustainable category. City centre
respondents also quickly get input for farming in their homegardens through an online shop. Respondents in the city centre also felt that free time would be more beneficial; in the future, households could harvest and enjoy different vegetables from the homegarden. These items in the city center fall into a highly sustainable category and in the suburbs.

City centre and suburban respondents feel that the cost for farming in the homegarden is not proportional to their benefits. They get a lot of intangible benefits; this item falls into a highly sustainable category. Overall, the Sustainability of the suburbs' economic dimension is greater than that of the city center. In Yogyakarta City, Sustainability from an economic dimension is good and highly sustainable.

All items from the economic dimension fall into the very continuous category except selling home produce both in the city centre and in the suburbs. However, this does not affect the Sustainability of the economic dimension because most Yogyakarta City respondents are not yet interested in selling their homegarden products. Their motivation is only to save money or reduce expenses for buying vegetables and/or fruit.

4.3.3. Sustainability of homegarden farming based on the social dimension. The sustainability index of homegarden farming for the social dimension is higher in the city centre than in the suburbs, as in Table 6. The sustainability index of homegarden farming from suburban respondents' social dimensions hopes that everyone will be entertained to see the homegarden. In contrast, the city centre respondents want to share the harvest. Respondents in the city centre were higher in participating in community service, caring for group gardens, exchanging experiences with others in farming, and participating in farming counselling. Suburban respondents were more active in providing input and suggestions on what crops to plant on the group's land. All are in a highly sustainable category.

Table 6. The mean score of homegarden farming sustainability from the social dimension.

| Social Dimension                                                                 | City Center | Suburbs | Yogyakarta City |
|---------------------------------------------------------------------------------|-------------|---------|-----------------|
| Want anyone to be entertained to see the homegarden                              | 4.43        | 4.53    | 4.46            |
| Will be happy to share the crop with neighbours                                  | 4.49        | 4.17    | 4.39            |
| Will always participate in community service to care for group gardens           | 4.32        | 4.19    | 4.28            |
| Will exchange experiences with others about farming                              | 4.38        | 4.19    | 4.32            |
| Will always attend farmer group meetings                                         | 4.19        | 4.06    | 4.15            |
| Will often follow counselling about agriculture                                  | 4.09        | 3.89    | 4.03            |
| Will provide input and suggestions on what crops to plant on the group's land    | 3.91        | 4.08    | 3.96            |
| It will be very easy to get information about farming in the homegarden           | 4.21        | 4.19    | 4.20            |
| It is important to educate the environment about the importance of consuming vegetables | 4.27    | 4.00    | 4.19            |
| Will have a good relationship with extension workers and production facility providers | 4.12        | 4.00    | 4.08            |
| The average number of scores                                                     | 42.41       | 41.3    | 42.06           |
| The highest total score                                                          | 50.00       | 50.00   | 50.00           |
| Social dimension sustainability rate (%)                                         | 84.82       | 82.60   | 84.12           |

City center respondents can get information about farming easily. Besides, there is also a higher level of importance for the homegarden in the city center to educate the environment about consuming
vegetables and maintain good relations with extension workers and production facilities providers. Each of these items is in a highly sustainable category.

The Sustainability of urban agriculture has three interrelated dimensions as described in this study, ecological, economic, and social. Compared to other dimensions, the low index of ecological sustainability can illustrate the existence of an ecological crisis. For this reason, policymakers and urban planning, especially concerning the homegarden, can take advantage of urban agricultural development opportunities in a more just and ecologically sustainable manner [22] and socially balanced [18].

Table 7. Farming sustainability index in Yogyakarta City.

| Dimensions       | City center | Suburbs | Yogyakarta City |
|------------------|-------------|---------|-----------------|
| Ecology / Environment | 80.17      | 77.91  | 78.71           |
| Economy          | 78.98       | 79.33  | 79.11           |
| Social           | 84.82       | 82.60  | 84.12           |

Overall, the city center’s social dimension is higher than that of the suburbs (84.82% and 82.60%). The sustainability of homegarden farming in Yogyakarta City from the social dimension is profitable and highly sustainable (84.12%). The future benefits expected from using the homegarden are strengthening the community by providing a place to meet and enjoy quality time with households and friends in a clean and calm natural environment [23]. The order of farming sustainability indexes in the city centre is, respectively, the social dimension (84.82%), the ecological dimension (80.17%), and the economy (78.98%). Meanwhile, the sequence of the index in the suburbs is the social dimension (82.60%), the economic dimension (79.33%), and the ecological dimension (77.91%). The agricultural sustainability index in Yogyakarta City as a whole for the environmental, economic, and social dimensions is useful and highly sustainable can be seen from Table 7. The highest is the social dimension (84.12%), followed by the economic dimension (79.11%) and finally the ecological dimension (78.71%). This result is highly different compared with Jakarta’s city case studied by Cahya (2016), where the index of ecological dimension for the Sustainability of agricultural development was less sustainable (43.67%) [24].

5. Conclusion and suggestions for further research

The study results showed that the contribution of homegarden farming in Yogyakarta City was relatively very small but still beneficial for the urban people from the ecological, economic, and social perspectives. Seen from ecological, economic, and social dimensions, the level of urban farming sustainability index in Yogyakarta City was categorized as highly sustainable. Researchers cannot dismiss the potential of urban agriculture for low-income people to overcome urban food sufficiency. Therefore, other studies are needed to take samples of low-income people in urban areas. Besides, it is also necessary to develop other potential commodities in urban areas such as ornamental flowers and spices, and medicinal plants to contribute to household income.

6. Acknowledgements

Thank you to the Agricultural Research and Development Agency, Ministry of Agriculture, Republic of Indonesia, for the research financial support.

References

[1] Irham 2012 Urban sprawl, food security, and Sustainability of Yogyakarta City, Indonesia, Urban Environment p 71-81
[2] Sudirman S, Irham, Slamet H dan Azwar M 2010 Analisis Faktor Penyebab Dan Dampak Perubahanpenggunaan Lahan Pertanian Pinggiran Kota Yogyakarta. J-SEP 4 1
[3] Rusida R 2016 Potensi pengembangan pertanian perkotaan untuk mewujudkan kawasan perkotaan Belopa yang berkelanjutan J. Perencanaan Wilayah dan Kota 5 p 125-135
[4] Puriandi F 2013 *Proses Perencanaan Kegiatan Pertanian Kota Yang Dilakukan Oleh Komunitas Berkebun di Kota Bandung Sebagai Masukan Pengembangan Pertanian Kota Di Kawasan Perkotaan* J. Perencanaan Wilayah dan Kota 24 p 227-240

[5] Cahya D L 2014 *Kajian peran pertanian perkotaan dalam pembangunan perkotaan berkelanjutan (Studi kiasus: pertanian tanaman obat rumah tangga di Kelurahan Slipi, Jakarta Barat).* In Forum Ilmiah 11

[6] Mougeot L J 2000 *Urban agriculture: Definition, presence, potentials and risks, and policy challenges*

[7] Orsini F, Gasperi D, Marchetti L, Piovence C, Draghetto S, Ramazzotti S and Gianquinto G 2014 *Exploring the production capacity of rooftop gardens (RTGs) in urban agriculture: the potential impact on food and nutrition security, biodiversity and other ecosystem services in the city of Bologna* Food Security p 781-792

[8] Badan Litbang Pertanian 2012 *Pedoman Umum Pengembangan Model Kawasan Rumah Pangan Lestari (M-KRPL)* (Badan Litbang Pertanian: Jakarta)

[9] Gusfarina D S dan Irham 2019 *Mengukur Tingkat Motivasi Masyarakat Terhadap Pemanfaatan Pekarangan Untuk Pertanian Perkotaan di Kota Yogyakarta.* Jurnal Kawistara 9 22 p 2018-2019

[10] Mohri H, Lahoti S, Saito O, Mahalingam A, Gunatilleke N, Irham, Hoang V T, Hitinayake, G, Takeuchi K, Herath S, 2013. *Assessment of ecosystem services in homegarden systems in Indonesia, Sri Lanka, and Vietnam* (Ecosystem Services) p 124-136

[11] Yusiana E, Slamet H, Irham. 2017 *Home Garden Efficiency in Kulon Progo District, Yogyakarta. Ilmu Pertanian J.* Agricultural Science 1 3 p: 111-114

[12] Irham dan S Sudirman 2017 *Farm Coeverion and The Sustainable City: The Case of Yogyakarta, Indonesia.* Sustainable Lanscape Planning in Selected Urban Regions.

[13] Irwan dan Sarwadi 2015 *Lanskap Pekarangan Produktif di Permukiman Perkotaan dalam Mewujudkan Lingkungan Binaan Berkelanjutan* (Prosiding Seminar Sains dan Teknologi; Universitas Muhammadyah Jakarta)

[14] Yulida R 2012 *Kontribusi Usahatani Lahan Pekarangan terhadap Ekonomi Rumah Tangga Petani di Kecamatan Kerinci Kabupaten Pelalawan Indonesia* J.of Agricultural Economics

[15] Suratiyah K 2009 *Ilmu Usaha tani* (Penebar Swadaya: Jakarta)

[16] Wiersum K F 2006 *Diversity and change in homegarden cultivation in Indonesia.* (In: Kumar B.M., Nair P.K.R. (eds) Tropical Homegardens. Advances in Agroforestry, 3. Springer, Dordrecht) p 13-24

[17] Galhena D H., Freed R and Maredia K M 2013 *Home gardens: a promising approach to enhance household food security and wellbeing* J.Agriculture & Food Security p 8.

[18] Putri A S 2017 *Analisis pemanfaatan lahan pekarangan di Desa Taman Tirto, Kabupaten Bantul, Yogyakarta* (Fakultas Ekonomi dan Manjemen: IPB)

[19] Kavanagh P and Pitcher T J 2004. *Implementing microsoft excel Software for rapfish: A technique for the rapid appraisal of fisheries status.* Fisheries Centre University of British Columbia Research Reports 12 p 75.

[20] Zezza A and Tasciotti, L 2010 *Urban agriculture, poverty, and food security: Empirical evidence from a sample of developing countries* (Food policy) p 265-273

[21] Soemarwoto O dan Conway G R 1992 *The Javanese Homegarden* J. for Farming Systems (Research-Extension) p 95-118

[22] McClintock N 2010. *Why farm the city? Theorizing urban agriculture through a lens of metabolic rift* Cambridge journal of region, economy, and society)\ p 191-207.

[23] Alkon A 2008 *Paradise or pavement: the social constructions of the environment in two urban farmers markets and their implications for environmental justice and Sustainability* (Local Environment) p 271-289

[24] Holmer M 2010 *Environmental issues of fish farming in offshore waters: perspectives, concerns and research needs* AEI (1) 1
[25] Cahya D L 2016 *Analysis of urban agriculture sustainability in Metropolitan Jakarta (case study: urban agriculture in Duri Kosambi)* CITIES 2015 International Conference, Intelligent Planning Towards Smart Cities, CITIES 2015, Procedia - Social and Behavioral Sciences p 95-100