Farmers’s perception and strategies for the development of sustainable livelihoods in disaster prone areas

S Anantanyu, Suwarto and Suminah
Faculty of Agriculture, Universitas Sebelas Maret, Surakarta, Indonesia
Email: sap_anan@yahoo.com

Abstract. Empowerment is a strategy to develop and build economy and community in both physically and mentally. One effort is to help generate a plan for community development in disaster-prone areas. For that, this study aims to develop farmers profile, to describe farmer perception towards farming effort and to formulate the empowerment strategies in the development of sustainable livelihoods in disaster prone areas. This study uses mixed methods. Farmers population use in this study were live in two villages of landslides prone areas, that are Beruk and Wonorejo which belongs Jatiyoso Subdistrict Karanganyar regency (Central Java). In depth structured interview was conducted to 150 farmers under Focus Group Discussion (FGD) followed with data analysis using SWOT analysis. The results showed level of farm management is in anxiety level, perception of farmers toward the availability of agricultural inputs is at a reasonable level and the agricultural information becomes the reduction factors. The result of QSPM matrix calculation through SWOT analysis on livelihood of agricultural, resulting some strategy according to the priority level that are development of conservation farming, strengthening the farmers capacity in agricultural products processing, strengthening farmer groups and improving the performance of agriculture extensionist.

1. Introduction
Agriculture can be considered as an attempt to establish an artificial ecosystem which has function to provide food for human [1]. In order to establish a stable ecosystem, it means the plant must be maintained well on a steady land. This means that every unit of energy and nutrients which removed from the soil in an attempt to obtain agricultural products should be returned to the system in another format. Agricultural system refers to a specific arrangement of farming operations that are managed based on the physical, biological, and socio-economic basis and in accordance with farmers’ goals, capabilities and resources owned by farmers [2]. Farming system is a unique agro-ecosystem, because it has a combination of different physical, biological, and human resources. It is further explained that the genetic resources, techniques and strategies that farmers that can be chosen to create, to maintain, and to develop a farming system that are largely determined by the characteristics of the ecosystem.

In developing the agricultural livelihood strategies, the structure of program directed the objectives and outputs for sustainable mechanisms of life with respect to biodiversity conservation [3]. Specifically the following themes are included into strategies for decreasing poverty reduction and sustainable livelihood promotion. The nature of poverty and vulnerability, including causes and indicators, differ from each site. The poor and vulnerable become poor in different ways, at different times, in different places. There are some strategies to overcome the poverty therefore they will be responsive and adaptive to the local situation. The strategies presented here are general approaches that will be addressed to the specific needs for each demonstration site. In Jatiyoso sub district, the
condition of agricultural land mostly in the form of dry land with oblique contours so that it has potential landslides. In addition, the dependence of community on agricultural land, as a source of livelihood, has encouraged the exploitation of land so that it causes landslides. This condition leads to complex problems related to livelihoods where the majority of the society are farmers, such as the absence of harvests or agricultural products which cannot be taken evenly throughout the year and lack of farmers' income due to landslides. This condition has an impact on the availability and accessibility of local food. The efforts to restructure pattern of agricultural land use through sustainable livelihood strategy becomes an alternative solution to the problems of farming communities.

The objectives of this research are to arrange the farmers profile in disaster prone areas, to describe farmer perception on agricultural business and to formulate empowerment strategy in sustainable livelihood development in disaster prone areas.

2. Method
The research was conducted in Beruk and Wonorejo Village, Jatiyoso Sub-district, Karanganyar Regency, because most of the agricultural land is disaster prone area. This research using mixed method [4]. In order to obtain the farmer profile data, structured interviews with 15 farmer respondents were performed to get an overview of site condition, general agricultural impression, and in depth interview and farmer involvement in FGD. This combination of data collection techniques [5], will provide a better understanding of rural livelihoods. The quantitative data were analyzed using descriptive statistics, while the qualitative data were done by using SWOT Analysis, namely: First, the input stage by analyzing the external and internal environment then evaluated through IFE and EFE matrix; second, the strategy formulation phase using IE matrix and SWOT matrix [6].

3. Results and Discussion

3.1 Location Overview
Wonorejo Village is located in Jatiyoso District, Kayanganyar Regency. The location is a mountainous land with slope between 30-85%. This location is in 1000 - 2300 mdpl. Overall, the area of Wonorejo village is an area with its breadth 2,045,175 ha. The distance between Wonorejo Village and Jatiyoso Sub-district is about 12 km. Administratively, Wonorejo village has 17 hamlets. Beruk village is located in Jatiyoso sub-district of Kayang- anyar Regency. The location area has a mountainous land with slope between 23-85%. This location is in 850 - 2200 mdpl. Overall, the Beruk village has an area of 690,2740 hectares. The distance between Beruk Village and Jatiyoso Subdistrict is about10 km. Administratively Beruk village has 9 hamlets.

Based on the village monograph data in 2014, the population of Wonorejo Village is 7,076 inhabitants and the population of Beruk Village is 560 peoples. The population in Wonorejo village is higher than Beruk village due to the area of Wonorejo is wider than Beruk village.

3.2 Respondents and Perception to Agriculture
The characteristics of farmers provide an overview about farmers condition as individual and the general condition of farm household. These characteristics include farmer age, the farming duration, and number of family member. The summary of farmer profile (characteristic) is presented in Table 1.
Table 1. The farmer characteristics

| No | Description          | Wonorejo Village | Beruk Village |
|----|----------------------|------------------|---------------|
|    |                      | Frequency (orang) | Percentage (%) | Frequency (total person) | Percentage (%) |
| 1. | Age                  |                  |               |                           |               |
|    | a. < 30 years old   | 1                | 1.33          | 2                          | 2.67          |
|    | b. 30 – 50 years old| 42               | 56.00         | 43                         | 57.33         |
|    | c. > 50 years old   | 32               | 42.67         | 30                         | 40.00         |
|    | Total               | 75               | 100.00        | 75                         | 100.00        |
| 2. | Education (School level) |              |               |                           |               |
|    | a. Elementary (6 years) | 56             | 74.67         | 62                        | 82.67         |
|    | b. Junior (9 years)  | 13               | 17.33         | 7                         | 9.33          |
|    | c. High (12 years)   | 4                | 5.33          | 6                         | 8.00          |
|    | d. University (>12 years) | 2             | 2.67          | 0                         | 0.00          |
|    | Total               | 75               | 100.00        | 75                         | 100.00        |
| 3. | Farming duration    |                  |               |                           |               |
|    | a. < 5 years        | 2                | 2.67          | 0                         | 0.00          |
|    | b. 5 – 10 years     | 12               | 16.00         | 2                         | 2.67          |
|    | c. > 10 years       | 61               | 81.33         | 73                        | 97.33         |
|    | Total               | 75               | 100.00        | 75                         | 100.00        |
| 4. | The total of family member |            |               |                           |               |
|    | a. Small (< 4 people)| 39              | 52.00         | 25                        | 33.33         |
|    | b. Medium (4 – 5 people) | 34             | 45.33         | 34                        | 45.33         |
|    | c. Large (>5 people) | 2               | 2.67          | 16                        | 21.33         |
|    | Total               | 75               | 100.00        | 75                         | 100.00        |
| 5. | Number of working family member |        |               |                           |               |
|    | a. 1 person         | 4                | 5.33          | 39                        | 52.00         |
|    | b. 2 people         | 44               | 58.67         | 32                        | 42.67         |
|    | c. 2 people or more | 27               | 36.00         | 4                         | 5.33          |
|    | Total               | 75               | 100.00        | 75                         | 100.00        |

Source: Primary Data Analysis

In the Table 1 above, it can be seen that from 75 respondents in each village, most data which obtained show that the frequency of farmer's age were the age of 30-50 years, while the smallest frequency at age less than 30 years, this condition shows that the low interest of young generation who works in the agricultural sector. The level of formal education of respondents varies from elementary school to university. The frequency of education of farmers is dominated by elementary school graduates (SD) who were as many as 60 people in Beruk Village and 56 people in Wonorejo Village.

The experience of farming is one of the factors which influences production. The experience of farming of the respondents mostly has experience for more than ten years with the number of respondents 73 farmers (97.33%) in the Beruk village and the number of respondents of 61 farmers (81.33%) in Wonorejo Village. The number of family members of the farmer as respondents in Beruk and Wonorejo villages varies considerably. Most of the number of family members ranged from 4 to 5 people with a percentage of 45.33%, while the smallest is the number of family members more than 5 people.

Perception of farmers on agricultural business are reflected in the perception of farming adequacy which seen from farmers assessment toward the availability of production factors owned by farmers. The detailed information can be seen in the Table 2.
Table 2. The distribution of Farmers Based on the Farming Adequacy Perception

| No. | Description                                               | Areas              |
|-----|----------------------------------------------------------|--------------------|
|     |                                                          | Beruk Village      | Wonorejo Village  |
|     |                                                          | TT | KT | CT | ST | TT | KT | CT | ST |
| a.  | Farm land for farming                                   | -  | 22 | 32 | 21 | -  | 15 | 35 | 25 |
| b.  | Family labor that helps farming                         | -  | 23 | 34 | 18 | 5  | 26 | 32 | 12 |
| c.  | Outsourcing workers who can help                        | 1  | 4  | 41 | 29 | 2  | 31 | 33 | 9  |
| d.  | Quality seeds / seeds use                               | -  | 4  | 59 | 12 | -  | 24 | 46 | 5  |
| e.  | Fertilizer factory used                                  | -  | 9  | 59 | 7  | -  | 11 | 63 | 1  |
| f.  | Organic fertilizer / the cage use                        | -  | 37 | 38 | -  | 14 | 39 | 22 |    |
| g.  | Pesticides which are suitable for pest control and disease| -  | 10 | 61 | 4  | -  | 19 | 49 | 7  |
| h.  | Water / irrigation for watering or irrigating            | 3  | 16 | 35 | 21 | -  | 5  | 22 | 48 |
| i.  | Capital (money) to buy production facilities             | -  | 32 | 42 | 1  | -  | 36 | 36 | 3  |
| j.  | Useful agricultural techniques for managing crops and yields| -  | 32 | 43 | -  | 3  | 47 | 23 | 2  |
| k.  | Agricultural tools needed to manage crops and the result of farming | -  | 5  | 68 | 2  | 2  | 32 | 41 | -  |
| l.  | Collaborative management                                | 33 | 27 | 3  | 12 | 1  | 42 | 29 | 3  |
| m.  | Agricultural information                                | 61 | 9  | 4  | 1  | 4  | 60 | 9  | 2  |

Source: Primary Data Analysis
Description: TT = Not Available, KT = Less Available, CT = Simply Available, ST = Very Available

There are thirteen factors of production which related to the distribution of farmers’ perceptions based on the basis of whether it is adequate, available, unavailable or not. From the factors above, the agricultural information are still not enough according to the farmers in Beruk and Wonorejo Villages. The organic fertilizer or cage is the most widely used by farmers in Beruk Village, while water / irrigation is the most available in Wonorejo Village. Farming land for farming in both villages is sufficient, the labor availability, factory fertilizer, pesticides, capital, and agricultural tools are enough too. From the description above about the perception of farmers toward the agricultural business, It shows condition that:

1. Land as the main capital in agricultural availability which is very diverse. There are some farmers with limited land and other with adequate land. The level of land adequacy is strongly influenced by the availability of family labor. The use of land with a relatively high slope for farming has become common. Farmers’ awareness for not planting seasonal crops on slopes is still low. Actually some farmers have obtained information about the danger of landslides, but all this time their knowledge has not been able to encourage the farmers to stop doing farming activities which have been done.

2. According to most farmers, they consider that the availability of water is still very adequate, but there are some of them who say that it is less adequate. The damage of environment slowly but surely causes the decreased of water supply. Absorption areas which are on the top used to have some plants and now they decrease their function as agricultural land.

3. The availability of labor, both family and outside workers, is very relative. The agricultural labor is dominantly done by farmers aged 30 years up to over 50 years. Young people (under 30 years old) are mostly not interested in agriculture, prefer to work in the city. Farmers’ working experience is more than 10 years old and they acquired it through generation.

4. It is easy to obtain some production facilities, such as seeds, fertilizers, pesticides, and agricultural equipment. This condition causes the perception of farmers toward the adequacy of this production facility. The opening of transportation access (road) facilitates the distribution / sale of production facilities.

5. Two things that are considered inadequate are agricultural information and group cooperation in the management of farming. Agricultural information meant by farmers is the necessary knowledge when farmers face problems, for example: pests or diseases. From the existing farmer groups, they do not show the cooperation between farmers to carry out the joint activities.
### Table 3. The SWOT Matrix of Agriculture Livelihoods in Beruk Village and Wonorejo Village Jatiyoso Sub-District Karanganyar

| INTERNAL FACTORS | POWER (S) | WEAKNESS (W) |
|------------------|-----------|--------------|
| 1. The land is fertile | 1. Have a high slope |
| 2. Road access is available | 2. Young workers happy to wander |
| 3. Water sources are available | 3. Lack of farm management cooperation |
| 4. Experience in horticultural cultivation | 4. Irrigation channels are inadequate |
| 5. Producing horticultural products mainly vegetables and fruits | 5. Cultivation technology is not yet available |
| 6. Production facilities are available | 6. Ability to process agricultural products is not adequate |
| 7. Available agricultural cooperatives | |

| EXTERNAL FACTORS | Opportunity (O) | Strategy (SO) | Strategy (WO) |
|------------------|-----------------|---------------|---------------|
| 1. Production of pilot farm (S1, S4, O5) | 1. Strengthening the capacity of farmers in the processing of agricultural products (W6, W3, O2, O5) |
| 2. Development of partnership cooperation (S7, O2, O3, O5) | 2. Strengthening of farmer groups (W3, O5) |
| 3. Improvement of Marketing Cooperation (S5, S6, O2, O1,) | 3. Procurement of agricultural cultivation technology (W5, W6, O1, O5) |
| 4. Optimizing the availability of facilities in supporting the improvement of product quality (S1, S2, S6, O1, O2) | 4. Increasing non-agricultural business opportunities in the local area (W2, O4) |
| 5. Growing institutional and partnership functions (S7, O4, O5) | 5. Improve irrigation channels as agricultural technology develops (W4, O1) |
| 6. Strengthening of Farmer Group (S4, S7, O5) (S2, S5, S8, O5) | 6. Utilization of location as a tourist village (W1, O3) |
| 7. Establishing the cooperation between the cooperative commission with farmer group in managing agriculture productivity so that farmers can easily sell their yields. (S2, S5, S8, O5) | |

| Threat (T) | Strategy (ST) | Strategy (WT) |
|------------|---------------|---------------|
| 1. Many farmers do not care about landslides | 1. Counseling on conservation farming (S1, S4, T1, T2, T4) | 1. Development of conservation farming (W1, T1, T2) |
| 2. The open land is easy to cause the landslide | 2. Increasing the cooperation among group members in selling crops to obtain stable prices (S5, S8, T3) | 2. Improvement of Agricultural Extension Performance (W6, T4) |
| 3. The selling price of the product fluctuates | 3. There is Evaluation on extension worker performance and farmer group (S7, T4). | 3. The need to foster youth gene-rasi in agriculture so that younger generation is encouraged in advancing their farming in their village (W2, T4) |
| 4. Performance of agricultural extension workers is still low | | 4. Improvement of irrigation channels to prevent erosion (W1, W4, T1, T2) |

Source: Data Analysis Results

#### 3.3 Development Strategy

**3.3.1 SWOT analysis** To obtain an overview of agriculture as a livelihood, the SWOT analysis which was used in this research include strengths, weaknesses, opportunities, and thread. The data required in
the SWOT analysis is obtained through observation, interview, and FGD, which are re-confirmed. Table 3 presents the SWOT Matrix of this research.

**Table 4. The Identification of QSPM Matrix of Agriculture Livelihood in Beruk Village and Wonorejo Village, Jatiyoso Sub-District, Karanganyar Regency**

| Main Factors | Development of farming conservation | Strengthening Farmers Capacity in the process of agricultural products | Farmers Group Strengthening | Improvement of Agricultural Extension Performance |
|--------------|-------------------------------------|---------------------------------------------------------------|----------------------------|-----------------------------------------------|
| **Opportunity** | Value | AS | TAS | AS | TAS | AS | TAS | AS | TAS |
| 1. Agricultural technology is growing rapidly | 0.1 | 4 | 0.4 | 3 | 0.3 | 1 | 0.1 | 2 | 0.2 |
| 2. The demand for qualified agricultural products increases | 0.09 | 4 | 0.36 | 1 | 0.09 | 3 | 0.27 | 2 | 0.18 |
| 3. The farm location is suitable for tourism | 0.09 | 4 | 0.36 | 3 | 0.09 | 1 | 0.09 | 2 | 0.18 |
| 4. A lot of time to do business outside the farm. | 0.13 | 3 | 0.39 | 4 | 0.52 | 2 | 0.26 | 1 | 0.13 |
| 5. There is a farmer group organization | 0.1 | 1 | 0.1 | 2 | 0.2 | 4 | 0.4 | 3 | 0.3 |
| **Threat** | Value | AS | TAS | AS | TAS | AS | TAS | AS | TAS |
| 1. Many farmers do not care about the danger of landslides | 0.13 | 4 | 0.52 | 1 | 0.13 | 2 | 0.26 | 3 | 0.39 |
| 2. Open land can cause landslide | 0.14 | 4 | 0.56 | 1 | 0.14 | 2 | 0.28 | 3 | 0.42 |
| 3. The selling price of the product is fluctuate | 0.07 | 2 | 0.14 | 1 | 0.07 | 4 | 0.28 | 3 | 0.21 |
| 4. The work performance of agricultural extension is still low | 0.1 | 2 | 0.2 | 1 | 0.1 | 3 | 0.3 | 4 | 0.4 |

| **Power** | Value | AS | TAS | AS | TAS | AS | TAS | AS | TAS |
|-------------|-------|----|----|----|----|----|----|----|----|
| 1. The land is fertile | 0.07 | 4 | 0.28 | 1 | 0.07 | 2 | 0.14 | 3 | 0.21 |
| 2. Road access is available | 0.06 | 1 | 0.06 | 4 | 0.24 | 3 | 0.18 | 2 | 0.12 |
| 3. Water sources are available | 0.09 | 4 | 0.36 | 1 | 0.09 | 2 | 0.18 | 3 | 0.27 |
| 4. Horticultural cultivation experience | 0.08 | 4 | 0.32 | 1 | 0.08 | 2 | 0.16 | 3 | 0.24 |
| 5. Producing the horticultural products mainly vegetables and fruits | 0.1 | 1 | 0.1 | 4 | 0.4 | 3 | 0.3 | 2 | 0.2 |
| 6. Production facilities are available | 0.08 | 4 | 0.32 | 1 | 0.08 | 3 | 0.24 | 2 | 0.16 |
| 7. Agricultural cooperative commission is available | 0.06 | 1 | 0.06 | 2 | 0.12 | 4 | 0.24 | 3 | 0.18 |
| **Weakness** | Value | AS | TAS | AS | TAS | AS | TAS | AS | TAS |
| 1. Has a high slope | 0.1 | 4 | 0.4 | 1 | 0.1 | 2 | 0.2 | 3 | 0.3 |
| 2. Young workers are happy to wander | 0.09 | 3 | 0.27 | 4 | 0.36 | 1 | 0.09 | 2 | 0.18 |
| 3. Lack of farm management cooperation | 0.05 | 2 | 0.1 | 1 | 0.05 | 4 | 0.2 | 3 | 0.15 |
| 4. Irrigation channels are inadequate | 0.05 | 4 | 0.2 | 1 | 0.05 | 3 | 0.15 | 2 | 0.1 |
| 5. Cultivation technology is not yet available | 0.08 | 4 | 0.32 | 1 | 0.08 | 2 | 0.16 | 3 | 0.24 |
| 6. The ability to process agricultural products is not adequate | 0.09 | 1 | 0.09 | 4 | 0.36 | 3 | 0.27 | 2 | 0.18 |

| **TOTAL** | 5.91 | 3.2 | 4.75 | 4.94 |

Source: Data Analysis Results

3.3.2 **QSPM analysis** The QSPM matrix analysis is used to select the main strategies where can be applied among several alternative options of existing strategies. Some strategies are analyzed based on the internal factors (strengths and weaknesses), external factors (opportunities and threats), and the
weight and total value provided. Analysis of QSPM matrix of agricultural livelihoods in Beruk Village and Wonorejo Village Jatiyoso Sub-district of Karanganyar Regency can be seen in Table 4 as follows:

In Table 4, there are four alternative strategies which are considered as important. Those strategies are development of farming conservation, strengthening the capacity of farmers in the process of agricultural products, strengthening of Farmer Groups, increasing the agricultural extension performance. After the calculation above, the total score for the first strategy is 5.91, second is 3.2, third is 4.75 and fourth is 4.94.

4. Conclusions
The conclusions and recommendations that can be taken are the description of farmers' profiles in both research villages shows that the management level is at the anxiety level, the perception of farmers on the availability of agricultural production facilities, which include: land, labor, seeds / seedlings, fertilizers, pesticides, irrigation, capital, technology, agricultural tools, management, and agricultural information are at sufficient level or they are available, agricultural information becomes factor which less sufficient. According to SWOT analysis resulted some strategies of livelihood development effort (livelihood) of farmer of Beruk Village and Wonorejo Village, Jatiyoso Sub-district, Karanganyar Regency. The results of the QSPM matrix calculation on the SWOT analysis of livelihood of agriculture, it produces strategies according to the main priorities, namely development of farming conservation, strengthening the capacity of farmers in the processing of agricultural products, strengthening farmer groups and improving the performance of agricultural extensionist.

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