Spatial Distribution of Socioeconomic Characteristics in Rural's Java: A Case from Three Different Rural Areas in Central Java

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Abstract. The intention of this paper is to combine the socio economic development into spatial aspect with the fact that the divided sub study areas are differed in its socio-economic characteristic. The research was conducted in three different rural areas, i.e.; coastal area in Sayung sub district – Demak Regency, plain area in Delanggu sub district – Klaten Regency, and mountain area in Kledung sub district – Temanggung regency. Spatial interpolation technique has been applied in order to identify the spatial distribution of socioeconomic data. The results show that socioeconomic characteristic in plain area and coastal area is more varied and regularly distributed as compared to the mountain area. Educated people are less found in the plain area while in coastal and mountain area the condition is better. Coastal area is identified as the prone area to the disaster issues and therefore socioeconomically vulnerable. The result of this research is very important to the development policies that need to undertake regarding to socioeconomic development in each associated location.

Keywords: Socioeconomic, Spatial Interpolation, Household, Rural Area, Central Java

1. Introduction

Socioeconomic characteristics in a rural area is very much related to the resource use owned by the farming families as well as the location where the family lives [1–4]. In the socioeconomic development, the location of the rural's family is indicated by the settlement distribution in a specific place. Generally, rural settlements are in high pressure of the urbanization and have been significantly transformed into a more urbanized area [5]. The existence of settlements in rural area is a central unit as it may reveal the relationships between land and the people, the historical background of a community, as well as the socio-political connections [6,7]. Therefore, the settlement distribution in rural area will also show the socioeconomic conditions of the people. On the other hand, resource use in the rural area indicates the relationship between economic and environmental aspect. Income gain by the farming family represents the economic aspect while land resource utilisation represents the environmental aspect. Farming families are the main player between those two aspects where the decision on how to utilise the resource very much depends on the family [8].

Rural area is mostly dominated by the agricultural land where income of rural people is majorly generated from this sector. Usually, the location of agricultural land owned by the farming family is located nearby the settlement area where the family lives. Even, most of the houses of farm families is located within their farm field which made the land maintenance is much easier. Therefore, the assessment of socioeconomic characteristics of rural area becomes more attractive since it may reveal the capability of rural people in maintaining their land resource which implicates to the family income. In addition, rural areas have a great diversification in terms of physical environment, ecology, and pattern of land use as well as their socioeconomic characteristics [9]. Due to their great diversification, each socioeconomic characteristics of rural area has it owns specification either in coastal, plain, or mountain area where spatial concern is the major aspect. Knowing the socioeconomic characteristics of each typical rural area would certainly useful in understanding the socioeconomic development and what type of characteristic is found more in one region as compared to others.

To understand the socioeconomic development, a set of socioeconomic characteristics data need to be elaborated, tabularly and spatially. The assessment of spatial distribution of socioeconomic characteristics in typical rural area by using Geographical Information System (GIS) and Remote Sensing (RS) has become widely concerned to describe more clear understanding on the specific issue [10–12]. The concept of spatial distribution is derived from the interaction of resource use and farming activities indicated by the location of each farming family. Spatial description on socioeconomic characteristic therefore is able to define the situation more clearly instead of a table format which the researchers normally did. Tables succeed in organizing information for easy comparison and for analysis in spreadsheets or statistical packages, but they do so by largely ignoring one particular property of each object: its geographic location [13]. By distributing and analyzing table data into its geographical location, a better understanding on how the data correlated can be spatially presented. This paper is amed to describe the socioeconomic characteristis of farming family by assesing the socioeconomic development of three different rural areas in Central Java.

2. Data and Methods

2.1 Study Area

Three different rural areas were selected as the study area, i.e.; rual coastal area, rural plain area, and rural mountain area. The reason of selecting those rural areas is to compare and to show how the socioeconomic characteristices distributed in each rural area. Those three rural areas are Sayung sub district in Demak Regency for coastal rural area, Delanggu sub district in Klaten Regency for plain rural area, and Kledung sub district in Temanggung Regency for mountain rural area. Concerning the elevation level, the study areas located on the different altitudes level following a gradient line from coastal to mountain area. Sayung sub district is located on 0 - 3 meters above sea level (asl); Delanggu from 100 up to 200 meters asl, and Kledung varied from 1138 m up to 1500 m (asl). The location of study area are shown in Figure 1.

2.2 Data Needs

To provide basic data on socio economic characteritics, randomly selected farm family was applied in study areas by handing out standardized questionnaires to 83 farm families (see Figure 2) distributed in study area. Those 83 farm families were distributed more less equal in three study areas; 23 samples in Sayung subdistrict, 30 samples in Delanggu subdistrict, dan 30 samples in Kledung subdistrict. Specifically in Sayung subdistrict, less samples number were applied due to less farm families found in that area. Selection of farm family surveyed is based on their geographical location where the even

distribution is preferable. Socioeconomic data that are being captured were related to farm income, off farm income, family income, education level, and farm yield in 2017.

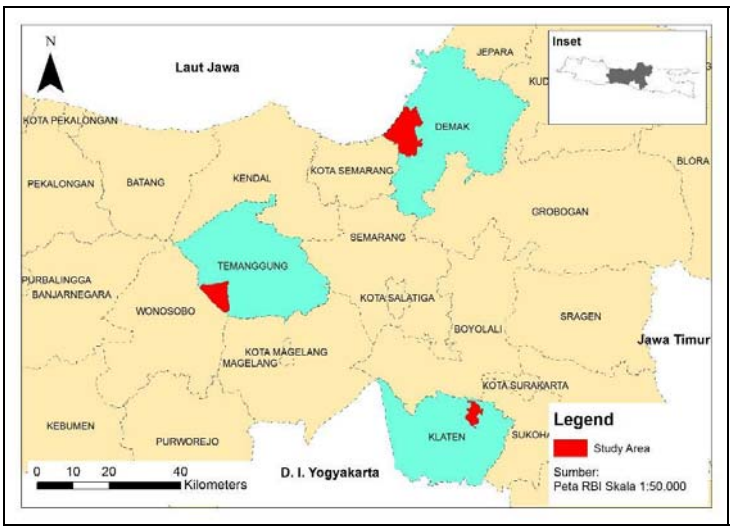

Figure 1. Study Area

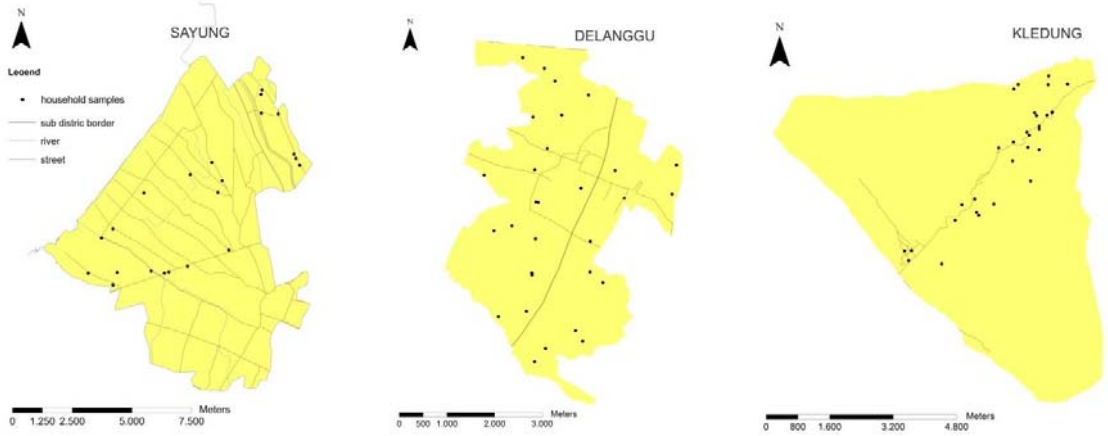

Figure 2. Samples Distribution in Study Areas

2.3 Method

A spatial calculations were carried out with interpolation technique to generate data for the whole study areas. Prior to the interpolation technique, each location of surveyed families was recorded using the Global Position System (GPS) to locate them into their geographical location. This step is very important to be performed as the location of each sampling family will be the link between socio economic data and its spatial aspect. By linking all related data and information to its spatial location, spatial analysis in GIS can be carried out.

The interpolation technicque was done from point data collected throuh the micro level survey. Spatial interpolation is the procedure of estimating the value of a field variable at un-sampled sites within the area covered by sample locations or in simple words, given a number of whose locations and values are known. Kriging method was applied as the interpolation technique to generate socioeconomic data for each stuy area. Krigging method involves several steps in its process and more appropriate used if the user has already known the spatially correlated distance or directional bias in the data [4].

Interpolating socioeconomic data from sampled points is intented to identify all the unknown value of unsampled area within the study area where specific socioeconomic data can be generated to the whole study area. However, the interpolation results may over or underestimate the conditions at the edge of surface. The interpolation, particularly at the border of study area and at the less sample point area, is often continued with unrealistic values. Once the last sampling point is passed, the derived trend continues with the same gradient as before the sampling point and makes the values rise or decline inappropriately in some cases. To avoid these possible errors, the interpolated grid layers were classified, thus only the class bandwidth is readable from the maps [3].

3. Results and Discussion

3.1 Farm İncome Distribution

Farm income shows the economic ability of a farm in a year to provide an economic surplus to the farming family. Farm income in Sayung sub district is dominated by fish farming activity that is commonly found in coastal rural area. Delanggu sub district as a plain rural area is one of the main rice producer in Central Java and it dominates its household farming activity. On the other hand, Kledung sub district as a mountain rural area shows a dominant farming activity for tobacco and vegetables. Table 1 below shows the amount of average farm income from each study area. The highest average farm income comes from Kledung sub district with Rp 164.213.000,- for each household, followed by Sayung sub district with Rp 36.388.000,- and the lowest is Delanggu sub district with Rp 11.404.000,-. These outcomes can give the raw insight on the value of the product from each area type.

Table 1. Average Farm Income

Sub District	Area Type	Avg. Farm Income (in 1000 rupiah)
Sayung	Coastal Rural	36.388
Delanggu	Plain Rural	11.404
Kledung	Mountain Rural	164.213

Spatial calculation was applied to describe further differentiation of farm income between area types. Through interpolation technique that has been explained before based on information from household interview, Figure 3 shows the distribution of farm income of each study type. The darker colour portray the higher income. Kledung sub district is dominated by the darker green while Delanggu sub district has its darker green mainly in the central area. Although Sayung sub district has higher average farm income than Delanggu, the distribution of its farm income is generally on the lower side as shown in the lighter green colour that dominate it. However, the spatial differentiation in study areas is only to show the distribution of farm income among the interviewed household but not to take into account as the representative for the whole area. The more samples will influence the spatial distribution and accordingly change the spatial differentiation as well.

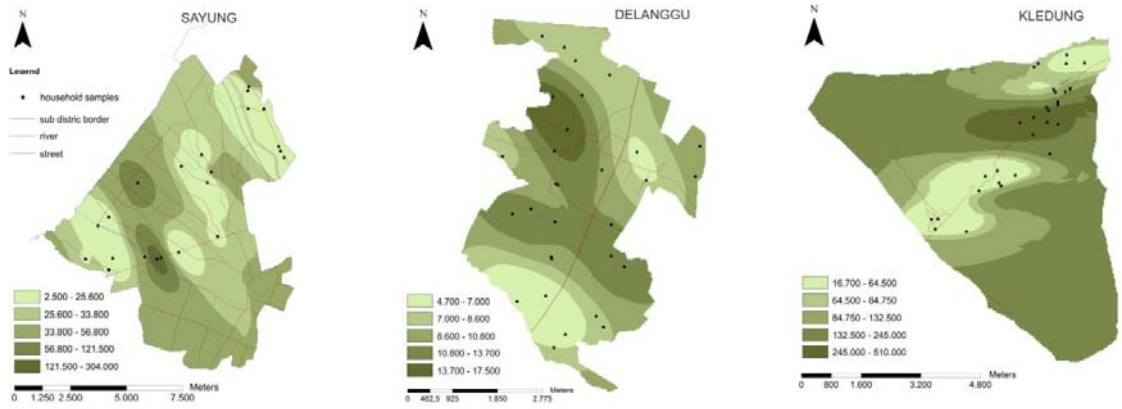

Figure 3. Farm Income Distribution (in 1000 Rupiahs) in Study Areas

3.2 Off-Farm İncome Distribution

Off-farm income derived from off-farm activities per year that take place outside the family's own responsibility of farm business. As farming becomes the main activity for almost all the household in study area, the existence off-farm income for some households is not as vital as farm income in supporting family livelihood. The involvement of family members in off-farm activities can be classified into two categories in general: permanent and seasonal jobs. Permanent job of the interviewed households are government official, private employer, and trader. Seasonal job is related to all types of jobs that family members irregularly involved such as field worker, building worker, and driver.

Table 2. Average Off-Farm Income

Sub District	Area Type	Avg. Off-Farm Income (in 1000 rupiah)	Household with Off-Farm Activities
Sayung	Coastal Rural	17.346	7
Delanggu	Plain Rural	17.928	13
Kledung	Mountain Rural	7.613	15

In the study area, there are 42% households from total interviewed households who are engaged in off-farm activities. Kledung sub district has a highest total of 15 households or 50% of composition followed by Delanggu sub district with 13 households or 43% and the last is Sayung sub district with 7 households or equal to around 30%. Eventhough there is not always a household member that engage in off-farm activities, for the households who do, a member who engage in off-farm activity can has more than one off-farm jobs.

As shown in Table 2, the highest off-farm income is Delanggu sub district with the average of Rp 17.928.000,- followed closely by Sayung sub district with Rp 17.346.000,- and Kledung sub district with Rp 7.613.000,-. Spatial distribution of off-farm income (Figure 4) shows clearly the spatial differentiation of off-farm income from high level to the low level income. It can be inferred as well that the amount level of family who gained off-farm income had been increased from coastal rural area which is Sayung

sub district to mountain rural area type which is Kledung sub district. More households are engaged in off-farm activities the higher the area.

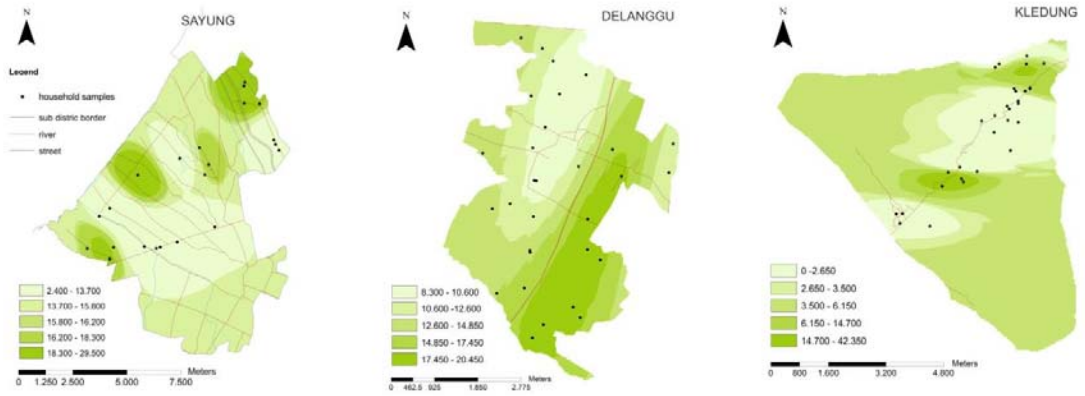

Figure 4. Off-Farm Income Distribution (in 1000 rupiahs) in Study Areas

3.3 Family İncome Distribution

Family income is the main criteria in economic ability of family to support family needs and expenses. Family income is generated in one year by integrating farm and off-farm incomes. Usually, family income of the rural area households are largely contributed by farm income, but among the three study areas, Delanggu sub district shows different condition where off-farm income makes up 61% of the average family income while farm income only contributes 39%. Although in average the contribution of off-farm income is higher to the family income in this sub district, there might be some households that their farm incomes make up their family income more. For Sayung sub district, average family income is made up by farm income at 68% while for Kledung, the average family income dominantly comes from farm income at 96%.

Table 3. Average Family Income

Sub District	Area Type	Avg. Family Income (in 1000 rupiah)	Compotition	
			Farm income	Off-farm income
Sayung	Coastal Rural	53.735	68%	32%
Delanggu	Plain Rural	29.332	39%	61%
Kledung	Mountain Rural	171.826	96%	4%

Table 3 shows that the average family income in all three study areas is alined with the amount of average farm income. Kledung sub district has the highest average family income with Rp 171.826.000,- followed by Sayung, that barely has a third of Kledung's, with Rp 53.735.000,- and Delanggu sub district with Rp 29.332.000,-. Spatial analysis using interpolation is also used to see the distribution of family income in three study area (Figure 5). The darker orange colour covers most of high family income level in study area. Lighter orange colour shows low family income level that is distributed more in Sayung sub district and some part of Delanggu subdistrict. The interval of family incomes in each study area can also

indicate the income gap of the households. From the picture we can see that although Delanggu sub district has the lowest family income, the income gap is nogt as severe as Sayung sub district and Kledung sub district.

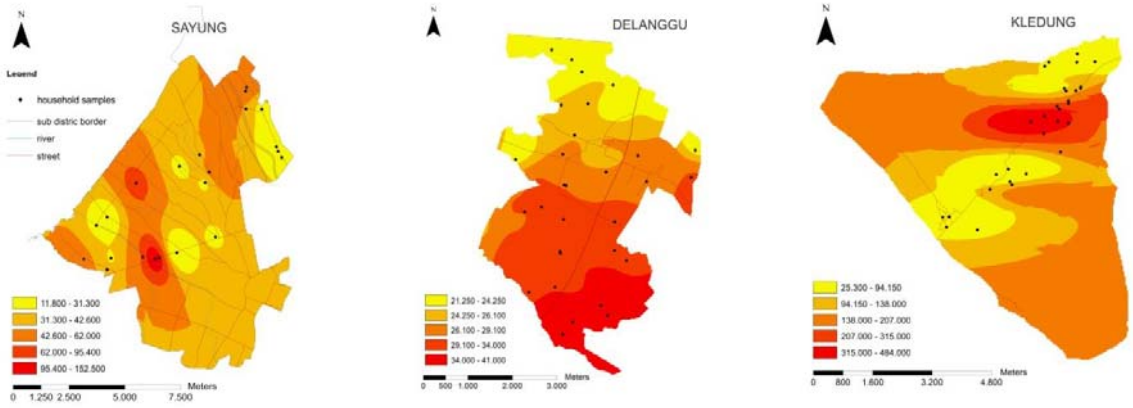

Figure 5. Family Income Distribution (in 1000 rupiahs) in Study Areas

3.4 Education Level

Educational background of family members determines family's perception in society and how they make decission surrounding their lives. The higher education level the wider knowledge and information can be gained which is very useful in managing and developing the ability of various family resources. In general, analysis from interview data shows that level of education in study area is noticeably medium where only a little number of people found illiterate as shown in table 4.

Table 4. Education Level

Sub District	Area Type	Education Level			Weighted Education Index
		Illiterate	Elementary - High School	Higher Education	
Sayung	Coastal Rural	2	60	16	0,82
Delanggu	Plain Rural	1	83	13	0,77
Kledung	Mountain Rural	2	102	5	0,82

Weighted education index shows that there are more higher-educated people in Sayung sub district (coastal rural area) and Kledung sub district (mountain rural area) with average index of 0.82 compared to Delanggu sub district which has average index of 0.77. However, from the number of total people from each education level, Sayung sub district and Delanggu sub district have more people with higher education level than Kledung sub district. It can explains that the level of high education following altitudinal gradient and increasingly from higher altitude area to lower altitude area.

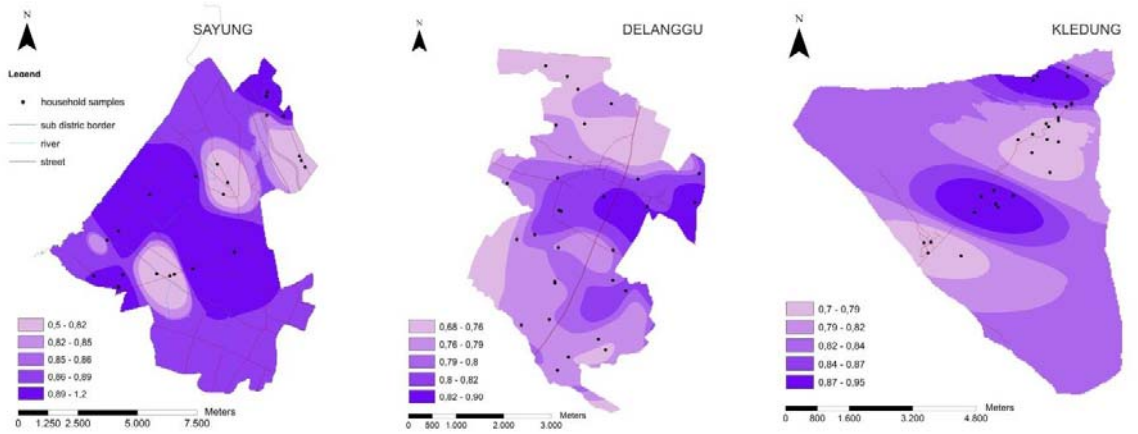

Figure 6. Weighted Education Index

Spatial distribution of weighted education index was built by using interpolation technique that allows measurement of surrounded data where there is no data available. As shown in Figure 6, the distribution of educated people is expressed by violet colour where the darker the colour indicate a higher index. Sayung sub district overall shows indication that higher-eductaed people are spread mostly in its central area and they have higher index than the other two study area. Delanggu sub district shows more lighter colour which mean that it has less higher-educated people. Lastly, Kledung sub district shows that it is placed in the middle level with more area covers by moderate amount of darker colour yet less with lighter colour. This empirical result may arise due to the possibilities of different level of educational facilities and infrastructures that exist.

3.5 Farm Yield

Farm yield shows the amount of a commodity that was harvested per unit of land which in this reasearch is measured in kilograms per hectare (kg/ha). It shows the productivity of farm activity. The size of land is not the main factor that can make a higher level of productivity. The opposite condition of the corelation between land size and land productivity is shown in Table 5. The area with biggest number of leverage and size has the lowest number of farm production.

Table 5. Average Farm Yield

Sub District	Area Type	Avg. Land Size (ha)	Avg. Farm Yield (kg/ha)
Sayung	Coastal Rural	2,21	3.233
Delanggu	Plain Rural	0,54	11.214
Kledung	Mountain Rural	1,15	9.832

Sayung sub district has the highest average land size of 2,21 ha but it can only produce fish product as much as 3.233 kg/ha. Kledung sub district has average land size of 1,15 ha with farm yield of 9.832 kg/ha while Delanggu sub district with only average land size of 0,54 ha can produce 11.214 kg/ha of rice. This opposite condition between the land size and farm yield can also be caused by the difference land size it is needed to produce each kind of commodity. The spatial distribution of farm yield is as shown in Figure 6

where darkest red colour dominates central area of Delanggu sub district while the same dark colour only appears in the smallest part of both Sayung sub district and Kledung sub district. But at the same time, Delanggu sub disrict also has the most area covered in lighter red colour than the other study areas which indicate that a lot of its area has a tendency of producing smaller amount of product.

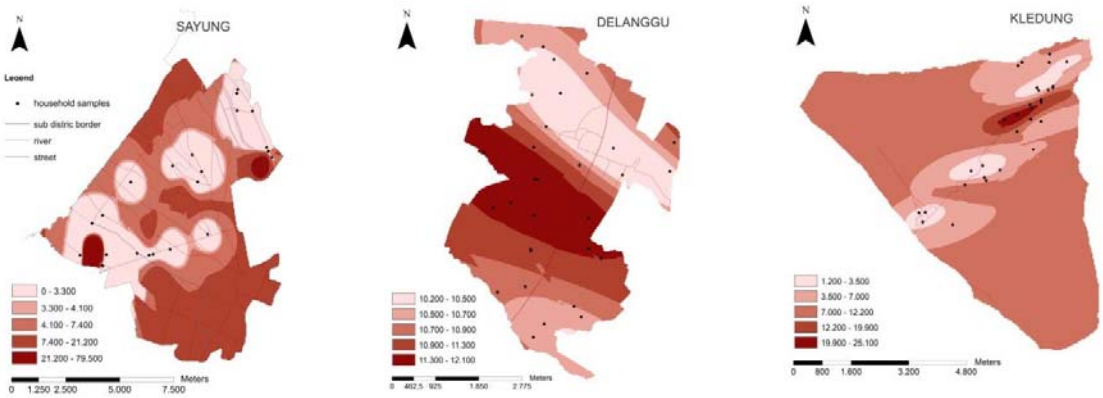

Figure 7. Farm Yield Distribution (kg/ha) in Study Area

4. Conclusions

Spatial assessment of socioeconomic characteristics in three study areas had shown how the socioeconomic development were distributed and what kind of characteristics found more dominant as well as which rural area has a better condition as compared to other rural area. In general, the spatial pattern of socioeconomic distribution was found more regular with more less equal distributed in coastal area - Sayung sub district and in plain area - Delanggu sub district as well. While in mountain area - Kledung sub district the spatial pattern was quite irregular where most of the socioeconomic characteristics distribution was found centred. This condition occurred due to the location of the household samples mostly located along the main road.

In terms of socioeconomic characteristics, mountain area – Kledung sub district was found more advance in family income where most of the family gain the income from the tobacco farming. It is also shown that the closer the area to the urban area, the higher the family income as indicated in plain area – Delangu sub district. As the expanded urban area of Solo city, Delanggu sub district has more opportunity to have more income from different sources. Surprisingly, the education level of plain area which is close to the urban area of Solo was not linearly related to the education condition where more educated people is usually found in urban area as the access to education facilities is more possible. On the other hand, plain area – Delanggu sub district has more productivity, indicated by the farm yield per hectare as compared to mountain and coastal area. It looks like the farmer in plain area has more capability in optimizing or even maximizing the input concerning the average land size.

5. Acknowledgement

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