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FACTORS AFFECTING FOOD SECURITY IN RURAL AREAS IN YOGYAKARTA PROVINCE[1]

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ABSTRACT

The purpose of this research is to identify and analyze the factors influencing the food security of rural society in the Province of Daerah Istimewa Yogyakarta (DIY). The location included several sub districts in the Regency of Sleman, Bantul, Kulon Progo, and Gunungkidul. Data utilized in this research were primary and secondary data. Primary data were compiled by survey and interviews. Secondary data were compiled from various publication sources. Data analyzed with multinomial logit regression model.

Factors influencing the food security of rural society in the Province of Daerah Istimewa Yogyakarta are based on three basic groups that are economy (income), socio-culture (gender, kind of food, way of fertilization, technique of cultivation and knowledge of ecology) and ecology (land capability, land suitability, irrigation) ceteris paribus. The three factors cannot be separated in the equilibrium of eco-economy, eco-culture and ecology models.

***Keywords**: food security, rural society, multinomial logit, DIY.*

INTRODUCTION

Food security does not only cover the availability of food, but also covers the ability to buy food. It also means that there is no dependency on food to other parties. In this context, peasants have strategic roles in food security; because they function as the providers of food and at the same time they are also the biggest consumers of it. The majority of them still live in poverty and their purchasing power are still low. In addition, the quality of food is also one of the important factors in to be considered.

Thus, peasants need to have the ability to produce food as well as to have sufficient income to fulfill their food need. On the other hand, they are expected to preserve the environment. Often, human being destroys ecosystem in their efforts to fulfil their needs Because of poverty, land is exploited continuously, inorganic fertilization is continuously done to boost productivity, and as a result the soil becomes arid and famine emerges.

Yogyakarta Province (DIY) was chosen to be the object of the research because it has neither industrial areas nor large-scale farming. Some areas threatened by malnutrition cover Kulon Progo, Gunung Kidul, some areas in Bantul and Sleman. In 2006, Sleman and Bantul regencies received awards in National Food Security for their success in maintaining farming product prices. However two other

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regencies failed to make it. Despite the fact that the four regencies belong to rural areas, the soil in Kulon Progo and Gunung Kidul are infertile compared to that in Bantul and Sleman.

Previous studies have been done by other researchers. Darwanto (2005) reveals that production and peasants'welfare are two factors supporting food security. Valeeva *et al*. (2005) states that peasants' knowledge is a the most important factor supporting food security. Shackleton *et al*. (2001) state that the contribution of land-based activities have significant roles on the financial and social welfare of the people living in rural areas. People welfare is expected to increase food security.

Rachman *et al*. (2004), investigated the availability and food security by using accounting methods and descriptive statistics. The results showed that the aggregate of national food security in Indonesia is stable, despite the fact that it has some problems in the household level in terms of its availability. Ariani (2006) reminded that although nationally food national product is sufficient , there are many areas suffering from food scarcity

The fact was supported by the findings of Purwantini *et al*. (2002) who analyzed food by observing the production, availability, and food trade based on food scale. Food security in an area does not guarantee the same condition in the household level. The percentage of household suffering from food scarcity in rural areas is higher than that in big cities. Srivastava *et al*. (2004: 958) states that there is a significant relationship between poverty and critical land. So that it can affect food security.

Based on the facts above, it will be interesting to study food security not only from normative factors such as availability and individual nutrition needs, but also from wider aspects such as biogeophysic ones, purchasing power, social-cultural ones.

Literature Review

Food Security

F*ood security* in the regulation No 7 in the year of 1996, World Bank (Tambunan, 2008a), and FAO (Tambunan, 2008b) basically means the availability of food in the household in terms of quantity, quality, nutrition and there is a guarantee in the safety, equal distribution, and the ability to purchase it to have an active and healthy life. The view of food security should be altered from food *first* to *livelihood*, from availability to *food entitlements*, (*vulnerability*) or *food sovereignty* (FAO, 1996; UU RI Number 7/ 1996). The four components must be fulfilled to achieve sufficient food security and stable availability unaffected by seasons, and accessibility of food.

According to PPK-LIPI (2007) the availability of (1) ≥ 240 days is categorized as sufficient; (2) 1-239 days – less sufficient; and (3) 0 – not sufficient. The combination of food availability and the eating frequency (eating three times a day is categorized as sufficient, two times a day is not sufficient and one time a day is categorized as poor eating) is an indicator of food security as can be seen in Table 1.

Table 1. Food Availability Indicators in Household Level

Food availability	Eating frequency in the household		
	> 3 times	2 times	1 time
> 240 days	Stable	Less stable	Not stable
1-239 days	Less stable	Not stable	Not stable
Not supplies	Less stable	Not stable	Not stable

Source: PPK-LIPI (2007)

Then, how the households get the food is categorized into two categories namely: (1) self-production and (2) buying. Accessability indicators can be seen in Table 2.

Stable availability indicator is a combination of food availability and accessibility. The indicator shows some categories namely:

(1) sufficient availability; (2) normal consumption; (3) direct access to food as shown in Table 3.

Table 2. Household Accessability Indicators

Farm ownership	How the households get food	
Yes	Direct access	Indirect access
No	Indirect access	

Source: PPK-LIPI (2007)

Food security index is calculated by combining the four factors (food availability, stable food availability, continued and quality or food safety). The combination food availability and eating frequency show the stability of food availability. The combination of stable availability and access to food show continued food availability. Table 4 shows the categories of household food security index. It is a combination of continued availability factor and food quality or food security.

Based on the matrix above, a household can be categorized in three catagories: (1) strong food security; it always have staple food continuously (measured by the food availability in one harvest time as well as by the eating frequency); (2) Less strong food security– it always have staple food continuously but the income is spent on vegetable protein only or it does not have staple food continuously but it has the capability to spend on animal and vegetable protein; (3) fragile food security is characterized by the avialability of food, but it does not have income to be spent on neither vegetable nor animal protein or the availability of food is not a continued one and it only have income to be spend on either animal or vegetable protein or neither of them; or the availability of food is not a continued one although the family has money to spend on both vegetable protein and animal one.

Environment ecosystem and Food security

Land is an area on the earth surface having a fixed characteristics vertically upward and downward , including atmosphere, *soil*, geology dan geomorfology, hidrology,

Table 3. Household Food Availability Indicators

Access to food	Household food availability		
	Stable	Less stable	Unstable
Direct access	Continues	Less continues	Not continues
Indirect access	Less continues	Not continues	Not continues

Source: PPK-LIPI (2007)

Table 4. Household Food Security

Continued food availability	Food security/quality:The consumption of animal protein and /or vegetable protein		
	Animal and vegetable protein	Vegetable Protein	Neither vegetable nor animal
Continued	Strong	Less strong	Fragile
Less continued	Less strong	Less strong	Fragile
Not continued	Fragile	Less strong	Fragile

Source: PPK-LIPI (2007)

plants and animals. It is the product of human activities in the past and at present. The extension of the characteristics will affect *land use* by human being now and in the future (Van Zuidam & Van Zuidam-Cancelado, 1979).

Thus, in an ecosystem, food security is influenced by *land capability* and *land suitability* to be used without risking it. Land capability is the categorization of land into certain level (based on the effects of permanent factors such as climate, topography, hidrology, land, and so on). In other words, land capability shows general classification such as land to be used for farming, forestry, conservation and so on.

Land capability consists of eight classes. The first class does not have many obstacles. This class is suitable to be used for farming, forestry, conservation. The topograpy is flat (the slope is 3%). It does not face erosion or flood. It is also very fertile, thus the first class is suitable for farming.

The second class has some drawbacks. It needs to be improved in order to be used. The structure of the land is not very good. The slope is is usually wavy with the gradient of 3-8%. Sometimes natrium emerges, sometimes it contains too much water. The second class land can be used for farming after some improvements are made.

For III-VIII classes, the land has many obstacles that it needs speical conservation treatment. The land belongs to these classes have wavy or hilly slopes with the gradient over 8%. They are also prone to be attacked by erosion or heavy flood. These classes are not suitable for farming but they can be used for other purposes.

Land suitability is categorized into two classes namely (S, *suitable*) – meaning the land can be used for certain activities (e.g. for farming); and (N, *not suitable*) – meaning the land can not be used (CSAR, 1996).

RESEARCH METHODS

Data and Research Location

There are several steps done in the research, namely: (1) documenting the areas to be investigated by collecting information about them in the forms of maps articles, papers and other publications; (2) documenting the existing resources; (3) evaluating and analyzing.

Primary data were collected by survey using interviews. Secondary data were taken from many sources including internet. Sample representation depends on: (1) the significant level desired, (2) the errors that can be tolerated (3) the dispersion in the population estimated (Palumbo, 1977). However, the size of the samples is also based on the researcher's *professional judgment* (Zikmund, 1991).

Multiplicative samples were used in the research (Van Zenten, 1994; Cochran, 1991). First, the research locations cover rural areas in Selman, Bantu, Kulon Progo, and Gunungkidul in DIY province. The city of Yogyakarta was not included in the study because it is not a rural area. The researcher also chosed some districts (50%) and 25% of the villages in the four regencies above was taken as the samples. The samples were taken randomly. Finally, the peasants' household samples were taken randomly by using the Watson formula (1993: 333-371) as follows

$$n = \frac{4.Z^2_{½\alpha}\, p(1-p)}{(\omega)^2} \qquad (1)$$

n is sample size, p is the successful samples expected, q is the proportion of (1-p), $Z_{½\alpha}$ is the confident level, ω=L+R is the sums of errors that can be tolerated from the left (L) population and the right one (R). Based on the opinions of Palumbo (1977), Zikmund (1991) and Watson *et al*. (1993) the researcher set some criteria (1) the expected success of this study is (p) 90% or the failure is (q) 10%; (2)

error (α) is set at 1% of the level of confidence is 99% so that from the table it is known that $Z_{½\alpha}$= 2,58; (3) L and R are the average errors of the left and right population.

The samples used were 600 respondents representing the peasants. Based on the formula (1) thus:

$$n = 600 = \{4.(2{,}58)^2.(0{,}9).(0{,}1)\}/(\omega)^2;$$

so that $\omega^2 = 2{,}3963/600 = 0{,}00399$.

Thus $L=R = \frac{\sqrt{0{,}00399}}{2} \approx 0{,}0315$ or 3,15%.

Data Analysis Techniques

The technique used in analyzing the data is multinomial logit multinomial model. (Maddala, 1991; Gujarati, 2003). *Polychotomous choice framework* is used to explain about the level of food security. Stynes & Peterson (1984) state that binary logit model is the appropriate framework to analyze binary options. For those having more than two options *multinomial logit model* derived from random *utility model* is used (Maddala, 1991). The utility, U_{ij}, food security -*i* from option-*j*; can be formulated as:

$$U_{ij} = \overline{U}_{ij} + e_{ij} = x'_{ij}\,\beta + e_{ij} \qquad (2)$$

U_{ij}, is the average of the utility; e_{ij}, is the *random error*; x_{ij}, is a series of descriptive variables and β is an unknown parameter vector. The assumption of maximum utility and *error* e_{ij} based on Weibull distribution; so the derivative probability P_{ij} is related to the alternative options -*j*:

$$P_{ij} = \frac{\exp(x_i'\beta_j)}{1+\sum_{j=2}^{j}\exp(x_i'\beta_j)} \qquad (3)$$

By considering food security indicator variable, social-economic, psychographic and environment factor, the general estimation is as follows:

$$KP_{ij} = f\,(ENV_j, SEC_i, NEP_i, KAB_i, \varepsilon) \quad (4)$$

KP is food security of the people in rural areas in DIY province, which are categorized into three, namely: 0=fragile, 1=less strong and 2=strong. The criteria for food security are based on availability, stability, accessibility and protein consumption (Table 5).

Env is environment factor land capability (1=good namely land class I-II, 0=no good namely class III-VIII), land suitability (1=suitable– land can be used for farming without obstacles, 0=not suitable – it has many obstacles to be used for farming), irrigation (1= technical, 0=precipitation).

SEC – social economic – income (rupiah per year, family size, education, gender; plants owned (1=paddy, 0=others), fertilizing (1=organic – DIY province does not have land which is a hundred percent free from chemical substance, so semi organic land is considered as organic *proxy*, 0=inorganic), farming techniques (1=polyculture, 0=monoculture); NEP_i is the awareness toward household environment *i*, NEP is measured by Dunlap & Van Liere instrument (1978); ε *error*. The probability of marginal effect by Greene (2003: 674-675, 794-797) is formulated as:

Table 5. Food Security Criteria

Food	Fragile	Less strong	Strong
Availability (day)	0	1-239	≥ 240
Stability (frequency of eating)	1	2	3
Land accessibility	Indirect	Indirect	Direct
Protein consumption	No	Vegetable	Animal and vegetable

Source: Primary data (processed)

$$\frac{\delta P_j}{\delta \chi_i} = P_j(\beta_j - \sum_k P_k \beta_k) \quad (5)$$

RESULT AND DISCUSSION

Respondent Profiles

561 out of 600 respondents can be processed. 82.7% are males; most of them did not finish their senior high school (76.3%). Most of them are married (97.5%) and 34% have more than 3 dependents. They live in 4 regencies, 33 districts, 104 villages and 212 sub-villages in rural areas in DIY province namely in Sleman, Bantul, Kulon Progo and Gunung Kidul (Table 6).

Table 6. Research Location

Regencies	Districts	Villages
Bantul	11	43
Gunungkidul	9	17
Kulon Progo	7	25
Sleman	6	19
Jumlah	33	104

Source: Data Primer data (Processed)

The ages of the respondents are between 26 to 90 years old as shown in Table 7. It shows that age is not an obstacle for some people to keep on working in the farming sector; it also shows that the majority of the people do not have saving so they have to work during their lifetime.

Most of them work as farmers (77.4%), while others consider being farmers as additional jobs since their main jobs are civil servants , army members, employees and so on. 64.3% state that they have other jobs besides being farmers. 67.4% have access to land, however they belong to small farmers because on the average they only have 2.463,49 meter square or about sekitar 0,25 hectare. The number is smaller than the average in DIY province which is 0,5 hectare (Bapeda DIY, 2008); others work as employees working for other farmers.

Some farmers attend their own land, some others rent their land because they cannot attend to it. The majority of them plant paddy (*Oryza sativa*), others plant crops (Table 8).

Table 7. Types of Plants Per Season

Types of plant	Frequency (Respondent)	Percentage
Crops and others	28	5
Paddy	533	95
Total	561	100

Source: research (processed)

The average income in farming sector is Rp 2,6368 million per harvest time or Rp 5,2736 million per year, while income in non-farming sector is Rp 2,9961 million so the total is Rp 8,2697 million. The result shows that the farmers'income in the year 2008 is slightly above the DIY province basic minimum wages which was Rp. 7,032 million per year.

Table 8. Respondents'ages

Age (year)	Regencies				Total
	Bantul	Gunungkidul	Kulon Progo	Sleman	
< 35	2	5	5	4	16
35 - 50	51	40	73	71	235
51 - 65	67	67	72	39	245
> 65	23	13	19	10	65
Total	143	125	169	124	561

Source: Primary data (Processed)

Table 9. Actual and Prediction Food Security

Actual (Food security)	Prediction			Total	The accuracy of the prediction
	Fragile	Less strong	Strong		
Fragile	77	2	5	84	91,67
Less strong	12	8	91	111	81,98
Strong	5	6	355	366	96,99
Total	94	16	451	561	

Source: Primary data (processed by LIMDEP)

Table 10. Estimated Empirical Result

Variables	Prob[Y = 1]	Prob[Y = 2]
Constanta	-2,446362769$^{***)}$	-4,012870096$^{*)}$
MAMPULHN (Land capability)	3,508496818$^{*)}$	2,101788090$^{*)}$
SUAILHN(Land suitability)	5,120004796$^{*)}$	8,621595539$^{**)}$
GENDER	1,566393233$^{**)}$	-1,103429450$^{*)}$
LYT (Income)	-,9421489074	-1,078703269$^{***)}$
LTNEP (Ecological knowledge)	-1,722123828$^{**)}$	-2,135391252$^{*)}$
EDU(Education)	0,6700437258	1,235747322$^{***)}$
JENPANG (Types of food)	0,8608404786	3,254789992$^{*)}$
PUPUK (Ways of fertilizing)	-1,918408284$^{***)}$	-2,108038267$^{**)}$
IRIGASI	5,478071517$^{*)}$	6,948600031$^{*)}$
TEKBDDY (Agricultural techniques b)	-2,205322819$^{*)}$	-2,191961965$^{*)}$
LFZ (Family size)	0,2259438105	-0,2676703013

Notes: McFadden *pseudo*-R^2 = 0,429; Log likelihood ratio= - 283,2025; $^{*)}$ p<0,01; $^{**)}$ p<0,05, $^{***)}$ p<0,10; Y=1 the probability of sufficient food security household, Y=2 the probability of strong food security household

Source: Primary data processed

If it is assumed that 0,25 hectare yields Rp 5,2736 million per year, thus per havest time per hectare per year they will get Rp. 21,0944 million. The production cost spent by the farmers on the land on the average is Rp 4,98 million rupiah with the standard deviation of Rp 0,71 million per hectare each harvest time. It is in accordance with the press release of Agricultural Ministry (2008) which stated that the production cost in the farming sector is about Rp 4-5 million per hectare in one harvest time. Thus, the net income in farming sector is Rp 11,1344 million per hectare per year or Rp. 5,5672 million per harvest. It means that almost nothing is left. That is why they have to find other source of income.

However, they still consider the farming sector as the main job since it does not require specific skills. Being a farmer is more than a job, but it is also an ethnic identity. Thus, agriculture is a part of culture (O'Connor, 1995). Usman (1998) stated that land ownership is only enough to cover basic needs, often it has social functions. Economic needs are fulfilled by working outside the areas. Ownwership patterns of the land form cultural and structural responses toward programs to be implemented. Consequently, the response of those having land access will be different from those who do not have one.

85.2% of respondent use monoculture, others use polyculture, by means of unorganic fertilizer (39.9%), organic (6.4%), and mixed techniques (53.7%). It shows that the use of chemical fertilizer is still widely used in the research locations. According to Kartodihardjo & Jhamtani (2006), the use of chemical substance in the short term will boost the production, but in the long term it will make the production stagnant and finally decreases. Thus, chemical fertilizer should be avoided and altered into unorganic one such as compost.

The harvest frequency ranges from 1-3 times; the majority was 2 times (52.4%) a year. The majority of them use modern equipment such as tractor (71.7%) and the rests still use traditional techniques of using cows and buffalos (20.5%).

The yield is used for self-consumption (79%), for some the yield is enough to cover the needs for the next harvest (55.6%). When they have a surplus, they will sell it to cover their needs. The rests said that the yield was not enough so they are categorized as fragile food security.

Food Security in DIY Province

Polychotomous choice framework is used to explain the concept of food security. There are three categories namely: (1) fragile, (2) less strong, or (3) strong. The study found 84 people categorized as fragile, 111 people categorized as less strong and 366 people as strong food security (Table 9).

Limited Dependent Variable or LIMDEP (Table 9) shows that out of 561 samples 94 people (16.76%) were predicted as fragile food security, 16 people (2.85%) were less strong and the rests are categorized as strong food security. Thus, 19.61% of the samples were predicted as fragile food security. It is in accordance with the data from Kuncoro (2004) and BPS DIY (2007) that show the percentages of poor people in the province of DIY as 19.14% and 19.04% respectively. They are poor and categorized as fragile food security. The accuracy of the prediction is above 75%.

Polychotomous choice framework analysis shows that utility function is not directly estimated by food security model (Table 10). McFadden value of *pseudo*-R^2 0,429 or 42.9% shows variety in the probability of food security as the dependent variable that can be explained by predictor variables. The Likelihood Ratio (LR) with the value of χ^2 283,2025 is higher than dari χ^2 in the table which is 10.851 at df=20 and α=5%. It means that the model is appropriate to be used (Maddala, 1991; Mitchell & Carson, 1989).

At Y=1 (the probability of sufficient food security household); income (LYT) and education (EDU) do not have significant effects, while land capability (MAMPULHN), land suitability (SUAILHN), irrigation, and agricultural techniques (TEKBDDY) are significant at $p<0.01$, while ecological knowledge (NEP) and ways of fertilizing (PUPUK) are significant at $p<0.05$ and $p<0.10$.

At Y=2 (the probability of strong food security household); the class of land (MAMPULHN), types of plants (JENPANG), gender, irrigation, agricultural techniques (TEKBDDY) and ecological knowledge (NEP) have significant p-*value* ($p<0.01$). While land suitability for farming (SUAILHN), ways of fertilizing (PUPUK) are significant at $p<0.05$. Education (EDU) and income (LYT) are significant at $p<0.10$. It can be concluded that predictors are significant to the criteria and they are in accordance with the theories used.

Negative coefficient in PUPUK, TEKBDDYA and GENDER show that there are differences in food security caused by those variables. Organic fertilizing will increase the probability of food security (49, 16%) compared to inorganic one. Polyculture techniques has a higher probability to increase food security (70.47%) compared to monoculture one. Females are considered to have higher probability to increase food security (83.53%) compared to males.

Table 11. Marginal Effects on Food Security

Variables	Prob [Y = 0]	Prob[Y = 1]	Prob[Y = 2]
Constanta	0,8370454023***	0,2755224921	-0,3592270323***
MAMPULHN	0,6050550818**	0,2868273250*	-0,2263218168*
SUAILHN	0,1871130239***	-0,6227087343*	0,8098217582*
GENDER	0,2115781369	0,1618731320*	-0,1830309457*
LYT	0,2386771814	-0,3270601383	0,08838295686**
LTNEP	0,4933495103**	0,6612958855	-0,1154645396**
EDU	0,2526335248	-0,1008122795***	0,1260756320**
JENPANG	0,6097209115***	-0,4387815764*	0,4997536676*
PUPUK	0,4787246393**	0,2336006979E-01	-0,7123253372*
GENDER	0,2155676773	0,1710658505	-0,1495090828
IRIGASI	0,1525913412*	-0,2390437729**	0,3916351141*
TEKBDDY	0,5107519090**	-0,1606258256	-0,3501260834*
LFZ	0,1950390752	0,7026534187	-0,8976924939

Source: Primary data (processed)

Notes: *) p<0,01, **) p<0,05, ***) p<0,10; Y=0 the probability of fragile food security household , Y=1 the probability of sufficient food security household, Y=2 the probability of strong food security household

The marginal effects can be found in Table 11 and Table 12. At Y=0, it is shown that there is an increase in the land capability p<0.05. Land suitability p<0.10, irrigation p<0.01 and ecological knowledge p<0.05 will reduce the probability to be hit by malnutrition. Variety of plants planted p<0.10 will also improve the strength of household security by 25.91%. Organic fertilizer p<0.05 will increase the strength of household food security by 12.15% compared to inorganic one.

Land capability used in the research ranges from class I to V. The researchers simplified the classes into two categories namely good (Class I-II) and bad (Class III-VIII) (Table 13).

At Y=1, the improvement of land capability will increase the probability of changing from fragile to less strong food security by 1.33 times p<0.01. Land having limited obstacle factors will increase the probability of changing from fragile to less strong food security by 53.64%. The variety of plants planted will increase food security by 65.05% at p<0.01. Irrigation will increase by 78.74 % at p<0.05.

Marginal effect at Y=2, the improvement of land capability will increase food security 79.75 ($e^{-0,2263}$)%. The improvement of land capability is usually related to other components such as *form*, hidrology and micro climate. When the obstacles such as topography, erosion sensitivity, salinity and so on can overcome, there is a bigger possibility to plant there.

Land suitability for farming will increase household food security by 2,2 times ($e^{0,8098}$). Land suitability is categorized into suitable (S) and marginal (N). There is much marginal land such as that in Kulon Progo that is still possible to be improved. For example, lack of water can be solved by irrigation, lack of nutrient can be solved by fertilizing and so on. However, some factors such as climate or moisture can not be improved.

Table 12. Average Individual Marginal Effect

Variables	Y=00 (fragile)	Y=01 (less strong)	Y=02 (strong)
MAMPULHN	-0,0633	0,2131	-0,1499
SUAILHN	-0,1720	-0,3997	0,5716
GENDER	0,0180	0,1093	-0,1273
LYT1	0,0237	-0,0277	0,0040
LTNEP	0,0469	0,0366	-0,0835
ONE	0,0986	0,1742	-0,2728
EDU	-0,0292	-0,0658	0,0950
JENPANG	-0,0650	-0,3046	0,3696
PUPUK	0,0602	-0,0005	-0,0597
IRIGASI	-0,1872	-0,1212	0,3084
TEKBDDY	0,0654	-0,0311	-0,0343
LFZ	0,0194	0,0702	-0,0896

Source: Primary data (processed)

Table 13. Land Capability Classes

Land capability	Regencies				Total
	Bantul	Gunung Kidul	Kulon Progo	Sleman	
Good(Class I-II)	72	25	36	124	257
Bad (≥ Class III)	71	100	133	0	304
Total	143	125	169	124	561

Source: Primary data (processed)

Natural fertilizing is one of the efforts to stay healthy. Land fertilized by compost will reduce the harmful effect on the land. Therefore, organic fertilizing will increase food security by 49.16 ($e^{-0.71}$) %.

Gender also increase food security by 19, 72 ($e^{-18..30}$)%. It shows that females are very much needed to support food security. It can be concluded that females belong to the nature while males belong to the civilization (Grivin, 1988). Females are now considered as the backbone of preparing food security

The increase of income causes the possibility of increasing food security by 1.09 times ($e^{0,088}$). Not being dependent on one type of food will increase the possibility of having better food security by 65 ($e^{0.4997}$)%. Cassava, fruit, vegetable, meat, fish, can all be used .

Areas having their own irrigation system will have better food security by 47.7 ($e^{0.39}$)%. Those whose irrigation system depends on rain must find ways to water their farm. In the dry season, they have to find activities to earn money. They can produce handicraft to earn money. The money then can be used to boost food security. The variety of food has the ability to increase food security by 70.47 ($e^{-0.35}$)%.

CONCLUSIONS

From the research, it can be concluded that in general the food security in rural areas in DIY province is good, however some areas still suffer from fragile food security.Those areas are in the four regencies investigated. The land in the areas have some permanent drawbacks that cannot be improved.

Some factors affecting food security (availability, distribution, stability and accessibility) in rural areas in DIY province are based on three components namely income, socio-cultural (gender, types of food, ways of fertilizing, agricultural techniques and ecological knowledge) and ecology (land capability, land suitability, irrigation), ceteris paribus. The three components cannot be separated .

There are some implication of the research. First, the government should support women to strengthen home industry in villages. Second, the government should increase infrastructure, transportation and facilities to smoothen food accessibility. Third, water resources must be well-managed. The community must be involved in taking care of water resources.

Ecological function must be well-maintained hydrological recycle. The quality of water must always be protected. Vegetative plants can be used as forest buffers or waterbreaks.

Finally, land capability class having non-permanent obstacles must be improved individually and collegially by means of SWC (*soil and water conservation*) technique. *Trapping water* or preserving *run off* can be done by bioengineering combining physical, vegetative and cultural. All the activities must be followed by good community planning involving the province as well as the regencies.

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