**Profitability and Farmers Conservation Efforts on Sustainable Potato Farming in Wonosobo Regency**

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**Abstract**

It takes into account of potato farming sustainability, since it was recognized as a holticulture commodity for farmers subsistence in Wonosobo Regency. For the reason that farming land degraded by errossion, the potato productivity apparently continued to decline. Potato farming sustainability can be deliberated from points of view of economic (profitability) and environmental (conservation efforts), in order to keep profitable in a long term sustainable environment. This study is aimed to (1) to analyze the profitability of potato farming; (2) to analyze the farmers effort in soil conservation and factors which affecteed the sustainability of potato farming. The study method was using basic descriptive analysis. The study sites was in Kejajar District, Wonosobo Regency, subsequently was obtained randomly 50 farmers for respondences. Gross Margin, Return on Invested Capital, and Operating Ratio were used to measured the profitability of potato farming. Conservation Activity Index (CAI) was used to measured the effort of farmers in soil conservation, while paired liner regression model with Ordinary Least Square (OLS) method was used to understand the factors in which affected the conservation efforts of test sites. The study results revealed that the potato farming was profitable. Farmers conservation efforts mostly was in average category (74%), and only view in high category (16%) and low category (10%). Factors in which affected the farmers conservation efforts i.e. land area, potato products, potato price, the off-farm income, number of family members, farmers ages, and village dummy.

Keywords: profitability, potato farming, soil conservation, land degradation, Wonosobo

1. **Introduction**

In various countries including Indonesia, in farming there are many serious problems that threaten the sustainability of crop production. One of the serious problems is the occurrence of land degradation, due to the effect on crop productivity, environmental quality, and have the effect on food security. It is estimated up to 40% of the agricultural land that exists in the world today has been degraded.

Land degradation means the reduction of land capacity because it has been expolarated over its own ecologycal capacity. The land degradation inhibits plant growth (Khormali, 2009). Fragility of topsoil, affected by farm management such as fertilization and cultivation process, causes erosion so that removes the soil nutrient content (Ferreras, 2007). Over aplication of pesticides reduces soil quality and it should be controled properly (Mosher, 1996; Van and Mendoza, 2003; Galt, 2008; VanderZaag, 2010).

Potato (*Solanum tuberosum L.)* is a horticultural commodities and also consumpted by almost people in the world. It’s potentialy grown and developed in Indonesia because the country has sufficient agroclimatic condition (Novary, 1997 *cit.* Sukayana *et.al*, 2013; Ghadimi et.al., 2014). Based on Statistic Indonesia (2013), the highest production of potato was in Central Java (273.513 ton) and Wonosobo was the central of its production. It has stabil price with a good prospect of business, suitable to be run in many levels of business capitals,

the market was assured and certainly, and has a long shelf life so that many farmers and investors interst to cultivate potatoes. It causes the higher land requirements (Edi Syafril *et.al.*,2003 *cit.* Razak *et.al.*, 2015). Land requirement is getting high and uncontrolled without any consideration of conservation area. As the effect, the land has suffered serious degradation so the environmental carrying capacity is decreased. The impact of land degradation which decreased potato productivity showed in Graphic 1.

Graphic 1. Potato Productivity in Wonosobo Regency

(Source: Statistic Indonesia, 2006-2015)

Potato farming became the main source of livelihood of the communities in Wonosobo. Sustainable livelihoods society can be achieved when income and welfare are increasing gradually (Sconnes, 1998). Because of it, it’s important to maintain a sustainability of potatoes farm to help farmers livelihood. Sustainability must be seen from various aspects: the economy (profitability) and the environment (conservation efforts), so that in the long term sustainability of potato farming remains a profitable and stable environment (Eltun *et.al*., 2002; Saragih *et.al*., 2007; VanderZaag, 2010). So that potatoes farming must consider profitability and conservation practices (De Fauw *et.al.,* 2012). The aims of the research are (1) to analyze the profitability of potato farming; (2) to analyze the farmers effort in soil conservation and influencing factors to farmers effort in soil conservation which affecteed sustainability of potato farming.

1. **Materials and Methods**
	1. **Study sites**

This research was conducted in the Kejajar district, Wonosobo regency as a region that has a percentage of land degradation with the criteria of low, moderate and high. For sampling taken two villages as a sample using the method of purposive sampling. Serang and Surengede village selected as study site because it is an area that has a high production of potato in 2013. Serang village have a slope of the topography are low (<400) and moderate (400-700), while the Surengede village on the slope of the topography are moderate (400-700) and high (> 700).

* 1. **Respondents**

The population of the research were farmers who cultivated potatoes. Respondent was choosen by simple random sampling. The number of samples taken were 25 farmers from each villages.

* 1. **Data Analysis**

**2.3.1 Profitability of Potato Farming**

Profitability of Potato Farmingmeasured by Gross Margin (GM), Return on Invested Capital (ROIC), and Operating Ratio (OR) . It is formulated by :

1. Gross Margin (GM)

Gross Margin (GM) = GFI – TVC in which :

GM = Gross Margin

GFI = Gross Farm Income

TVC = Total Variabel Cost

1. Return on Invested Capital (ROIC)

Return on Invested Capital (ROIC) = $\frac{GM}{TVC}$ in which:

ROIC = Return on Invested Capital

GM = Gross Margin

TVC = Total Variabel Cost

1. Operating Ratio (OR)

Operating ratio (OP) = $\frac{TOC}{GFI}$ in which:

OR = Operating Ratio

TOC = Total Operating Cost

GFI = Gross Farm Income

**2.3.2 Farmers Efforts in Soil Conservation to Maintain Sustainablity of Potato Farming**

Conservation Activity Index (CAI) used to determine farmers soil conservation efforts and calculated by the formula :

CAI= $\frac{acquaired score }{maximum score }x100\%$

CAI was measured using 10 questions types of soil conservation activities, namely: a) Planting reinforced terrace plants (b) Planting crops intersects slope (c) rotation of seasonal crops (d) Planting grass in the Sewers (e) The use of mulch (f) the use of animal manure (g) Planting annual crops (h) Making buildings conservation (i) Maintenance conservation building (j) Tillage intersecting slope

**2.3.3 Factors Affecting Farmers Effort In Soil Conservation To Maintain The Sustainability Of Potato Farming.**

Multiple linear regression model with Ordinary Least Square method (OLS) used to explain factors which affected farmers' soil conservation efforts. The model equations described with:

Y = α + b1x1 + b2 x2 + b3x3 +...+bn xn +d1 D1+ d2 D2 + d3 D3+ µ in which:

Y = Conservation Activity Index (%)

α = constant value

b1, b2, b3,..., bn = coefficient regression

X1 = Land area (ha)

X2 = potato production (kg/year)

X3 = potato price (Rp/kg)

X4 = Off farm income (Rp/year)

X5 = farmers education (year)

X6 = farmers age (year)

X7 = number of family members (people)

X8 = potato farming experience (year)

D1 = dummy variable of farmers group (1= active and 0 =non active)

D2 = dummy variable of credit access (1= available and 0 = unavailable)

D3 = dummy variable of status land ownership (1= private property and 0 = others)

D4 = dummy variable of village (1= Serang and 0 = Surangede)

µ = error factor

Ordinary Least Square for regression needs classic assumption test, they are normality test, multicollinearity, heteroskedasticity. Adjusted R2 value, F test and t test used for hypothetical test.

1. **Results and Discussion**
	1. **Profitability of Potato Farming**

Potato farming is the main livelihoods of farmers in Wonosobo and it contributes mostly in farmers' income. Sustainability of potato farming determined by economic aspect, when potatoes farming did not give any benefit for farmers, it could be switched by others more profitable crops. Profitability potato farming in Wonosobo Regency analyzed and showed in Table 3.1.

Table 3.1 Potato Farming Profitability in Wonosobo Regency 2014 - 2015

|  |  |
| --- | --- |
| Description | Profitability |
| Gross Margin (Rp) | Return on Invested Capital | Operating Ratio |
| Mean | 62.188.000 | 2,39 | 0,49 |
| Standard Deviation | 69.636.000 | 3,30 | 0,34 |
| Minimun | (10.668.000) | (0,26) | 0,05 |
| Maximum  | 290.360.000 | 20,39 | 1,36 |

Source: Primary Data Analysis (2015)

 Gross margin is used to measure the performance of farming in small scale. By which gross margin calculation, the value of the profitability of potato farming per year was Rp.62.188.000 > 0 (zero). The revenue of potatoes farming was greater than the variable costs and or operational cost so it concluded that potatoes farming provided benefits.

The rate of capital return invested by farmers in potato farming found from the value of invested capital return, 2.39; every rupiah which was invested by farmers in potatoes farming amounted into 2.39 rupiah in gross margin so that the farmers got twice from invested capital. It was concluded that potato farming was profitable. Besides these two previous calculations, operating ratio was a ratio which was directly related to the level of input which was used such as seeds, fertilizers, pesticides and labor. The lower of the ratio, the higher of the farming profitability. Operating ratio rate was 0,49 and indicated that potato farming was profitable enough and gave positive return for the capital amount which had been invested. Potato farming was profitable for farmers and prospectif enough to be cultivated in the long term, so from economic aspects view, potatoes farming was considered to be sustainable.

* 1. **Farmers Efforts in Soil Conservation to Maintain Sustainablity of Potato Farming**

Farmers in Wonosobo regency have been implementing soil conservation to increase land the quality and productivity. Land degradation can be restored by doing soil conservation activities. The conservation efforts measured by Conservation Activity Index (CAI). Farmers have practiced conservation techniques both vegetatively and mechanically. The mean (μ) of conservation activity index (CAI) was 48.72% wand its standard deviation (σ) was 11.52%.

Table 3.2 Percentage Farmers by Conservation Activity Index (CAI)

|  |  |
| --- | --- |
| Category | Percentage (%) |
| Low (CAI< (µ-σ)) | 10 |
| Midle ((µ-σ) <CAI< (µ+σ)) | 74 |
| High (CAI> (µ+σ)) | 16 |

Source: Primary Data Analysis (2015)

Based on table 3.2, 74% farmers implemented soil conservation efforts in the midle category and the index of conservation activities ranged from 37.2 to 60.23%,so most of the farmers had applied more than a half of the top ten conservation efforts. Sixteen percent of farmers was in a high category of conservation activity index (16%) and 10% farmers was in a low category.

 After decades of cultivating potatoes, farmers have been being aware of the danger of land degradation so that farmers begin to pay more attention to the land situation and implement soil conservation efforts. Farmers know that their farm area was ​​potentialy degraded so that conservation efforts should be held to rehabilitate the farm area. Farmers which had high conservation value of the index were expected to participate land preservation in order to avoid land degradation.

* 1. **Factors that influence to conservation maintaining the sustainability of potato farming**

Soil conservation activities are necessary to maintain the sustainability of potato farming in Wonosobo regency. Sustainability potato farming in the long term was influenced by farmers conservation efforts. To improve conservation activity index by farmers, it is important to know the factors that influence them. Ordinary Least Squares (OLS) was used to analyzed it, and showed in Table 3.3.

Table 3.3. Regression Coefficient Of Factors Affecting Soil Conservation Efforts To Maintain The Sustainability Of Potato Farming In Wonosobo

|  |  |  |
| --- | --- | --- |
| Variables | Regression Coefficient | Sig. t |
| Constanta | 16,314ns | 0,324 |
| Land area (X1) | 9,496\* | 0,002 |
| Potato production (X2) | 0,000\*\* | 0,035 |
| Potato price (X3) | 0,008\* | 0,003 |
| Off farm Income (X4) | -1,818E-7\*\*\* | 0,093 |
| Farmer’s education (X5) | -0,151ns | 0,823 |
| Farmer’s age (X6) | -0,367\*\* | 0,016 |
| Number of family members (X7) | -1,955\*\*\* | 0,082 |
| Potato farming experience (X8) | 0,242ns | 0,168 |
| Dummy of farmers group (1= active and 0 =non active) (D1) | 3.564ns | 0,262 |
| Dummy credit access (1= available and 0 = unavailable) (D2) | -0,903ns | 0,817 |
| Dummy the land ownership (1 = their own land, 0 = others) (D3) | 2,803ns | 0,406 |
| Dummy village (1 = serang, 0 = surengede) (D4) | 9,354\*\* | 0,016 |
| Adj R2 | 0,575 |
| Sig. F | 0,000 |

Note :

\*) = significant in α = 1%

\*\*) = significant in α = 5%

\*\*\*) = significant in α = 10%

ns = non significant

Table 3.3 explained that the conservation activities index were influenced 57,5% by independent variables and 42,5% was influenced by other variables outside the regression model. Partially, individual variables which was affected significantly CAI was land, the production of potato, the price of potato, off-farm income, number of family members, age of farmers and dummy of village (p <0.05).

1. **Land**

Agriculture is a natural asset which used by farmers to earn a living. The increased land area affect the conservation efforts being higher. From the regression model, when farmers land increased 1 ha, conservation activities index increased 9,49%. Narrower area of farm land, the conservation efforts was lower because farmers thought that conservation activities decreased farm land widht and they should provide additional burden which caused higher costs.

1. **Potato Production**

Production affect the conservation efforts of farmers but the increasing number of potato production will not affect the change of the soil conservation activities index, by cultivating potatoes indirectly farmers have been doing conservation example in the use of mulch and manure. A large scale of exploitation was done by farmers to obtain a high production of potatoes. Farmers who had narrow areas focused on its production only without any adoption principles because the conservation inhibits growth of potatoes and the activity takes a higher cost.

1. **Potato Price**

Increasing the price of potato increased the conservation efforts of farmers. When the price of potato increased by Rp. 1, the index of conservation activities could be increased by 0,008%. Due to the high prices, it provides a greater revenue to the farmers, so that the excess of these revenues could be used to finance conservation activities. Conservation efforts of farmers has positive correlation with commodities prices (Mulyoutami, 2004; Evizal *et.al,* 2005).

1. **Off farm Income**

Off-farm income used as an additional income to sufficient farmers households. If the off-farm income increased by Rp.1, it caused the conservation activity index farmers decreased by -1,818E-7%. The condition happened because farmers spent less time on their farm so they can’t do soil conservation properly.

1. **Number of Family Member**

Larger number of family member would decrease farmers conservation activity index. An increasing of 1 person in the family decreases the conservation activity index by 1,955%. The more family members, the farmers spent more times in the household so that farmers decided to use their income to meet household needs inside.

1. **Farmer’ Age**

The older of farmers age would decrease farmers conservation activity index. When age of the farmers increased 1 year, the conservation activity index reduced by 0,37%. Increasing age of farmers would lower their productivity due to declining physical condition.

1. **Village**

There were two villages in this research. Conservation index conducted by farmers between two villages was different. In Serang village, farmers had a higher conservation efforts (9,54%) than Surengede village. Due to the topography of land area in Serang was more ramps than in Surengede village, the conservation efforts was easier and cheaper. Farm land with various and steep slope in Surengede village caused some difficulties for farmers to do the conservation activities because it needed high costs.

1. **Farmer’s education, Potato farming experience, Dummy of farmers group, Dummy credit access, Dummy the land ownership**

The factors which did not affect to farmers conservation effort include farmer’s education, potato farming experience, dummy of farmers group, dummy credit access, and dummy the land ownership. Farmers education were just studied until the elemetary school, only a few farmers continue studied until university. Potato farming experience was also same namely 10-15 years. There were only 2 people farmers active in a farmer group, access to credit was also easily accessible, there are many local banks and moneylenders to got a loan. Farmers' land ownership were generally in the their own land, so farmers did not much attention to conservation.

1. **Conclusion**

Potato farming was profitable, the invested capital return was obviously obtained, and had a higher income compared with its operational budget. In conservation efforts aspect, most farmers was categorized in middle category, it means that farmers have to apply half of the ten soil conservation activities, and few farmers was in high category and a few farmers was in a low category who implement conservation efforts. Middle category showed that the farmers were performing soil conservation activities with erratic behavior that mean sometimes farmers were performing soil conservation activities. Conservation activities often performed by farmers were using manure dan mulch, building a conservation building like a terrace, annual crop rotation. Factors which affected the farmers conservation efforts i.e. land area, potato products, potato price, the off-farm income, number of family members, farmers ages, and village dummy. Variables affected positively to farmers conservation efforts was the total land area, potato products, potato price, and village dummy; and the variables affected negatively was off-farm income, number of family members, and farmers ages.

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