Does Technology Influence Female Farmer Income? Case Study in Pidie District, Aceh

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Abstract—The purpose of this study was to determine the impact caused by the modernization of agriculture on the female farmer’s income in Pidie district. The model used is independent sample t-test. The result showed that agriculture modernization has a positive and negative impact on farmer’s income. While the farmers who own the land have more revenue because of the reduced cost for production, female farmers who do not own the land have less income. This is because opportunity and working hour carried out by farmer is replaced by modern machine. Thus, the female workers must improve their technology skill to be able to farm. On the other hand, mastering the technology can help them to access other sectors that provide better job opportunities and income.

Keywords—Modernization agriculture; Income; Independent sample

I. INTRODUCTION

Nowadays, traditional agriculture has begun to transform into modern agriculture. Modernization of agriculture was arisen because the traditional agriculture did not have significant progress and have uncertain result (Arsyad, Lincoln, 1992). Moreover, traditional agriculture still uses traditional tools such as hoes, sickles and the others. In addition, the aim of farmers in traditional agriculture is to continue living, which is different with modernization agriculture.

The change process from traditional to modern goes hand in hand with the increasing number of agricultural tools and increasing technology used by farmers. One of the objectives of modernization agriculture is to increase farmers’ income. This goal can be achieved considering that modernization increase the quality and quantity of output so that products can become more competitive, and hence bring more income to the farmers (Prayitno and Arsyad, 2009: 127).

The Indonesian Ministry of Agriculture (2015) released the industrialization process of agriculture in Indonesia which assumed to be able to save production costs up to Rp2.62 million/year, equivalent to 31.75 percent. Agriculture industrialization is also able to reduce the use of labor to 12 people/ha so that the agricultural production process can run more efficiently. On the other hand, agriculture industrialization has created new unemployment due to the failure of workers to move to other sectors. Most of farmers who are vulnerable are farmers with low education and productivity levels. This argument is supported by research (Thirll et al., 2005) which found that in the last few decades in the South African, there has been a replacement of human labor with technology. This can increase agricultural productivity and ultimately reduce the use of human labor in the agricultural sector.

Furthermore, introduction of technology is usually not beneficial for female farmers. There are few women farmers who have an access to the technology and many of them are being excluded in accessing the information related to industrialization agriculture. Moreover, the study about the impact of modernization to the woman farmers is limited. Some studies show that the new technology introduced is not approachable to women. When the green revolution was implemented with high-yield rice technology, for example, woman farmers were removed from activities that had originally become their work (Collier et al. 1973; Wijaya 1985). Whereas Lilja, N and Sanders, John H. (1998) stated that the use of technology made female farmers experience the reduction in income.

Pidie is one of Aceh's rice barns, where the majority of the population’s occupation in Pidie is farmers. According to BPS (2013) it is estimated that there are approximately 6,000 women working in agriculture sector in Pidie. In 2014, Pidie's rice production increased along with the increasing use of technology in production process. Given the large role of the agriculture sector and large number of female farmers involved in the agriculture sector, it is assumed that the use of agricultural technology has an impact on the income level of female farmers.
II. LITERATURE REVIEW

A. Agriculture Industrialization

Agriculture Industrialization has an important and strategic role in the development of industrial agriculture systems. Mechanization of agriculture not only increases the cultivation area and cropping intensity, but also increases farm productivity and efficiency. Moreover, it controls the loss of production and improves the quality and value added of agriculture products and improves the job opportunities in the countryside through the creation of integrated agribusiness systems, which in turn will stimulus economic activities in the rural areas (Manwan, I, 1994). Although the use of agriculture technology can increase income of female farmers but in aggregate, the use of technology will actually reduce the total income of female farmers. (Lilja, N and Sanders, John H. 1998).

B. Production Theory

Production is a system which utilizes inputs to produce some goods or services (Schroeder, 1999). Production is related to how resources (inputs) are used to produce the products. However, the amount of output produced is influenced by the technology. Study about the relationship between the amount of use of input and the amount of output produced with technology is called the production function. Soeratno (2000: 82) explains that the production function is a function that shows the relationship between the level (and combination) of the use of inputs and the level of output per unit of time (In this model, the relationship between input and output is arranged in the form of production functions (Nicholson, 2002: 159) :

\[ q = f(K, L, M) \]

Where \( q \) represents the output during one period, \( K \) represents the machine (i.e. capital) used during that period, \( L \) represents the input of labor hours, and \( M \) represents the raw material used. The form of this notation shows the possibility of other variables that affect the production process (Nicholson, 2002: 159).

C. Revenue Theory

The income of farmers is measured by the difference between the income of farmers (Revenue) and the cost (Cost) that must be spent during production (Asnawi, 2014). Therefore, the income can be known by using the following equation:

\[ \Pi = Y \times P_{y} - E \times X_{i} \times P_{i} \]

Where \( \Pi \) is the Farmer's income (Rp.); \( Y \) is the Rice Production (Kg); \( P_{y} \) is the Price of rice (Rp); \( X_{i} \) is the Use of the i factor, and \( P_{i} \) is the i factor price.

D. Production cost

Production costs are defined as expenditures spent to obtain all factors of production which will be used in the production process. Production costs can be divided into short-term and long-term production costs. In the short term there are production costs that do not change (Fixed cost) while in the long term all factors of production will change (Nicholson, 2008).

E. Farmer

According to Sastraatmadja (2010), based on land ownership, farmers are divided into several groups, namely:

1. Farmers / farm laborers, are farmers who have no paddy fields at all.
2. Smallholders are farmers who have paddy fields between 0.1 to 0.50 hectares.
3. Small farmers are farmers who have 0.51 to 1 hectare of paddy fields.
4. Large farmers are farmers who have more than one hectare of paddy fields.

III. RESEARCH METHODS

The population in this study were female farmers in Pidie district who openly feel the impact of the modernization of agriculture. However, because the population in this study is not yet available, the formula \( n > 30 \) is used to determine the sample. The criteria used to determine the sample are explained as:

1. Female farmers who previously used traditional tools
2. Female farmers who harvested using two methods (traditional and technology)
3. Female farmers who worked on other lands
Data are collected in the form of primary and secondary data. Primary data is collected from the respondents through direct interviews. Then, secondary data is obtained from the relevant institutions, such as Central Bureau of Statistics. The data are analyzed using Purposive Random Sampling method which use specific criterion to identify samples to represent the population (Sugiyono, 2013).

A. Model and Data Analysis

Descriptive analysis model is used to analyze the effect of independent variables on dependent variables. The hypothesis was investigated using Mann-Whitney and Wilcoxon Tests.

Modernization of agriculture is important to improve the welfare of farmers. The used of modern technology in agriculture is proven to be able to improve the welfare of farmers, as well as the use of various modern agriculture tools in Pidie District is able to increase the average income of farmers.

### TABLE I. FARMERS REVENUES BEFORE AND AFTER AGRICULTURE MODERNIZATION IN PIDIE DISTRICT

<table>
<thead>
<tr>
<th>Farmers Revenues</th>
<th>Mean (Rp)</th>
<th>SD</th>
<th>N</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before Agriculture Modernization</td>
<td>3.180.833,33</td>
<td>2711824,26</td>
<td>60</td>
<td>0,000</td>
</tr>
<tr>
<td>After Agriculture Modernization</td>
<td>3.275.833,33</td>
<td>3155815,34</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

However, the increase in the average income of farmers does not reflect the condition of the real welfare of farmers. There are differences in income between farmers who own land and farm laborers. The difference in income between land owners and farm laborers is still a problem in agriculture sector. Production factors such as land and the ability to access other production factors make the decisions and production patterns are largely determined by landowners' decisions. This implies that there is an imbalance in the income distribution of land owners and farm laborers.

### TABLE II. FARMERS REVENUES BETWEEN LAND OWNERS AND FARM LABORERS BEFORE AGRICULTURE MODERNIZATION

<table>
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<th>Farmers Revenue before Agriculture Modernization</th>
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<td>Farmers-Land Owners</td>
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<td>1772417,18</td>
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The modernization of agriculture has made the gap in farmers’ income even greater. Farmers who own the land experience an increase in income compared to conditions before modernization. Meanwhile, farm laborers who do not own the land experience a decline in income.

### TABLE III. FARMERS REVENUES BETWEEN LAND OWNERS AND FARM LABORERS AFTER AGRICULTURE MODERNIZATION

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</tr>
<tr>
<td>Farm Laborers</td>
<td>536.666,67</td>
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<td>30</td>
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Farmers who own land experience a significant increase in income. This is due to the efficiency of production costs and reduced working time. New technologies such as tractors have reduced production costs because of the reduced in the number of workers and working days. At the same time, the use of new technology has increased the output. Therefore, land owners enjoy an increase in income from the increased of output and reduced in production costs.

### TABLE IV. FARM- LAND OWNERS REVENUES BEFORE AND AFTER AGRICULTURE MODERNIZATION

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On the other hand, farm laborers experienced a decline in income. The modernization of agriculture has caused farmers who own land to reduce the number of farm laborers. As a result, there is decreasing in working hours and cultivated land area of farm laborers.

### TABLE V. FARM LABORERS REVENUES BEFORE AND AFTER AGRICULTURE MODERNIZATION

<table>
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**IV. FINDINGS**

Modernization of agriculture reduces the absorption of female farm laborers. The introduction of technology has replaced their works in harvesting. If this continues, implementation of modernization is only positively impact toward the farmers who own their land. If it happens in the long run, then female workers who are not land owner would lose their job. Thus, there is inequality occurs between the farm-land owners and farm laborers. If these female farm workers lose their jobs, their welfare will certainly decrease because the only source of income has been lost.

**V. CONCLUSIONS**

Based on the results of the research discussed in the previous chapter, the conclusions from this study include:

1. There is income inequality between the income of farmers who own land and female farm workers after the modernization. While, farmers-landowners' income increased after modernization, although not too significant, the income of female farm laborers decreased significantly after the modernization of agriculture in Pidie District.

2. Female farmers who own their own land and use machinery for their production processes feel a positive impact, because the reduced in the production costs. Moreover, the production time is also reduced compared to those who previously only used labor.

3. There was an increase in income for farmers who owned the land before and after the use of technology even though the difference was not too large.

4. The use of technology in Pidie District causes the productivity level of female farm laborers who do not own their own land to be lower than before. Before modernization, they were able to work on large area of land. However, after used of technology, their roles are being replaced by machines. If this happens in the long run, then there is possibility that they will be lost their job. Eventually, the female farm laborers would lose their income as well.

It is expected that the governments will empower the women laborers. Moreover, it is also expected for the government to be able to provide access to capital loans to these female workers so that those who have only relied on agriculture sector can easily move to other sectors such as to become an entrepreneurs or other field of works. This is because their role in the agricultural sector has been replaced due to the inclusion of technologies.

**REFERENCES**


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