Comparative cost analysis of pepper farming income under certification and non-certification seeds implementation (Case in Towuti District, East Luwu Regency, South Sulawesi Province, Indonesia)

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Abstract. Certification is an activity to foster farmers about good and correct cultivation in accordance with agreed standards to improve quality and ask farmers to care for the environment, which then increases social and economic resilience so that our cultivation can be maintained. This study aims to (1) know the ongoing pepper certification process; (2) comparing income between certified pepper farming and non-certified pepper farming; and (3) understand the factors that influence income differences between pepper farming certified and non-certified pepper farming in Matompi Village, Towuti District, East Luwu Regency. Data analysis techniques used are descriptive analysis, farm productivity analysis, farming income, and R/C ratio. Analysis of farmland productivity is divided into two, namely seeds productivity and seed productivity. Seeds productivity results show that non-certified farmers are higher than certified farmers, while seed productivity results are only carried out by certified farmers. The results of the study showed, although the productivity of pepper seeds (fruit) in certified pepper farms is lower, however, is more profitable due to the high sales value of its pepper seeds (cuttings).

1. Introduction
Global debates on sustainable agriculture have brought alternative farming systems like organic agriculture and fair trade to the forefront. While organic certification focuses on production methods, fair trade is concerned with agricultural marketing. Both these certified systems critique conventional agriculture and claim to follow eco-friendly cultivation and ethical aspects of trade, respectively [1].

The head of the Ministry of Data and Information System Center, Kelvin, revealed that 2016 pepper production reached 82.17 thousand tons. The amount of this production rose 0.82% from 2015 production
which only reached 81.50 thousand tons. While pepper production in 2017, is estimated to increase 0.97%, which is 82.96 thousand tons from 2016. Of the size of the production, in 2016 Indonesia's total pepper exports were 53.10 thousand tons. Pepper exports in the period of January to August 2017 reached 27.46 thousand tons, up 16.57 percent compared to the same period in 2016, which was only 23.56 thousand tons. The official who also serves as Acting Head of the Public Relations and Public Information Bureau of the Ministry of Agriculture emphasized that according to import control policies and to encourage exports, the results have been seen from the increase in export volumes followed by declining import volumes. Pepper imports in the January to August 2017 period were only 690 tons, while pepper imports in the same year in 2016 were very high at 2,663 tons, meaning that the volume of pepper imports decreased significantly by 74 percent. This proves that the condition of Indonesian pepper cultivation has the potential to be developed so that it can be successful again as it was 500 years ago. As a result, foreign exchange generated from pepper exports in 2016 reached USD 431.14 million [2].

Pepper (Piper nigrum L.), the King of spices, with its varied uses and dominance in the global spice trade, is the oldest and widely used spice in the world [3]. It has occupied a position that is supreme and unique and is today a foreign exchange earner for several countries, including Malaysia. Pepper has secured a pivotal position in food, pharmaceuticals, perfumery and cosmetic industries. With the development of modern science and technology and greater awareness and demand among people for the use of natural products, particularly in food and pharmaceuticals, pepper indeed secured a better position and has a better prospect in the years to come [4].

Pepper, including plants from the family Piperaceae. The family consists of 10-12 genera and 1,400 species of diverse shapes such as herbs, shrubs, vines and trees. Pepper of the genus Piper is a plant species originating from Ghats, Malabar India. Pepper plants are known as climbing annual plants. The trunk has a height of up to 10 meters, but its cultivation is limited to a height of 3-4 meters and is attached to a climbing pole (tajar) in order to facilitate maintenance. Pepper plants consist of stems, roots, leaves, branches, branches, flowers and fruit [5].

Based on the potential of natural resources that support pepper plantation activities that are potential to be developed, Matompi Village Towuti District of East Luwu Regency becomes the scope of research based on the objectives to be achieved. This pepper plant is also the production of smallholder plantations according to the largest crop type compared to the production of other smallholder plantations. Pepper is a mainstay commodity for the community in the village of Matompi District Towuti to improve their welfare, besides that the community’s economy becomes better so that the community becomes prosperous from the results of the pepper plantation. Pepper plants provide major changes to the social-economic and environmental conditions for the community [6].

Pepper plants have the highest economic value. The foreign exchange value generated from pepper exports in 2004 amounted to US $ 73,845 IPC-FAO (2005), which originated from black pepper exports totaling 32,000 tons and white pepper 13,760 tons. In Indonesia, most pepper plants are cultivated by farmers in the form of smallholder plantations which absorb a lot of labor in their businesses [7]. Indirectly, pepper farming has supported thousands of farmers in Indonesia, especially in pepper crop development areas where food crops cannot grow properly [8].

The production and profitability of black pepper is highly influenced by its international price. This makes the revenues from black pepper highly volatile. The domestic price in India is further influenced by the instabilities in international prices. This has made black pepper a risky crop. As a consequence, many black pepper smallholder farmers in India have shifted to organic farming practices and have adopted fairtrade marketing [9].

Organic and fairtrade standards are a recent phenomenon as far as the black pepper crop is concerned. The problems of soil fertility in conventional black pepper production popularized organic methods of production. Under organic standards, certified black pepper farmers have to follow production methods
that enhance soil fertility and promote biodiversity. Moreover, organic certification systems are rigorous and require a conversion period of a minimum of three years. During this conversion period, the yields are low and smallholders may require additional sources of income to meet their livelihood needs. However, certified organic farmers can sell their black pepper at organic premium prices which are higher than conventional market prices [10].

Pepper is a plant that is cultivated by farmers, especially in the village of Matompi. The commodity is cultivated by farmers with the main purpose to be traded and a small portion for self-consumption. Thus, pepper plants become one source of income for farmers in the village of Matompi. With the certification of pepper in the village of Matompi it is hoped that it can increase the income of farmers so that the welfare of pepper farmers in the village also increases. Pepper farming is very much needed by farmers in the research location because to support their families is very dependent on the income from pepper farming. Along with the decline in the price of pepper, the government is trying to keep the pepper farmers from experiencing losses and also farming in the village continues so that farmers advise farmers to follow the pepper seed certification program.

Organic certification does not offer any floor pricing. The minimum price offered by fair trade is intended to protect farmers from downside risk. However, this is not the case for conventional black pepper. As per FLO, the minimum fairtrade price for conventional pepper does not exist and is equivalent to its commercial price. Therefore, fair trade certification systems for black pepper seem to protect only organic farmers from organic market price shocks. Hence, the benefit of a fairtrade certificate becomes significant for organic farmers only when the organic black pepper prices falls below the minimum organic fairtrade price for black pepper [11].

A list of smallholder conventional pepper farmers was obtained from the agricultural office of Idukki district. With regard to certified farmers, the details were collected from a local non-government organization (NGO) promoting organic agriculture and fairtrade certification. Thereby, we have three farm management regimes namely, (1) conventional, (2) organic and (3) organic and fair trade. Hence, using stratified random sampling data was collected from 90 conventional, 98 organic and 89 joint organic and fairtrade certified farmers resulting in a total sample of 277 farmers. We do not have an only fair trade certified black pepper farmers as such farmers in this region were large plantation holders with more than 10 hectares of land. The survey was focussed on smallholders who own less than 1 hectare of pepper area [12].

In recent decades, organic and fairtrade certification schemes have captured the willingness to buy of the environmentally conscious and morally motivated consumers, threatening to break out of its current niche markets. This is reflected in the worldwide sales of these products. The organic market witnessed a five-fold increase in revenues since 1999 and reached 72 billion USD in 2013. Similarly, money spent on fair trade products increased by 15% from 2012 to global sales of 5.5 billion euros in 2013. Moreover, many studies have reported that such certifications improve smallholder producer livelihoods [13].

While there are many papers that have analyzed the adoption and impact of organic and fairtrade certification separately, so far there is no study that has examined the combined effects of both certification schemes. Hence this research studies to what extent black pepper produced organically and marketed under fair trade managements can improve the income of smallholder. Moreover, most of the adoption studies do not explicitly examine the counterfactual analysis and the differential gain of adoption. Therefore, we analyze the causal impact of adopting organic and both organic and fairtrade certification on smallholder livelihoods and welfare in terms of total household [14].

The international decline of black pepper prices in 2003-04 prompted the introduction of fairtrade standards for black pepper by the Fairtrade Labeling Organization (FLO). Unlike coffee, in which fair trade standards and certification were launched in 1988; it was only introduced for black pepper in 2005. A fairtrade certificate offers black pepper farmers certain advantages [15].
Moreover, most of these studies on yield and material input costs do not control for selection bias. Besides, literature does not discuss in detail whether organic farmers also having a fairtrade certification are better producers. Although fair trade is focused on agricultural trade aspects and labor conditions of workers, it does have the possibility to affect the efficiency of the smallholders indirectly through its social standards. For example, the ease of credit access under fair trade schemes can help meet input costs. Therefore, a joint organic and fairtrade certification can influence smallholder crop productivity. Nonetheless, these aspects are yet to be widely discussed in agricultural literature. Hence, our study attempts to build this gap in the literature by examining whether a joint adoption of organic and fairtrade certification can increase yield and reduce costs [16].

Based on the formulation of the problem, this study aims to (1) determine the stages of the ongoing pepper certification process, (2) compare income between certified pepper farms and non-certified pepper farms and (3) find out the factors that influence the difference in income between certified pepper farms with non-certified pepper farming.

2. Material and Method

This study uses qualitative methods and quantitative methods, which aim at solving existing problems at the present time by collecting, compiling, explaining, analyzing and interpreting data and then drawing conclusions. Data collection is done by survey techniques, namely data collection by interview techniques and direct observation in the study area based on a list of questions or questionnaires [17].

There are 343 pepper farmers in Matompi Village, 13 certified farmers and 330 uncertified farmers. This study took a sample of 46 farmers, each consisting of 13 farmers who had certified pepper farming (all samples were taken) and 33 farmers who were not certified (samples were taken 10% of the population), so through this study we could find differences income from these farmers.

The data collected consists of primary data and secondary data. Primary data were obtained from direct interviews with respondent farmers using a list of questions or questionnaires that had been prepared previously. Data were collected among respondents’ identities, land area, number of plants, costs incurred, income, certification process, amount of production, price. While secondary data were obtained from the Central Statistics Agency of East Luwu Regency, Agriculture Office of East Luwu Regency, and related agencies, literature, as well as other sources related to this research. Secondary data collected are regional conditions, population conditions, and agricultural production.

2.1. Descriptive analysis

Descriptive analysis aims to explain the stages carried out during the certification process and explain the factors that influence differences of opinion from certified farmers and non-certified farmers.

2.2. Analysis of farm productivity

Pepper productivity is a comparison between pepper production and the area of land used for pepper farming. The production used to calculate the productivity of pepper is the average production of pepper during the past year produced by pepper farmers in the study area. Pepper productivity calculation is done to see whether or not there are differences in productivity in certified and non-certified pepper farms. Systematically, it can be formulated as follows:

\[
\text{Pepper productivity} = \frac{\text{pepper production, kg}}{\text{pepper land area, Ha}}
\]

2.3. Analysis of farming income

Income farming, simply similar with farming profit. So, farming income analysis used to determine the income is calculating the profit both of certified and un-certified pepper farming.
Net farm income can be calculated by the formula:

\[ \pi = TR - TC \]

explanation: \( \pi \) = Profit or farming income (IDR)
TR = Total revenue (IDR)
TC = Total cost (IDR)

2.4. Revenue-cost ratio Analysis

In farming, to find out whether a farm is profitable or not, it can be analyzed by using R/C ratio analysis, i.e., the ratio of total revenue to total cost:

\[ \frac{R}{C} = \frac{TR}{TC} \]

explanation:
R/C = Revenue and cost ratio
TR = Total revenue (IDR)
TC = Total cost (IDR)

The measurement criteria in the R/C ratio are as follows:
(1) If R/C > 1, it means that the farming is done has a profit
(2) If R/C < 1, it means that the farming done has suffered a loss; and
(3) If R/C = 1, it means that farming is break-even (no profit and no loss).

3. Result and Discussion

3.1. Overview of the Research Area

The research respondents were in the productive age of 15-50 years, with a percentage of 53.85% for certified pepper farmers and 42.42% for non-certified pepper farmers. The average education level of certified pepper farmers and non-certified pepper farmers is high school, with a percentage of 38.46% and 33.33%. The average number of dependents of certified pepper farmer families is 4-5 people (53.85%) and the average number of dependents for non-certified pepper farmer families is less than 3-4 people (51.52%). Certified pepper farmers have an average of 16-27 years of farming experience (46.15%), while non-certified pepper farmers have 26-35 years (33.33%), and the average area of land owned by certified pepper farmers covering an area of 0.6-1 ha, and non-certified pepper farmers covering an area of 0-0.5 ha.

3.2. Overview of the Pepper Certification Process

Pepper Seed Quality Certification is to increase farmers' income while providing guarantees to seed users that seeds that have passed certification are clear seeds of quality and variety and provide legality for seed producers. In the process of reaching certified farmers, of course, there are stages that must be passed during the certification process.

The stages of the pepper seed certification process are as follows:
1. The South Sulawesi Plantation Office informed the pepper seed certification program to the Agriculture Department, East Luwu Regency Plantation. The plantation office is collaborating with district-level offices to provide knowledge and understanding of Lada (Geographical Indications) certification to the community, pepper producers/producers, business actors, and the government so that efforts are needed in obtaining the certification due to better prices and world market opportunities so able to restore the glory of pepper as before.
2. The Agriculture, Plantation Office of East Luwu Regency coordinates with the district level PPL, then the PPL will deliver/make prospective farmers who agree with the pepper seed certification
program to the Agriculture, Plantation Office of East Luwu Regency. With the information about the certification, PPL then conducts outreach to pepper farmers, so that PPL can determine the prospective farmers who will follow the certification process. For farmers who are willing to take part in the certification process, the names will be submitted to the district defense department.

3. Furthermore, the Department of Agriculture, Plantation of East Luwu Regency continues the prospective farmers of the source of pepper seeds to the Plantation Office of South Sulawesi Province.

4. Based on a proposal from East Luwu Regency, the South Sulawesi Provincial Plantation Office submitted an application letter to the director-general of the estate, regarding the request of the pepper plantation reception officer in South Sulawesi.

5. Based on the South Sulawesi Plantation Service application letter, the Director of Plantation Seedling makes a letter of assignment to the team that will carry out the certification process.

The team goes to the field (to Towuti sub-district) to inspect the prospective seed source pepper plants regarding eligibility based on technical standards. As for what needs to be considered when examining pepper is about the brand (Variety), location specificity in order to provide the unique quality characteristics of the product produced and distinguish it from similar products on the market, the condition of the plant (whether the plant is eligible for the certification or not). Then the team made a report on the results of the inspection. Making minutes of the examination of the assessment of the Malonan 1 variety source of pepper seed garden in Matompi village, Towuti District, East Luwu Regency.

3.3. Analysis of Pepper Farmer Income

Farming as an activity to obtain products in the agricultural field will ultimately be assessed from the costs incurred and the revenue obtained. The difference between the two is the income from farming activities. Farm revenue are multiplications between the production obtained and the selling price. The amount of production is the result obtained from the farm business, while the selling price is the value or price of the farm per unit of production. Meanwhile, the costs incurred by Pepper farmers include labor costs, input production costs, land taxes, and depreciation of equipment. While farm revenue is the result of production sales. The analysis is shown in Table 1.

Table 1. Cost Analysis of yearly farming income per hectare of certification and non-certification pepper seeds implementation in Matompi Village, Towuti District, East Luwu Regency, South Sulawesi Province, Indonesia.

| Description                        | Certification | Non-Certification |
|------------------------------------|--------------|-------------------|
| Value                              |              |                   |
| Amount of seeds production (stek/ha) | 49,885       | -                 |
| Price (IDR/stek)                   | 900          | -                 |
| Revenue (IDR)                      | 44,896,500   | -                 |
| Amount of seeds production (kg/ha) | 865.38       | 1,940.32          |
| Price (IDR/kg)                     | 35000        | 35000             |
| Revenue (IDR)                      | 30,288,300   | 67,911,200        |
| Total Revenue                      | 75,184,800   | 67,911,200        |
| Variable cost (VC, IDR)            |              |                   |
| Pole cost                          | 29,338,485   | 29,629,393        |
| Fertilizer cost                    | 2,731,385    | 2,116,406         |
| Pesticide cost                     | 497,885      | 381,106           |
| Labor wages cost                   | 3,294,981    | 4,877,011         |
| Total variable cost                | 35,862,736   | 37,003,916        |
| Fixed cost (IDR)                   |              |                   |
Table 1 shows that the average acceptance of certified pepper growers was IDR75,274,800 per hectare in the first harvest year (2 years) with an average total cost of IDR35,946,338 per hectare so that the average net income earned farmer certification per hectare is IDR34,765,410. Pepper farmers' net income is obtained by the difference between revenue and expenditure. Meanwhile, the non-certified farmers earned an average of IDR67,911,200 per hectare in the first harvest year (2 years) with a total cost of IDR37,110,671 so that the average net income obtained by non-certified farmers was IDR30,907,284 per hectare. I calculate the farmers' income by calculating the income at the first harvest (1 season). I do this because in the next harvest season, there is no cost of the pole that will be spent because the pole will continue to be used while trying to farm unless there is a broken pole (broken) so that the farmers' income in the following season will increase.

R/C ratio illustrates the ratio of revenue and expenditure of certified and non-certified pepper farmers. Certified pepper farmers have an average R/C ratio of 2.09, meaning that each cost incurred is IDR1.00, then the farmer receives an income of IDR2.09 and for non-certified farmers has an average R/C value C ratio of 1.83 which means that each cost incurred is IDR1.00, then the farmer receives an income of IDR1.83. Based on this, it can be seen that the results of the R/C ratio for both certified and non-certified pepper farmers > 1, which means that the farming carried out by each experience benefits. However, it is clear in his comparison that the value of R/C ratio of certified farmers is greater than the value of R/C ratio of non-certified farmers. Calculation of the R/C ratio, it can be concluded that farming activities carried out by certified farmers have a greater advantage compared to non-certified farmers for their farming activities per hectare for one year. In Macedonia, implementing an integrated crop management method on peper production gave more beneficial than the conventional one [18].

4. Conclusion
Based on the description of the results of this research discussion, it can be concluded that the number of seed certification farmers in Matompi Village is still very small from the total number of pepper farmers. Until now, there are only 13 farmers who have certified superior seeds and 330 peoples who do not have pepper superior seeds certification.

The productivity of certified pepper farmers from pepper seed production is lower compared to non-certified pepper farmers, and certified farmers are 865.38 kg per hectare in one year while non-certified farmers are 1,940.32 kg per hectare in one year. However, in addition to producing seeds, farmers also produce seeds in the form of cuttings, which will then be distributed in the form of superior seeds.

The income of certified pepper farmers is higher than non-certified farmers in Matompi Village, Towuti District, East Luwu Regency, South Sulawesi Province. The results of the calculation of the R/C ratio of certified and non-certified farmer pepper farms have a value of greater than 1, that is, 2.09 for certified farmers and 1.83 for un-certified farmers, meaning both certified and non-certified farmers certified experiencing profits and their business is feasible to run.

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