The potential of liberoid coffee cultivation on the peatlands (a case study: the peatlands in the Meranti island, Riau)

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Abstract. The Meranti Islands is one of the liberoid coffee production centers in Indonesian of which 94% of its total land area consists of peatland. The objective of this study was to disclose the potential of liberoid coffee cultivation in the peatlands of the Meranti Islands, Riau Province. The study was conducted from July to December 2015 in the Meranti Islands Regency. This study was conducted by means of survey method. The data used were the primary and the secondary data. The results of the study showed that liberoid coffee was adaptive on peatlands of the Meranti Islands and had a high economic value, therefore it can be used as an alternative usage of peatlands in Indonesia. The superior varieties of coffee recommended for the development of liberoid coffee are Liberoid Meranti 1 and Liberoid Meranti 2. These varieties are classified as open-pollinated composite types with respective yield potential of 1.69 and 1.98 tons ha⁻¹ of coffee, good seed quality, "excellent" flavor, and caffeine content of 1.02 and 1.11%. This variety is adaptive on peatlands with a climate A type or other areas that have the same agroecosystem as that of the Meranti Islands Regency.

Keywords: liberoid coffee, meranti islands, peatlands, liberoid meranti 1, liberoid meranti 2

1. Introduction

Indonesia has extensive peatlands, which cover a total area reaches 14.9 million ha. The largest area of peatlands in Indonesia is located in Riau Province, covering around 4,043,602 hectares or 56.1% of the total peatland area in Indonesia. Meranti Islands is one of the regencies in Riau Province which has 416,029 ha of peatlands or 94% of its total land area. The rest is in the form of the peatland (0-50 cm) and minerals, while the peatland with a thickness of > 300 cm is found in areas farther away from the coast with less area [1].

Meranti Islands is one of the liberoid coffee production centers in Indonesia. Liberoid coffee plants in this archipelago have significant economic value because they involve 950 farmers or heads of households. The area of liberoid coffee plantations in the Meranti Islands reaches 1,074.5 ha with a total production of 676.87 tons. Liberoid coffee in the Meranti Islands spreads in 6 subdistricts, namely Rangsang Pesisir Subdistrict, Rangsang Barat Subdistrict, Rangsang Subdistrict, Tebing Tinggi Barat Subdistrict, Tebing Tinggi Timur Subdistrict, and Pulau Merbau Subdistrict. Liberoid coffee plantations in the islands are traditionally cultivated by the farmers.

The cultivation of liberoid coffee on the peatland through the application of local wisdom can improve community welfare while maintaining the sustainability of the peatlands. The productivity of liberoid coffee plants in the Meranti Islands is still very low (<0.7 tons of coffee bean ha⁻¹ year⁻¹), because the existing coffee plantations have not been managed optimally, which is indicated by lack of
pruning, lack of care, and irregular spacing of coffee plants. Coffee productivity can be increased if farmers use superior coffee seeds which is accompanied by intensive care. The data of 2012 showed that liberoid coffee plants that were old / damaged in Meranti Regency reached 122.5 ha or 11.16% of the total area [5]. Rejuvenation of old coffee plants and expansion of the plantation area using superior seed varieties which suit their agroecology is necessary. This will have an impact on increasing the production and income of the farmers in the future.

In relation to this, the availability of sufficient coffee seeds from high productive mother trees are needed to support the program. Development of superior varieties seed gardens are necessary to provide superior seeds and maintain their purity. The objective of this study was to reveal the potential of cultivating liberoid coffee on the peatland in Meranti Islands Regency.

2. Materials and Methods

The study was conducted in Kepulauan Meranti Regency, Riau Province from July to December 2015. This activity was carried out by means of survey method. The data used were the primary and the secondary data. The primary data were obtained through interviews, while the secondary data were obtained through literature studies and documentation studies obtained from relevant offices or agencies.

The financial feasibility was calculated by using a Discounted Cash Flow Method. with regard to financial cash flows, both revenues and expenses, the present value was calculated so that direct comparisons could be made. The analysis criteria used included Net Present Value (NPV), Net Benefit Cost Ratio (Net B / C Ratio), Internal Rate of Return (IRR) and Payback Period (PBP). An investment is considered feasible if the NPV is positive, Net B / C Ratio is greater than 1, IRR is greater than the interest rate on bank loans and PBP is achieved in the shortest possible time.

3. Results and Discussion

3.1. Characteristics of Agroecosystems

3.1.1. Geographical location and topography

Meranti Islands Regency is one part of Riau Province’s area which is an expansion of Bengkalis Regency in 2009. Administratively Meranti Islands Regency consists of 9 Subdistricts which are spread over Tebing Tinggi Island, Padang Island, Merbau Island and Rangsang Island. Kedaburapat Village is one of the villages in the area of Rangsang Pesisir Subdistrict of Meranti Islands Regency with an area of 24.40 km² which has the following regional boundaries:

- The northern side borders with the Malacca Strait.
- The eastern side borders with Tanah Merah Village.
- The southern side borders with Sendaur Village.
- The western side borders with Melai Village.

The natural condition of this area consists of lowland swamps with altitudes ranging from 3-12 m asl and slope classes of A (0 - 8%). The northern side of Kedaburapat Village directly faces the Malacca Strait, with the beach having a lot of mangroves, Avicennia trees, Fig trees, and other forest plants.

Kedaburapat Village consists of 6 trenches, namely Senang Trench, Besar Trench, Jang Trench, Amat Trench, Gantung Trench and Kasan Trench. There is a river in this area, namely Junjung River. The area of Rangsang Pesisir Subdistrict is located in the west of Rangsang Subdistrict which is located between N: 01° 05’ 45.1” - E : 102° 49’ 50.2”. All villages in the Rangsang Pesisir Subdistrict, except Sendaur Village, are coastal villages, because they are directly adjacent to the coastline. The topography is relatively flat and is dominated by plantations’ plants such as coconut, areca nut, coffee, sago, and rubber.
3.1.2. Climate

Climatic elements that influence growth, production, quality, and taste of coffee are rainfall, solar radiation, air temperature, air humidity, and wind speed [18]. In addition, the distribution of sunlight has a strong influence on flowering, seeds, and maturation [19]. Meranti Islands Regency has climate A type with wet months > 100 mm throughout the year, the average rainfall of 175.8 mm day\(^{-1}\) or 2110.4 mm year\(^{-1}\), while annual rainy days are 144. Temperatures are relatively warm with a monthly average temperature ranges from 21.58\(^\circ\)C to 34.80\(^\circ\)C or an average of 29.21\(^\circ\)C year\(^{-1}\). The humidity is relatively humid with an average monthly air humidity of 46 - 98% or an average of 66%.

3.1.3. Land condition

By its percentage, the area of Meranti Islands has a proportion of peatland of 94% of the total land area. Peat soil has a pH ranging from 3.4 - 4.4 so that it is generally classified as a very acidic. In mineral soil the deeper layer (< 30 cm) has soil pH which is slightly higher (4.0) than the soil of surface layer (0-30 cm). This is strongly suspected to be closely related to the lower levels of soil organic matter. It is generally known that the acidity (H\(^+\) ion) of peat soil is derived from the carboxyl group. The indication relating to that is shown by the deep peat soil with > 2 m of thickness which has a pH of 3.5. In some coffee plantations, the thickness of the peat layer is very thin, in some places the mineral soil has risen to the surface. Local people refer to it with the term “Kelamanis”, and it is believed that the nature of the soil is more fertile than the deep peat.

The results of soil analysis showed that the Kedaburapat peat soil had varying levels of nutrient adequacy from very low to high. The N content in the top soil or tillage layer (0-30 cm) has a value of 0.45% (medium), while in the deeper layers (> 30 cm) it drops to only 0.13% N (low). On the other hand, in deep peat soil (thickness > 2.0 m), the N value reaches 0.64%, so it belongs to the high category. P and K nutrients are 19 ppm P\(_2\)O\(_5\) and 21 mg/100g K\(_2\)O, so that each of which is categorized as very low and low. Likewise, Ca and Mg of the soil, which are 0.65 and 0.47 cmol / kg, each of which is categorized as very low and low [4].

3.2. The origin of liberoid coffee of Meranti

Initially, liberoid coffee was imported to Indonesia as a substitute for Arabica coffee, which in 1878 was almost destroyed because it was attacked by a fungus that caused leaf rust (*Hemileia vastatrix*). To find out the origin of liberoid coffee in Meranti. Interviews were conducted with the mainstay farmers, the farmer groups, the farmer managers, the community leaders, the local residents, the village governments, and the heads and the staff of the Forestry and Plantation Office of Meranti Islands Regency. They mentioned that liberoid coffee in the Meranti Islands originated from Malaysia. At first, one resident named Haji Saleh migrated to Batu Pahat Johor Baru Malaysia.

In 1942, H. Saleh, whose real name was Dul Samad, brought 6 coffee seeds to Sempian to be planted in his garden. As they grew and produced fruit, H. Saleh tried to breed them. The effort to cultivate coffee in Kedaburapat Village was done by utilizing coffee seeds that grew around the parent trees. As they showed good growth performances, the community began to cultivate them as plantation crops. From the Amat Trench, coffee plantations expanded to the Gantung Trench and Kasan Trench which became known as Sempian. Afterward, they developed in the area of the Besar Trench, Senang Trench, and Kasan Trench. At present, the area is the largest coffee producer in Meranti Islands Regency.

The potential of liberoid coffee in the Islands is quite large, however the management is not optimal. In the area of Rangsan Pesisir, liberoid coffee was planted among coconut and areca trees with fairly good growth even without intensive fertilization and maintenance. Some farmers in the area have implemented more intensive maintenance by pruning and fertilizing. In addition, in order to obtain high-quality coffee, need efforts to encourage farmers to harvest only ripe fruits (red colour). Because this greatly affects the selling price and the quality of coffee, the wider impact will affect the maintenance of the image of liberoid coffee in the area.
3.3. The area and production of liberoid coffee

The area of liberoid coffee plantations in the Meranti Islands reached 1,074.5 ha consisting of 311 ha of immature plants, 668 ha of producing plants, 122.5 ha of old / damaged plants which spread in 6 subdistricts with varying widths, namely Rangsang Pesisir Subdistrict (605 ha), Rangsang Barat (130 ha), Rangsang (160 ha), Tebing Tinggi Barat (104.5 ha), Tebing Tinggi Timur (65 ha), and Merbau Island (10 ha). Liberoid coffee production in Meranti Regency reached 676.87 tons or an average production of 629.94 kg ha⁻¹ (Table 1).

Liberoid coffee in Meranti Islands spreads in 6 subdistricts covering 18 villages, with varying widths of area between 1-575 ha. The production ranges from 0.2-540 tons per year and involves as many as 6-320 households. Rangsang Pesisir is one of the largest liberoid coffee centers in Meranti Islands Regency with a land area of 605 ha consisting of 115 ha of immature coffee plants and 490 ha of producing coffee plants with annual production of 540 tons which involves 355 heads of households. Liberoid coffee in Rangsang Pesisir spreads in 2 villages, namely Kedabu Rapat Village (575 ha) and Tanah Merah (30 ha) (Table 1). The cultivation of liberoid coffee in 5 other subdistricts including Rangsang Barat Subdistrict, Rangsang Subdistrict, Tebing Tinggi Barat Subdistrict, Tebing Tinggi Timur Subdistrict, and Pulau Merbau Subdistrict reached an area of 339.5 ha or 43.70% of the coffee area in Meranti Islands Regency with a total production of 136.87 tons or an average production of 403.15 kg ha⁻¹.

| No. | Subdistrict | Immature Plant (ha) | Mature Plant (ha) | Damage Plant (ha) | Total (ha) | Households | Production (ton) |
|-----|-------------|---------------------|------------------|------------------|------------|------------|-----------------|
| **I. Rangsang Pesisir** | Kedabu Rapat | 85 | 490 | - | 575 | 320 | 540 |
| **II. Rangsang Barat** | Bina Maju | 20 | 65 | - | 85 | 92 | 79.90 |
| | Melai | - | 45 | - | 45 | 35 | 42.30 |
| | Total | 20 | 110 | - | 130 | 127 | 122.20 |
| **III. Rangsang** | Tanjung Samak | 85 | 13 | 2 | 73 | 81 | 1.85 |
| | Tanjung Medang | 11 | 5 | 2 | 18 | 23 | 1.50 |
| | Tanjung Kedabu | 10 | - | - | 10 | 10 | - |
| | Beting | - | 4 | - | 4 | 10 | 1.17 |
| | Bungur | 25 | - | - | 25 | 25 | - |
| | Topang | 2 | 8 | - | 10 | 25 | 1.45 |
| | Tanjung Bakau | 10 | 9 | - | 19 | 24 | 2.02 |
| | Teluk Samak | - | 1 | - | 1 | 6 | 0.06 |
| | Total | 143 | 40 | 4 | 160 | 204 | 8.07 |

Table 1. Total area and production of liberoid coffee in Meranti Islands Regency
3.4. The potential of liberoid coffee

3.4.1. Adaptability

Liberica and Excelsa coffee are the types of coffee that belong to the liberoid coffee group that is cultivated by the coffee farmers in the Meranti Islands Regency, Riau Province. Liberoid coffee is the main crop of the community along the road leading to Gantung Trench Village, Kasan Trench, Amit Trench, Jang Trench, Besar Trench, Senang Trench, and Kedabu Rapat Trench. Almost all of the community’s land in Parit Kasan Village and its surroundings is planted with liberoid coffee under stands of coconut and areca trees. According to information obtained from the farmers, the name Sempian includes Kasan Trench Village, Gantung Trench, Amat Trench, and Jang Trench which are famous for their liberoid coffee plantations. Liberoid coffee is used as a warming drink that is consumed both in the Meranti Islands Regency, Malaysia, and in Singapore.

The superiority of liberoid coffee in the Meranti Islands is that it can grow on peatlands with low fertility, bear fruit throughout the year, is relatively resistant to pests and diseases. It is free from the use of chemical fertilizers and pesticides.

3.4.2. Production

In trees of over 15 years of age, the average liberoid coffee production ranges from 21.19-34.40 kg tree⁻¹ year⁻¹. The number fruit of 1 kg of ripe fruit is between 128.80 and 397 with the weight of seed of 73.94 to 136.57 g. Based on fruit size, there were small, medium and large fruit sizes with seed yields ranging from 7.32 to 13.5% or an average of 10.67% [9][10][12].

3.4.3. Flavor

Liberoid coffee of Meranti has an "Excellent" flavor with specific flavor like caramelly, greenish, chocolate, acidy and sweet, with relatively low caffeine level. In addition, it shows the favorite value (preference) ≥ 80 so that it is likely to produce specialty coffee. Taste test results show the final value ranged from 81.50-84.50 with uniformity score and clean cup score are classified as high or reach 10 (Table 2).
and Malays ease can result in a decline in coffee of 3 to 13 weasels. At present in 800,
iberoid coffee tends to disease in coffee plants because it can kill coffee plants. This disease is a very detrimental cause by very thick and hard fruit skin, so that fruit borer pests are difficult to pierce fruit [7].

3.4.4. Pricing and Marketing
Liberoid coffee is not only accepted in the local market but is also exported to Singapore and Malaysia, known as Sempian coffee. In Singapore and Malaysia, the price of liberoid coffee tends to be higher because it is considered to have a distinctive flavor and aroma and is different from that of other coffees. At present, the price of coffee bean in Malaysia ranges from 14 to 16 ringgit or around Rp. 44,800.- to Rp. 51,200. As a community commodity that has been cultivated for a long time, liberoid coffee is able to become one of the sources of income for the coffee farmers in the Meranti Islands Regency besides sago, coconut, areca nut and rubber.

Most of the liberoid coffee harvests are sold to the collectors in the form of fresh coffee fruit with a price range of coffee fruit ranging from Rp. 2,500 to Rp. 3,500 kg⁻¹, - while for dry coffee bean is sold at a price of between Rp. 50,000.- to Rp. 55,000 kg⁻¹. The number of coffee collectors and processors of coffee bean in this area is ± 20 people. Coffee are harvested usually in September to December.

Meranti’s liberoid coffee is sold in the form of ground coffee. The coffee bean originates from the harvest and natural civet coffee. There are two civet coffee processing industries originating from animal rearing, namely the household industry of civet coffee Nur Jaya and Insan Mandiri, each of which has ± 10 members. Each member of the group has an average of 3 to 13 weasels. At present in Kedabu Rapat Village, there are two selling prices of civet coffee powder, the one originating from peaberry coffee can reach Rp. 2,000,000, - kg⁻¹, while ordinary civet coffee is usually sold at Rp. 1,000,000.- The civet coffee is marketed to Selat Panjang, Tanjung Balai, Karimun, Pekanbaru, Siak, Tanjung Buton, and Perawang. During the harvest season, the production of civet coffee of Nur Jaya can produce 150 kg of civet coffee month⁻¹ and is sold in 100 g packages at a price of Rp. 100,000.-.

3.5. The resistance of liberoid coffee against main pests and diseases
In Indonesia coffee-fruit borer is one of the main causes of the decline in national coffee production and quality [17]. The attacks of coffee-fruit borer in South Sulawesi have caused yield losses of between 30 and 60% [8]. In general liberoid coffee in the Meranti Islands is resistant to coffee-fruit borer’s attacks [11]. The resistance mechanism of coffee fruit against fruit borer is thought to be caused by very thick and hard fruit skin, so that fruit borer pests are difficult to pierce fruit [7].

A major coffee disease is leaf rust caused by Hemileia vastatrix. This disease is a very detrimental disease in coffee plants because it can kill coffee plants. This disease can result in a decline in coffee

| Characteristics | 1   | 2   | 3   | 4   |
|-----------------|-----|-----|-----|-----|
| Fragrance       | 7.25| 7.75| 7.75| 8.00|
| Flavor          | 7.75| 7.75| 7.75| 8.00|
| Aftertaste      | 7.75| 8.00| 7.75| 8.00|
| Acidity         | 7.75| 8.75| 8.00| 8.00|
| Bitterness      | 8.00| 8.50| 8.25| 8.50|
| Body            | 7.50| 7.75| 7.50| 7.75|
| Uniform         | 10.00| 10.00| 10.00| 10.00|
| Balance         | 7.75| 7.75| 7.75| 8.00|
| Clean cup       | 10.00| 10.00| 10.00| 10.00|
| Overall         | 7.75| 8.00| 7.75| 8.25|
| Preference b     | 81.50| 84.25| 82.50| 84.50|

Notes:  

a Score: 6-6.75 = Good, 7-7.75 = Very good, 8-8.75 = Excellent, 9-9.75 = Outstanding.  
b Minimum value for specialty grade = 80.  

Source: [11]
production in Indonesia by up to 25% [15] and in Sri Lanka more than 50% [3]. The initial symptom is leaf spots which are initially light yellow, then will then turn into dark yellow, when observed at the bottom of the leaf. In that section, the orange flour will be clearly seen. The orange flour is the uredospora of *H. vastatrix* fungi. Further symptoms, brown spots will appear on the leaves joined together, become larger and then dry and fall, so the plants become bare [14][15][16].

Most of the existing selected parent trees are resistant against *H. vastatrix*. The results of observations in the field showed that the attack symptoms found are only in the form of small to moderate patches which are brownish yellow and in some trees no symptoms are found [6]. This agreed with what [13] and [16] stated that liberoid coffee was more resistant to leaf rust disease.

3.6. Superior varieties of liberoid coffee Meranti 1 and liberoid coffee Meranti 2

The need of liberoid coffee seeds in Meranti Islands Regency is increasing along with the development and rejuvenation program of coffee plants. In 2015, the Indonesian Industrial and Beverage Crops Research Institute in collaboration with the Meranti Islands Forestry and Plantation Office released two superior liberoid coffee varieties from the selection of the Liberoid coffee populations in Kedaburapat Village, Rangsang Pesisir Subdistrict, Meranti Islands Regency. Both varieties were released as Liberoid Meranti 1 (LIM 1) and Liberoid Meranti 2 (LIM 2) with potential yields of 1.69 and 1.98 tons ha\(^{-1}\) of coffee beans, respectively. The yield ranged from 8.71 to 13.53%, the taste quality was "excellent", caffeine levels was 1.02 and 1.11%, adaptive on peatlands in the Meranti Islands with climate A type or other regions that have the same agroecosystem [11].

The component of the physical quality of coffee beans that determine the quality of good beans is the percentage of beans that are normally equal to or greater than 85% [1]. The results of the observations showed that the normal seed content of LIM 1 coffee beans was 86.67 to 92% or an average of 90%, while the average percentage of defective seeds in the form of round seeds, elephant seeds and triage seeds were 2.42, 6.25 and 1.78%, respectively. The high percentage of normal beans and the low number of defective seeds reflects that the physical quality of LIM 1 coffee beans is good (Table 3). The same thing was also shown by LIM 2 coffee with the percentage of normal seeds of 86.67% and the percentage of round seeds (2.67%) and elephant seeds (10.67%) (Table 4).

| Location | Normal bean (%) | Peaberry (%) | Empty bean (%) | Elephant bean (%) | Triage bean (%) | Interpretation |
|----------|----------------|--------------|----------------|-------------------|----------------|----------------|
| Afisah   | 91.33          | 2.00         | -              | 6.67              | -              | Good           |
| Sutrisno | 86.67          | 2.67         | -              | 10.67             | -              | Good           |
| Kosim    | 90.00          | 2.00         | -              | 6.67              | 1.33           | Good           |
| Arifin   | 88.67          | 3.33         | -              | 6.67              | 1.33           | Good           |
| Nusi     | 90.00          | 2.67         | -              | 6.00              | 1.33           | Good           |
| Marjuki  | 90.00          | 3.33         | -              | 5.33              | 1.33           | Good           |
| Sarno    | 92.00          | 1.33         | -              | 2.67              | 4.00           | Good           |
| Samsurizal | 91.33 | 2.00         | -              | 5.33              | 1.33           | Good           |

Mean 90.00±1.71 2.42±0.71 - 6.25±2.22 1.78±1.09

CV (%) 1.90 29.26 - 35.58 61.41

Notes: Good quality the percentage of normal bean is more than 85% [2]
Source: [11]
Table 4. The average value of the physical characteristics component of LIM 2

| Varieties       | Normal bean (%) | Peaberry (%) | Empty bean (%) | Elephant bean (%) | Triage bean (%) | Interpretation |
|-----------------|-----------------|--------------|----------------|-------------------|----------------|----------------|
| Composite       | 86.67           | 2.67         | -              | 10.67             | -              | Good           |

Notes: Good quality the percentage of normal bean is more than 85% [2]
Source: [11]

3.7. Analysis of financial feasibility of cultivation of LIM 1 and LIM 2 coffee

The optimal production of LIM 1 coffee can be achieved in the 15th year (13th harvest) with the assumption of using recommended technology. The cash flow of coffee LIM 1 development can be seen in Table 5 assuming the LIM I coffee price used is 3500 kg\(^{-1}\) of wet beans.

Table 5. Financial feasibility of developing LIM I coffee covering an area of 350 ha for 25 years

| No. | Feasibility Criteria    | Value          |
|-----|-------------------------|----------------|
| 1   | NPV (Rp. 000,-)         | 17,055,769,828|
| 2   | IRR (%)                 | 62%            |
| 3   | Net B/C Ratio           | 1.09           |
| 4   | Payback Period (tahun)  | 6.7            |

Viewed from the basis of the criteria of financial feasibility, the development of LIM I coffee plants covering an area of 350 ha with an economic age of 25 years, is worth the effort. The data in Table 5 show that the net present value (NPV) is Rp. 17,055,769 billion making it feasible to work on because a project can be said to be financially feasible if it has a NPV of greater than zero. Likewise, when considered on the basis of the IRR generated by 62% which shows that the project is also feasible to be undertaken. Viewed from the net B / C ratio criteria, a value of 1.09 is obtained, which means that for every Rp. 100, - costs incurred, a profit of Rp. 109,- can be obtained or revenue of Rp. 209,-. This value also shows that the cultivation of LIM I coffee is very feasible to be undertaken, because the project can be said to be feasible if it has a net B / C ratio of greater than zero. While payback period criteria indicates that the period of time needed to return the investment spent is 6.7 years.

The projected optimal production of LIM 2 coffee can be achieved in the 12th year, assuming that all recommended cultivation technologies are carried out well. The cash flow for the development of LIM 2 coffee can be seen in Table 6. Assuming that the price of coffee used is Rp. 3500, - kg\(^{-1}\) of wet seeds.

Table 6. Financial feasibility of cultivating 350 ha of LIM 2 coffee for 25 years

| No. | Feasibility Criteria    | Value          |
|-----|-------------------------|----------------|
| 1   | NPV (Rp. 000,-)         | 14,935,931     |
| 2   | IRR (%)                 | 58%            |
| 3   | Net B/C Ratio           | 0.89           |
| 4   | Payback Period (year)   | 5.2            |

Viewed from the criteria of financial feasibility, the cultivation of LIM 2 coffee covering an area of 350 ha with an economic age of 25 years is worth the effort. The data in Table 6 show that the net present value (NPV) is Rp. 14,935,931 billion, therefore the cultivation is feasible to be undertaken, because one project can be said to be financially feasible if it has a NPV of greater than zero. Likewise, if it is considered on the basis of the amount of IRR generated by 58%, it shows that the
project is also worth working on. Viewed from the net B/C ratio criteria, a value of 0.89 is obtained, which means that every Rp. 100,- costs incurred a profit of Rp 89,- can be obtained or an income of Rp. 189,-. This value indicates that the cultivation of LIM 2 coffee is very feasible to be undertaken. While the payback criteria period shows the period of time needed to return the investment spent can be achieved for 5.2 years. The coffee varieties are very potential to optimize the use of peatland, which is quite extensive in Indonesia, namely around 14.9 million hectares spread across Sumatra, Kalimantan and Papua.

4. Conclusion

Cultivating liberoid coffee on peatlands by utilizing local wisdom innovations can improve people's welfare without damaging the sustainability of the peatlands. The case study in the Meranti Islands has proven that liberoid coffee cultivation can improve people's welfare without causing an adverse impact on the environment. Liberoid coffee plants that have high economic value and are adaptive on the peatland can be used as an alternative to the use of the peatlands to improve people's welfare while maintaining its sustainability. The recommended superior varieties of liberoid coffee are Liberoid Meranti 1 (LIM 1) and Liberoid Meranti 2 (LIM 2).

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References

[1] Anonymous. (2014) ‘Buku Persyaratan Pendaftaran Indikasi Geografis Kopi Liberoid Sempian Meranti’. Dinas Kehutanan dan Perkebunan Kepulauan Meranti.
[2] BSN. (2008) Standar Nasional Indonesia untuk Biji Kopi. SNI 01-2907-2008. ICS 67.140.20, 16p.
[3] Brown, J.S., Whan, J.H., Kenny, M.K., and Merriman, P.R. (1995) ‘The effect of coffee leaf rust on foliation and yield of coffee in Papua New Guinea’, Crop Prot. 14 (7): 589-592.
[4] Daras, U., and Martono, B. (2015) ‘Budidaya kopi Liberoid pada lahan gambut di Kabupaten Meranti’, Warta Penelitian dan Pengembangan Tanaman Industri, Vol. 21 (1): 24-28.
[5] Dishubun Meranti. (2012) Luas dan produksi kopi Liberoid di Kepulauan Meranti. Dinas Kehutanan dan Perkebunan Kabupaten Kepulauan Meranti.
[6] Harni, R., Taufig, E., and Martono, B. (2015) ‘Ketahanan pohon induk kopi Liberika terhadap penyakit karat daun (Hemileia vastatrix B. et Br.) di Kepulauan Meranti’, Jurnal Tanaman Industri dan Penyegar, Vol. 2 (1): 35-42.
[7] Hulupi, R., and Nugroho, D. (2013) Usulan pelepasan varietas kopi Liberoid asal Tanjung Jabung Barat-Jambi untuk lahan gambut. Dinas Perkebunan Kabupaten Tanjung Jabung Barat, Dinas Perkebunan Provinsi Jambi, Pusat Penelitian Kopi dan Kakao Indonesia. 30 hal.
[8] Laila, M.S.I., Agus, N., and Saranga, A.P. (2011) ‘Aplikasi konsep pengendalian hama terpadu untuk pengendalian hama babuk buah kopi (Hypothenemus hampei)’, Jurnal Fitomedika, 7(3): 162-166.
[9] Martono, B. (2015a) Indikasi geografis kopi Liberika Rangsang Meranti. Medkom Perkebunan Tanaman Industri dan Perkebunan, Vol. 3 (6): 45.
[10] Martono, B. (2015b) Keragaan buah dan biji kopi Liberoid di Kepulauan Meranti. Medkom Perkebunan Tanaman Industri dan Penyegar, Vol. 3 (12): 104.
[11] Martono, B., Rubiyo, Setiyono, R.T., and Udarno, L. (2015) Pelepasan Varietas Kopi Liberoid
Meranti 1 dan Liberoid Meranti 2. Balai Penelitian Tanaman Industri dan Penyegar. 63 hal.
[12] Martono, B. (2017) ‘Performance of the selected main tree of Liberoid coffee in the peatland of Kepulauan Meranti, Riau’, *Journal of Wetlands Environmental Management*, 5 (1): 32-36.
[13] Mawardi, S., Sastrowinoto, N. Pusposendjojo, and Nasrullah. (1994) ‘Evaluasi ketahanan tak sempurna kopi Arabika terhadap penyakit karat daun (*Hemileia vastatrix B etBr.*),’ *Pelita Perkebunan*, 9: 135-147.
[14] Rodrigues, W.N., Tomaz, M.A., Apostólico, M.A., Colodetti, T.V., Martins, L.D., Christo, L.F., Brinate, S.V.B., de Jesus Jr, W.C., and Amaral, J.F.T. (2014) ‘Severity of Leaf Rust and Brown Eyespot in Genotypes of *Coffea arabica* L. Cultivated with High Plant Density’, *American Journal of Plant Sciences*, 5: 3702-3709.
[15] Semangun, H. (2000) *Penyakit-penyakit Tanaman Perkebunan Indonesia*. Gadjah Mada University Press. 835 hlm.
[16] Silva, M.C., Varzea, V., Guimaraes, L.G., Azinheira, H.G., Fernandez, D., Petitot, A.S., Bertrand, B., Lashermes, P., and Nicole, M. (2006) ‘Coffee resistance to the main diseases: leaf rust and coffee berry disease’, *Braz. J. Physiol.*, 18 (1): 119-147.
[17] Sulistyowati, E., Mangoendihardjo, S., and Wagiman, F.X. (1999) ‘Respon fungsional parasitoid *Cephalonomia stephanoderis* Betr. Terhadap penggerek buah kopi, *Hypothenemus hampei* (Ferr.’, *Pelita Perkebunan*, 15 (2): 101-108.
[18] Supriyadi, H., Rusli, and Heryana, N. (2013) *Kesesuaian lahan untuk tanaman kopi. Bunga Rampai Inovasi Teknologi Tanaman Kopi untuk Perkebunan Rakyat*. Balai Penelitian Tanaman Industri dan Penyegar, Sukabumi: 47-56.
[19] Vaast, P., Cilas, C., Perriot, J., Davrieux, J., Guyot, B., and Bolanos, M. (2005) ‘Mapping of coffee quality in Nicaragua according to regions. Ecological conditions and farm management’, *In Proceedings of the 20th International Conggres on Coffee Research (ASIC) Bangalore, India*. P. 842-850.