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Article

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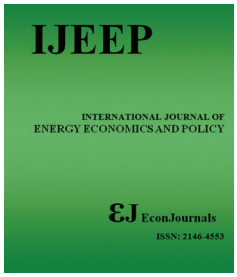

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Economic Analysis of Environmental and Cultural Impacts of the Development of Palm Oil Plantation

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ABSTRACT

This research focuses on the economic assessment of the development of palm oil plantation Perkebunan Kelapa Sawit (PKS) at the area of Taman Nasional Bukit Dua Belas (TNBD/Bukit Dua Belas National Park) in Jambi Province. TNDB area is a forest dedicated to conserve the culture of Suku Anak Dalam (SAD or also known as Kubu People, a group of indigenous people of Jambi). The hollistic economic assessment of the present research is to estimate the benefits and cost to build a palm oil plantation in TNBD. The benefits consist of the benefits having palm trees and the woods whereas the cost consists of the cost to build a palm oil plantation, the cost to produce wood, the environmental cost, and the cost of the decline of indigenous culture. In this regard, the environmental cost refers to the erotion cost and the carbon release cost. On the other hand, the cost of indigenous culture's decline consists of the lost of SAD's culture from the perspective of community's users, the lost of SAD's culture from the perspective of indigenous people, and the lost of SAD's culture from the perspective of non users' community (NBG). The assessment techniques apply the formula and benefit's shift to obtain the value palm oil plantation. The SAD's culture from the perspective of community's users is assessed from the cultural tourism of SAD and estimated with travel cost method. The SAD's culture from the perspective of indigenous people is estimated with contingent valuation method (CVM). SAD's culture from the perspective of non users' community (NBG) is also estimated with CVM. The results of present research show that the building of PKS is sensitive to the choices of carbon price and discount level. The result of net present value of PKS is negative if the carbon price is around USD 5 per ton with approximate discount level is 8%. There is an equity issue which influences many groups of people.

Keywords: Economic Analysis, Environmental and Cultural Impacts, Building Perkebunan Kelapa Sawit, Net Present Value
JEL Classifications: O13, Q5

1. INTRODUCTION

The economic development is an effort to improve the living standard of a nation. A development is a process of changing in certain scope of time and is marked with a structural change or a change in basic economic activity as well as economic structure of community. According to Truman, a development concept of a developing country needs to pass a transition period from decolonization to democracy. Such concept is not without flaws related to the humanity and environmental issues (Baiquni, 2002).

Therefore, a development should be considered as a multidimentional process (Todaro and Smith, 2006). In this consideration, a development involves fundamental changes in society's attitude, social structure, and national agents. The achievements in economic growth should be accompanied with rules to shrink the gap in the revenue distribution as well as to achieve a successful eradication of poverty and unemployment. Such activity also involves a fundamental change in society but without overlooking basic needs of individuals or groups to achieve a prosperous or better life.

To encourage the development of plantation in Indonesia, Indonesian government has made several regulations and guidelines for national development. Some of them are UU No 18 Tahun 2004 tentang Perkebunan (Law of Republic Indonesia Number 18 of 2004 about Plantation; Peraturan Pemerintah (PP) No. 31 Tentang Perlindungan wilayah Geografis penghasil Produk Perkebunan Spesifikasi Lokasi (Government Regulation Number 18 of 2004 about the Protection of Geographic area which produces Plantation Product Location Specification); Peraturan Menteri

Pertanian No. 26 Tahun 2007 Tentang Izin Usaha Perkebunan (Regulation of Minister of Agriculture Number 26 of 2007 about the Business Permit of Plantation). According to PP Number 11 of 1986 about environmental impact analysis, a suitable forest area for the palm oil plantation can be converted into a palm oil plantation. Such regulation can be a reference for the development of palm oil plantation, including one in jambi province.

The development of palm oil plantation in Jambi Province is performed 100% by converting the forests and 55% caused the forest destruction (KKI WARSI, 2005). There were some cases in Sarolangon, Tebo, and Batanghari in which the developments of palm oil plantation converted the forest edge of Taman Nasional Bukit Dua (TNBD) which is an area for Suku Anak Dalam (SAD) to roam and continue their culture, one that can be considered as one of prehistoric human cultures (Bayliss-Smith and Feacham, 1977).

The area of TNBD is also an example of tropical lowland rain forest ecosystem as well as an important area of drainage basin of Batanghari river and several other rivers. This ecosystem combination has formed a big spectrum of ecosystem as well as being an interesting attraction (BKSDA, 2004). Biodiversity and the ecosystem of lowland tropical forest can be an interesting tourist attraction. In addition, there is an indigenous cultural zone which is believed to have special value of SAD's culture and a potential as a highly attractive tourist attraction (BKSDA, 2004).

The development of TNBD is intended to ensure the sustainability of SAD's culture and conserve all kinds of living things there. Such policy is an important step and in line with the continous development. However, the policy will cause changes to some parts of area intended for the utilization of economic activities' such as the development palm oil plantation and else, the benefit utilization and the estimated sacrificed cost.

The development of TNBD is an issue of land utilization and causes several problems. Firstly, is the development of TNBD an economically suitable enough project considering the estimated environmental and cultural costs caused by it? Secondly, how enormous will the benefits and sacrifices the community get from the project's implementation? Thirdly, there is a problem related to the equity aspect especially to the questions such as who will take care of the cost and who will get the benefits?

The first problem, the development of TNBD will give direct and indirect benefits to people in Jambi and Indonesia. In the level of province, this development will encourage economic activities through the trading activities of Perkebunan Kelapa Sawit (PKS). In the national level, the increase in palm oil production will incur revenue of plantation exports and be able to contribute balance in the national trading. However, of the problems, the net benefits of the development of palm oil plantation should consider the cost of environmental and cultural impacts.

The second problem is the focus on environmental and cultural values. Those values are very related to the the cost of goods with no market values. Thus, such goods need the community's assessment toward the use value and non use value of goods and service.

The third problem is the development of palm oil plantation gives benefits to involved community. Nevertheless, there will be some communities, either local, national, or international that suffer from the environmental and cultural cost. Then, there are the values of enviromental and cultural benefits that need to be considered to answer problems which cause the equity issue in society. For example, the questions related to who will get benefits and who will endure the cost? For that needed convergent a strategy to solve the problem (Peranginangin, 2018).

The environmental and cultural assessment are parts of a new field of study which need to be developed and reckoned when making a decision about the source use. This approach is not a base to conserve the original source or reject the decision but as a base to efficiently determine a source distribution based on choices which maximize the community's welfare.

The present research aims to discuss some raised problems. The impact of the development of palm oil plantation needs to be objectively considered and estimated. Sacrificed cost and the community's obtained benefits need to be assessed by using a comprehensive economic assessment method (BCA*h*). It is why the assessment of the development of this palm oil plantation estimates the environment and cultural impacts.

If the environmental and cultural sustainability concepts are considered simultaneously in the development, they can be parts of community's welfare. A culture can be defined as a representation of group's value and a development or a process to expand human's chances in choosing limited natural source, Peranginangin (2015), (Taylor, 1920; 1871; Susanto et al., 2008). Throsby (1997) views a nation' economic and cultural developments are integral policies. According to UNESCO's World Commission on Culture and Development, a culture has a high place in the sustainable development of a nation.

2. RESEARCH BACKGROUND

2.1. Research Objective

Generally, the research objective applies a comprehensive BCA (BCA*h*) to determine the feasibility of PKS in TNBD Jambi. Specifically, following are the objectives of this research:

1. To know the net benefit of the development of palm oil plantation per hectare by estimating the environmental and cultural impacts.
2. To know the amount of cost and benefits sacrificed by the community due to the implementation of the development of palm oil plantation in TNBD jambi province.
3. To analyse an equity issue such as who gets the benefits and who endure the loss of project's implementation.

2.2. Research Benefits

The use of source's choice has a cost sacrificed by the community that obtains benefits, unlike other community that is forced to endure the cost. Thus, it raises an issue of benefit and cost's allocation. Specifically, following are the present research' benefits:

1. Providing a framework analysis of comprehensive cost benefit (BCA*h*) including a flow of enviromental and cultural service for each of the designated resource use option.

2. Compared to developed country, the framework of is still relatively new and has not been widely used in Indonesia.
3. Providing a framework assessment to investigate equity issue between communities which get the benefits and ones that endure the impact of policy.
4. Strengthening an environmentally friendly development strategy and a cultural conservation for a community in the project area.
5. Obtaining expected results of society's cultural values in the project area as a contribution for new knowledge in this field.

2.3. Research Scope

The present research's scope is an analysis of PKS's feasibility by estimating the environmental and cultural impacts with the period of 25 years and the discount factors of 2%, 8%, 15% as well as the carbon prices of US$2, US$5, US$9. Some environmental impacts are the costs of land erosion and carbon release. The cultural impact consists of the costs of the loss of SAD's culture from the perspective of users community, the perspective of indigenous people, and the perspective of non users community (NBG).

3. RESEARCH METHODOLOGY

3.1. Research Design

The feasibility of PKS' development is assessed by estimating the environmental and cultural impacts during the project's period. The main issue of the research is to answer this question; is the development of PKS in TNBD in Jambi Province, Indonesia feasible considering its environmental and cultural impacts? This research applies a comprehensive framework of cost and benefits analysis (BCA*h*).

The main concept of BCA*h* is to estimate the cost and benefit of the project's influence. The use of BCA*h* to estimate the environmental economic value has been conducted by experts since 1936. Hutscmidt et al. applied AKF*h* to analyse irrigation projects in the USA. In 1808, the Minister of Finance of USA, Alben Gallatin proposed the use of benefit and cost to analyse the irrigation project. Hanley and Spash (1993) suggest that the use of BCA*h* to assess several projects in USA has shown a progress. Eckstein (1958) emphasizes the use of BCA*h* to analyse the development of water resource. Clawson and Knetsch (1966) mention the use of BCA*h* for assessing the benefits of natural tourist attractions by using the approach in travel cost method (TCM). Krutilla (1967) applied BCA*h* to assess the use and non use values of the sustainable forest project.

The further use of BCA*h* is extended to assess the benefits of environmental goods, wild animals, air quality, human health, and comfort. World Bank applies an extended BCA (BCA*h*) to analyse the proposals of investment projects in developing countries. However, the environmental assessment is not something popular in Indonesia. Some of researchers who have conducted it were Herman and Irsal (2009) who analysed the forest conversion for palm oil trees.

3.2. Population and Data

Population used to estimate the economic value of non-market goods are the user and non-user communities in Jambi Province. Data to estimate the economic value of marketed goods is obtained through the estimation method (formula) and shifting benefits. On the other hand, the value of non-marketed goods is assessed by using TCM and contingent valuation method (CVM). Interviews were applied to obtain data. Table 1 shows the information used to estimate the economic value of PKS development, taking into account the environmental and cultural impacts.

3.3. Analysis Model

The present research applies the estimation method (formula) of shifting benefits and interviews. The estimation method and shifting benefits are used to estimate the net benefits of palm oil plantation, wood, land erosion, and carbon release. The interviews method, TCM is used to estimate the cultural value of Kubu people in touristic value of SAD's culture. The interviews method, CVM is used to estimate the non use value of SAD's culture.

Table 1: Types of benefits and methods of assessment

Goods and service	Products	Type of value	Data source	Assessment method
Palm trees	TBS	Direct use	Shifting benefits of palm	Market values
Wood products	Wood stumpej	Direct use	oil plantation in Air Hitam	Market values
Land erosion	Erosion impact	Direct use	Transmigration Project.	The cost of land erosion
Carbon	Carbon uptake and storage	Indirect use	Forestry Service of Jambi	counter measure
Tourism	Tourism	Indirect use	Province1	Method to avoid the
Culture	The ceremonial value of indigenous	Indirect use	Forestry Service of Jambi	destruction
Non use value (NBG)	culture	Non use value	Province	TCM
	The heritage and materialization value		Shifting benefits;	CVM
			Firmansyah's research2	CVM
			Kurnia's research3	
			Shifting benefits	
			Previous studies on Biomass	
			content and forest carbon as	
			well palm trees4	
			Interviews	
			Interviews	
			Interviews	

1Plantation and forestry service of jamni province (Unpublished) (2007). 2firmansyah (2007) erosi perkebunan sawit di kalimatan timur. 3kurnia (2001) pengendalian erosi tanah di bogor. 4World bank (1992); Hairiah and sitompul (2000); Tomisch (2002); Pearce (1996); Hadisuparto (2008); Ahmad mohd zin (2004). TCM: Travel cost method, CVM: Contingent valuation method

The flow benefits period of the development of palm oil plantation in TNBD is 25 years. The period refers to a circle of time in which palm trees can give maximum flow of benefits (Manurung, 2001). The feasibility of the development of palm oil plantation in the present research applied the adapted Albelson's 1979 formula below:

$$NPV_{PKSW} = PV_{sw}+PV_{Bl}-(PV_{L}+PV_{Bud})$$

In which;
NPV_{PKSW} = The present net economic value of palm oil plantation.
PV_{sw} = The present net value of palm oil plantation's development.
PV_{Bl} = The present net value of wood products.
PV_{L} = The present net value of the impact of environmental damage.
PV_{Bud} = The present value of cultural damage of palm oil plantation's impact.

This research uses discount factors of 2%; 8%; 15% to estimate present value (PV) of each benefit flow:

1. Formula to estimate the PV of palm tree:

PV of palm oil plantation is estimated by using following formula[1]:

$$PV_{sw} = \sum_{t=1}^{t=25} \frac{(F_t - K_t)}{(1+r)^t} \quad (1)$$

2. Formula to estimate the present value of wood.

Following is the formula applied to estimate wood stumpej in this research[2]:

$$SV = V*(H-K-M) \quad (2)$$

3. Formula to estimate the present value of land erosion.

The present value of land erosion of development of palm oil plantation is estimated with following formula[3]:

$$PV_h = \sum_{t=1}^{t=n} \frac{E_t k}{(1+r)^t} \quad (3)$$

4. Formula to estimate the present value of changes in carbon dioxide absorption.

The present value of changes in carbon dioxide absorption is obtained by converting the estimated natural forest with following formula[4]:

$$PV = \sum_{t=1}^{t=n} \frac{(C_{ht} - C_{st})P_k}{(1+r)^t} \quad (4)$$

5. Formula to estimate the present value of cultural tourism of SAD in the perspective user's community.

The estimation method of benefit flow of cultural tourism of SAD from the perspective of user's community is estimated by using TCM. This method has obtained the value of cultural resource through the use of distance and frequency (Arrow et al., 1993). A lot of researches have shown the progress in economic theory, not only for politics but also culture (Noonan, 2002). Several experts such as Adis (1998), Jamal and Norlida (2003), Jamal and Anggi (2009) use the assessment technique of cultural resource in economic assessment. Thus, the present value of cultural tourism of SAD from the perspective of user' community is estimated by following formula[5]:

$$PV = \sum_{t=1}^{t=n} \left(\frac{CS * \hat{V}_t}{(1+r)^t}\right) \quad (5)$$

6. Formula to estimate the present value of indigenous culture from the perspective of SAD.

The budgeting of (PV of indigenous culture from the perspective of SAD is estimated with following formula[6]:

$$PV_{bunga} = \sum_{t=1}^{t=n} \left[\frac{\overline{WTP}_{bunga} * P_0 (1+P_{tb})^t * P_{rm}}{(1+r)^t} \right] \quad (6)$$

7. Formula to estimate the present value of culture from the perspective of non user's community.

1 PV*sw* = Present value per hectare of PKS, F*t* = The benefit of PKS at year of t, K*t* = The cost of PKS at the year of t, r = Discount factor, t = Project period, sw = Palm oil tree.

2 According to Noor and Shahwahid (1999) SV = Value of wood stumpej per hectare, V = Stumpej volume per hectare of wood (m^3), H = Cost of wood per m3, K = The cost to produce wood per m3, M = Profit ratio.

3 PV = The present value of land erosion of palm oil plantation, E*t* = Annual speed of land erosion per ton, k = The annual cost of repairing land erosion per ton based on the research of Kurnia (2001), r = Discount factor, t = Project period, n = 25. E is estimated with the formula of RUSLE, E = the approximate of land erosion (ton/hectare/annual), R = The rain erosivity factor erosivitas (ton/hectare/annual), K= The land erodibility factors, or rain erosion index on standard size plot (length of 22 m, slant of 9 hundred), L= The slant length factor or a approximate ratio of land erosion with the length of ratio 22 m under similar condition, S = The slope steepness factor or a ratio of land erosion with the 9% slant under identical condition, C = The management and cultivation factor is an erosion ratio on the area closing and management toward certain plants in an open area of identical land, P = the maintenance factor is an erosion ratio on an area without any unchanging mechanical treatment on a vacant land area which has no certain plant. Rain erosion value calculation method (*R*) according to Soemarwoto (1992), $R = a*H^b$. R = rain erosion factor (ton/per hectare/annual), H = Rainfall (mm/year), a, b = Calibration parameter obtained from the studies of international scientists (a = 0.41, b = 1.09).

4 PV = Present Value of carbon release of development of palm oil plantation per hectare, Cht = The unchanging annual carbon absorption and storage per hectare, CSt = The annual carbon absorption in palm oil plantation per hectare of palm tree' age, *t* = time, *n* = 25, *r* = Discount factor.

5 In which PV = The present value of cultural tourism of SAD, CS = Individual tourist consumer surplus, $\hat{V}$ = the annual arrival of local tourists t, r = Discount factor, t = time, n = 25. Common budgeting model of semi log demand curve of individual tourist is: $LnV = \alpha_0 + \beta_1 Kp + \beta_2 Pdt + \beta_3 Um + \beta_4 Pendik + u_i$. Tourism curve demand is estimated with OLS model. *V* is the number of annual visit of tourists, K*p* is a travel cost of each visit, *Pdt* is revenue, *Um* is age and *Pendik* is the education level of respondent. Consumer Surplus (CS) of semi log demand curve is estimated with CS =-1/β based on Jamal et al. (2004); Hanley (1989).

6 In which: PVinterest = Aggregate of Present Value of culture from the perspective of SADs community, P0 = Population of SAD from the year of 0, Ptb = Population growth of SAD (percent), Prm = Percentage of SAD who still perform cultural ceremony and are willing to look for sacred flowers in other area/further area from existing one, t = time, n = 25, r = Discount factor.

3.4. Non Use Value (NBG)

Non use value (NBG) is a community that is willing to preserve the culture by paying annually for the length of project and some of them pay once for the length of project.

The present value of SAD's culture from the perspective of non user's community (NBG) by paying annually for the length of project and estimated with following formula:[7]

$$PV_{NBG}^{A}\sum_{t=0}^{T}\left(\frac{\overline{A}*\frac{P_0}{Is}(1+Ptb)^t\ \Pr WTP^{A}}{(1+r)^t}\right) \quad (7a)$$

The present value of SAD's culture in the perspective of non user's community (NBG) by paying once for the length of project and estimated with following formula[8]:

$$PV_{NBG}^{B}=\overline{B}\left[\sum_{t=0}^{T}\frac{P_0}{Is}+Ptb*\frac{P_0}{Is}(1+Ptb)\Pr WTP^{B}\right] \quad (7b)$$

The present and non use values of culture from the perspective of non user's community: $PV_{NBG}{}^{A}+PV_{NBG}{}^{B}$.

4. RESULT AND DISCUSSION

4.1. Net Present Value (NPV) of the Development of Palm Oil Plantation

NPV of the development of palm oil plantation consists of palm oil trees PV plus the wood benefit value and reduced by the environmental and cultural loss.

4.1.1. PV of palm oil plantation

The cost parameters and the benefits of palm oil plantation are obtained from the shifting benefits of the development of palm oil plantation's project of Air Hitam transmigration in Jambi Province which has similar situation with research area. Palm oil trees are estimated to be able to produce at the age of 4 year old until 25 year old. Palm oil trees are estimated to live for 25 years. The estimation that palm oil trees are able to produce minimally at the age of 4 and will increase third times in the subsequent year and fourth or fifth times at the age of 6 or 7 years old. The palm oil tree will reach maximum production at the age of 10–17 years old and decline at the age 18–25 years old. The first production (age 4) is around 5, 9 tons whereas maximum production is around 28, 7 ton. The price of fresh batch of fruits of palm oil tree is graded and depends on the age of palm oil tree. The age span of palm oil tree is 4 years, 5 years, 6 years, 7 years, 9 years, 10 years, and 11–25 years.

The cost of development of palm oil plantation consists of the development and operation costs. The development of palm oil plantation consists of the costs of land clearing, road construction, terrace manufacturing, expedience cost, water system, fencing and plant protection, coating, site and planting, seeds, the implementation of plant area, fertilizer, and others. Operation cost consists of the costs of pollination, fertilizer, management, insect and plant disease treatment, harvesting, transportation, and etc.

The analysis result of present value development per hectare of palm oil plantation is obtained by using the formula (1) and discount factor of 2% is around US$9,146.93; discount factor of 8% is around US$3,639.47; discount factor of 15% is around US$911.08.

4.1.2. The wood benefit value

According to Forestry Service of Jambi, the marketed wood products per hectare of Bukit Duabelas National Park is one with diameter of 15 cm or more. This research uses an approximate price from 3 sets of price; the national lowest price, the national highest price, international price in Serawak published by ITTO. The logging cost per m3 uses the findings of Muttaqin and it has been compared with the estimation of Awang Noor and Mohd Shawahid. Obtained profit ratio uses the findings of Awang Noor dan Ahmad Mohd Zin's study.

4.2. Environmental Loss

The environmental loss in this research only considers the land erosion and reduced carbon due to the impact of forest conversion to palm oil plantation.

4.2.1. The present value of land erosion

The impact or land erosion consists of on-site and off site impacts. The on-site one is the decline of land productivity whereas the off site impact includes mud resevoir, buried agricultural land, water quality decline, and irrigation ecosystem loss. This research only estimates the on-site impact of land erosion. RUSLE, an improvement of USLE from Soemarwoto is used to estimate the land erosion. This formula has been applied by Firmansyah to estimate land erosion in palm oil plantation in East Kalimantan.

Data of rainfall (R Factor) obtained from Meteorological Office of Jambi Province. The soil erosion factors used K as the soil erosion number at Gunung Mas, East Kalimantan, is similar to one used by Firmansyah. It considers the soil types and similar as well as the identical locations. The slope length (LS Factor) is estimated with Goldmand's Table Factor and topographic display of BKSDA of Jambi province. Plant types and land management (CP factor) is based on the Table 2 of CP abdulrahchman et al. The dimension of annual land erosion per hectar is around 21, 74 ton and still considered into mild criteria. The repairing cost of land erosion uses Kurnia's research.

7 In which: PVA = The present value of culture of SAD in the perspective non user's community by paying yearly for 25 years, A = The average annual paying of WTP for 25 years, P0 = Population of Jambi Province in the beginning year, Is = The average number of family in research area, Ptb = The annual average population growth of Jambi Province (%),PrWTPA = The community's percentage of non user's community who are willing to pay annually for 25 years, r = discount factor.

8 In which: PV^{B} = The present and non use values of Suku Anak Dalam's culture from the perspective non user's community by paying once for a lifetime, $\overline{B}$ = the average of WTP (paying once for a lifetime model), P_0 = Population of Jambi Province in the beginning year, Is = the number of family in research area, Ptb = Population growth of Jambi Province (%), PrWTPB = Percentage of people who are willing to pay once for a lifetime,T = 25, r = Discount factor.

Table 2: Carbon dioxide price and discount factor

Carbon price/ton	Discount factor 2%	Discount factor 8%	Discount factor15%
US$2	US$7,522.55	US$4,451.45	US$2,814.18
US$5	US$18,806.38	US$11,128.63	US$7,035.35
US$9	US$33,851.48	US$20,031.53	US$12,663.81

Kurnia's research is a shifting benefit to repair the land productivity due to erosion. The PV of land erosion per hectare by using the formula (3) and the discount factor of 2% is around US$181; discount factor of 8% is around US$129.6; the discount factor of 15% is around US$96.3.

4.2.2. The present value of carbon dioxide release

The parameter of eternal carbon of forest and palm oil plantation use method of shifting benefits. The annual carbon absorption and storage of natural forest according to World Bank is around 350–500 tons per hectar. The findings of Hairiah's research in Bungo area, Jambi Province shows 306 tons per hectare in a year. On the other hand, the findings of Tomisch's research in natural forest in Jambi Province show carbon contents of 250 tons per hectare in a year, the lowest number used for the present research.

The carbon content of palm oil tree per hectare after the age of 15 is 75 tons according to the report of World Bank. The increase in carbon content is around 4–5 ton/hectare/year. This research uses shifting data of eternal carbon content of forest and palm oil tree from the report of World Bank. Carbon prices used for the present research are US$2; US$5 and US$9/ton C and are based on Pearce's research. These numbers are used to estimate PV of carbon changes in the development of palm oil plantation. PV of changes in the carbon absorption of the impact of the development of palm oil plantation uses the formula (4) and discount factors of 2%, 8%, 15% and carbon prices are around US$2, US$5, US$9.

4.2.3. Cultural loss

The cultural loss in this research refers to one of SAD from the perspectives of user's community, SAD and non user's community.

4.3. The Present Value of Cultural Tourist Attraction from the Perspective of User's Community

The cultural tourism service value of SAD from the perspective of user's community is estimated with TCM. The cultural tourism demand curve of SAD uses following equation:

$$LnV = 1{,}290 - 0{,}000043\,KP + 0{,}041\,Pdt - 0{,}003\,Um - 0{,}093\,Pendik$$

LnV Attached Variable

Note: VIF = Variance Inflation Factors, Statistik D-W = Durbin-Watson, CI = Condition Index, Analysed sample number (n).*Significant at α 0.1,**Significant at α 0.05, *** Significant at α 0.01.

F Statistic is significant at 0.01 tolerance in which the manufactured model is perfect. R^2 Statistic can explain 73.5 % variation in the visit and is explained by the variables of travel and revenue cost, age and educational level, and the rest is with other variables. Condition index – CI' shows a model which has no serious collinearity problems. Durbin-Watson (D.W)[9] can be concluded as one without a serious autocorrelation. Travel cost variable is negative with frequency of visits and significant at α 0.01. It means if the travel cost increases so that the visit to research area will decrease. For each Rp100.000 increase in travel cost, the number of visit will decrease around 4.3 times if there are no changes in other factors.

If revenue shows positive sign of and significant at α 0.05, it means for each Rp 1000 increase, there will be an increase around 41 visits. But if the age variable whos negative sign and significant at α 0.10, it shows that the increase of respondents is in line with the decrease in the visitation's willingness. If the education variable shows negative sign and significant at α 0.01, it shows that the increase of respondents' educational level will decrease the willingness of respondent to visit the research area.

Consumer surplus is estimated with the formula of Jamal et al.; Hanley, CS = 1/−0.000043 = US$2.3 per respondent/per visit. The net benefit value is based on the estimation of semi-log attached variable model of consumer surplus around US$2.3 per visitor/per visit. The results of consumer surplus are relatively higher than the findings of Jamal et al.' study at a tourist attraction in Legenda Beach, Parangtritis, Yogyakarta which show the number of US$1.5 per visitor/per visit. However, it is closer to the the number of cultural value at Yogyakarta Palace which shows the number of US$2.7 per visitor/per visit and lower than the cultural value's number of Borobudur's historical site at US$14 per visitor/per visit.

The indigenous cultural tourism value of SAD is lower than the cultural value of research findings of Adis toward Suku Bukit Traditional Village at Thailand National Park which show the number of US$5.3 per visitor/per visit. The numbers are lower than the findings of Jamal et al.'s study at Tioman National Sea Park Traditional Village, Malaysia which show US$6 per visitor/per visit. The service of indigenous cultural tourism of SAD can be considered as a unique thing because from the demand's point of view since it has a scarcity problem and is not easy to be obtained. The present value of the service of indigenous cultural tourism of SAD is estimated with the formula (5) and the scope of local tourist arrival uses regression linear of tourist data of Jambi for the last five years. The discount factor of 2% is around US$41.2; discount factor of 8% is around US$18.4: Discount factor of 15% is around US$9.1.

4.4. The Cultural Present Value from the Perspective of SAD's Community

The forest conservation's tradition should exist and be sustainable. In the present research, the analysed traditions of SAD are cultural ceremonies which need sacred flowers grown and picked only inside of the forest. The decline of forest's area negatively affects the availability of sacred flowers. The cultural value of ceremony in the present research is estimated with format 1 of CVM model. The

9 D.W <1 or more than 3 shows a serious autocorellation problem (Gujarati, 2003).

additional time sacrificed to pick sacred flowers is used as a utilized market for estimating the willingness to conserve culture (WTP_{flower}).

The applied WTP_{flower} market with format 1 of CVM model is: "If the palm oil plantation is built, are you willing to look for sacred flowers in other area or enter the forest deeper? How many days will you take to look for sacred flowers in other areas?"

The average estimation result of WTP_{flower} is around US$98/year. The number obtained from the average number of days to perform ceremonies each year plus days needed to obtain sacred flowers multiplies with the average daily salary of research area. The average population growth of Jambi Province is 1.83%. The number of P_0 = 401 families. The PV's estimation of cultural ceremony with the discount factor of 2% is around US$48.38; with the discount factor of 8% is around US$25.12; and with the discount factor of 15 % is around US$14.57.

4.5. The Present Value Estimation of Indigenous Culture of SAD-Non Use Value

Due to the difficulty of separating components of each value, the non use value component consists of Option Value, Heritage Value and Materialization Value. The research population is limited to people in Jambi Province whereas the estimation method is CVM. Utilized market is "The Sustainability of life and culture of SAD is endangered with the development of palm oil plantation." They are in need of conservation due to their unique culture. If the conservation period is 25 years and needs relatively huge amount of cost, are you willing to support the cultural conservation of SAD?" The PV result of SAD's culture from the perspective of non user's community or non use value (NBG) with the discount of 2% is around US$764.4, with the discount of 8% is around US$429.3 and the discount of 15% is around US$277.5.

4.6. NPV of the development of Palm oil plantation (PKS) at Bukit Duabelas National Park (TNBD)

NPV of palm oil plantation by including the estimation of the environmental and cultural impacts are shown on Table 3 without wood profit and Table 4 with wood profit.

4.7. Research Result's Formulation

The result of economic analysis of the development of palm oil plantation by estimating the environmental and cultural impacts are concluded below.

4.7.1. The feasibility of palm oil trees in TNBD

The feasibility of the development of palm oil plantation in TNBD depends on:

a. The wood revenue as project revenue or vice versa,
b. The discount factor option,
c. The carbon dioxide price option.

If the wood becomes the project revenue with discount factor of 2% and carbon dioxide price is around US$2/ton, the project's NPV is positive and the development of palm oil plantation is suitable to be implemented. If the increase of discount factors is around 8–15% and the carbon price is around US$5 - 9, the development of palm oil plantation is negative (not suitable to be implemented).

4.7.2. Environmental and cultural cost

The development of palm oil plantation in the forest area of TNBD environmentally and culturally affects the culture of SAD. The environmental and cultural loss component of SAD's culture is sensitive to the carbon price. By using the carbon price of US$2/ton, the loss component of environmental and cultural loss of SAD is around 90%. The carbon price increase affects the increase in the ratio of environmental loss and the decrease in the ratio of cultural loss of SAD.

4.7.3. The discount factor option and NPV

The discount factor has an important role in determining the feasibility of the development of palm oil plantation. This research found that the relationship between the discount factor and NPV of the development of palm oil plantation is negative. If the discount factor is increased, NPV falls. Policy makers need to be careful in determining a discount factor because NPV is sensitive to the changes in the discount factors.

Table 3: Development feasibility of PKS in TNBD/hectare

Net benefit	Discount factor 2%	Discount factor 8%	Discount factor 5%
Carbon price of US$2/ton			
Palm oil tree's benefit	9,146.93	3,639.47	911.08
Environmental impact	(7,703.55)	(4,581.05)	(2,910.48)
Cultural impact	(813.98)	(472.82)	(301.17)
NPV of palm oil tree without the wood's profit	629.4	(1,415.17)	(2,300.57)
Carbon price of US$5/ton			
Palm oil tree's benefit	9,146.93	3,639.47	911.08
Environmental impact	(18,987.38)	(11,257.63)	(7,131.65)
Cultural impact	(813.98)	(472.82)	(301.17)
NPV of palm oil tree without the wood's profit	(10,654.43)	(8,090.98)	(6,521.74)
Carbon price of US$9/ton			
Palm oil tree's benefit	9,146.93	3,639.47	911.08
Environmental impact	(34,032.48)	(20,160.53)	(12,760.11)
Cultural impact	(813.98)	(472.82)	(301.17)
NPV of palm oil tree without the wood's profit	(25,699.53)	(16,993.88)	(12,150.2)

PKS: Perkebunan kelapa sawit, NPV: Net present value, TNBD: Taman nasional bukit dua

Table 4: Development feasibility of PKS in TNBD/hectare

Net benefit/impact	Discount factor 2%	Discount factor 8%	Discount factor 15%
Carbon price of US$2/ton			
Palm oil tree's benefit	9,146.93	3,639.47	911.08
Wood's benefit	5,137		
Environmental impact	(7,703.55)	(4,581.15)	(2,910.48)
Cultural impact	(813.98)	(472.82)	(301.17)
NPV of palm oil tree	5,766.4	(1,415.17)	(2,300.26)
Carbon price of US$5/ton			
Palm oil tree's benefit	9,146.93	3,639.47	911.0
Wood's benefit	5,137		
Environmental impact	(18,987.38)	(11,257.63)	(7,131.65)
Cultural impact	(813.98)	(472.82)	(301.17)
NPV of palm oil tree	(5,517.43)	(8,090.98)	(6,521.34)
Carbon price of US$9/ton			
Palm oil tree's benefit	9,146.93	3,639.47	911.08
Log's benefit	5,137		
Environmental impact	(34,032.40)	(20,160.53)	(12,760.11)
Cultural impact	(813.82)	(472.82)	(301.17)
NPV of palm oil tree	(20,562.29)	(16,993.88)	(12,150.20)

PKS: Perkebunan kelapa sawit, NPV: Net present value, TNBD: Taman nasional bukit dua

4.7.4. The carbon price option and NPV

The research findings toward the increase of carbon price influence the decline of NPV of the development of palm oil plantation. It shows a negative relationship between carbon price and NPV. Because NPV of the development of palm oil plantation is sensitive to carbon price, policy makers need to be careful in determining the carbon price in their analysis.

4.7.5. The equity of the development of palm oil plantation in TNBD

The development of palm oil plantation in TNBD has different influences on the equity distribution of many communities. Following are the benefits and cost which will be borne by these communities:

a. Local community outside of the community of SAD that involved in the development project of palm oil plantation will get the benefits from the palm oil trees in the forms of the palm oil products.
b. The wood benefits when the forest is converted into palm oil plantation will be received by the government and local communities outside of the community of SAD that are involved in the project in Jambi Province.
c. The land erosion cost will be borne by the communities of SAD and Jambi Province.
d. The cost of loss chance to have a cultural tourism of SAD will be borne by the user's community.
e. The cost of cultural decline from the perspective of SAD will be borne by SAD's community.
f. The loss cost of non use value (NBG) of SAD's culture will be borne by the non user's community in Jambi Province (the present research limits to the population of Jambi Province).
g. The carbon release cost (the occurrence of global warming and climate change will be borne by the local communities of outside or SAD, the communities of Jambi Province as well as other provinces in Indonesia, and the world's community).

This research found that the development of palm oil plantation in TNBD is sensitive to the utilized discount factor and carbon price. The discount factor option is related to the equity problem between the present and future generations. If the discount factor is zero, it means the project has a similar interest for the present and future generations. Implicitly, the discount factor is a weighting that will be given to illustrate the interest between the present and upcoming uses.

The economists have different point of views to determine social discount factors to assess the environmental projects. The use of cost benefit analysis (CBA) doesn't have a certain social discount agreement. The social discount factor is universally positive on the ground that the rate of investment result is also positive. If the utilization and production activities cause environmental pollution, the rate of social investment can turn into zero (0) (Dasgupta et al.)

Developed countries usually apply social discount factor for lower environmental projects (3-7 %) whereas developing countries apply higher discount factor (8-15 %). Robert Shisho also supports the description of Harberger and Stokfisch related to the discount factor option for the environmental projects around 8% or 10%. In Indonesia, the National Development Planning Agency or *Badan* Perancang Pembangunan Nasional (Bappenas) usually uses social discount factors around 10-15 % to assess the feasibility environmental projects that can be implemented (Clive et al).

The options to use certain discount factors and carbon price in the present research will cause implications related to the feasibility of the development of palm oil plantation and equity problems. There are three scenarios of discount factor options and carbon prices:

(i) Discount factor of 2% and carbon price of US$2/ton (Scenario A),
(ii) Discount factor of 15% and carbon price of US$9/ton (Scenario B),
(iii) Discount factor of 9% and carbon price of US$5/ton (Scenario C).

4.7.6. Scenario A

The discount factor option of 2% and the carbon price of US$2/ton turns NPV to be a positive project, making the development of palm oil plantation in the forest area of TNBD as suitable (NPV>0). The discount factor option and carbon price in this scenario implies

the existence of compensation. There are two criteria before taking decision for the suitability of the project. First is based on Kaldor Compensation Theory and the criteria of Hicks' Compensation. Second is based on the Pareto's theory of efficiency.

4.7.6.1. According to the kaldor and hicks' compensation theory
Based on Kaldor and Hicks theory, the development of palm oil plantation in TNBD with the discount factor option of 2% and the carbon price of US$2/ton is suitable to be performed. This decision is made if the benefited community can give compensation to the community which is devastated due to the project and the former community can still gain profit. However, such compensation is not paid to give prosperity to the devastated community. The condition will cause an equity problem as the impact of the development of palm oil plantation in TNBD. The devastated community will protest since the compensation is only on paper.

4.7.6.2. According to the efficiency theory of pareto
The discount factor option of 2% and the carbon price of US$2/ton turn NPV to be a positive project although there is still a devastated community. Based on the efficiency criteria of Pareto, the development of palm oil plantation in the forest area of TNBD can be performed. This decision is made if the benefited community can give compensation to the community which is devastated due to the project and the former community can still gain profit. The given compensation needs to be regulated with rules and payment mechanism.

4.7.7. Scenario B

If the discount factor option is 15% and the carbon price is US$9/ton, NPV of the development of palm oil plantation turns to be negative (NPV<0). It shows that the development of palm oil plantation at the forest area of TNBD is unsuitable. Based on Kaldor and Hicks Compensation Theory as well as Pareto's efficiency theory, the discount factor option of 15% and the carbon price of US$9/ton of the development of palm oil plantation at the forest area of TNBD is unsuitable.

Based on this scenario, the government's scenario to not allow the appeal of the development of palm oil plantation at the forest area of TNBD is an economically good decision. Then, a community that agrees with the development of palm oil plantation should find another suitable area. Due to this policy, some groups such as a community that agrees with the the development of palm oil plantation, the local government of Jambi, as well as Central Government will suffer financially from to the losses of palm oil profit, retribution, and tax. The forest area of TNBD will still be conserved to maintain the ecological functions of the forest such as avoiding the land erosion, absorping and binding carbon as well as being a nomadic area of SAD to conserve their culture.

The biggest ecological functions of forest area are to absorb and store carbon. This value function will increase with the agreement of carbon price. The benefits of carbon absorption and storage service will be enjoyed by local community, province community, national as well as international community.

4.7.8. Scenario C

Scenario C is suggested to be applied at the decision making before the project implementation. The consideration to use scenario C is due to its neutrality compared to scenario A or B. The implication of choosing scenario C for the development of palm oil plantation at the forest area of TNBD is because the project's negative NPV is forbidden to be implemented. However, if the government chooses either scenario B or C, there will be some implications that need to be considered related to the conservation. The conservation is not only a local or national issue but also an international one. The problems in temperature increase and the world's climate change are always related with the forest cleaning, especially forests in tropical areas.

5. CONCLUSION

There are some policy implications found in this research. Firstly, the problem with the implementation of the development of palm oil plantation. Secondly, the forest conservation of TNBD needs to be conducted to conserve the culture of SAD by providing the empowerment program of SAD. The development of palm oil plantation gives the benefits to the involved community. However, the project still takes a toll on the environmental and cultural costs of SAD.

The objective of present research is not to reject the development of palm oil plantation or conserved forest area of TNBD but to obtain the option of efficient land use. The simple discount factor and the carbon price shows that the development of palm oil plantation is unsuitable. The research findings indicate that if the development of palm oil plantation is continued, the community of SAD that lives in the project area will be devastated from the loss of cultural extinction. However, if the development of palm oil plantation is not continued, the central government as well as the government of Jambi Province will suffer the revenue loss from the development of palm oil plantation.

This research suggests the use of other area outside of TNBD area, especially the damaged forest areas or abandoned land that need to be considered as the place to develop palm oil plantation. The community of SAD needs to be conserved as well as improved its empowerment in national development. Surplus Consumer of cultural tourism is relatively high, showing that the culture of SAD can be considered as unique. A problem that needs to be considered is if there is any prospect for a cultural tourism area in which the management is enhanced and the tourists are charged with entrance fees.

The activities of reduction of emissions from deforestation and forest degradation (REDD) need to be expanded so that it may involve the indigenous community that conserve the forest. The culture of SAD's community that lives in the forest area is not destructive toward the forest and one with a positive relationship with the program to avoid the climate change. Therefore, a national policy related to the incoming revenue distribution from the environmental service value which is included in the REDD program is important. The development of eco-cultural tourism at TNBD is suggested to be improved attractively. Tourists are

charged with entrance fees to the site and the revenue can be used to improve the welfare of SAD. Besides that, the religious counselling since early ages is needed.

A discourse related to the Kyoto Protocol which has approved reduction of emisstions from deforestation and forest degradation (REDD) is listed in the clean development mechanism. The debate in international forums is related to the social additional benefits which need to be added in the planning and execution of REDD in the climate change treaty. The clearance reduction of forest deforestation and degradation is based on the homage idea of individual, community, project, and nation that are able to reduce the clearance of greenhouse gas (GHG) produced by the forest. REDD has potentials to reduce GHG with low cost in limited time, reduce poverty as well as to implement sustainable development. Following steps are suggested:

1. The involvement of indigenous community (indigenous people) in the REDD program needs to be defined clearly in the international treaty of climate change. Thus, it can provide a clear program that able to gain additional benefits, reduce the poverty level, and provide sustainable development to undo the release of GHG. They are important parts that gain benefits from the program activity of REDD.
2. Ahmad Mohd Zin conducted a research at Malaysia National Park and suggested international aid to finance the prospect of research program of bioprospecting. The said suggestion can be implemented for the present research. It is known that TNBD area contains biodiversity as the place to cultivate highly valued medicinal ingredients. The program implementation will contribute to the welfare improvement of SAD's community. The biodiversity wealth has unique potentials to maintain health, agriculture, and industry. Those potentials depend on the scientific research and development, including biotechnology.
3. Biotechnology utilizes the useful knowledge of biological system to produce bio-products with daily applications such as medicines, food, and other environmental products. The invention of natural resource will lead to the development of herbal therapy, nutraceuticals, and cosmaceuticals to fight diseases such as cancers. The upcoming research benefits can be profited by the indigenous community of SAD, the Jambi's community, the Indonesian community to the international community.
4. The service given by a tropical forest is as free carbon absorber and storage. Then, the collaboration with neighboring countries, especially developing ones in the tropical areas is fundamentally needed to establish a mutual establishment in an international forum related to compensation payment from industrial countries due to benefits of forest conservation.

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