

# **THE COMPENSATION TO STOP AGRICULTURAL FIELD BURNING FROM TOURISM: EVIDENCE FROM LUANGPRABANG, LAOS\***

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## **Abstract**

This paper tackles the impact of smoke from agricultural field burning on tourism using data of LPB, the world heritage site, in 2011. A statistical test, the contingent valuation method, and simple cost of working in agricultural farm are used for the consciousness, the willingness to pay, and the cost for not to burn. 284 firms and 280 households are interviewed in 2011 to data use. The empirical results showed that people in tourism area concern about the smoke problem. The business with potential to earn more from tourism as well as firms locate in main tourism area is likely to concern more on the smoke problem. The WTP of business and household to stop the smoke is 1,578 millions kip (197,342 US dollars) annually, and the cost for farmer to clear their field without using fire is 620 millions kip (77,487 US dollars) annually.

**Keywords:** Agricultural; tourism

## **Introduction**

Agricultural field burning is a common practice of many rural farmers for clearing, expanding, and reallocating their agricultural land. Rural people like to burn their fields because it is one of the cheapest ways to clear the fields (Fox, 2000). However, even the agricultural burning fields may help rural people in reducing cost and time for farming, it create a lot of negative externality as well. And the major negative externality is a smoke from the burnt area. Usually, farmers burn their field nearly same time of the year (dry season), so they all together can generate a huge smoke that can spill to closed regions (passive regions). The health problem of people in passive regions is usually concerned as the main impact of smoke (see also Mário Jorge Cardoso et al. 2006), however the smoke can also effect on economic activity, especially for tourism sector. The smoke can potentially decrease revenue from tourism in the passive region by bothering tourist in sightseeing, transportation, etc. If the burning causes a high social cost, it is probably an economic inefficient way.

Several problems from burning have been concerned from the government as well as many organizations. However, the agricultural field burning has been done by rural poor

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farmers who have a limited way for earning. If government prevents these people to the burn, it will cause a significant problem to the poor farmers that later also cause an economic inefficiency.

Some studies have shown ways to stop the burning. Ketterings et al (1999) demonstrates an alternative way to do agriculture without doing slash and burn in Indonesia. A study of Smith et al (1998) shows how to stop slash and burn by compensating to the farmers. Yet it is rare to see a study that finding the compensated value in tourism area to stop the agricultural field burning, thus our general objectives are to observe a consciousness in tourism area, to measure a compensation of business and households to stop field burning and a cost of farmers for not burning. We have specific objectives as below:

1. To assess the consciousness of tourism and its related businesses and households in tourism area on agricultural field burning
2. To assess willingness to pay of the households, tourism and its related businesses establishment in the tourism area to stop agricultural burning
3. To calculate the farmers' cost of not burning for comparing with the willingness to pay

This study will consider the agricultural field burning around Luangprabang (LPB) district, LPB province, Laos. LPB is one of the World famous tourism region (UNESCO World Heritage) that is surrounded by mountains where ethnical people traditionally do slash and burn. The provincial population is estimated at 430,000 persons, composed of 12 different ethnic groups, and 80 percent of them are farmer. Number of tourist is increasing rapidly; in 2009 the number of visitor was 375,669 people. Reason above shows that LPB has high revenue from tourism sector, therefore we can clearly see how tourism sector response on the impact of the smoke.

### **Impact of the smoke and LPB agricultural field burning**

In this section, we first look for a motivation for farmer to burn their field, then its potential negative impact on the passive area and finally we will characterize agricultural field burning in LPB. Clearing field by burning is believed as the cheap and cost-effective way (Mazzola et al., 1997). Fewer cost compare other alternative remove residue way and less of time use in clearing field are the main reason that motivate farmers to burn their field. Also some studies also state that the field burning decrease the use of chemical for reducing plant disease, insect, and weeds (Cook and Hagland, 1991). Without burning, the residue becomes an appropriated place for development of pathogens (Jain te al., 2007).

The impact on economy, particularly tourism, can come from the effect on health problem and tourism activity itself. Several studies illustrate number of the negative impacts from the smoke. The burning smoke include a number of air pollution such particular matter, carbon dioxide, nitrogen dioxide, etc (Jenkins et al., 1996) and can effect on human health directly (Jacobs et al., 1997 and Roberts and Corkill, 1998). Those pollutants can be the reason of health problem such keen eyes, cough, wheezing, chest tightness, and respiratory disease (Sutherland, 2004; and Sutherland and Martin, 2003). Beside the health problem above that effect local people as well as tourist, the smoke also have direct impact on decreasing

The heritage site and other main tourism areas set in the center of LPB district (the main district of LPB province) and also close to Chompet district in the west (Mekong river site). The tourism area is surrounded by mountains where rural farmers have done burning in the beginning of March until the middle of May. In practice, after farmer finished cutting,

they wait for one to two week for plant to get dry (depend on wetness) and then start to burn the residue. The fire will completely burn one hectare within one hour, and sometime the burnt area is wider than actual use. Subsequently, it would take two to three days to clear the left from burn and prepare the ground for planting. The common crops that use burning in clearing land are showed in Table.1. Removing leaves on ground, especially from teak, is widely used fire, which covers about 235.16 hectares around LPB tourism area.

Table 1 - Type of crop area use burning in LPB district

| Item         | Area in Hectare | Percentage |
|--------------|-----------------|------------|
| Up land rice | 152             | 7%         |
| Corn         | 849             | 37%        |
| Potato       | 197             | 9%         |
| Bean         | 140             | 6%         |
| Peanut       | 250             | 11%        |
| Duer fruit   | 493             | 22%        |
| Sesame       | 156.2           | 7%         |
| Others       | 54              | 2%         |

Source: LPB investment and planning sector

LPB provincial agricultural and forestry sector has noted nineteen villages in LPB district and four villages in Chompet district as main areas that potentially cause the smoke to tourism area. List of the villages and total burnt area are show in Table.2.

## Methodology

### Consciousness on smoke from slash and burn farm cultivating in LPB

To observe the consciousness of businesses and households on the smoke of agricultural field burning, we make an interview and ask several questions about the problem of the smoke on their health, LPB tourism businesses. We examine the level of consciousness by asking those businesses and households to rank a score of their consciousness. The score is 0 if business doesn't worry about the smoke problem and 5 if business worry the most. Businesses are interviewed on the potential impact on health problem, their own business, and general tourism business, while households are interviewed only for their health problem and general tourism business in LPB. Furthermore, the businesses will be separated into high potential earn from tourism and non low one; and different area (in tourism area and non tourism area) is also concerned in this part. The basic descriptive statistics will be reported to show the comparative analysis across the socio-economic indicators.

Table 2 – Smoke generated villages

| District         |               |
|------------------|---------------|
| LPB              | Chompet       |
| Phonexai         | Pohlad        |
| Donemai          | Xiengman      |
| Donekao          | Khoksawang    |
| Kohkwa           | Natha         |
| Donekeo          |               |
| Hadhien          |               |
| Phanom           |               |
| Naxangwei        |               |
| Naluang          |               |
| Kaotinuerng      |               |
| Donekang         |               |
| Mar              |               |
| Naduer           |               |
| Pongwan          |               |
| Lukpead          |               |
| Naxai            |               |
| Luksiip          |               |
| Huaipai          |               |
| Phonxai          |               |
| 2526.36 Hectares | 57.9 Hectares |

Source: LPB agricultural and forestry sector

## Measuring WTP of business and household to stop smoke

In order to measure the value of any good, we often give it in monetary term. If the air pollution in Luangprabang city creates a negative externality to the society, this research, aim to measure such value of air pollution. However, value of such good is absence in the market. Thus we need some association of economics theory and econometrics model. This implement known as *double-bound dichotomous contingent valuation method*, in this study, it has been employed in order to capture willingness to pay of people in Luangprabang to avoid smoke during March to April.

To facilitate capturing WTP of respondents for improving air quality, in this study, rely on the stated preference (SP) approach; namely contingent valuation method; that is, directly asking people about their willingness to pay for changing in air quality (stop farmers' burning activity). To accomplish the objective above, this study will follow three steps as follow: (1) setting up the hypothetical market (scenario build up); (2) find the payment vehicle; (3) obtaining bids.

## Step 1: the hypothetical market (scenario build up)

For making the scenario more reliability, this study assumed that government will run a project to deal with smoke problem. This project will subsidize farmers for their clearing land without burn.

## Step 2: Payment vehicle selection

The respondents will be also told that this project could only go ahead if extra funds are supported by them. And these extra funds will be added to their monthly electricity expense (in this study electricity fee will be presented as a *payment vehicle* or sometime known as *bid vehicle*). Additionally, respondents will be informed that this project will go ahead for implementing if half of them votes for this project; subsequently, everybody have to pay the additional charge in their electricity bill (there is no country for free riders).

## Step 3: obtaining bids

A “bid” is an amount of money that respondents will be asked to sacrifice for environmental improvements. In contingent valuation survey, by the literatures, individuals can be asked to state their WTP in several ways. But in this research, *double-bounded dichotomous choice* were used, since this way obtains more observations for probability model (one individual provides two observations). And regarding to a study of Hanemann et al. (1991), he concluded that WTP confidence intervals were greatly reduced by using the double-bounded dichotomous choice model, and provide more efficient than the single-bounded model.

Researchers give high concerns about validity of bid values, too high or too low bids may lead to data collecting distortion. Range of bids is important as well, suggested bid is that *highest bid* should take 90% of respondents not willing to pay for improvement of environmental quality (say “no” to support the proposed project), and 90% of respondents willing to pay for the improvement (say “yes” to support the proposed project) regards to *lowest bid*. Additionally, this research has 8 initial bids which are obtained by pilot survey; 2,000 kip, 5,000 kip, 10,000 kip, 25,000 kip, 40,000 kip, 60,000 kip, 80,000 and 100,000 kip<sup>1</sup>.

For estimating WTP, the standard approach in the economic valuation using the CV method start from the *indirect utility function* incorporates with the level of environment quality. We want to measure WTP for the improvement of air quality in Luangprabang during March to May. WTP is defined as the amounts of money that must be taken away from Luangprabang residential income in order to keep his/her utility remain constant. The utility function can be represented like this:

$$V(i - WTP, q_1) = V(i, q_0)$$

where  $V$  denotes the indirect utility function,  $i$  is income of residents (household and business),  $q_0$  and  $q_1$  are air quality (with  $q_1 > q_0$ , indicating that  $q_1$  refers to improved in air quality). However, using double-bounded dichotomous choice style, we cannot observe WTP directly, we can only infer that whether WTP is greater than bid value or not. Respondent’s WTP is greater than bid value if he/she is favour in this level of air quality ( $q_1$ ), or less than bid if respondent vote against this improvement. Since the possible decisions of respondents are only two outcomes (yes/no), from now on authors will treat it as

<sup>1</sup> The exchange rate is \$1 = 8,000 kip

a binary outcome model. Let's denote this unobserved WTP by  $wtp^*$ . Then we can write the conditions of this binary outcomes variable as:

$$y = \begin{cases} \text{yes if } wtp^* \geq bid \\ \text{no if } wtp^* < bid \end{cases}$$

where  $y$  stands for respondent's decision;  $bid$  is bid values. Now we can obtain the probability function;

$$Pr(yes) = Pr[wtp^* \geq bid].$$

To estimate this equation, the dependent variable coded as  $1 = \text{yes}$  and  $0 = \text{no}$ , then regress variable  $y$  on the offer bid ( $bid$ ) which each business and household were asked. And the general model of this regression will look like this:

$$Pr(y = 1) = f(bid)$$

$$Pr(y = 1) = 1/(1 + e^{-(\beta + \alpha bid + u)})$$

where  $\alpha$  and  $\beta$  are unknown parameters with the disturbance  $u$ . The problem of estimating probability models is how we treat the disturbance terms, and this related to what model should be used in order to obtain the unknown parameters. In this study we assume that the disturbance terms is a normal distribution. So the unknown parameters will be estimated under the properties of maximum likelihood estimation. The log likelihood function can be written as follow:

$$L = \prod Pr(y = 1)$$

$$L = \prod 1/(1 + e^{-(\beta + \alpha bid + u)})$$

The most fitted model is, that, the unknown parameters those maximize the likelihood function. After obtained the unknown parameters above, then mean WTP can be calculated as follow:

$$E(WTP) = -\frac{\beta}{\alpha}$$

since we know the average of WTP by the formula above, it allows us to compute the aggregate WTP of Luangprabang residents for air quality improvement by the following calculation:

$$\sum_{r=1}^2 E_r(WTP) * N_r$$

where N refers to the census numbers of which identify groups of stakeholders by r, 1 stands for households and 2 stands for business.

Calculating cost for not burning

We now turn to give details on how to get a cost of not burning. Farmers burn their field because it is a quick and cheap way to clear their land, thus the opportunity cost of farmer for not burning field is, generally, the cost for remove residue from their field by not burning, so the price of smoke for farmers must equal to the area of field multiply by the wage to hire an extra labor and time use for clearing the residue. Thus we have:

$$\text{Cost for not burning} = \text{Burnt area} * \text{Wage} * \text{Time use}$$

where the burnt area is a sum up of farmers' burning area (in hectare) in one year. We use only the area in some potential villages that would cause the smoke to LPB district that are presented in Table1. For wage, because there is no one works to clear land in real practice, so we will not be able to get a real wage. The wage in equation is a common wage for hiring one person in the village of burning to do daily agricultural work. For the time use, we asked several farmers in order to find an average time use to clear one hectare of agricultural land. The equation above is a simple calculation for the opportunity cost.

## Data collection

Data for analysis will be conducted by a face to face interviewing in order to reduce biasness from misunderstanding of interviewee. The unit of analysis of the consciousness test and willingness to pay are household and firm level, while for the cost of burning is farmer level. For the business and household survey, a questionnaire for both households and firms was compiled in simple way. The questionnaire for households contains questions about basic socio-economic characteristics of household, perception and awareness on risk and problems of the smoke, and at the end of the questionnaire included a simple double-bounded dichotomous choices CVM question. And questionnaire for firms included questions about business' features; such as characteristics of firm's owners, type of business, and financial statements; and firm's owner also has to state his/her perception on risk and problems of the air pollution problems that Luangprabang faces. And like the household's questionnaire, a CVM question appeared to capture his/her WTP for avoiding the smoke problem. This survey was conducted in Luangprabang, with the sample size of 280 households and 284 firms. From household data, 64% of the samples said "agree" to stop clearing land by burning, while 71% of firms agreed for stopping the conventional clearing land.

## Result

### Consciousness of businesses and household

Table.3 shows the level of the consciousness of seven different types of business which are hotel and guesthouse, restaurant, souvenir and massage shop, guiding, glossary shop, shops in local market, and shops that are along roads in town. In general, all the score level is statistical difference from zero. This shows that business concern about the problem. Several business types that potentially earn more from tourism have higher consciousness on their own business, tourism and its related business, and health problem. In order to see whether related tourism business has a different in consciousness compared to other business, we treat business type 1 to 4 as direct tourism group and 5 to 7 as non direct tourism group. Furthermore, business type 1 to 4 have higher score on health, own business, and tourism business compare to business type 5 to 7, and after calculate the average score of both group, they confirm the higher. However, not all of them are statistical higher. The level on health problem is not different among two groups. This illustrate that business in LPB have no difference in about health concern, or in another words, they all are worried in the same level on health problem. But the average score of group 1 to 4 about their own business and general tourism business are higher than another group for 0.5 and 0.2 rank score and statistically significant at 5% and 1% level, respectively. The result show businesses that potentially earn more from tourism are worried the problem of smoke on LPB tourism and their own business more.

Now we regroup the businesses into two groups of different location to see how location can affect their consciousness. The first group is the businesses that locate in the main tourism area (in the World heritage site), so call inner; and the second one locates in sub-region of the town (outer). Table 4 shows how business in different location concerns about the impact of smoke on health, its own business, and tourism business. There is slightly difference between the average score of the inner and outer, and only the test of score on tourism business is statistically significant at 5 percent level. Even the result state only small difference among inner and outer, all average score of inner is higher than the average score of outer. So this result figure similar picture with the result in Table.3.

Table 3 – Business consciousness

| Type of business                      | Health | Own business | Tourism business |
|---------------------------------------|--------|--------------|------------------|
| 1. Hotel and guesthouse               | 2.872  | 2.933        | 3.283            |
| 2. Restaurant                         | 2.905  | 2.450        | 3.077            |
| 3. Souvenir and massage shop          | 3.250  | 2.067        | 3.533            |
| 4. Guide                              | 3.091  | 2.400        | 3.300            |
| Average rank score of business 1 to 4 | 2.941  | 2.580        | 3.223            |
| Observations                          | 118    | 112          | 112              |
| 5. Glossary shop                      | 2.835  | 1.978        | 2.926            |

|                                                                                                                                                                                                   |       |        |        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|--------|
| 6. Shops in local market                                                                                                                                                                          | 2.800 | 1.600  | 3.500  |
| 7. Shops along roads in town                                                                                                                                                                      | 3.017 | 2.130  | 3.296  |
| Average rank score of business 5 to 7                                                                                                                                                             | 2.898 | 2.006  | 3.089  |
| Observations                                                                                                                                                                                      | 166   | 157    | 158    |
| Chi square test                                                                                                                                                                                   | 4.392 | 12.710 | 15.677 |
| P – value                                                                                                                                                                                         | 0.494 | 0.026  | 0.008  |
| Note: All average rank score are statistically different from zero at 1% level, and Chi square test is a test for average score of businesses group 1 to 4 compared with businesses group 5 to 7. |       |        |        |

Additionally, the consciousness level of household is demonstrated in Table 5. We ask households to score the level of consciousness on their health and general business, and the mean of score is greater than middle of score rank that tell us that households also worry about the problem properly.

Table 4 – Different location and business's consciousness level

|           | Health | Own business | Tourism business |
|-----------|--------|--------------|------------------|
| Inner     | 3.067  | 2.435        | 3.321            |
| Outer     | 2.845  | 2.158        | 3.069            |
| F – test  | 0.437  | 0.529        | 6.079            |
| P – value | 0.509  | 0.467        | 0.014            |

Note: F – test is Levene's test for equality of variances

#### Willingness to pay to stop smoke

This section presents the trends of WTPs for stopping the air pollution problem, and followed by the mean WTP of household and firm, obtained from the two probit models. Two figures of Figure.1 below provided the WTP's profiles of household and business in Luangprabang. Less than 10% of the firms are willing to pay for the project at the price 100,000 kip, and 98% of them willing to pay if the fee of this service was 2,000 kip. While household has a quite similar WTP's profile with 7% agreed for the price of 100,000 kip. But when price go down to 2,000 kip, 97% of them will support this project.

Table 5 – Household's consciousness level

|                     | Health | Tourism business |
|---------------------|--------|------------------|
| Mean of score level | 2.644  | 2.785            |
| t – test            | 25.899 | 27.371           |
| P – value           | 0.000  | 0.000            |

Note: t – test is mean test difference of zero

Additionally, these figures also showed that the demand for this project has a negative relationship regarding to the price of the service. The demand curve

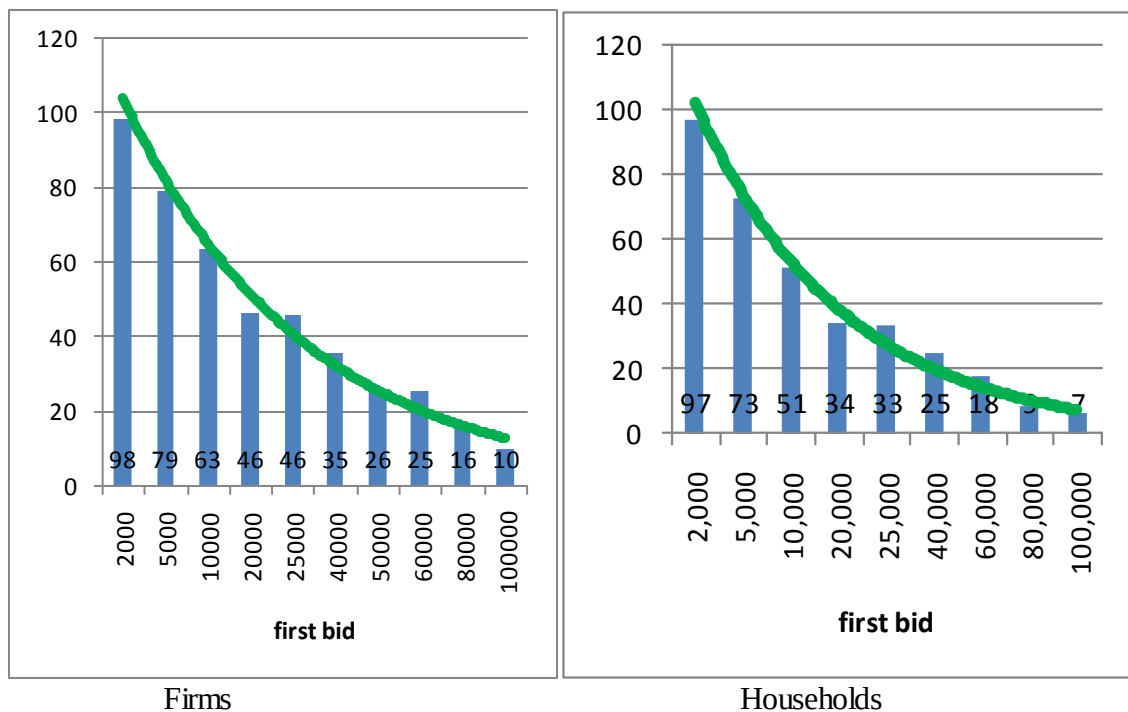


Figure 1: percentage of respondents said “yes” to support the project regarding the first bid demonstrated downward sloping; it means that our samples’ response to the CV question is consistency with the standard economics theory. As the graph clearly show that, as the price (bid) of the service goes up, the probability that respondents will say “yes” to support this project decline. That means this good is a normal good, and can be sale in the market.

Two probit models were estimated; one for the household data with 560 observations, and the other one is for business with the observation of 568. Results of these models clearly showed that bid variable is a significant factor influence probability of supporting the project. The findings showed that households have less WTP for the project, compared to WTP of firms. The mean WTP of household is about 200,655 kip annually (25 US dollars), and 255,561 kip annually (31.9 US dollars) for business.

Now we use the WTP above to multiply with number of household and business in the World heritage site and main tourism area. There are 4,531 households (LPB planning

and investment sector, 2011) and 2,620 registered firms (LPB municipal city office, 2011). Therefore, the total WTP from households is about 909 millions kip (113,645 US dollars) and from business is about 669 millions kip (83,696 US dollars), and the total from both of them is 1,578 millions kip (197,342 US dollars).

#### Cost of not burning

To clear farm land without using fire for 1 hectare, farmer need to spent 8 days of one labourer (information from interviewing farmers in burnt area). And the wage for hiring one labourer is 30,000 kip (3.75 US dollars) per day. In calculating, we assume that all type of farm need the same time use and wage for one labourer. By combine information above with the burnt area shown in Table.2, we will have total cost for not burning agricultural field in LPB as about 606 millions kip (75,791 US dollars) for LPB district and about 14 millions kip (1,737 US dollars) for Chompet district. Thus the total cost for 1 year is about 620 millions kip (77,487 US dollars).

When we compare the cost for not burning with the total WTP to stop smoke, we see that the cost is only 30% of the WTP. The result shows that people in tourism area are willing to pay for no smoke higher than the cost to implement to stop the smoke, and it also confirm that with an absence of market, welfare wouldn't improve.

#### Conclusion

This paper tackles the impact of smoke from agricultural field burning on tourism using data of LPB, the world heritage site, in 2011. The main purpose of this study is to find a consciousness of business and household in tourism area on the smoke, the willingness to pay of the business and household to stop the smoke, and the cost for making farmers not to burn their field. A statistical test, the contingent valuation method, and simple cost of working in agricultural farm are used for the consciousness, the willingness to pay, and the cost for not to burn. 284 firms and 280 households are interviewed in 2011 to data use.

The empirical results showed that people in tourism area concern about the smoke problem. The business with potential to earn more from tourism is likely to concern more on health problem, their own business, and general tourism business; however only own business and general tourism business are statistically significant. In addition, firms locate in main tourism area are also worry on the problem. The result is potentially explained by impact of the smoke on revenue of tourism sector; because an increasing in environmental problem (smoke) lowers the number of tourist, which later worsens in come from tourism. After that, we calculate the WTP of business and household to stop the smoke and it yield 1,578 millions kip (197,342 US dollars) annually, and the cost for farmer to clear their field without using fire is 620 millions kip (77,487 US dollars) annually.

The finding in this paper is imperative in policy making. Firstly, in order to increase revenue from tourism, the environmental problem need be concerned. Secondly, it is important to note that, without government influence in absence of market for environment such smoke, it results an economic inefficiency and lower people welfare.

After all, future study should define more specific the character of business, household, and type of farm land in order to detail the result. Also, several environmental problems that cause problem on tourism sector are still left to be investigated.

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