The Economic Benefits of Tawangmangu Forest Park in Indonesia: An Application of Individual Travel Cost Method

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ABSTRACT

This study is an attempt to apply one of environmental valuation methods, individual travel cost method, that really depends on individual data in Indonesia. To doing so, Tawangmangu Forest Park as one of famous natural-based recreational sites was selected. And, for collecting data this study used on-site interview survey based on questionnaire. We assumed that because of this study was conducted in a developing country so that might have different socioeconomic characteristics. Therefore, our hypothesis is that the average number of visits may be smaller than in developed countries due to the differences in welfare condition particularly income level. As a result, an aggregate consumer surplus as recreation benefits may be low. Based on double-log functional recreation demand form this study obtained an average individual CS is US$41.50 per year and US$18.20 per visit. Total benefits of Tawangmangu Forest Park as an aggregate CS is US$7.51 million. This value was comparable to other selected studies.

Keywords: *use value, consumer surplus, individual travel cost method, Tawangmangu.*

ABSTRAK

Studi ini mencoba untuk mengaplikasikan salah satu metode valuasi lingkungan yaitu metode biaya perjalanan individu, yang mana dalam hal ini data yang digunakan adalah data individu di Indonesia. Dalam melakukan penelitian dipilih hutan wisata di Tawangmangu yang merupakan salah satu tempat wisata yang terkenal. Pengumpulan data dalam studi ini yaitu dengan interview berdasarkan kuisioner. Kita mengasumsikan bahwa karena dalam studi ini mengamati di negara berkembang, maka mungkin ada perbedaan karakteristik sosialekonomi. Selanjutnya hipotesis kami adalah bahwa rata-rata jumlah pengunjung lebih sedikit daripada negara maju hal itu dikarenakan tingkat kesejahteraan dan tingkat pendapatan. Hasilnya dari *aggregate consumer surplus*, keuntungan dari rekreasi mungkin rendah. Berdasarkan fungsi permintaan rekreasi double-log dalam studi ini mendapatkan hasil untuk rata-rata individu adalah US$ 41.50 per tahun dan US$ 18.20 per kunjungan. Total nilai Hutan Wisata Tawangmangu sebagai tempat wisata adalah US$7.51 juta.

Introduction

Tourism is an increasingly important component of Indonesia's national income and foreign exchange earnings. It has improved tourism-supporting industries, infrastructures, and promoted the development of hotels and areas in Indonesia. Statistically, the tourism sector in Indonesia has been identified as an excellent sector with an increase in foreign exchange earnings every year. Since in the beginning of the first PELITA (5-year-plan), the number of foreign tourists has increased rapidly from about 86,000 persons in 1968 to 4,006,312 people in 1999.

Another issue is that in 1999 the Government imposed Regional Autonomy policy, the new format of decentralization policy that permits provincial government to manage their main resources optimally such as mining, forestry, marine, and natural based-tourism sector. There are many provincial governments that promote natural based-tourism as the leading sector or even as the biggest share of revenue source. This policy is good news for natural based-tourism development in regional level and national level as well.

As a tropical country that rich in natural resources, Indonesia heavily dependent on the use and management of natural resources, such as land, water, forests and fisheries.-Exploration, development and utilization of the natural resources require careful intention and sustainable development considerations, which include cost-benefit analysis particularly.

In order to analyze policies by using cost-benefit analysis, the quality or quantity of the non-market goods should be expressed in monetary terms. Economic valuation methods of non-marketed goods have become essential when determining the costs and benefits of public goods. Non-market valuation exercises have been conducted in many different areas, ranging from natural resources accounting to health and environmental applications (Walsh, 1986)

The most commonly used method of valuing recreational site is the travel cost method (Ward et.al. 2000). The travel cost method infers people's valuation of an un-priced amenity from the value of the time

taken to travel to the site, and the direct costs of travel that are incurred in getting to the site. Valuation using this approach requires the collection of data on the costs of travel to the amenity, the frequency of visits made by people from similar regions and with similar preferences and income. This information makes it possible to construct demand curves for the services of the site for each group of consumers. The sum of the areas below these demand curves reveals the estimate of the benefit from the amenity. This method would be implemented for valuing economic benefit of forest park in a case study in Tawangmangu Forest Park, Central Java, Indonesia.

Materials and methods

Regarding the economic value of environmental goods, economists classify the values into several types. The two main categories are use values and non-use, or "passive use" values. Whereas use values are based on actual use of the environment, non-use values are values that are not associated with actual use, or even an option to use, an ecosystem or its services Turner et al., (1999).

Thus, use value is defined as the value derived from the actual use of a good or service, such as hunting, fishing, bird-watching, or hiking. Use values may also include indirect uses, For example, an Alaskan wilderness area provides direct use values to the people who visit the area. Other people might enjoy watching a television show about the area and its wildlife, thus receiving indirect use values. People may also receive indirect use values from an input that helps to produce something else that people use directly. For example, the lower organisms on the aquatic food chain provide indirect use values to recreational anglers who catch the fish that eat them.

Option value is the value that people place on having the option to enjoy something in the future, although they may not currently use it. Thus, it is a type of use value. For example, a person may hope to visit the Alaskan wilderness area sometime in the future, and thus would be willing to pay something to preserve the area in order to maintain that option.

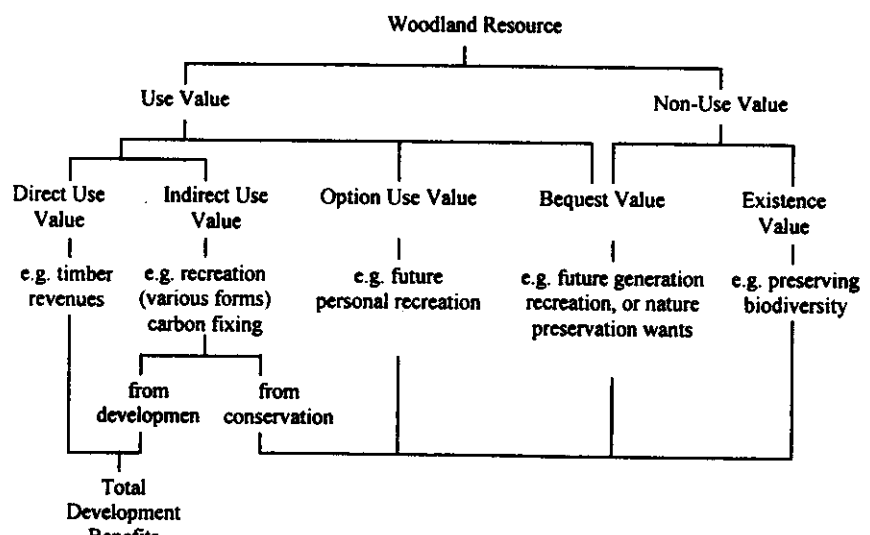
Similarly, bequest value is the value that people place on knowing that future generations will have the option to enjoy something. Thus, bequest value is measured by peoples' willingness to pay to preserve

the natural environment for future generations. For example, a person may be willing to pay to protect the Alaskan wilderness area so that future generations will have the opportunity to enjoy it.

Non-use values, also referred to as "passive use" values, are those not associated with actual use, or even the option to use a good or service. Existence value is the non-use value that people place on simply knowing that something exists, even if they will never see it or use it. For example, a person might be willing to pay to protect the Alaskan wilderness area, even though he or she never expects or even wants to go there, but simply because he or she values the fact that it exists.

It is clear that a single person may benefit in more than one way from the same ecosystem. Thus, total economic value is the sum of all the relevant use and non-use values for a good or service.

Figure 1. Total Economic Value of Woodland



Source: Turner et al. (1993)

Study Site

This study was conducted in Tawangmangu Forest Park, Central Java, Indonesia. Administratively, the Tawangmangu Forest Park (TWFP) belongs to Karanganyar Regency, one of the 35 regencies in Central Java province. It is located about 40 kilometers from Surakarta or around two hours by public transportation. It is about 75 kilometers (three hours) from Yogyakarta, and around 125 kilometers from Semarang (four hours), the capital city of Central Java Province, respectively. Topographically, this site is located in mountainous altitude of 800 to 2000 or 1,200 meters above sea level in average on the western slope of Mt. Lawu. It is also near or next to East Jawa province. Figure 2. illustrates detailed location of the site.

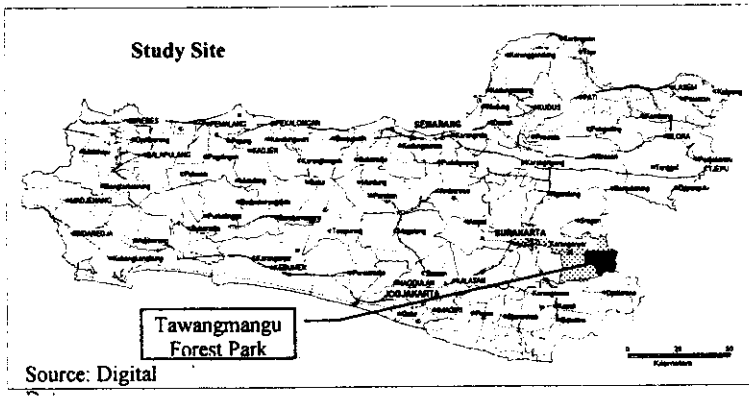


Figure 2. Map of Study Site

This forest park was officially named as a conservation area on 12th October 1968 under Agriculture Ministry Decree No. 264/Kpts/Um/10/1968, which covers 64.30 hectares. Astronomically, the park stretched out in 7° 38'54" - 7° 42' 41" latitude and 111° 10' 05" - 111° 17'16" longitude, it goes to type B climate that has the average rainfall of above 3,000 mm/year.

The range of temperature is between 10° - 25°C. The flora dominated the area are *Pinus merkusii*, *Caliandra* sp., *Agathis* sp., *Casuarina* sp. Fauna are *Macaca fascicularis* (monkey), *Gallus* sp.,

Acridopteres fuscus, *Stretopelia chenensis*, *Pyconotus cafer aurigaster*, *Prinia serfescens*, *Geopelia striata* and *Strunus contra*. The most attractive object in Tawangmangu is Grojogan Sewu, the 80-meter high waterfall which is well known as Grojogan Sewu Park.

Among several natural-based recreational sites in Central Java province, this site received some trophies for many years, because of its famous, beautiful scenery, well-developed and good management. Also, in the provincial level, this site generated 454 million rupiah in 1998 or 20% of total revenue among several natural based-tourism sites in this region. Moreover, according to statistical data, since 1990 the number of domestic visitors to Tawangmangu Forest Park has ranged from 350,000 to 400,000 per year. One important finding here is that in 1998 the number of visitors decreased, may be due to political riots that occurred in several cities.

Data collection

It is necessary to conduct a pilot study before actual survey. The main purpose of the pilot study is to test respondents' understanding, especially regarding the questions, ordering and the acceptance of the questionnaire. Even with a budget constraint, but still keeping carefulness, the pilot survey has been implemented on January 4, 2002 among 25 Indonesian students and their families who are staying in Higashi-Hiroshima.

While, an on-site survey had been conducted from January 22 to February 3, 2002 in several weekday and weekend periods. Before the day of the implementation, a short briefing with local assistants held to explain the objectives of the study and discussed on the technical aspect of data collection. Technical aspect included how to start and interviewing respondents as well as how to fill-out the questionnaire.

In total 253 sample data were gathered and interviewed in 13 days. However, one of the problems with TCM was the difficulty of gaining an accurate estimate of the proportion of each trip which was solely due to the attraction of the site being valued. This problem deals t with multiple destinations trip. To solve that problem and to meet the

assumption of TCM, it is necessary to select the sample to include only those who are on sole-purpose trip (Freeman, 1993). Therefore, from a total of 253 data, 80 stated that they were on a multi-destinations trip so that they were excluded from the data. As a result, the data were reduced to 173 respondents. Table 1 shows the summary of sample characteristics.

Table 1. Summary individuals' statistics

	Number of visits	Total travel costs	Income	Age	Size of group
Minimum	1	10,968	500,000	20	1
Maximum	7	419,952	3,250,000	65	115
Average	2.28	97,079	767,341	25.34	26.87

Method

Methods to value the environment can be broadly divided, according Turner et al. (1993), Garrod and Willis (1999), into two categories: demand curve and non-demand curve based approaches. Moreover, demand curve based approaches were generally divided into *expressed or stated preference* (SP) and *revealed preference* (RP) methods.

The most popular type of expressed preference technique was contingent valuation methods (CVM). CVM attempts to measure the value of a good attributes and describing what will be protected. The idea of CVM was first suggested by Ciriacy-Wantrup (1947), and the first study ever done was in 1961 by Davis (1963). Since then, CVM surveys have become one of the most commonly used methods for valuation of non- market goods, although its use has been questioned (e.g. Diamond and Hausman, 1994 and Hanemann, 1994).

While, in the revealed preference methods, there were a number of approaches. However, this research only discussed on the travel cost method. The travel-cost method (TCM) was primarily employed to estimate the demand or marginal valuation curve for recreation sites.

Entrance fee to many recreation sites was low even sometimes free of charge. But, individuals need to purchase a private good, such as the cost of transport. So, to gain access to the recreation site the demand for the recreation site can therefore be estimated by observing how the number of visits to the site varies according to the price or cost of transport to access the recreation site. Invariably, there was an inverse relationships between the cost of visiting the recreation site and the number of visits observed: people living a greater distance from the site and incurring higher transport cost make fewer visits per year.

Practically, once we know travel costs and the number of trips that people take, we can plot these data, connect the dots, and estimate the demand curve also consumer surplus of trips. The area under this demand curve indicates the total consumer surplus available to the visitor because it is the total amount that individuals would be willing to pay in addition to the amount that they currently pay.

Moreover, there were two most frequently used TCM empirical approaches; the zonal travel cost method (ZTCM) and the individual travel cost method (ITCM). The TCM was first proposed by economist Harold Hotelling in a letter to the U.S. Park Service of June 1947. He got an idea from Jules Dupuit, French engineer who wrote formula for the benefit of roads, bridges, and canals a hundred years before. Then he worked out more general formula for benefits from wider and more complicated classes of public services. Firstly, he suggested concentric zones of origins assuming that the cost of travel to the park in one of these zones is approximately constant. Then, the demand curve could be constructed by comparison of the cost of travel of people entering the park in a year with the number of people entering the park from the zone, together with the population of the zone. The benefit of the park in particular year was calculated by the above process with a deduction for the cost of operating the park called the consumer surplus. This method was known as traditional travel-cost model "trips per capita" distance-decay function or zonal travel cost model (ZTCM).

Another TCM approach was the individual travel cost method. It was similar to zonal travel cost method hence this method uses individual observations data. This approach firstly suggested by Brown and

Nawas (1973) with empirical study, which indicated aggregating data caused multi-collinearity and had difficulty in estimating the parameters of recreation demand functions. When individual consumers are aggregated into groups living in origin zones, the socio-economic variables usually have shown little or no significant relationship to quantity demanded. Therefore, the averaging process in ZTCM reduces the apparent variability across zones and thus the statistical tests of various aspects of the regression analysis may give the appearance of better coefficients and a better fit of the regression in using individual observations (Walsh, 1986).

In order to estimate recreation demand for visiting the Tawangmangu Forest Park, this study used individual travel cost model adopted from Fix and Loomis study (1997). In the same way, this study also utilized semi-log structure using count data estimator. It was assumed that the number of visit data is always a positive number and without zero number.

According to Creel and Loomis (1990) count data estimators restricted positive probability assignment to possible events, while continuous distribution estimators gave positive probability to fractional and possibly negative value of the dependent variable. Thus, poisson distribution was far more consistent with a data generating process producing only a few visits. Hellerstein (1992) showed that when the average number of visits was small (such as this data set, where the average number of visit is 2.28) the poisson was a much closer approximation then regression techniques based on the normal distribution. The basic semi-log model is:

$$VISIT_i = \exp(Prices_i, Demographics_i, \text{error term}) \qquad (1)$$

where dependent variable, VISIT is the number of visits made by individual in the last 12 months. The explanatory variables that were used in this study were travel cost, individual income, experience, size of group, substitute site, gender, age, and education. Specifically for travel cost variable, this composed of round-trip travel cost and costs reported while visitors in the site plus time cost. The cost of time should be included in the analysis (Cesario, 1979 and Freeman, 1993). Thus, although this study was not specific estimates of the value of time, an arbitrary value of 30 percent of hourly income then

was used as the opportunity cost of time. Hourly income in this area was equal to 1,640.5[1] rupiah. This value was then multiplied by travel time and length of visit is and included to the travel cost variable.

Results and Discussions

Then the survey data was regressed to find a recreation demand function and the statistical results are shown in Table 2 and used variables in Table 3.

Table 2. Summary regression results of Semi-log Model

	full model	t-value	reduced model	t-value
Intercept	0.5142048	1.96 *	0.331798	2.08 **
TRVCOST	-1.514E-06	- 2.42 **	-1.569E-06	- 2.52 **
INC	2.383E-07	2.27 **	2.233E-07	2.21 **
EXP	0.681	6.29 ***	0.7004635	6.65 ***
AGE	-0.0131426	- 2.13 **	-0.0119493	- 1.98 **
EDU	-0.0774598	- 1.23		
SIZE	-0.0008961	- 0.72		
SUB	0.0741466	0.74		
GENDER	0.0948012	1.08		

Statistically significant at the 1% level (***), at the 5% level (**), at the 10% level (*); R^2=0.26

Table 3. Definition of Used Variables

Variables	Definition
VISIT	Number of visits in the last 12 months
TRVCOST	Travel cost (round-trip cost of travel + entrance fee + other expenses)
INC	Individual monthly Income
EXP	Individual experience, equals 1 if ever visited the site before
AGE	Individual age
EDU	Individual education
SIZE	Size of group
SUB	Substitute, equals 1 if visited other site(s) in the last 12 months
GENDER	Gender = 1 if the respondent is male

The results of regression estimation seem consistent with the theory that travel cost as variable of prices gives a negative sign. This meant that consumers prefer to take more visits at a lower price, as inverse of price and quantity of purchased good correlation.

The income has a quite small coefficient but still has a positive sign as the demand shifters. The highest explanatory power of the regression is experience variable. It means people take more visits because they already know and visited before. It is also shown that older visitors tend to take fewer trips. However, the above analysis was based on semi-log model specifically on reduced model that most explanatory variables have significant level at 0.05 and R^2 is 0.26. Thus, in order to find other the best-fit model, this study also attempted to use double-log model using the same variables in the semi-log model.

This study investigated several log combinations and found that the combination of log on VISIT variable (dependent variable) and TRVCOST (explanatory variable) was the best model. The statistical results are shown in Table 4.

Table 4. Summary of regression results by Double-log Model

	full model	t-value	reduced model	t-value
Intercept	2.1907543	3.59 ***	2.1482414	3.64 ***
LNTRVCOST	-0.1690422	- 3.11 ***	-0.1787213	- 3.36 ***
INC	2.454E-07	2.36 **	2.304E-07	2.31 **
EXP	0.6919245	6.50 ***	0.7017305	6.78 ***
AGE	-0.0121775	- 1.99 **	-0.0108749	- 1.83 *
EDU	-0.0670145	- 1.07		
SIZE	-0.000423	- 0.34		
SUB	0.065314	0.66		
GENDER	0.0832227	0.96		

Statistically significant at the 1% level (***), at the 5% level (**), at the 10% level (*); R^2=0.28

Table 5. Demand Functions Comparison (in results and discussion)

	Independent variable	Coefficient	t-value	R^2	s^2	N
With Semi-log Model:	Constant	0.331	(2.08) **	0.2607	0.2934	173
	TRVCOST	−1.569E-06	(−2.52) **			
	INC	2.233E-07	(2.21) **			
	EXP	0.700	(6.65)***			
	AGE	−0.011	(−1.98) **			
With Double-log model:	Constant	2.148	(3.64)***	0.2809	0.2854	173
	LNTRVCOST	−0.178	(−3.36)***			
	INC	2.304E-07	(2.31) **			
	EXP	0.701	(6.78)***			
	AGE	−0.010	(−1.83) *			

Statistically significant at the 1% level (***), at the 5% level (**), at the 10% level (*); R^2=0.28

Table 5 shows the comparison of estimated demand function from semi-log and double log calculations. The double-log model gives higher R-square value and coefficient significant at 0.01 than 0.05 in semi-log model. On the other hand, Draper (1981) criteria states that the best-fit model should have the higher R^2 value and lower residual mean square (s^2). Therefore, based on both calculations and Draper criteria, the double-log model is judged as the best-fit regression equation.

Then, the recreation demand model is specified as follows:

$$LNVISIT = 2.14 - 0.178*LNTRVCOST + 2.304E\text{-}07*INC + 0.70*EXP - 0.01*AGE \quad (2)$$

And, the estimated demand curve is shown in Figure 3.

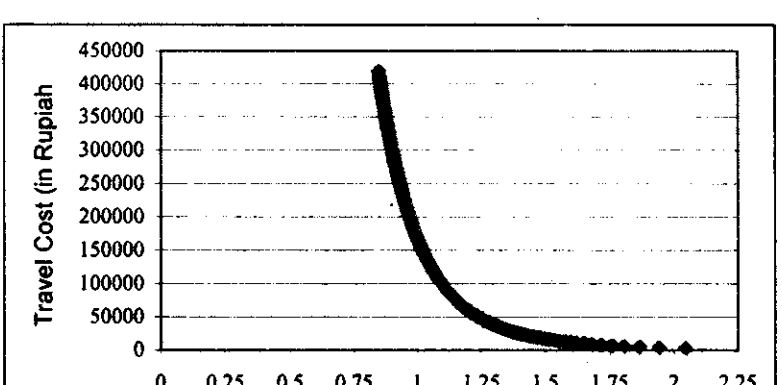


Figure 3. Recreation Demand Curve for Tawangmangu Forest Park, Indonesia

Recreation Benefits Estimation

The double-log recreation demand function then was used to obtain the consumer surplus as economic benefits value. This study estimated annual individual consumer surplus using the integral of the double-log demand function with respect to the price (travel cost) between the lower bound and the upper bound. The minimum travel cost was then used as a lower bound. It meant only the entrance fee which is 3,000 rupiah, while, the upper limit of integration function is set at maximum reported travel cost that is equal to 419,952.9 rupiah. Furthermore, in order to estimate the consumer surplus per visit, the annual individual consumer surplus was divided by the annual sample average number of visits. The consumer surplus per visit was

then multiplied by the total number of visitors to the site during the year to obtain total benefits of Tawangmangu Forest Park.

As a result, this study indicated that an individual consumer surplus per year that was 425,851.05 rupiah or US$41.50. Then this value was divided by the annual sample average number of visits that is 2.28. This obtained an individual consumer surplus per visit of 186,776.78 rupiah or US$18.20. Finally, the total recreation benefits value of the Tawangmangu Forest Park, Indonesia was 77,088,005,988.70 rupiah or US$7.51 million (multiplied by total visitors in year 2001).

Result Comparison

We compared our result to some selected previous studies that conducted in several countries. Table 6 showed the total recreation benefits of selected studies in developed and developing countries. This study results an average individual consumer surplus per visit is $18.20. Indeed, this value is lower than in developed countries especially from the USA study that was US$197-205. However, our estimated benefit is relatively similar to Heyes et al. (1999) study that found CS accessing the Dartmoor National Park in England was $19.9 for a day visitor also Sato and Masuda (1994) study in Yokohama that was ¥1457 or $17.12.

In addition, our individual CS per visit much higher than other several studies in developed countries. Lockwood et al. estimated individual CS visiting to Eurobodalla National Park, Australia, to be US$4.8 per visit. Also, Willis and Garrod, estimated consumer surplus per visit in the UK as US$0.1-1.7. However, it is still comparable to other developing country studies like in Thailand. Indeed, there is a big difference especially comparing to Heyes et al. and Seenprachawong studies but it might be because of large difference in the size of study site.

Table 6. Total Benefit of Recreational Site in Selected Studies

No.	Authors	Method	Study Site	Site Size	Sample Size	CS per Visit (US$)	Total Benefit (US$ million)
1.	**This study, 2002**	**ITCM**	**Indonesia, Forest Park**	**64.30 (ha)**	**173**	**18.20**	**7.51**
2.	Seenprachawong, 2001	ITCM	Thailand, Coral reef	21,800 (ha)	630	85	230.32
3.	Wunsiri, 1999	ZTCM	Thailand, Sanctuary	n.a.	313	n.a.	0.99
4.	Heyes, 1999	ITCM	England, National Park	1000 (km2)	298	19.9	242.14
5.	Purwanto, 1998	ZTCM	Indonesia, Forest Park	590 (ha)	500	n.a.	0.99
6.	Fix and Loomis, 1997	ITCM	US, Mountain Biking Sites	n.a.	194	197 205	9.51 9.91
7.	Lookwood and Lindberg, 1996	ITCM	Australia, National Park	n.a.	618	4.8	0.54
8.	Thi Hai and Duc Thanh, 1996	ZTCM	Vietnam, National Park	22,000 (ha)	282	n.a.	0.15
9.	Sato and Masuda, 1994	ITCM	Japan, Recreation Park	64.30 (ha)	627	17.1	3.14
10	Agus Luthfi, 1994	ZTCM	Indonesia, Beach	31 (ha)	100	n.a.	1.01
11	Willis and Garrod, 1991	ITCM	UK, Forest Parks	n.a.	126	0.1-1.7	8.94

Note: Adjusted value is calculated by the benefits value in local currency converted to US$ then, multiplied
by the Consumer Price Index (CPI) in year 2001 price.

Conclusion

This study generally wanted to implement such environmental economic method in order to provide better information for decision-making policy in natural-based recreation sites development. This transfer monetary value of non-marketed goods has become

essential when determining the costs and benefits of public goods, for example recreational site.

The results comparison mentioned in above did not make an argument for the hypothesis that the total benefit of recreation sites in developing countries was lower than in developed countries. However, based on recent Randall and Loomis (2000) study, the range of estimated average consumer surplus values on general recreation activities was around US$1.18 – 214.59. Then, our result that is US$18.20 is still a reasonable value.

For policy implication, this study obtained the value of individual net willingness to pay visiting the Tawangmangu Forest Park, Indonesia, as the individual consumer surplus per year was 425,851.05 rupiah. This value can be used straightforwardly for managers, and policy or decision-maker to determine an appropriate user fee for Tawangmangu Forest Park. In fact, the current entrance fee 3,000 rupiah is quite low compared to visitors' willingness to pay.

Future Study

Regarding methodology issues, this study showed how revealed preference approach, particularly the individual travel cost method, can be used to estimate the non-marketed environmental benefit of a single site forest park in Indonesia. Also, there was lesson to be learned from this study that may be relevant to future researches. This study used on-site interview survey which can introduce sampling biases to the analysis. For example, there were some visitors who frequently visit the site and also there are some visitors that may take only one visit to the site. This should be considered when selecting on-site sample.

This study also found, as mentioned in TCM theories, that travel cost and the experience factors in this study give strong influence in visiting the site. Other factor was income that meant people take more visits because they already know and have visited the site before. Also, it was shown that older visitors tend to take fewer trips.

However, the correlation level of all tested factors to the number of visits did not strong enough that was only 28% (represents as R^2) so

it meant that there were still 72% of other factors that influenced people to visit the site. This needs further study on investigating those other determine factors.

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