Economic valuation of environmental resources at Malaysia Agriculture Park
(Penilaian ekonomi sumber persekitaran di Taman Pertanian Malaysia)

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Abstrak

Kaedah kos perjalanan individu digunakan untuk menilai sumber persekitaran yang ada di Taman Pertanian Malaysia. Soal selidik telah dijalankan pada April 2003 yang melibatkan 100 pengunjung. Kebanyakan pengunjung tinggal kurang 20 km dari taman dan mengambil masa kurang 30 minit untuk perjalanan ke tempat tersebut. Kebanyakannya berbelanja kurang daripada RM60.00 untuk kos berkaitan perjalanan itu. Fungsi terbitan perjalanan dianggar dengan menggunakan kaedah kuasa dua terkecil biasa (OLS). Angkubah kos perjalanan menunjukkan tanda negatif bererti kunjungan akan berkurangan apabila kos perjalanan meningkat. Faedah bersih purata yang dinikmati oleh pengunjung dianggarkan RM152.00 bagi setiap lawatan. Jumlah faedah ekonomi bersih tahunan yang disumbangkan oleh sumber alam sekitar di Taman Pertanian Malaysia kepada masyarakat berdasarkan jumlah pengunjung bagi tahun 2000 dianggarkan RM19 juta setahun.

Abstract

An individual travel cost method was used to evaluate the economic value of environmental resources at Malaysia Agriculture Park. Primary survey was conducted in April 2003 involving 100 visitors. Majority of the visitors were staying less than 20 km from the park, and spent less than 30 minutes for their travel time. Most visitors spent less than RM60.00 each for their travel related costs. A trip generating function was estimated using the Ordinary Least Square (OLS) procedure. The travel cost variable showed negative sign indicating that the number of visits tends to decrease as the travel cost increases. The average net benefit that the visitors got out of recreating at the park was estimated at RM152.00 per visit per year. The total annual net economic benefit that the park environmental resources provide to society based on the total number of visitors in the year 2000 was estimated at RM19 million per year.

Introduction
The Ministry of Agriculture initiated the Malaysia Agriculture Park (MAP), the world's first agro-forestry park in 1986. It is located at Bukit Cahaya Seri Alam, about 32 km from Kuala Lumpur and 8 km from Kelang. The 1 258 ha park was opened to the public in 1988. The park provides

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visitors with the opportunity to appreciate the wonders of agriculture and nature preserve and recreate therein. It also aims to attract tourists: local and foreign.

Despite the stiff competition from emerging commercial recreational centres in the Klang Valley, the MAP remains popular as an alternative for visitors to explore the natural environment landscape. However, the number of visitors is declining over the years. The total number of visitors in 1992 was more than half a million and declined to about 120 000 in the year 2000, a reduction of about 77% in 8 years.

Although the MAP is a popular recreational site for local visitors and foreign tourists, there is very limited information regarding the economic contribution of the MAP to the local economy. There is not much information pertaining to the benefit derived by visitors utilizing the recreational services at the park. This is significant by virtue that most of the services and activities offered are free or minimally charged.

The recreational service offered at the MAP is unique and site specific. Recreational utility receives at the MAP site is different from other sites in the sense that each site has its unique environmental features. It is not possible to transfer the environmental services at the park to the consumer location. Each individual consumer needs to travel to the recreational site to utilize the services offered.

By going to the site, the consumers have to incur both travel cost and travel time. In each case, an implicit transaction involves the cost of travelling in return for access to the site. This makes the study of the MAP's economic contribution manageable. The access price to the park has been fixed which constraint the econometric estimation of demand function. However, the use of travel cost as a proxy for price can overcome this problem. The demand function of the MAP services can still be estimated by adopting the travel cost method (TCM).

The TCM has been used to estimate the economic values of outdoor recreational services in Malaysia. Nik Mustafa (1994) utilized the zonal travel cost method (ZTCM) to estimate the net economic benefit of out-door recreational resources for Sungai Congkak Forest Reserve in Selangor. The total annual net economic benefit is estimated at RM27 772.00, while the consumer surplus per trip is RM5.80. Jamal and Redzuan (1997) used the individual travel cost method to estimate the annual net benefit for Kuala Selangor fireflies recreational activities. The net benefit is RM225.00 per trip or RM2.2 million per year. Norlida (2000) adopted the zonal travel cost method to estimate the economic benefit of forest recreational resources at Taman Negara. The net economic benefit per trip is estimated at RM120.00. Based on the total number of visitors to Taman Negara National Park in 1995, the total net benefits from recreational service flows are estimated at RM2.6 million.

The objectives of this study were to estimate the demand function for the recreational resources at the MAP, to assess the economic value of the environmental services provided to visitors at the park, and to recommend strategic consideration on increasing visitation while conserving the environmental resources at the park.

Materials and methods
Source of data
Primary survey was conducted at the MAP in April 2003. The sampling unit was visitors going to the park. A total of 100 visitors were involved in the survey. Structured questionnaire was used in this cross-sectional study. The questionnaire was divided into two sections; first section was the socio-economic background of the respondents, and the second part was the travel related time and expenses incurred for the visit. Data were collected through personal interview.

Theoretical framework

There are a few methods of measuring non-market environmental goods and services. The travel cost method (TCM) is one of the non-market valuation techniques. The TCM is popularly used in outdoor recreation modelling such as fishing, hunting, boating and forest visits.

The TCM seeks to place a value on non-market environmental goods and services by using consumption behaviour in related markets. The costs of consuming the environmental assets and services are used as a proxy for price. These consumption costs include travel cost, entry fees, on-site expenditure and outlay on capital equipment necessary for consumption. The method assumes weak complementary between the environmental assets and consumption expenditure. An implicit assumption made in most travel cost studies is that the representative visitor's utility function is separable in the recreation activity being modelled.

Model specification

Travel cost (TC) for a given site 'j' was specified as:

$$TC_{ij} = f(DisC_{ij}, TimC_{ij}, PetC_{ij}, TolC_{ij}, FeeC_{ij}, FodC_{ij}, LogC_{ij}, OthC_{ij}) ….. \text{ Eqn. 1}$$

$$i = 1……..n \text{ and } j = 1……….m,$$

Where,

TC_{ij} = travel cost for each individual i to site j;

$DisC_{ij}$ = distance cost for each individual i to site j;

$TimC_{ij}$ = time cost which depend on how long it takes to get to the site and the value of individual's time;

$PetC_{ij}$ = petrol cost/transport cost for each individual i to site j;

$TolC_{ij}$ = toll cost for each individual i to site j;

$FeeC_{ij}$ = entrance fee cost for each individual i to site j;

$FodC_{ij}$ = food cost for each individual i to site j;

$LogC_{ij}$ = lodging cost for each individual i to site j; and

$OthC_{ij}$ = other costs incurred by individual i to site j.

Travel cost (TC_{ij}) was included in a trip generating function (TGF), which predicts how many visits (V_{ij}) would be undertaken by any individual i to site j. The socio-economic variables of each individual visitor such as income, age and number of family members were also included in the TGF.

$$V_{ij} = f(TC_{ij}, Inc_{ij}, Age_{ij}, Famil_{ij})…..\text{Eqn. 2}$$

Where,

V_{ij} = number of visits for each individual i to site j;

TC_{ij} = travel cost for each individual i to site j;

Inc_{ij} = income level for each individual i to site j;

Age_{ij} = age level for each individual i to site j;

$Famil_{ij}$ = number of family members of individual i to site j.

Both equation (1) and equation (2) were estimated using the ordinary least square (OLS) procedures. A demand relationship was estimated by simulating what would happen to number of visits, as the travel cost increased. The travel cost was driven until visits went to zero or to less than one. The TGF was used to trace out the demand curve, which showed that visits would be made to the site as long as the cost of the visit stayed below the choke price (P*). The essential assumption behind the demand curve was that as the travel cost increased, the number of visits fell. Measuring the area under the demand curve gave an estimate of consumer's net benefit per visit.

Results

Socio-economic profile of visitors

The number of visitors involved in the survey was 100. The socio-economic profiles of the respondents were presented in

Appendix I. More than 80% of the respondents were male and the rest were female. About 80% of the visitors were Malays and the rest were Chinese (16%) and other races (4%).

In terms of education, majority of the visitors were highly educated; holding degrees and diplomas (51%). The rest were having secondary (41%) and primary (7%) level of education. Majority of the respondents were working with private sectors (52%). The rests were working with government organization (17%), as businessmen (10%) and others (21%).

Majority of the visitors to the park were the younger generation aged 40 and below (77%) and 41–50 years (18%). About 66% of the visitors were single, and the rest were married. Irrespective of single or married, majority of the respondents (44%) were having medium family of 4–7 members and 42% were having small family of 1–3 members and the rests were having large family of more than 8 members.

In this survey, majority of the visitors were having relatively lower monthly income of RM2000 or less (43%). The rest were the middle income group with monthly salary of RM2001 to RM4000 (32%) and higher income group with monthly salary of more than RM4000 (25%).

Majority of the visitors came either with their families (63%) or with their friends (35%). They came by own transport (83%), public transport (11%) or other means of transportation (6%).

Majority of the visitors and their family members (96%) were not members of any environmental awareness organization. This indicates the environmental awareness among the visitors were low. However, majority of the respondents (86%) indicated that the main aim of their trip was to visit the MAP recreational site.

The respondents were questioned on the total visits they made during the year 2002 and the total expected visits they were going to make in year 2003. More than half of the respondents (54%) did not visit the TPM Park in 2002. For those who have visited the park in 2002, majority of them (54%) visited 1-2 times and the rest visited more than two times. For the year 2003, majority of the respondents would visit the park only once (62%) and the rest intend to visit more than once.

Distance and distance cost to the MAP

The visitors travelled as close as less than a kilometer to as far as 500 km to the park. Majority of the respondents (55%) were living within 20 km from the recreational site. They came mainly from the Klang Valley area. About 39% were from Selangor and 25% from Wilayah Persekutuan. The rest were from other states in the Peninsula. The distribution of visitors by their travel distance is presented in *Table 1*.

The distance cost was calculated based on transportation allowance provided by the government according to class of transports and category of monthly salary. Majority of the respondents (57%) incurred RM10 or less on distance cost, and small percentage (7%) incurred more than RM100 for the distance cost *(Table 2)*.

Time taken and time cost for a one-way trip to the MAP

The respondents were also questioned on the time taken for travelling from their home to the site. Majority of the respondents (66%) spent 30 minutes or less to travel to the site, 21% took 31–60 minutes and 13% took more than an hour *(Table 3)*. As a scarce commodity, time clearly has an implicit price. In this study, the opportunity cost for time was estimated using the wage rate per hour. The monthly wage rate was converted into hourly rate multiplied by the amount of time the visitors spent on travelling to the site. The estimated time cost for the visitors is presented in *Table 4*. Majority of the respondents (63%) incurred RM5 or less for their travel time.

Table 1. Distance of the visitors' residence to the MAP (n =100)

Distance (km)	%
≤5	16
6–10	18
11–20	21
21–30	14
31–40	11
41–80	10
>100	10
Total	100

Table 2. Distance cost from the visitors' residence to the MAP (n = 100)

Distance cost (RM)	%
≤1	5
1–5	33
6–10	19
11–20	21
21–50	13
51–100	2
>100	7
Total	100

Table 3. One-way travel time to the MAP (n = 100)

Travel time (minutes)	%
1–15	28
16–30	38
31–60	21
>60	13
Total	100

Table 4. One-way time cost for visitors to the MAP (n = 100)

Time cost (RM)	%
≤1	13
1–5	50
6–10	20
11–20	8
>20	9
Total	100

Table 5. Distribution of respondents by distance to substitute sites (n = 100)

Distance (km)	%
0	11
1–10	20
11–20	19
21–50	17
51–100	15
>100	18
Total	100

Table 6. Distribution of respondents by distance cost to substitute sites (n = 100)

Distance cost (RM)	%
0	11
>0–5	28
6–20	25
21–50	19
50–100	7
>100	10
Total	100

Table 7. Distribution of respondents by travel cost (n = 100)

Travel cost (RM)	%
<30	23
30–50	23
51–70	19
71–100	17
>100	18
Total	100

Substitute sites
The respondents were asked on the substitute sites and the distance from their homes to the substitute site that they preferred in case they did not go to the MAP. The substitute sites may have influenced the visitation rate to the MAP. The substitute sites are listed in *Appendix 2*. The distribution of respondents by the substitute site distances and estimated costs are presented in *Tables 5–6* respectively.

Other expenditure
The respondents were asked on the amount of money they spent for the trip to the MAP site. The expenses included the cost for fuel, bus or taxi fair, toll, food, tickets, lodging and other relevant costs associated with the

visits. The summary statistics on the expenses incurred by the visitors on their trips to the MAP is presented in *Appendix 3*.

Travel cost

The travel cost for each individual respondent was calculated by taking into account all costs relevant to the trips, which included distance cost, time cost and other expenditure related to the trips. The individual travel cost ranged from a low of RM11.95 to a high of RM1209.00. Majority of the respondents (56%) spent less than RM60.00 each for their travel related costs *(Table 7)*.

Trip generating function (TGF)

A TGF shows the relationship between the number of visits and the travel cost and socio-economic variables; income, age and number of family members. In this study two separate TGFs' were estimated using the OLS procedure. The dependent variable was the number of visits and the independent variables were the travel cost, income, age and number of family members. The first TGF was estimated for the year 2002 visits, and the second TGF was estimated for the year 2003 visits. During the interview the respondents were asked on the visits that they made in the year 2002 and the expected visits that they were going to make in the year 2003. More than half of the

respondents (54%) did not visit the park in 2002. The parameter estimates for the TGF (2002) and TGF (2003) are presented in *Table 8*.

Trip generating function (2002 and 2003) For the TGF (2002) and TGF (2003), the travel cost variable showed the expected negative sign indicating that as the travel cost increases, the number of visits tends to decrease. Except for variable income, the other independent variables (age and number of family members) were significant in influencing the visitation rate to the MAP. The R^2 was relatively low (0.1398) in 2002 and was relatively higher (0.1738) in 2003. This can be explained by the lack of variation in the dependent variable.

In TGF 2002, most visitors went to the park once. The average number of visits in 2002 was 2.58 and the average travel cost was RM99.85 per trip. The travel cost and visit relationship at the mean value of income, age and number of family members is represented as:

$$V^{02} = 2.9356 - TC^{02} \quad \text{..... Eqn. 3}$$

The choke price was estimated at RM293.00.

In TGF (2003), most visitors went to the park once or twice. The average number

Table 8. Parameter estimates of trip generating function (TGF) for 2002 and 2003

Variables	TGF 2002			TGF 2003		
	Coefficient	t-value	Probability	Coefficient	t-value	Probability
Intercept	−4.3980	−1.804	0.074	−4.9812	−2.042	0.044
Travel cost	−0.010	−2.277	0.025	−0.0099	−2.247	0.027
Income	0.098	0.2125	0.832	0.2238	0.4829	0.630
Age	0.1510	1.907	0.060	0.1682	2.122	0.036
Family	0.6028	2.209	0.030	0.7118	2.605	0.011
R^2	0.1398			0.1738		
Adjusted R^2	0.1036			0.1390		
N	100			100		
Mean no. of visits	2.58			3.47		
Choke price	RM293			RM450		
Net benefit	RM129			RM175		
Economic benefit	RM16 million			RM22 million		

of visits in 2003 was 3.47 and the average travel cost was RM99.85 per trip. The travel cost and visit relationship at the mean value of income, age and number of family members is represented as:

$$V^{03} = 4.4595 - 0.0099TC^{03} ….. \text{Eqn. 4}$$

The choke price was estimated at RM450.00.

As long as the travel cost stay below the choke price, visitors were expected to visit the park. However, if the travel cost went up above the choke price, visitors might not go to the park, as the utility derived would not compensate the costs incurred. Using the Gum-Martin approach, the net benefit derived by visitors was estimated at RM129.00 per visit for TGF (2002) and RM175.00 per visit for TGF (2003). The total annual net economic benefit that the park provided to society in the year 2002 was about RM16 million and in the year 2003 was about RM22 million.

Discussion

Majority of the visitors have been to the MAP once or twice. Unless the park management provides more participative activities, the tendency for the visitors to go there frequently will be low. There are other substitute recreational sites in the country. The park management should carry out market study to determine the participative activities preferred by the visitors. Besides providing broad recreational services, it can concentrate on offering a few participative services that can generate income to the park such as fishing, hunting and tracking. The private sectors should consider this on a joint venture with the park.

This study has indicated the current on-site use value associated with the recreational services provided by the MAP, represents only a small fraction of the total array of economic values of the environmental services that the park provides to the society. However, the overall net benefit was reasonably high, at an average of RM152.00 per visit per year. Currently the access price is RM3.00 per person. Given the knowledge of the ecological carrying capacity of the MAP combined with the information that can be gathered from the demand curve, an optimal access fee can be established. Optimal entrance fee would help regulate visitation rates to the MAP on economic grounds.

The total annual net economic benefit that the park provides to the society was about RM19 million per year. This figure is significant in the sense that for the purpose of evaluating the park site, the economic benefit of environmental resources should be included in the accounting. It has not been a normal practice to include the economic value of the environmental resources service flow in property valuation. The consequences will be under valued resources.

Acknowledgement

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Appendix 1. Selected profiles of respondents (n = 100)

Gender :
  Male   81%
  Female   19%
Race:
  Malay   80%
  Chinese   16%
  Indian   0%
  Others   4%
Education:
  Primary school   7%
  Secondary school   41%
  Diploma/Degree   51%
  Others   1%
Occupation:
  Government   17%
  Private sector   52%
  Businessman   10%
  Others   21%
Age:
  19–20   32%
  26–40   45%
  41–50   18%
  51–63   5%
Marital status:
  Married   34%
  Single   66%
Number of family members:
  1–3   42%
  4–7   44%
  8–12   14%
Income (RM):
  <500   2%
  501–1000   13%
  1001–2000   28%
  2001–3000   22%
  3001–4000   10%
  4001–5000   11%
  >5000   14%

Companion:
  Alone   2%
  Family   63%
  Friend   35%
Transport mode:
  Personal   83%
  Public   11%
  Others   6%
Status of membership in environmental
awareness organization:
  Member   4%
  Non member   96%
Aim of trips:
  To visit the site   86%
  Other purpose   14%

Number of trips:

	Visitors (2002)	Visitors (2003)
0	54	0
1	13	62
2	12	10
3	5	9
4	3	5
>4	13	14

Appendix 2. Substitute sites

Location	Number of respondents
1. Taman Tasik Shah Alam, Selangor	14
2. No response	8
3. National Zoo, Kuala Lumpur	7
4. Cameron Highlands	7
5. Lake Garden, Kuala Lumpur	7
6. Port Dickson, Negeri Sembilan	6
7. KLCC, Kuala Lumpur	4
8. Taman Tasik Perdana, Kuala Lumpur	4
9. Ulu Yam, Selangor	4
10. Taman Rekreasi, Kuala Lumpur	4
11. Taman Tasik Titi Wangsa, Kuala Lumpur	3
12. Air Terjun, Kuala Lumpur	3
13. Genting Highlands, Pahang	3
14. Air Keroh, Melaka	2
15. Pantai Morib, Selangor	2
16. Tasik Kundang, Selangor	2
17. Templer Park, Selangor	1
18. Taman Orkid, Kuala Lumpur	1
19. Fishing areas	1
20. Pusat Sains, Kuala Lumpur	1
21. Shopping complexes	1
22. Melaka	1
23. Sunway Lagoon, Selangor	1
24. Taman Rakyat	1
25. Pulau Tioman, Pahang	1
26. Sungai Congkak, Selangor	1
27. Langkawi, Kedah	1
28. Bukit Bendera, Pulau Pinang	1
29. Pantai Bachok, Kelantan	1
30. Taiwan	1
31. Botanical Garden, Kuala Lumpur	1
32. National Park, Pahang	1
33. Putrajaya,	1
34. Pulau Pangkor, Perak	1
35. Ulu Bendol, Selangor	1
36. Merdeka Square, Kuala Lumpur	1

Appendix 3. Summary statistics on the expenses incurred for a one-way trip to the Malaysian Agriculture Park

	Mean (RM)	Minimum (RM)	Maximum (RM)
Transport fair	1.73	0	30
Petrol	16.83	0	250
Toll	8.11	0	200
Food	23.18	0	300
Tickets	9.52	0	45
Hotel	0	0	100
Distance cost	25.29	0.2	300
Time cost	8.47	0.22	78.12
Travel cost	99.85	11.95	1 209.1

Appendix 4. Statistics on visitors going to the Malaysia Agriculture Park 1989–2000

	Visitors	Stay in/family day/camping	Total
1989	30 975	2 424	33 399
1990	101 520	17 221	118 741
1991	331 069	28 894	359 963
1992	511 547	35 028	546 575
1993	398 693	31 169	429 862
1994	271 453	35 945	307 398
1995	278 197	40 842	319 039
1996	251 238	37 358	288 596
1997	195 296	26 930	222 226
1998	160 070	21 582	181 652
1999	150 865	0	150 865
2000	126 263	0	126 263
Total	2 680 923	277 393	2 958 316

Source: Personal communication with the Malaysia Agriculture Park management