

IMPACTS OF NEW DEVELOPMENT PROJECTS ON PROPERTIES: MEASUREMENT AND INFLUENCE TO ENVIRONMENTAL IMPACT ASSESSMENT

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Abstract

Rapid development in Malaysia has not only led to the launching of new real estate projects but also new infrastructures and services to support the growing settlements and population. Owing to limited strategic open areas, the enactment of some of these new development projects, roads, drainage facilities and solid waste landfills unfortunately are sited quite close to housing areas. Not all new projects, infrastructural and service projects have to conduct a detailed environmental impact assessment (DEIA). Where such projects fall under the "prescribed activities", a DEIA has to be done. Apart from assessing the physical impacts, a DEIA has mandated that an economic valuation of the environmental impacts has to be studied and presented to the DEIA panel at the Department of the Environment, Putrajaya for deliberation. Here lies the opportunity for the impacts upon property values including that of other externalities be discussed.

Proposed development projects and of infrastructural and service activities have impacts upon the public living surrounding these projects. These impacts may take many forms ranging from health, safety, livelihood, environmental resource loss and pollutions and also on changes to property values. Awareness on the outcome of the environmental impact assessment for such projects are being made known by the Department of the Environment, although this could be improved especially for those living within the vicinity of these new proposed developments. Economists have established a framework and empirical methodologies to place values to environmental and socio-economic impacts and a discussion on these will be provided.

Keywords: *impacts, environmental impact assessment, economic valuation*

Introduction

Rapid development in Malaysia has led to the launching of new real estate projects, infrastructures and services to support the growing settlements and population. Owing to limited strategic open areas, the establishment of many new development projects, roads, drainage facilities and solid waste landfills unfortunately are sited quite close to housing areas. When these projects falls under the "prescribed activities" a detailed environmental impact assessment (DEIA) has to be done. Apart from assessing the physical impacts, a DEIA has mandated that an economic valuation of the environmental impacts has to be studied and presented to the DEIA panel at the Department of the Environment, Putrajaya for deliberation. This mandate has open an opportunity for economists to investigate the value of the environmental impacts.

EIA is essentially a planning tool for preventing environmental problems due to an action. It seeks to avoid costly mistakes in project implementation, either because of the environmental damages that are likely to arise during project implementation, or because of modifications that may be required subsequently in order to make the action environmentally acceptable. In Malaysia, EIA is required under section 34A, Environmental Quality Act, 1974.

The aim of the environmental impact assessment is to assess the overall impact on the environment of development projects proposed by the public and private sectors. The EIA procedure adopted in Malaysia consists of three major steps. The steps in the EIA procedure are as follows:

1. Preliminary environmental impact assessment (PEIA) of all prescribed activities;
2. Detailed environmental impact assessment (DEIA) of those prescribed activities for which significant residual environmental impacts have been predicted in the preliminary assessment;
3. Review of assessment reports;

To assist in the preparation of environmental impact assessment reports, the Department of the Environment (DOE) has provided for reference "A Handbook of Environmental Impact Assessment Guidelines" and EIA guidelines for specific activities.

A PEIA for prescribed activities are normally initiated during the early stages of project planning and it involves

- to examine and select the best from the project options available.
- to identify and incorporate into the project plan appropriate abatement and mitigating measures.
- to identify significant residual environmental impacts

The PEIA should follow certain Standard Procedural Steps provided by the DOE and the assessment might be conducted "in house", or by a consultant. Some form of public participation is mandatory. Environmental data collection may be necessary and close liaison between the assessor and relevant environment related agencies is encouraged. The results of the PEIA are reported formally for examination and approval by the project approving authority and the Director General of Environmental Quality. PEIA requires resources that are a small proportion of the man-hours, money, skills and equipment committed to a pre-feasibility study.

The second form of an EIA report - DEIA is mandatory for those prescribed activities for which significant residual environmental

impacts have been predicted in the preliminary assessment; The objectives of DEIA for prescribed activities with potentially significant residual environmental impact include

- to describe the significant residual environmental impacts predicted from the final project plan;
- to specify mitigating and abatement measures in the final project plan; and
- to identify the environmental costs and benefits of the project to the community.

It is in this last objective, that environmental economist have a significant role to play. The specific knowledge base required is economic valuation.

DEIA should continue during project planning until the project plan is finalised. Standard procedural steps are provided and specific terms of reference based on the results of the PEIA are issued for each project. The Assessment might be conducted "in house" or by EIA consultants registered with the Department of the Environment (DOE). The assessment method is selected according to the nature of the project; some form of public participation is required. Environmental data collection is almost certainly necessary. The results of the DEIA is **reported formally**.

The EIA Review Process for the DEIA include:

- to critically review the Detailed Assessment reports;
- to evaluate development and environmental costs and benefits of the final project plan; and
- to formulate recommendations and guidelines to the project approving authority relevant to the implementation of the project.

Review of EIA Reports is carried out internally by the DOE with the assistance from the relevant technical agencies for PEIA reports and by an ad hoc Review Panel for DEAI reports. Recommendations arising out of the review are transmitted to the relevant project approving authorities for consideration in making a decision on the project. The DOE maintains a list of experts who may be called upon to sit as members of any Review Panel established. The selection of the experts depends on the areas of environmental impacts to be reviewed.

Application of Economic Valuation on Significant Impacts of a Prescribed Activity

The purpose when undertaking the economic valuation of environmental impacts is to assess in monetary terms changes in the flow of goods and services provided by the environment. In line with the objective of the DEIA process, an economic valuation is required to

- i. identify and quantify the environmental impacts of the project and
- ii. to make an economic assessment of these impacts into environmental costs and benefits.

In scoping for the environmental impacts, the 'with' and 'without' project scenarios are adopted. Adequate considerations have to be taken with regard to identifying

- i. potentially significant environmental impacts,
- ii. the area over which these impacts are identified,
- iii. a clear discussion of the different stakeholders who may be affected by the environmental impacts of the project, and
- iv. the time horizon over which these impacts would occur.

For each of these environmental impacts, appropriate economic valuation methods are selected. These impacts that are valued are then aggregated into a total economic valuation framework to indicate the extent of their monetary value. This total economic valuation would then serve as an additional information input into the overall environmental impact assessment process.

To illustrate how an economic valuation of environmental impacts of a project is undertaken a hypothetical case study involving the establishment of a sanitary landfill is provided. For the purpose of anonymity, the hypothetical project site is not disclosed. The purpose of this exercise is to merely illustrate how an economic valuation of potential environmental impacts could be undertaken. To be more consistent with the DOE's Guidelines on Economic Valuation of Environmental Impacts for EIA Projects, a matrix is provided in Table 1 linking the physical impacts of the proposed project to affected stakeholders.

Valuing the Environmental Impacts Loss of land and water ponds used in various economic activities located at the Project site.

- i. Pond angling
Water ponds are popular angling site to local angling enthusiasts. This site is operated by a private venture for more than 10 years. It has attracted average visits of about 10 anglers per working day and 45 anglers per day during the weekends. The water ponds operate daily from the morning until late nights into the morning hours especially during the weekends depending on the presence of clients. The pond is slightly less than an acre with fish stocks claimed at around 10,000kg comprising of various fisheries including Patin, Pacu, Luhu, Keli and Tilapia. The pond is daily restocked from angling catches by the anglers that are resold back to the pond operators at an average price of RM2/kg. The pond is also restocked regularly every 2 – 4 weeks with fish fries.

Table 1: Physical Environmental Impacts of the Project to Affected Stakeholders.

No.	Stakeholders	Physical Impacts of Project	Suggested Economic Valuation Methods
1.	Local communities establishing economic activities on land and in ponds at the project site	Loss of land and water ponds used in various economic activities located at the Project site.	Market prices – capitalised value of future streams of net returns from i. crop cultivations, and ii. Pond angling services
2.	Local communities living in the vicinity of the project and nearby township	Exposure to pollution from domestic waste transported and dumped at project site especially odour	Contingent valuation method of valuing the negative impacts from odour
3.	Angling enthusiasts frequenting water ponds	Potential decline in quality of recreational benefits owing to noise from frequent transporting of domestic wastes to the Project and odour from blowing wind	Travel cost method to valuing a decline in angling fishing trips

The pond is operated by a clerk and an assistant, as well as a cook in a small canteen facility provided. The canteen sells drinks and snacks to the anglers. There is an angling fee charged according to the following rates:

Duration	Fee
3 hours	RM25
1 hour	RM12
½ hour	RM4

Electricity is available by operating a turbine and water is taken from the small river prying through the forest upstream. Water is also sourced from this river to irrigate the pond which would assure that the pond is regularly filled with fresh and clean water.

A cost and earning structure of the angling pool is provided below (Table 2). With an estimated monthly gross income of RM14,504 and a operating cost of RM8,256.67, a monthly net return of RM6,247.33 is obtained. This cash flow stream is estimated to provide an annual net income of RM74,968.

The information above is useful in determining the foregone property value of the pond if the water pond is utilised as part of the project site. There will be a loss in economic value of the streams of incomes from the angling business. The pond could be considered as a capital that is generating a series of income that are capitalized into the (asset) value of the natural pond. The pond is similar to agricultural and forest land where their value is based on the land expectation value (Klemperer 1996) that could be computed based on the net present value (NPV) of future streams of income emanating from the asset.

Hence the NPV of the investment onto the water pond and its annual cash flow streams into the future could be used as a basis to compute the value of the pond and land property. Using a discount rate of 5%, it is possible to obtain the value of the water pond estimated to be RM1.5 million. The conversion of the water pond for use as part of the sanitary landfill project would incur this estimated economic loss.

Table 2: Cost and earning structure of the angling pool

Revenue	RM/month
Fishing fees	13,776.00
Canteen sales	728.00
Total	14,504.00
Costs	RM/month
Bimonthly Winning angling gifts	1,500.00
Workers salary	4,160.00
Restocking fish fry	600.00
Repurchasing of fish caught	1,096.67
Other overheads	900.00
Total	8,256.67
Monthly Net Revenue	6,247.33
Annual Net Revenue	74,968.00
Net Present Value*	1,499,360.00

* computed using a discount rate of 5%

ii. Crop cultivations

There is no official records of the number and size of agricultural farms at the potential project site. Various crops are being planted including bananas, corn, water melon, oil palm and lime. Farms located within the potential project site would have to be closed and the production of farm produces would be loss. It is the objective of this investigation to estimate the value of the loss in environmental resources.

From interviews of twenty farmers and workers, both located in and outside of the project site, it was possible to estimate the cost and earning structure of several farms in the project area. Bananas and yams have longer production period of between 8 to 9 months and are anticipated to be planted with a one year production cycle. For corn and water melons

that have shorter production periods are expected to be rotated with other short term crops. Water melons are planted twice a year as it requires a dry season during harvesting and have to be rotated with other crops. These crops cost and earning breakdowns are provided in Table 3.

Using the above cost and earning information, net present values of the utilisation of land for these crops are provided in Table 4. These NPVs could be used as a means of estimating the loss in economic values when these farm lands are closed to give way to the project. The range of losses could range from as low as RM60,000 per ha to as high as RM450,000 per ha. If the project is to close down 50 to 100 ha of cultivable land, then the economic value loss could be large ranging from RM10.4 million to RM20.8 million.

Table 3: Cost and earning structures of several crops planted on land at the project site

	Banana¹	Corn²	Water melon³	Yam⁴
Revenue	12,350	8,645	11,733	17,290
Cost	-	-	-	-
Seedling/sucker	2,470	494	235	1,235
Insecticide	247	301	161	247
Fertilizer	247	494	741	1,235
Salaries	4,940	3,952	865	11,115
Depreciation of machinery & water pumps	192	206	72	463
Total cost	8,096	5,447	2,073	14,295
Net Revenue	4,254	3,198	9,660	2,995

¹ production period of bananas is 8 months

² production period for corn is 4 months

³ production period for water melon takes 2 months

⁴ production period of yam is 9 months

Table 4: NPVs from alternative agricultural land use

Land uses	NPVs (RM) ¹	NPV (50 ha) distributed evenly	NPV (100 ha) distributed evenly
Banana only	85,078	850,778	1,701,556
Yam only	59,898	598,975	1,197,950
2 seasons of water melon with corn in between	450,347	4,503,469	9,006,937
2 seasons of corn with water melon in between	321,108	3,211,082	6,422,165
Yam with corn	123,854	1,238,540	2,477,081
Total		10,402,844	20,805,688

¹ discounted at 5% level

iii. Aquaculture

There is no official records of the number and size of fish farming ponds at the potential project site. According to a local pond operator there might be around 20 to 30 ponds in the project site. Ponds located within the project site would have to be closed and the production of fish from the area would be loss. It is the objective of this investigation to estimate the value of the loss in environmental resources.

From interviews of ten fish pond workers, it was possible to estimate the cost and earning structure of fish farming ponds in the project area. Using a 1 ha pond as illustration, fish farming would involve 8 months of production process followed by a four months harvesting season. A 1 ha pond could produce about 5 m.t. of fish per month yielding a sales value of about RM24,000 for a year (Table 5). The total cost of production would take up RM56,100 with the bulk of it coming from the costs of fish fries, salaries of two workers and feedstuffs (Table 6). Over the long run, the fish farming would provide a NPV of RM467,125 (Table 7).

When such ponds are closed. A project impact on a 1 ha pond would generate a permanent loss of the above amount (-RM467,125). If 25 of such ponds are affected, the economic value loss would escalate to as high as - RM11.7 million.

Exposure to pollution from domestic waste transported and dumped at project site especially odour and health

The local community is likely to be affected by the proposed Project. A major concern among households living in the vicinity of the project, is the concern of being forced to experience odour pollution from domestic waste transported using the roads close to their homes and work place, and wastes dumped at project site that would provide odour pollution depending on the directions of wind flows. These perceived fears could be unfounded and would be mitigated by the authorities. But the perceptions linger until the project could prove their worries are unnecessary. A contingent valuation survey was undertaken with the objective to determine the economic value of the above perceived environmental impacts of the proposed project to the community. This survey was carried out using a questionnaire. The survey involved 100

household heads of villages and housing projects.

The respondents were briefed on the concept and planned implementation of the sanitary landfill. They were probed about their opinions and perceived impacts of the project. Then they were asked to imagine the situation where a sanitary landfill will be constructed and implemented at the potential land site. They are aware that this area have long been used by settlement, including possibly themselves to rear fish, cultivate crops and rear cattle. The sanitary landfill will not be seen by settlements including themselves, as it is located in

the pond land area 2.5 to 5 km away from their homes. But for housing owners will experience a rise in traffic of lorries carrying domestic waste which possibly bring about odour, risk of traffic accidents, noise among others. Before and without this project, this problem does not arise.

Then the respondents were asked how much taxes on their land/home are they now paying?

As a result of this project, their welfare are affected and most likely to reduce. They were then ask: How much reduction in the above taxes on their land/home per year do they feel they should receive to

Table 5: Sales value of fish harvests in a 1 ha pond

Species	Weight (mt/month) ¹	Value (RM/year) ²
Tilapia	3	15000
Lohu	2	9000
Total	5	24000

¹ computed based on fish production of Grades A, B and C with proportions of 3:5:2.

² computed using prices ranges from RM.2 to 7.5 per kg for Tilapia and ranges from RM2 to 7 per kg for Lohu

Table 6: Costs of fish farming in a 1 ha pond

Cost items	Quantity	Costs (RM/year)
Frys	100,000/year	30,000
Salary (workers)	2	24,000
Feedstuff eg restaurant rice bottles of 8.5 kg	17kg/month	11,952
Depreciation on nets, water pumps		300
Total		66,252

Table 7: NPV of fish farming in a 1 ha pond

Revenue	Cost	NPV ¹
96000	66,252	467,125

¹ computed using a discount rate of 5% over a long period (60 years)

compensate the loss of their welfare as a result of the rise in environmental impacts?

This information is then used to compute the Willingness To Accept compensation estimates that the community is willing to receive in lieu of their welfare loss cause by the Project.

The range of the taxes on their land/home that these respondents are currently paying range from RM50 to RM120 per year. With the potential loss cause by the environmental impacts, these respondents have a Willingness To Accept compensations in the form of reduced average taxes on their land/home of RM39.50 per year (Table 8). Using a discount rate of 5%, the net present value of the loss in economic value is RM791.01 per household. There is no record of the total number of households living in the vicinity of the project but using 1,000 households, it is estimated that a net present value loss of RM791,011 would occur. This is a measurement of the loss in economic value perceived by the affected households within 2.5 to 5 km of the project site.

Potential Impacts on Recreational Services: Angling Services

Within the 5km radius of the project area, there is an angling pond. As mentioned earlier, a closedown of the angling pond would incur a loss to the pond operator. On the demand side, consumers namely angling enthusiasts would also incur a loss of opportunity to fish recreationally. This loss in consumer surplus is computed.

An investigation was undertaken with the objective to determine:

- how important the fish pond is to the anglers and how much they value the trip to the pond?
- whether the recreational services are perceived to be affected by the proposed project and if so by how much?

The travel cost method (TCM) is the appropriate valuation procedure to use when estimating the value of outdoor recreation such as angling from the water pond. The TCM requires first fitting a trip generating function (TGF) that represents

Table 8: Loss of economic values from the perceived environmental impacts of the proposed project to households living in the vicinity of the project site

Willingness to accept compensation	Mean
Average household per year	RM39.50/year
Net present value per person ¹	RM791.01
Average willingness to pay value ²	RM791,011

Note:

¹ using a discount rate of 5%

² working on 1,000 households living within 2.5 – 5 km from project site.

the demand for the angling activity. The economic value is obtained by calculating the consumers surplus which is the area below the demand curve but above the travel cost of the anglers.

A survey of 100 anglers was undertaken at the pond. A common functional form for a TGF to estimate is the semi-logarithm form that has the advantage of obtaining the consumer surplus for a visit directly. The estimated TGF is provided in Table 9 that gives the following function:

$$\text{Ln Visit} = -0.6138 - 0.0184\text{Travel Cost} - 0.00034\text{Income} + 0.0188\text{Education} + 0.0956\text{Age}$$

The function is overall relatively well-fitted with an F statistic statistically significant at the 1% level and a coefficient of multiple determination (R2) of 44.1%. The age coefficient is statistically significant at 1% while the coefficients for travel cost and income are statistically significant at the 10% level. The negative coefficient for income is interesting suggesting that pond angling is mainly a recreation activity engaged by relatively lower income anglers.

From the TGF function the average consumer surplus per visitor is estimated by the following formula (Hanemann):

$$\begin{aligned} \text{Consumer Surplus} &= -1 / \text{coefficient of Travel Cost} \\ &= 1 / 0.01835 \\ &= \text{RM}54.50 \end{aligned}$$

The economic values gain by anglers for the fishing trip to the water pond is estimated to worth RM54.50 per person. In 2011 for the first 6 months, an angler made on average of 14.5 trips. Hence, the average economic value per visit is RM3.69.

The second component of the investigation is to estimate how much losses in recreational services would anglers suffer from the proposed project. From the survey of the anglers, it was found that 'with the project' they perceived a reduction of 21.9% in recreational satisfaction arising among others from the sewage odour and air quality. This allows a computation of the reduction of economic value 'with the project' to RM2.88 per fishing visit or a decline of economic value of RM0.81 per fishing visit (Table 10). Using this information and an annual visitation of

Table 9: Trip generation function for angling at The angling pond

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	-0.06138	1.385597	-0.0443	0.965087
Travel cost ¹	-0.01835*	0.010767	-1.70392	0.103149
Income	-0.00034*	0.000172	-1.94674	0.065066
Education (years schooling)	0.018757	0.098806	0.189838	0.851259
Age	0.095596***	0.028755	3.324438	0.003221

¹ travel cost inclusive of angling fee

***, * statistically significant at 1% and 10% levels respectively

R2 = 44.1%

F statistic = 4.14 statistically significant at the 1% level

6,720 trips, it was estimated that the decline in economic value from angling activity 'with project' of RM5,413 would occur. If the pool is not closed in a situation where it is at the outskirts of the project, the net present value (NPV) loss is estimated at RM108,253 at 5% discount rate. If the pool has to be closed down, then the NPV loss is raised to RM495,352.

Total Economic Value of the Environmental Impacts

Total economic value can be used to illustrate the aggregated extent of environmental impacts of a project. It is an estimate of the total, rather than the incremental value of the environmental impacts of the project to society. This

Table 10: Economic value from a decline in angling activity at the pond (RM/year)

Impacts	NPV ¹ (RM)	NPV ² (RM)
Loss of angling pond	(108,253)	(495,352)
Loss of Land used for crop cultivation	(10,402,844)	(20,805,688)
Loss of Ponds used for fish farming	(11,678,133.66)	(11,678,133.66)
Welfare loss from exposure to odour and other environmental pollution	(791,011)	(791,011)
Loss of recreational fishing services from the pond	(108,253)	(495,352)
TEV	-23,088,495	-34,265,537

¹ Computed using (i) annual visitation rate of 6,720 and (ii) the assessed maximum WTP per visit 'without project' of RM12.11 and average decline in values from recreational ambient including from potential negative odour from the sanitation landfill activities of RM2.65 per visit.

² Using a discount rate of 5% a net present value loss of (i) is obtained if the pond is not used for the sanitation landfill project and angling activity could continue and (ii) loss of RM495,352 if the pond is closed and used for the sanitation landfill project.

Table 11: Total Economic Value of Major Environmental Impacts

	RM/visit	RM/year	NPV if pool is not closed (RM) ²	NPV if pool is closed (RM) ²
Economic value from angling activity 'with project'	2.88	19,355	387,099	-
Economic value from angling activity 'without project'	3.69	24,768	495,352	495,352
Economic value from a decline in satisfaction from angling activity 'with project' ¹	-0.81	(5,413)	(108,253)	(495,352)

¹ & ² refers to low and high estimates

method is not a formal decision-making tool like cost benefit analysis, however it is important in highlighting to the decision-maker the value of the different environmental impacts of the project and, therefore, the appropriate decisions to mitigate against these potential impacts.

The total economic value of the environmental impacts associated with the proposed project is given in Table 11. The future series of impacts that occur are aggregated and converted on net present value terms by discounting at 5% rate. The aggregated value formed the total economic values of the impacts of the Project. The low TEV estimate is a loss of RM23.9 million while a high estimate is RM35.1 million.

Conclusion

This paper highlights the need to conduct EIAs for “prescribed activities” according to the Environmental Quality Act, 1974. In the DEIA an additional step was introduced to value the potential impacts of a project to the environment. The valuation principles adopted is based on economic theory. This requirement provides a mandate for economists to exercise their expertise in a formal investigation. This provides an opportunity for economist specialising in economic valuation to practice. An illustration is provided on the valuation of potential impacts of a hypothetical sanitary land fill project whereby assessments are made of the potential loss to society. The size of these losses could provide inputs to DEIA panel of assessors of the trade offs that are involved with the approval of the project and the significance of the mitigation measures to be established.