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Informing natural resources policy making using participatory rapid economic valuation (PREV): the case of the Togean Islands, Indonesia

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Abstract

Policy makers in Southeast Asia rarely have complete information to guide their land-use and development decision-making. This paper presents participatory rapid economic valuation (PREV), a practical tool that: (1) provides decision-makers with enough information of adequate quality to guide land-use and development decisions; (2) helps ensure decisions reflect the best available research findings; (3) be widely applicable. In order to achieve these goals, PREV results must be credible to decision-makers, requiring that the methods, data and assumptions used be easily understood, transparent and perceived as reasonable. The economic valuation work should also be carried out in a participatory consensus-building fashion so that the knowledge of local stakeholders is fully utilized, and a wide range of decision-makers are aware of and agree with the findings. PREV must also be rapid enough to respond to real-world policy making time lines, easily carried out and inexpensive if it is to be widely used. These requirements largely restricted PREV valuation analyses to those using currently available data, which are generally market-based. While such an approach provides only a partial valuation (a minimum lower bound on the actual total economic value), in many cases a partial valuation may be sufficient to guide land-use and development decisions. In these cases, the social costs of only a few impacts may be greater than the private profits of the activity, enabling development decisions to be made using only current information. An analysis using currently available data is the first step in an iterative process. If the values based on currently available data are not sufficient, then additional data can be collected and further analyses carried out. Case study results are presented of a PREV carried out with local government officials making natural resource policy decisions for the Togean Islands in Sulawesi, Indonesia. The results showed that decision-makers were sufficiently satisfied with analyses based on currently available data to make certain decisions. A consensus was reached that local societal economic interests would be best served by prohibiting further logging and pursuing a multiple-use conservation strategy, both as a basis for tourism and to allow the continued use of marine and terrestrial biodiversity. However, the workshop participants recommended that an improved understanding of community livelihoods and incentives was required before firm decisions regarding zoning and managing the islands could be made.

Keywords: Economics; Valuation; Conservation; Policy; Decision-making; Indonesia

1. Introduction

Natural resource and land-use policy choices targeting a specific location or user group can cause environmental impacts that impose economic costs on other

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social groups and economic sectors. Policy choices therefore often involve making trade-offs between the benefits that can be generated in one place or by one social group with the costs that choice imposes on others. While policy makers sometimes acknowledge these trade-offs, they are rarely quantified and often ignored in decision-making.

Decision-makers are more familiar with financial analyses of development activities, which describe the private costs and benefits that accrue to investors or others directly involved in the development activity. Such analyses may supply decision-makers and stakeholders with misleading information because they fail to take into account the trade-offs between different economic activities and the full range of costs and benefits associated with the activity. Financial analyses do not include essential environmental and social factors that are not traded and have no market price (e.g. water supply, soil and biodiversity conservation). Financial analyses also often exclude the costs of impacts that occur "off-site" (e.g. downstream), even though these impacts may result in obvious market-based costs to other people.

Economic valuation seeks to include the full range of costs and benefits in the analysis and determine the net benefits to society, rather than one or two individuals or groups involved in a specific activity. Economic valuation quantifies the trade-offs between competing and interacting development options and resource uses to determine the true economic—rather than financial—performance of development activities. As such, policy choices made on the basis of economic valuations can more effectively contribute to economic growth and poverty eradication.

However, such economic valuations are rarely undertaken as part of natural resource policy-making in Southeast Asia. In part this is due to technical capacity constraints. Perhaps more importantly, the types of total economic valuations often described in scientific journals are difficult to do and require extensive understanding of environmental impacts and high-quality data (e.g. on productivity of agricultural systems and the import of different environmental services inputs). Such understanding and data are generally poor or not available, and cannot be generated quickly enough by researchers to respond to requests from policy makers facing immediate natural resource policy choices.

This paper contends that the inability to quickly generate economic valuations of high scientific quality is not a barrier to the widespread use of economic valuation to better informing natural resource policy making. Participatory rapid economic valuation (PREV), the approach described here, is a practical economic valuation approach. It is possible that it can provide decision-makers with sufficient information of adequate quality to inform natural resources policy choices and that it is suitable for widespread use across Southeast Asian countries.

2. The theory behind participatory rapid economic valuation

Policy makers must view the results of the valuation as credible if they are going to consider them in decision-making. For the figures to be credible, the valuation methods need to be simple and easily understood, use data perceived as accurate, and use assumptions perceived to be reasonable. For PREV to be used widely, it must also be rapid and responsive enough to make information available to decision-makers before decisions need to be taken. It must also be technically easy, so non-experts in governments and other organizations can do the work, and inexpensive.

These requirements mean that the valuation approach should use currently available data as much as possible to reduce the expense of data collection. The data currently available is generally market-based, and describes either the production use of natural resources (i.e. fish catching, farming, forest products harvesting) or non-production uses (i.e. tourist visitor numbers and expenditure). An advantage of this approach is that decision-makers are more familiar and comfortable with these data than the information collected by the survey-based methods required by contingent valuation and other more complex valuation techniques. The valuation methods required to use market-based data are also considerably simpler than the statistical analyses required by complex survey-based valuation techniques. This simplicity means they can be understood by decision-makers, can be done reasonably quickly, and can be more readily applied by a greater number of staff in government departments and other organizations.

Given the above points, it appears that a valuation approach using simple methods to analyze available market-based data may be most suitable. However, the major drawback of such an approach is that it can only capture part of the total economic costs of impacts on the environment. The approach cannot determine bequest or existence values, or can it determine values if market-based data do not exist. These values may be significant, therefore, the figures determined using such an approach represent a minimum lower bound on the actual total economic value.

However, in many cases a full economic valuation is not required. A partial economic valuation will result in one of three decisions: (1) do not go ahead with a project or policy choice; (2) do go ahead; or (3) seek further economic information. A decision not to go ahead will occur when the products or services based on natural habitats have a high market-based value, the impacts of the proposed development activity are high but its benefits are low. In these cases, the social costs of only a few impacts may be greater than the private profits of the activity. When the social costs are bigger than the private profits, the net benefits to society are negative and the development activity is economically unattractive. Hence, it is not necessary to try to determine the economic value of further environmental impacts because the project can already be rejected based on current information. The opposite will occur when the benefits of a project or policy choice are high and its impacts are low, or the social costs of any impacts are low.

In most cases, it will not be known in advance whether the market-based natural habitat values that can be determined using currently available data will be greater than the value of proposed development activities, or vice-versa. An analysis using currently available data is then the first step in an iterative process. If the results based on available data are not clear-cut, then additional data can be collected and further analyses carried out.

The degree of participation by local decision-makers and stakeholders has a bearing on the likelihood that a partial economic valuation will impact policy choice. Local decision-makers and stakeholders often have the best currently available up-to-date information on the costs and benefits of different activities. Seeking their active participation in the valuation means that the data and knowledge of local decision-makers and stakeholders can be fully utilized. A high level of participation also maximizes the involvement and feedback from partners and counterparts to develop and improve the resource valuation analyses and approach. A high degree of participation also raises awareness among all participants of the benefits of using economic valuation for natural resource policy-making and the range of policy questions which can be supported.

A high degree of participation in a transparent setting also ensures a wide range of stakeholders and policy makers are aware of the conclusions of the economic valuation, and hence which policy choice makes most sense. An economic valuation approach that meets the criteria described above can act as a common framework for evaluating policy choices that increases transparency in natural resource use decision-making, thereby encouraging rational decisions to be made.

3. Participatory rapid economic valuation method

The techniques used to value environmental impacts in a PREV are as simple as possible, all based on simple cost benefit analysis with impacts being valued using techniques based on market prices such as the *change-in-productivity approach* and the *loss-of-earnings approach* (Dixon and Sherman, 1990). In some cases, values estimated using these market price based approaches could be checked against estimates obtained using expenditure-based approaches such as the *replacement-cost approach* (Dixon and Sherman, 1990).

The PREV process consists of several steps. While these steps are appropriate for a wide range of situations, the people who should be involved will depend on the decision being analyzed by the PREV. The example given below is for a PREV analyzing a decision to be taken by government (the situation described in the Togean Islands case study presented below).

- *Step* 1: Socialize the PREV concept and the decision to be analyzed with the relevant policy makers. Discuss the possible benefits, environmental impacts and social consequences of the decision to be analyzed, and seek agreement on the impacts to be valued at the PREV, based on their relative scale

and ease of analysis. Discuss and agree on options for valuing each of the impacts. Extend a formal invitation to the policy makers and their technical staff to prepare data, information and analysis to present and discuss during the PREV.

- *Step* 2: After a suitable period of time arrange a follow-up meeting with the policy makers and their technical staff to reconfirm the decision and impacts to be valued during the PREV, and assess the available data and information, identify any data gaps which may be filled quickly, and clarify the information they will bring to the PREV.
- *Step* 3: (Optional): When larger scale or more complex policies or decisions are being analyzed by the PREV it may be worthwhile holding technical focus group meetings (TFGMs) prior to the PREV focused on correctly valuing a single sector or activity, and reaching consensus among the relevant local technical experts.
- *Step* 4: Bring together the policy makers and technical experts in a participatory setting that integrates government technical experts from different departments and sectors with other key stakeholders (e.g. community leaders or representatives and individuals from non-governmental organizations (NGOs), local universities and research institutes). Describe the decision and impacts to be analyzed, and seek approval of these issues from the participants.
- *Step* 5: Present an initial analysis of the data available to determine the costs and benefits of the proposed economic activity. Seek comments, suggested changes and then confirmation from all participants that each number (or range) and assumption used is correct. Flag any numbers where consensus cannot be reached. Develop low, medium and high value scenarios that account for uncertainty in or disagreement over input numbers or assumptions. Calculate low, medium and high value scenarios using the approaches described above. All participants should agree that the real value is higher than the low value scenario, and lower than the high value scenario. The medium value scenario should be viewed as closest to the real value. Repeat this step for each of the other sectors or social benefits that may be affected by approving the economic activity.
- *Step* 6: Describe the environmental impacts to be valued and make an initial presentation of the extent to which each impact reduces the value of the other sectors or social benefits already analyzed. In many cases likely environmental impacts will have to be based on information from research carried out at other similar sites, although some local anecdotal information may exist. Seek agreement on the scale of each of the impacts on the other sectors, developing low, medium and high impact scenarios to account for uncertainty in or disagreement among the information presented by participants.
- *Step* 7: Complete the PREV calculations. Start with the high value scenario for the proposed economic activity to be decided upon. Obtain an estimate of the net value by subtracting the impact values obtained using the low impact and low value scenarios. If the low, medium and high scenarios have been established using the guidance set out in Step 5, then this approach means that all participants should find a negative net value for the proposed economic activity to be credible. If, after subtracting a few of the costs incurred by the impacts, the net value of the proposed economic activity becomes negative, then that activity can be rejected. If the net benefits are large and positive the proposed economic activity can be approved. If the net benefits are small but positive, then further data collection and analysis may be required
- *Step* 8: Review PREV results and seek an agreed recommendation from the participants that is consistent with the findings.

4. The Togean Islands case study

The Togean Islands are in the Gulf of Tomini in Sulawesi, Indonesia. The Togeans include seven main islands and a number of smaller ones with a land area of approximately 700 km^2, around 60% of which is still covered with good quality forest (Surjadi and Supriatna, 1998). Marine habitats include seagrass beds, mangroves and atoll, fringing, barrier and patch reefs in relatively close proximity. These habitats support a large number of species, many of which are unique to Sulawesi or the Togeans. The islands were first suggested as a priority for protection in 1984 as some form of marine conservation and tourism protected area.

Conservation initiatives in the Togeans must take into account the high human population, and support economic development if they are to meet with long-term success. Approximately, 30,000 people live in the Togeans in 37 main villages. The Indonesian government classifies 29 of these villages as poor, with per capita incomes of less than Rp. 700,000 (∼US$ 90). The main economic activities are fishing and farming, both to meet local needs and for export to the Sulawesi mainland and beyond. Considerable differences exist in the economic activities undertaken by different villages, with some depending mainly on fishing while others depend almost totally on farming. These differences may be due to different ethnic make up and geographical location. Although there are fishers, farmers and traders within each village and most ethnic groups, the majority of the Bajau are fishers, the Togeanese are mainly farmers and others (Chinese, Posonese, Gorontalonese, Babongko and Buginese) are principally traders (Purnomo, 1992).

Hook-and-line is the major traditional fishing method, although net, trap, dynamite and cyanide fishing are also used. Cyanide is used in the live fish trade. Divers squirt high-value target fish with cyanide to stun them, making them easier to catch. The first live-fish trader arrived in the Togeans in 1991 but by 1998 there were over five permanent fish-camps where traders collect live fish for export, primarily to Hong Kong. The live fish trade is so prevalent because the price received for live fish is considerably greater than that for fresh fish (Rp. 35,000/kg versus Rp. 2000/kg, in 1998 prices) and there are more buyers.

The main smallholder agricultural export crops are cacao and copra. Communities carry out logging for domestic boat building and furniture and house construction purposes, and hunt forest animals as an important source of meat. There has been recent pressure from business and elements of the Indonesian government to introduce commercial estate crops (rubber and oil palm). An Indonesian company also operated a logging concession from the 1970s to 1995, exporting logs to sawmills and plywood mills in other parts of Indonesia. Other economic activities include commercial pearl farming and coral mining to provide construction material.

Tourism has been a major growth area for the Togean economy. In 1991 there were less than 100 tourists, mostly categorized as “explorers” or “back-packers” (Cochrane, 1992), but by 1995/1996 over 3500 tourists visited the islands. The number of tourist-beds jumped from 66 in 1995 to 150 in 1996 (A. Suhandi, pers. commun.). Higher spending dive tourists make up an increasing proportion of the total number, and the first US$ 100 per night dive resort opened in 1998.

While the environmental impacts of all these economic activities can be mitigated or reduced to some extent, certain of the activities are likely to have a significant impact on the environment despite these efforts. Such activities include commercial logging, oil palm and rubber estate crops, destructive fishing, and coral mining. The clearing and degradation of forests is likely to increase sedimentation on coral reefs and the sea, in turn reducing benefits from fisheries, tourism and pearl farming. Water supply in the Togeans is limited, and any changes in hydrology due to land-use change could have significant economic impacts. Several communities live on islands with no fresh water supply and many more are dependent on a single spring source. Destructive fishing directly damages coral reefs, reducing the future productivity of destructive fishing itself, as well as traditional fisheries and tourism.

Fuel-wood collection has had major impacts on the mangroves in the Togeans but it may be possible to harvest fuel-wood sustainably. Other economic activities, such as traditional fishing and tourism, have not caused significant impacts to date. While they can both have impacts on the environment and biodiversity, effective management may be able to prevent such impacts occurring. Furthermore, there is a potentially strong incentive for effective management as both fishing and tourism are dependent on the conservation of biodiversity. While pearl farming is not strongly dependent on biodiversity, high quality water is essential. No significant environmental impacts arising from pearl farming have been detected, although the farms have had social impacts by reducing access to fishing grounds and navigation routes. Table 1 provides a summary of the main economic activities in the Togean Islands, their dependence on biodiversity and their impact on the environment.

Conservation efforts by non-governmental organizations in the Togeans to date have focussed on understanding these trade-offs, communicating

Table 1
A summary of the main economic activities in the Togean Islands, their dependence on biodiversity and their impact on the environment

Activity	Dependent on biodiversity	Impact on the environment	Comments
Commercial logging	Low	High	Impact terrestrial biodiversity, hydrological functions, and coral reefs by increasing sedimentation. Social impact due to changes in water supply and land ownership
Oil palm/rubber	Low	High	
Small holder conversion	Low	Medium	
Traditional fishing	High	Medium	Potential over-harvesting
Cyanide fishing	High	High	Long-term destruction of coral reefs, reducing marine productivity.
Coral mining	Medium	High	Over-harvesting of target species
Fuel wood collection	Low	Medium	Impacts terrestrial biodiversity, particularly mangroves, with resulting marine impacts
Tourism	High	Low	Potential impacts due to infrastructure development and over-visitation, social impacts
Pearl farming	Low	Low	Pearl farming is dependent on high quality water

findings to decision-makers and stakeholders, and promoting conservation compatible activities (principally sustainable tourism so far). The general goal of the NGOs has been to achieve a consensus on the designation, delineation and management of the islands between local communities, government and the private sector (Surjadi and Supriatna, 1998). They describe their approach as "top-down, bottom-up", recognizing that reaching a consensus on conservation and natural resources management in the Togeans requires efforts at all decision-making and stakeholder levels.

From the "top-down", the aim with government has been to influence development under government control (e.g. logging and commercial estate crop concessions), increase the role of communities in decision-making, set up appropriate policies and regulations required for community initiatives to be successful, and to build government capacity to support community initiatives.

From the "bottom-up", a main aim to date has been to gather and provide information regarding development choices and facilitate the communities reaching a consensus regarding land-use and natural resources management (Saad, 1992). Another aim has been to assist local communities and government in developing conservation based economic activities, such as sustainable tourism. The wide variation in livelihoods between villages is a complicating factor in achieving community consensus island-wide.

An important part of the NGO "top-down, bottom-up" approach is to provide the data and information needed to make rational development decisions, and to facilitate a more transparent decision-making process. The NGOs are operating on the hypothesis that local stakeholders, given the chance and the information, will chose conservation-based development on economic and socio-cultural grounds. The economic valuation described below is a first cut at confirming or rejecting that hypothesis for government decision-makers on economic grounds. The proposed economic activity that government officials had to decide on was whether or not to approve an application for a new logging concession in the coastal forests of the islands.

5. PREV with Central Sulawesi Provincial and District government officials

The PREV for the Togean Islands followed the methodology described previously. Step 2 took place 2–3 weeks after Step 1, and Step 3 was not undertaken. Steps 4–8 took place over a single day 2 days after the final of the second round of meetings. The PREV workshop was hosted by the provincial level spatial planning agency. Sixty individuals from Central Sulawesi Provincial and District governments and local NGOs attended the PREV workshop. The sectors valued were logging (the proposed activity), tourism and fisheries (the potentially impacted activities), and the impact of logging considered was sedimentation on coral reefs (reducing coral cover and thereby reducing fisheries

productivity and tourism visitation rates and expenditure).

5.1. Logging

Estimates of logging costs, revenues and profits were based on production figures from the old Togean Islands concession[1] (Anon., 1994), logging costs and prices from DFID studies[2] (Scotland and Whiteman, 1997), and a feasibility study for a concession in Donggala (Anon., 1998). The data are shown in Appendix A. The cost data used described a concession operating under Indonesian selective cutting system (TPTI) regulations, but did not include any levies or taxes.

Profits per meter cube of log estimated from each data source were similar, ranging from US$ 3.50 to 3.80/m^3. These profit estimates were based on pre-financial crisis log prices. Workshop participants suggested log prices were approximately 40% lower post-crisis, and that logging was not currently financially profitable in the Togeans. However, participants also felt that the profitability estimates based on pre-crisis figures seemed too low. The common perception of high logging profits may be based on observations of typical logging concessions, most of which may not satisfy TPTI regulations. Removing TPTI related costs from the Donggala and DFID studies increased profits per m^3 to between US$ 9.80 and 13.50/m^3 (see Appendix A).

A *high value scenario* was prepared for a concession following TPTI regulations in which no profits were available for the first 2 years of logging, after which a profit of US$ 2.50/m^3 was obtained. Over 25 years at a discount rate of 10% this profit level translated to an NPV of Rp. 4.1 billion.

5.2. Tourism

The economic value of tourism in the Togeans was based only on expenditures in the Togeans, ignoring the value of expenditures elsewhere in Indonesia and the additional value tourists actually gained from their visit (i.e. “willingness to pay”). As such, the estimated value represents only part of the total economic value of tourism.

NGO staff collected data on the volume of tourists and expenditures from tourism operators in the Togeans, and from government statistics. Approximately, 3500 tourists currently visit the Togeans annually for an average of 7 days each spending Rp. 40,000 per day (A. Suhandi, pers. commun.). Current revenues and profits were estimated at Rp. 980 and 588 million per year, respectively.

As noted in the introduction, the profile of the “average” Togeans tourist is changing from “back-packer” to older—and higher spending—“dive tourist”. The current figures were therefore thought to describe a *low value scenario*. In order to take account of the changing tourist profile two further scenarios were modeled: (1) a *medium value scenario*, where expenditures per tourist increased by 10% annually; (2) a *high value scenario*, where expenditures increased by 20% annually. Under the *medium value scenario*, expenditures per tourist per day reached Rp. 394,000 per day in year 25. In the *high value scenario*, expenditures per tourist per day reached Rp. 600,000 per day in 15 years and were then assumed to stay constant from year 15 to year 25. This maximum figure is lower than the expenditure rates currently seen in Bunaken (NRMP, 1993). NPVs for all scenarios are shown in Table 2.

The total number of visitor-days was kept at current levels in all scenarios under the assumption that this would prevent significant tourism industry impacts on the environment. Some workshop participants expressed the belief that even the *high value scenario* was probably too low, given that a US$

Table 2
Tourism NPV for alternative tourism development scenarios (PREV estimate)[a]

Scenario	NPV
Low value	Rp. 5337 million
Medium value	Rp. 13364 million
High value	Rp. 28781 million

[a] NPV calculated over 25 years at a 10% discount rate.

[1] The concession was held by PT. Arrow-M. Gobel from 1975 to 1995. An average of 750 ha was logged each year and logs were exported for processing into *sawnwood*.

[2] The Department for International Development (DFID) of the UK determined the price of roundwood sold for sawn wood processing based on a linear log–log regression of data obtained from concession operators across Indonesia. The study also surveyed the logging concessions to analyze operating costs.

Table 3
Traditional fishing revenues and costs (PREV estimate)

Figure	Calculation	Result
Total revenue	Total catch × average price = 13.4 million kg × Rp. 2000/kg	Rp. 26800 million
Total cost	Cost/fisher/day × fishing season × number of fishers = Rp. 6000 × 240 days × 3609 fishers	Rp. 5200 million
Profit (per year)	Total revenue − total cost = Rp. 26800−5200 million	Rp. 21600 million

Table 4
Traditional fisheries NPV for alternative scenarios (PREV estimate)[a]

Scenario	NPV
Low value	Rp. 36310 million
High value	Rp. 196000 million

[a] NPV calculated over 25 years at a 10% discount rate.

100 per day dive resort has already opened in the Togeans.

5.3. Traditional fisheries

Data on the reef-based fisheries of the Togeans are scarce and poor quality. Fishing profits were determined by subtracting fishing costs from revenues, which were determined as the product of total catch and average price. Government census data provided population numbers, and figures for other variables were obtained from interviews with NGO field extension workers. The resulting calculations were cross-referenced against information from several studies from elsewhere in Indonesia (see Appendix A). The data used are shown in Table 3, and were considered a *high value scenario*. A particularly cautious *low value scenario* was modeled, where revenues were 50% lower[3] and costs were 80% higher. The resulting NPVs are shown in Table 4.

Workshop participants expressed surprise at the low number of full-time fishers used in the analysis, although the number used was supported by information from similar areas (see Appendix A). This difference in perception may be explained by the distinction between full-time and part-time fishers. Workshop participants agreed that fisheries revenues were likely to be slightly higher than predicted under the *low value scenario*, while costs would be considerably lower. Therefore, the *low value scenario* represents a minimum value for the Togean Islands reef fisheries.

[3] Equivalent to a 30% reduction in both *total catch* and *average price* (i.e. 9,475,000 kg × Rp.1414/kg = Rp.13,400,000,000), or a 50% reduction in either *total catch or average price*.

5.4. Assessing development options

Logging in the Togeans is likely to cause sedimentation impacts on coral reefs and economic costs resulting from reduced fisheries productivity and tourism. Logging roads and log yards are reported to increase erosion 260 times relative to natural forest, so that even selective logging results in relatively high erosion rates (Hodgson and Dixon, 1988). In small coastal watersheds—like those of the Togeans—almost 100% of eroded soil is delivered as sediment (Mahmood, in Chomitz and Kumari, 1998). The short distance between the erosion source and the reefs in the Togeans means that there will be little or no time lag before any land-use changes result in increased sedimentation on the coral reefs.

Sediment deposition is thought to lead to oxygen and nutrient starvation that can cause the death of corals or increase their susceptibility to disease (Hodgson and Dixon, 1988). In their 1988 study of logging impacts on reefs in Palawan, Philippines, Hodgson and Dixon found that the increased sedimentation reduced coral cover by 50%.

Loss of live reef cover and reduced underwater visibility resulting from sedimentation also significantly reduce the attraction for dive tourists. In Palawan, it was estimated that logging sedimentation impacts would reduce the number of international dive tourists to zero within a few years. The absence of international dive tourists was predicted to reduce tourism revenues by 83% (Hodgson and Dixon, 1988). Access for international dive tourists to the Togeans is difficult, and if logging continues and diving conditions

deteriorate, these tourists may not make the effort to visit the islands.

If international dive tourists do not visit the Togeans, the *high value scenario* determined in Section 5.2 will not occur and the *low or medium value scenarios* are more realistic. The NPV of the *medium value scenarios* is Rp. 15,418 million lower than under the *high value scenario*.

A reduction in living coral cover also reduces food availability for fish, with corresponding declines in fish populations (Hodgson and Dixon, 1988). In his study of Indonesian reefs, Cesar (1997) assumed reefs that are 50% destroyed (defined as the ratio of dead coral cover to total coral cover) have a 50% lower maximum sustainable yield. Based on extensive field measurements, a 50% decline in coral cover was also predicted to cause a 50% reduction in fish catches in a study of logging impacts in Palawan, Philippines (Hodgson and Dixon, 1988).

Based on the previous logging operation, it was assumed that 750 ha of forest would be logged each year. The proposed logging operations in the Togeans would take place in strips along the coast, suggesting that each hectare logged results in significant extra impact on the reef. It was assumed that 5 m of coastline were impacted for every hectare logged. Under this assumption, approximately 1.5% (3.74 km) of the Togean's coastlines and reefs are cumulatively affected by sedimentation each year, with fish catches dropping by 50% in those reefs. Under these assumptions, the NPV of the *low value scenario* for fisheries would be reduced from Rp. 36,310 to 34,014 million, a reduction of Rp. 2294 million.

The economic case for logging can be determined by subtracting the costs of the impacts from the profits from logging as shown in Table 5. Based on the above analysis, the profits of logging are significantly outweighed by the costs of the impacts on tourism and fisheries. It should be noted that if logging related reef damage reduced the growth of tourism revenues from the 20% used in the *high value scenario* to 18.5%, then losses from tourism would amount to Rp. 1885 million. Reducing tourism revenues in proportion to the reef area damaged (as done to evaluate fisheries losses) reduces the value of tourism by Rp. 4588 million. Both these approaches to value loss of tourism profits still support the conclusion that logging should be rejected on economic grounds. Note that the impacts on fishing are valued using the *low value scenario* for fisheries, which was thought to be a considerable underestimate by workshop participants.

Table 5
The economic value of forestry estimated during the PREV

	Profits and losses
Profits from forestry	Rp. +4113 million
Reduction in tourism profits	Rp. −15418 million
Reduction in fisheries profits	Rp. −2294 million
Economic value of logging	Rp. −13599 million

6. Results

The analyses described above suggest that the sedimentation impacts of logging result in economic costs to both the tourism and fishing sectors. These costs are bigger than the benefits of logging, which should therefore be rejected as a development activity on economic grounds. Two of the costs of only one impact of logging (increased sedimentation) are apparently sufficient to reject logging as a development option.

Workshop participants agreed that there should be no further logging in the Togean Islands and that conservation-based activities may be the best development options. This result suggests that workshop participants accepted that not all impacts and interactions needed to be quantified and evaluated before rational development decisions could be taken. However, several participants expressed concern over the uncertainty and number of assumptions in the analysis. The assumptions and uncertainty fell into two categories: (1) the physical impacts caused by logging and other land uses; (2) the economic value of the fisheries and other community livelihood activities.[4]

The assumptions and uncertainties in the analyses were fully acknowledged and partly dealt with by valuing the economic impacts of logging using the

[4] Community survey work done in the months after the PREV did not reveal significant errors in the figures used at the workshop (e.g. Malenge fishers report profits of Rp. 20,000 per day; the price of fresh fish was Rp. 2000/kg).

minimum values determined for conservation based activities in the *low value scenarios*. These external costs were compared with the *high value scenario* for logging profits. Thus, the analysis presented an optimistic assessment of the economic value of logging, which still proved to be negative. The simplicity and transparency of this approach was broadly accepted by the workshop participants, hence the agreement that there should be no further logging in the Togeans. However, participants strongly felt that an improved understanding of community livelihoods and increased community involvement was required before any further development decisions could be made.

7. Discussion

The level of precision required from an economic valuation depends on the relative values of the options being analyzed. Where one option is clearly more valuable than another, a high level of precision is not required and it is also not necessary to value all economic impacts. This appears to be the case for the Togeans. Valuing only certain economic components of a few of the more significant impacts using currently available data may prove *sufficient* for decision-makers. The participatory nature of the workshop worked well in drawing out existing data and information from experts from local Government and other organizations. If the available economic information is already sufficient for decision-making then there may be no requirement for further research. The results of the participatory valuation workshop were generally encouraging in this regard, suggesting that decision-makers are reasonably comfortable with the concept of "sufficient information" and will take certain decisions based on the results from rapid valuation methods.

The level of precision required and the number of impacts that need to be valued more fully increases in situations where the economic values of alternative options are similar. The level of precision demanded is likely to increase with the sophistication of the audience and the size of the stakes involved, whether increased precision is required or not. Increasing the precision of the analysis presented above would involve improving understanding of: (1) community livelihoods and use of natural resources; (2) physical changes and impacts resulting from development activities. The participatory nature of the approach enabled precision requirements to be identified quickly. The critical shortfalls in data availability and quality became clear, and the necessary future work on data collection and essential research were prioritized.

Improving understanding of community livelihoods is a priority for further work in the Togeans. Given that communities need to be more fully involved in the process, the opportunity exists to do this while simultaneously gathering information and reducing uncertainty regarding community resource use. Another reason for focussing on understanding community livelihoods are the lower cost and time requirements relative to reducing the uncertainty related to watershed impacts. Rapid and low-cost analyses are required for the valuation approach to be widely used. However, there is a clear need to improve understanding of the impact of land-use change on hydrology, erosion and downstream sedimentation. Such information will be required in the situations where greater precision is necessary. These situations could span a wide range of watersheds and land-use changes. Due to significant uncertainties in generalizing impacts from research in dissimilar sites there is a need to coordinate watershed studies such that a representative range of watershed and land-use types are researched.

8. Conclusions

Participatory rapid economic valuation is an important tool for improving the quality of natural resource policy making. It may be sufficient on its own to guide policy makers, but even where the available information is not sufficient, carrying out a PREV spells out the trade-offs that must be evaluated, improves transparency in natural resource policy making, and identifies the research questions that are a priority for policy makers. As such, a PREV is a sensible first step to take in generating useful information for policy makers before embarking on more ambitious, costly and time consuming environmental impact assessments, cost benefit analyses and other valuation approaches.

Appendix A. Data and supporting information

A.1. Logging

Table 6
Logging data

Variable	Data
Gobel	
Area logged (average per year)	750 ha
Volume logged (average/ha)	30 m^3/ha
Proportion meranti	33%
DFID data	
Meranti price[a] (1996)	US$ 70/m^3
Non-meranti price[a] (1996)	US$ 60/m^3
Average price[b] (1996)	US$ 63.3/m^3
Unit cost[c] (1996)	US$ 59.5/m^3
Profit (loss)/m^3	US$ 3.8/m^3
Donggala study	
Average price (1998)	US$ 75/m^3
Cost (1998)	US$ 71.5/m^3
Profit (loss)/m^3	US$ 3.5/m^3

[a] From Table 3, Scotland and Whiteman (1997).

[b] Weighted according to harvest composition data from PT. Arrow-M. Gobel.

[c] Recalculated from 43 different budget lines for two scenarios—(i) a concession producing 40,000 m^3 per year at 24 m^3/ha; (ii) 40,000 m^3 per year at 36 m^3/ha. These two scenarios were averaged to obtain a cost estimate for a concession producing 40,000 m^3 per year at 30 m^3/ha (as observed in the Togeans).

The common perception of high logging profits may be based on observations of typical logging concessions, most of which may not satisfy TPTI regulations. In the Donggala study, TPTI required replanting costs totaled US$ 10. If a logging company did not carry out replanting the profit increases to US$ 13.50/m^3, generating annual revenues of Rp. 3038 million and an NPV of Rp. 27,572 million. The DFID data suggests TPTI related costs of approximately US$ 5.80 for a 40,000 ha concession being harvested at 30 m^3/ha. Using the DFID figures, this would increase profits to US$ 9.60/m^3, generating annual revenues of Rp. 2160 million and an NPV of Rp. 19,606 million. Logging companies therefore have a strong financial incentive to ignore TPTI regulations.

A.2. Traditional fisheries

Total revenue was determined as the product of *total catch* and *average price*. *Profit* was determined by subtracting *total cost* from *total revenue*.

A.2.1. Total catch

Total consumption was determined by multiplying *per capita consumption* by the Togeans *population*. *Total catch* was then determined by correcting to account for *percentage exports*. The data used are shown in Table 7, and supporting information discussed below. Earlier studies in Bunaken NP and the Togeans provide further information on *per capita consumption*. Each year 955 tonnes of fish are consumed by the 2555 full-time fishers and their families in Bunaken NP (NRMP, 1996a). This suggests 1 kg per day of fish is consumed by each full-time fisher and their dependents. Wirawan (1992) report that the 1123 fishermen of Kecamatan Una-Una in the Togeans came from 520 families, suggesting ~2 full-time fishers per "fishing" family. The average size of families is unknown, but seems likely to be higher than four persons. It is possible that the *per capita consumption* figure of 0.5 kg per day per person is too high.

Table 7
Total catch estimate

Variable	Estimate
Population	29347 people
Per capita consumption	0.5 kg per day per person
Total consumption	5355 tonnes per year
Percentage exported	60%
Total catch	13400 tonnes per year

Further information on *total catch* was obtained from Wirawan (1992), who noted that the 1990 census statistics report that, out of a total population of 16,676 in Kecamatan Una-Una, 1123 are fishermen and they caught 31,805 tonnes of fish annually. Scaling up to the total *number of fishers* (3609 full-time, see below) for the Togeans suggests a *total catch* of 10,200 tonnes per year in 1990. However, it is difficult to collect fisheries data and Government statistics are thought to report only part of the fish catch. For instance, the volume of fish represented within official

catch figures for Bunaken was estimated between 10 and 50% (NRMP, 1996a). Current catches may also be higher because of technological improvements in fishing methods in the Togeans since 1990, with a greater proportion of the fleet now using outboard motors.

The *total catch* figure was also checked by determining the *catch rate* (kg per fisher per day) and comparing the figure obtained with information from other Indonesian fisheries. In order to determine *catch rate*, the annual *total catch* is divided by the *number of fishers* and the number of fishing days in the *fishing season* (see Table 8).

Table 8
Implied catch rate

Variable	Estimate
Number of fishers (full-time)	3609 people
Fishing season	240 days per fisher per year
Total catch	13400 tonnes per year
Catch rate	15.5 kg per day

The 15.5 kg per day catch rate, obtained using the figures suggested by NGO staff, falls within the range observed by Riopelle (1995), who gave catch rates of 8.3 kg per day (assuming 3 days per fishing trip) or 12.5 kg per day (assuming 2 days per fishing trip) for sailboats and a minimum of 40 kg per day for outboards (the sailboats mainly fished the reef, while outboards took the majority of their catch from pelagic fisheries). In Bunaken, NRMP (1996a) estimated an average catch rate of 20 kg per day for the reef-based fisheries and up to 25 kg per day if the pelagic fisheries were included.

The numbers used in each of the options for calculating *total catch* are within the ranges reported for other Indonesian fisheries, and produce consistent estimates. Based on the above information, current annual *total catch* was estimated as 13,400 tonnes per year.

A.2.2. Average price

Average price was based on information from NGO staff that fresh fish for consumption in the Togeans fetched Rp. 1750/kg, while salted and dried fish for export earned Rp. ∼6000/kg In order to allow for weight differences between fresh and dried fish, a conversion factor of 0.3 was applied, giving an *average price* of Rp. 1800/kg for landed fresh fish. This price figure does not include the higher value Napoleon wrasse and groupers sold to the live fish traders for export to Hong Kong (based on my interviews with fishers and live fish traders in May 1998, fishers receive Rp. 15,000/kg for Napoleon wrasse). Nor do they include the other marine resources that are harvested in addition to fish, such as sea cucumber (or "teripang"). Wirawan (1992) reports prices for "teripang" between Rp. 1000 and 5000/kg, depending on the species. Riopelle (1995) reported revenue and catch figures that suggest an average price of Rp. 1340/kg for the coral reef fishery of West Lombok. An average price of Rp. 1300/kg is reported for the Bunaken artisanal fishery (NRMP, 1996a). In Biak (Irian Jaya) fish are sold for an average price of Rp. 1800/kg, but this figure does not include the most valuable fish (Cesar, 1996). The average Government auction price was Rp. 2200/kg (NRMP, 1996a). Based on the above information the *average price* was determined at Rp. 2000/kg.

A.2.3. Total cost

In the coral reef fisheries of West Lombok, costs for sailboats fishing the reef were 68% of revenue (Riopelle, 1995), while in the artisanal fisheries of Bunaken (the majority of which are also non-motorized), costs represented only 25% of revenue (NRMP, 1996a). In both cases costs per fisher (fixed and variable) represented were similar (Rp. 6320 per day in West Lombok, and Rp. ∼5000 per day in Bunaken) and labor costs amounted to ∼33% of total costs in both cases (Riopelle, 1995; NRMP, 1996a). The main source of the difference between West Lombok and Bunaken is probably due to the difference in catch rates used (see above).

There is no information available for fishing costs in the Togean Islands and we assume a *cost per fisher per day* of Rp. 6000, in line with the information from West Lombok and Bunaken. With 3609 fishers and a 240-day season, *total cost* is estimated at Rp. 5200 million per year ($6000 \times 3609 \times 240$).

References

Anon., 1994. Rencana Karya Tahunan Pengusahaan Hutan (Tahun 1994/1995). PT. Arrow-M., Gobel, Palu.

Anon., 1998. Studi Diagnostik HPH Bina Desa Hutan (PMDH) HPH PT. Satyasena Indratama. SK HPH: 81/Kpts-II/1997. Kab. Dati II Donggala, Propinsi Sulteng.

Cesar, H., 1997. Indonesian coral reefs—an economic analysis of a precious but threatened resource. Ambio 26, 345–350.

Cesar, H., 1996. Economic Analysis of Indonesian Coral Reefs. Environment Department, World Bank.

Chomitz, K.M., Kumari, K., 1998. The Domestic Benefits of Tropical Forests: A Critical Review. The World Bank Research Observer, vol. 13. February 1998, pp. 13–35.

Cochrane, J., 1992. Report on Tourism in Siberut Island, Togean Islands, Ruteng Mountains and Lorentz National Park. In: Management and Conservation of Tropical Forest Ecosystems and Biodiversity: Siberut Island, Togean Islands, Ruteng Mountains, Lorentz Nature Reserve. ADB/GOI (T.A. No. 1439-INO).

Dixon, J.A., Sherman, P.B., 1990. Economics of Protected Areas: A New Look at Benefits and Costs. Island Press, Washington, DC.

Hodgson, G., Dixon, J.A., 1988. Logging versus Fisheries and Tourism in Palawan: An Environmental and Economic Analysis. East–West Environment and Policy Institute Occasional Paper No. 7.

NRMP, 1993. Eco-tourism development in Bunaken National Park and North Sulawesi. NRMP Report No. 30.

NRMP, 1996a. Economic value of fisheries to the residents of Bunaken National Marine Park. NRMP Report No. 62.

Purnomo, A., 1992. Institutional aspects of biodiversity development programme. In: Management and Conservation of Tropical Forest Ecosystems and Biodiversity: Siberut Island, Togean Islands, Ruteng Mountains, Lorentz Nature Reserve. ADB/GOI (T.A. No. 1430-INO).

Riopelle, J.M., 1995. The economic valuation of coral reefs: a case study of West Lombok, Indonesia. MA Thesis in Development Economics. Dalhousie University, Halifax.

Saad, Z., 1992. Community development approach for integrated protected area systems (Lorentz, Togean, Ruteng, and Siberut). In: Management and Conservation of Tropical Forest Ecosystems and Biodiversity: Siberut Island, Togean Islands, Ruteng Mountains, Lorentz Nature Reserve. ADB/GOI.

Scotland, N., Whiteman, A., 1997. Economic rent in the Indonesian forest sector: the forest concession industry, vol. 4. Report Number: SMAT/EC/97/04, Indonesia–UK Tropical Forest Management Program.

Surjadi, P., Supriatna, J., 1998. Bridging community needs and government planning in the Togean Islands, Central Sulawesi, Indonesia. In: Proceedings of the ICRI Conference, Australia.

Wirawan, N., 1992. Buffer zone concept and activities in the integrated protected area systems. In: Management and Conservation of Tropical Forest Ecosystems and Biodiversity: Siberut Island, Togean Islands, Ruteng Mountains, Lorentz Nature Reserve. ADB/GOI.