# Preliminary Cost Benefit Analysis Format [template]

This Preliminary Cost-Benefit Analysis Format outlines the key information that should be included in a Preliminary Cost-Benefit Analysis (CBA) report.

The purposes of the Preliminary CBA report is to help strengthen the evidence-base of budget and overseas development assistance (ODA) project proposals. This in turn will provide for more informed and sound Government decision-making in Kosrae and hence more effective projects.

An example Preliminary CBA report is also provided at Annex A. Completed Preliminary CBA reports should be between four and six pages in length, excluding appendices.

## [Title of project]

## 1. Problem Statement

Write a short description of the problem that the project is trying to address. This should include

information on the nature and extent of the problem, making sure to reference sources of this

information.

#### Causes of the problem

List the main causes and drivers of the problem under consideration and include a preliminary appraisal of the relative importance of each of these causes and drivers. Typically, there are multiple causes and drivers contributing to a given problem.

The changing frequency and intensity of climate variables (e.g. rainfall, cyclone) should be considered here as one of the potential drivers of the problem (i.e. climate change risk considerations). This may be a large or small part of the problem at hand.

## 2. Objective of the project

Write a short statement of the project objective. This should directly link to one or more of the causes of the problem. It should also be as clear and as specific as possible.

## 3. Options

List and briefly describe each of the options that have been identified to achieve the stated objectives.

Also, check that these options:

* were identified through a thorough process, including review of what has been done

in other parts of the country and the broader Pacific region as well as consultations

with communities;

* clearly align with the project aim (and causes/drivers of the problem);
* are feasible given the budget constraint for the project (if applicable); and
* are clearly distinguishable from one another.

Further, there should be between three and five options listed in order to provide the decision maker (Agency/Department Director, Budget Review Committee, ODA Unit, Governor, Kosrae State Legislature etc) with real scope for exercising choice.

## 4. Costs and Benefits

Describe each cost and benefit category that is a material consideration for the project problem and options identified. This should be about a paragraph in length for each category and should reference any relevant studies, surveys, or reports.

## 5. Preliminary Results and Sensitivity Analysis

This section should provide a preliminary evaluation of the cost and benefit categories for each option. It should further provide an overall judgement on whether benefits outweigh costs for each option.

(Input) cost items should be quantified as much as possible. This can be expressed in terms of annualised cost or present value.

Benefit items (and 'external' costs) should be qualitatively evaluated. This can be done by rating the value of items as either 'high', 'medium' or 'low'. Ratings should take into account:

* the relative importance of each cost/benefit category; and
* the relative effectiveness of each option in generating benefits (and external costs).

The overall judgement on whether benefits outweigh costs can be summarised using a traffic light system whereby:

* green indicates the option clearly generates benefits that are greater than the costs;
* orange indicates that it is unclear whether project benefits outweigh costs; and
* red indicates the option clearly does not generate benefits that are greater than the costs.

Results can be summarised in a table like the one below:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Option | Costs | | Benefits | | | Traffic light |
| *Cost 1* | *Cost 2* | *Benefit 1* | *Benefit 2* | *Benefit 3* |
| *Option 1* |  |  |  |  |  |  |
| *Option 2* |  |  |  |  |  |  |
| *Option 3* |  |  |  |  |  |  |

#### Sensitivity Analysis (risks and uncertainties)

In addition to the main results, this section should list the key parameters (e.g. length of drought period) for which there is a significant amount of uncertainty and which are an important factor for realising project costs or benefits.

Commentary should also be provided explaining how significant (or sensitive) these uncertainties are for overall judgements about whether benefits outweigh costs.

## 6. Equity and distributional implications

Identify which stakeholder groups will incur costs and which stakeholder groups will accrue benefits for each major cost and benefit category.

Summarise this information in a table like the one below.

Cost/benefit Stakeholder group 1 Stakeholder group 2 Stakeholder group 3

|  |  |  |  |
| --- | --- | --- | --- |
| Cost/benefit category | Stakeholder group 1 | Stakeholder group 2 | Stakeholder group 3 |
| *Cost 1* |  |  |  |
| *Cost 2* |  |  |  |
| *Benefit 1* |  |  |  |
| *Benefit 2* |  |  |  |
| *Benefit 3* |  |  |  |

Comment/assess whether impacts on certain stakeholder groups may merit special consideration

(e.g. costs borne by low socio-economic groups).

Further comment on whether distributional effects will likely cause political or other issues that

may threaten the successful implementation of the project, and could benefit from refinements

to project design.

## Concluding Remarks and Recommendations

This section should firstly comment on the accuracy of analysis undertaken and hence the level of confidence in the results.

With this in mind, this section should then make recommendations using the results and findings outlined in sections 5 and 6.

Recommendations should primarily be about:

* which option(s) should be implemented, if any;
* which options should definitely not be progressed further; and
* whether any further research and analysis is warranted to assist with decision-making (taking into account the size of the investment, the cost of undertaking further research and analysis, and other factors).

## References

List full references for studies, surveys, and reports used in the report.

## Annex A: Example Preliminary CBA Report adapted from CBA study from Republic of Marshall Islands[[1]](#footnote-2)

This example is an adaptation of a CBA study from the Republic of Marshall Islands. **It has been simplified for the purposes of this illustration.**

TITLE: ADDRESSING WATER SHORTAGES IN MAJURO

1. Problem Statement

Water supply to households in the Rairok and DUD area of Majuro is provided from a mix of public (operated by Majuro Water & Sewer Company (MWSC)) and private (household rainwater tanks) systems. MWSC’s main source of this supply is the airport catchment. Water collected from this source is stored in reservoirs, treated using sand filtration and chlorination, and then pumped to the Rairok and DUD area via a 16 km distribution pipe.

Water supply (both from the public water supply system as well as private rainwater tanks) in DUD Rairok is considered to be inadequate to meet community needs. While data gaps prevent precise quantification, conservative estimates of current supply and demand (of 150 litres per household per day[[2]](#footnote-3)) indicate there is a shortfall in supply of at least 253,000 m3 per year during normal rainfall years (rainfall is 3.3 metres per year; SOPAC, 2007). During drought years, the water scarcity problem is much more significant. Optimistic estimates (assuming all existing storage capacity is available and is operating at 100% efficiency) suggest there is sufficient water storage to meet about 47 days of demand. This would be enough to get the area through most historical drought periods. More realistic estimates (including the assumption that distribution system losses cause 50% inefficiency in public system) indicate there is more like 28 days of water on hand.

A survey undertaken by the Marshall Islands Economic Policy, Planning and Statistics Office (2010), reported that nearly half of households say they face water scarcity “often” and 42% reported “sometimes”. Water shortages have been blamed for increased incidents of gastroenteritis, pink eye, and even a typhoid outbreak (EPPSO, 2010).

*Causes and drivers of the problem*

Some of the key causes and drivers of the water shortage problem are:

* inadequate pricing and charging for public water supply services (SOPAC, 2007b; USAID, 2009), which in turn means there is inadequate (financial) incentives for households to properly manage their water use;
* lack of public awareness (SOPAC, 2007b; USAID, 2009) of water scarcity issues, health-related water issues, and how best to manage water use;
* inadequate regulation of MWSC (monopoly water service provider) to provide efficient public water supply services;
* lack of capacity within MWSC (SOPAC, 2007b); and
* rural–urban migration and population growth at Majuro which is increasing demands for water.

Climate change may also contribute to the Majuro water scarcity problem in the future through a number of potential effects.

* *Extreme tide events.* Saltwater incursion into airport catchment and reservoirs (as well as the pump stations and treatment plant) associated with extreme sea level/high tide events degrades infrastructure and water quality and thus reduces yields (ADB, 2011). The PCCSP (2011) projects with “very high confidence” that sea level rise near RMI will increase by between 5 and 15 cm by 2030 under medium and high emission scenarios. This in turn is expected to contribute to increased frequency and extent of inundation events.
* *Changing rainfall patterns and drought events.* Changing rainfall patterns and drought events may also impact on water availability in Majuro, though best-available modelling suggests that future changes are most likely be in the positive direction. The PCCSP (2011) predicts that the most likely future rainfall and drought scenarios in RMI through to 2030 will be no or little change. After 2030, PCCSP reports with “moderate confidence” that dry-season rainfall will increase by greater than 15% and the frequency of drought events will decline.

2. Objective of the project

The primary objective of the project is to increase efficiencies of the existing public water supply system.

A secondary objective is to reduce risks of water supply disruptions associated with extreme tide events and drought.

3. Options

Three options to increase efficiencies were identified, drawing on previous work and suggestions from the ADB (2011) and USAID (2009). These options were:

1. Reline airport storage reservoir (to reduces losses at this facility);
2. Install evaporation cover on airport storage reservoir (to reduces losses at this facility); and
3. Repair and/or replace leaking distribution pipes (to reduce losses in distribution system including pollution from saltwater inundation).

4. Costs and Benefits

The costs considered were construction and maintenance costs. Both construction and maintenance costs included capital, equipment, materials, and labour. Details of construction and maintenance costs for each option is provided in Appendix 1.

The benefit streams were considered as two main categories.

The first category related to the benefits from additional water supply. The quantity of additional water supplied from each option is estimated at around 50,000 m3 per year, 4,700 m3 per year, and 87,000 m3 per year for options i, ii and iii respectively. More information on how these quantities were calculated is provided in Appendix 1.

The second benefit category related to lower incidences of water-related health problems such as gastroenteritis (indirect benefits of additional water).[[3]](#footnote-4) In this study, lack of data/information and time constraints did not allow this benefit category to be quantified. Suffice to say, lower incidence of water-related health problems is considered to be a significant benefit of the project options.

5. Preliminary Results and Sensitivity Analysis

Table 1 below provides a preliminary evaluation of the cost and benefit categories for each option. Costs are quantitatively expressed in annualised terms using a 4% discount rate. The value of benefit items are qualitatively rated as either 'high', 'medium' or 'low' and in this case are based on quantities of additional water supply summarised in Table 1.

Table 1 further provides an overall judgement on whether benefits outweigh costs using a 'traffic light system'. That is:

* a green light indicates the option clearly generates benefits that are greater than its costs;
* an orange light indicates that it is unclear whether project benefits outweigh costs; and
* a red light indicates the option clearly does not generate benefits that are greater than the costs.

Table : Summary of preliminary CBA results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Option | Annualised Construction and Maintenance Costs @ 4% (US$/year) | Benefits | | Net benefit |
| *Additional quantity of water* | *Lower incidences of water-related health problems* |
| *1. Reline reservoir* | 4,171 | High | High |  |
| *2. Evaporation cover* | 12,844 | Medium | Medium |  |
| *3. Repair and replace leaking pipes* | 67,654 | High | High |  |

*Sensitivity Analysis (risks and uncertainties)*

There is some uncertainty about the length of project life for reservoir liner and the evaporation cover. If the true expected life of the liner and cover is 20 years[[4]](#footnote-5) rather than the estimated 30 years, then annualised costs will increase to US$6,242 and US$19,012 for the liner and cover respectively. This highlights the importance of following a proper maintenance schedule for the liner and cover, should they be implemented. It also highlights the importance of making sure the materials are suitably maintained to withstand salt water incursion (associated with extreme tide events).

6. Equity and distributional implications

Table 2 below summarises which stakeholder groups will incur costs and which stakeholder groups will accrue benefits for each major cost and benefit category. This is done for option 1 only at this stage, noting that a similar distribution of costs and benefits between stakeholders would also apply to options 2 and 3.

Because of limited information on the overall cost of providing public water supply services and the extent to which services are subsidised, the distribution of costs and benefits is roughly approximated using dots (i.e. ●).

Table Distribution of costs and benefits between stakeholder groups for option 1

Cost/benefit Stakeholder group 1 Stakeholder group 2 Stakeholder group 3

|  |  |  |
| --- | --- | --- |
| Cost/benefit category | MWSC | Households in the Rairok and DUD area of Majuro |
| *Construction and maintenance costs* | ●● | ●● |
| *Additional water supply* | ●●○ | ●●○ |
| *Health benefits* |  | ●●● |
| *Net benefit* |  |  |

Concluding Remarks and Recommendations

The preliminary analysis has been completed with information and data that is readily available.

This is sufficient to confidently demonstrate that relining the reservoir will generate a net benefit for the Majuro community (refer Table 1). Further, net benefits will accrue to low socio-economic groups in the Rairok and DUD area (refer Table 2). **It is recommended that (option 1) reline the reservoir be implemented.**

It is unclear from the preliminary analysis whether option 2 (evaporation cover) and option 3 (repair and replace leaking pipes) will generate a net benefit for the Majuro community (refer Table 1). In particular, further analysis on the value of water is needed to determine this. **It is recommended that more detailed analysis is undertaken for options 2 and 3.**

It is also important to note that a number of key causes and drivers of the water shortage problem in Majuro are not directly addressed by these efficiency measures (e.g. inadequate pricing and charging for public water supply services, and lack of public awareness). To properly address this water shortage problem, demand-side measures should also be a focus of future water sector policies and projects, including education and awareness and pricing reforms. Demand-side measures help to provide the correct incentives needed for efficient use of water, and so that supply side measures are effective in reducing community vulnerability.

References

ADB (2011a) “Strengthening the Capacity of Developing Member Countries to Respond to Climate Change. Baseline Report – Republic of the Marshall Islands.” Prepared by Kellogg Brown and Root Pty Ltd. 53 pp.

ADB (2011b) “Strengthening the Capacity of Developing Member Countries to Respond to Climate Change. Baseline Report – Draft Vulnerability Assessment Report – Republic of the Marshall Islands.” Prepared by Kellogg Brown and Root Pty Ltd. 75 pp.

ADB (2011c) “Strengthening the Capacity of Developing Member Countries to Respond to Climate Change. Baseline Report – Draft Adaptation Concept Design Report – Republic of the Marshall Islands.” Prepared by Kellogg Brown and Root Pty Ltd. 49 pp.

EPPSO (2010). “Majuro and Kwajalein Atoll Household Water Survey Report.” Draft. 64 pp.

MWSC (2012). Engineer’s report on evaporation estimates from reservoirs. Microsoft Word document.

Pacific Climate Change Science Program (PCCSP) (2011). “Chapter 7: Marshall Islands.” In *Climate change in the Pacific: Scientific assessment and new research. Volume 2: Country Reports.* p. 111 – 127.

SOPAC (unknown date a). “Desalination in the Pacific Island Countries.” Technical Report No. 437. 49 pp.

SOPAC (unknown date b). “Water Demand Management: Leakage assessment and detection in Majuro, RMI.” SOPAC Technical Report 347.

SOPAC (2007). “National Integrated Water Resource Management Diagnostic Report RMI.” SOPAC Miscellaneous Report 639. 51 pp.

USAID (2009). “Adaptation to climate change. Case study – Freshwater resources in Majuro RMI.” 69 pp.

Appendix 1: Data and assumptions for calculating (i) construction and maintenance costs, and (ii) quantity of additional water supply for project options.

Table : Construction and maintenance costs for each project option

|  |  |
| --- | --- |
| Option | Cost |
| 1. Reline reservoir | Construction costs is estimated at $123,781 for the current system (Fabtech).  Annual materials and labour costs for maintenance are $35 and $43 respectively (Fabtech, MWSC).  The liner is expected to last 30 years (Fabtech, MWSC). |
| 2. Evaporation cover | Construction cost is estimated at $50,873 for tank 3 of the current system (Fabtech).  Annual materials and labour costs for maintenance are $98 and $47 respectively (Fabtech, MWSC).  The evaporation cover is expected to last 30 years (Fabtech, MWSC). |
| 3. Repair and replace leaking pipes | Material and labour costs for construction are estimated at $267,080 and $192,298 respectively (MWSC).  Annual materials and labour costs for maintenance are $26,708 and $64,099 respectively (MWSC).  The repaired and replaced pipes are expected to last 30 years (MWSC). |

Table Calculations for water savings for each project option

|  |  |
| --- | --- |
| Option | Data and assumptions for calculating quantity of additional supply |
| 1. Reline reservoir | Current leakage from tank 4 is estimated to be 49,964 m3 a year.  This is based on two tests run by MWSC (first between June 29-July 1, 2012, second 2–4 July 2012). Water loss was calculated as: tank surface area (3,456 m2) x change in height (0.04 m2) – evaporation rate for tank (12 m3/day) + rainfall capture for tank (18.61 m3/day) x number of days in 1 year (365). This level of leakage is assumed to continue for the next 30 years.  The new liner is assumed to reduce leakage losses altogether. |
| 2. Evaporation cover | Current evaporation from tank 3 is estimated to be 4,704 m3 a year. This is calculated by multiplying the surface area of tank 3 (3,790 m2; MWSC) by the estimated daily evaporation rate (3.44 mm/day; Engineers report, MWSC) by the number of days in 1 year (365). This level of evaporation is assumed to continue for the next 30 years.  The new evaporation covers is assumed to completely mitigate evaporation losses. It is further assumed that rainfall hitting the covers will not be captured. |
| 3. Repair and replace leaking pipes | Current leakage losses from pipes is estimated to be 173,514 m3/year. This is calculated by multiplying the current volume of water flowing through the pipes (347,000 m3/year; MWSC) by the leakage rate (estimated at 50%; MWSC). This level of leakage was assumed to continue into the future.  With repair and replacement of leaking pipes, the leakage rate from pipes is expected to be reduced to 25% of flow volumes (MWSC), which equates to a water saving of 86,757 m3. |

1. this appendix can be changed to the 4 case studies prepared for the P-CBA in Kosrae, once completed. [↑](#footnote-ref-2)
2. per capita water demand is reported between 33-45 gallons per day (SOPAC, 2007b; EPPSO, 2010), although this range seems unsubstantiated by any household studies or data. [↑](#footnote-ref-3)
3. Where community members fully understand the health risks of drinking poor quality or insufficient water and where health services are not significantly subsidised (such that individuals consider the full cost of health services in their decisions to purchase water), then the value of water in the first benefit category should capture most of the health-related benefits of additional water supply. However, in practice these conditions do not sometimes hold and so some proportion of health benefits from additional water supply should be considered separately. [↑](#footnote-ref-4)
4. ideally, a reasoning and rationale for this lifespan should be included. [↑](#footnote-ref-5)