WISER Socio-Economic Benefit Guidance

WISER
Weather and Climate Information Services for Africa

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WEATHER AND CLIMATE INFORMATION SERVICES FOR AFRICA (WISER)

The Weather and Climate Information Services for Africa (WISER) programme is enhancing the resilience of African people and economic development to weather related shocks. The programme aims to improve the generation and use of weather and climate information across Sub-Saharan Africa.

WISER is funded with UK aid from the British people and will deliver maximum value for money by working in partnership and collaboration, capacity building and leveraging funds to ensure long term sustainable delivery and improvement of weather and climate services for Africa.

To find out more about the programme, please visit:

https://www.metoffice.gov.uk/about-us/what/working-with-other-organisations/international/projects/wiser

Images: I-stock; Robert Powell, Paul Watkiss.

Cover photograph. Fish drying around Lake Victoria: WISER 2 provided new marine forecasts that were used by these users to reduce weather related losses.

Citation. Watkiss, P. and Cimato, F. (2021). Socio-Economic Benefit Guidance for the WISER Programme. Published February, 2022.

WHAT ARE SOCIO-ECONOMIC BENEFITS?

Investing in weather and climate information (W&CI) services leads to improved information, such as enhanced early warning or seasonal forecasts. In turn, this information provides economic benefits to users, as it leads to positive outcomes from the actions and decisions that users subsequently take. This is known as the value of information.

For example:

- Early warning systems (EWS) produce advance forecasts of extreme weather. These allow users to take action to reduce damage and losses, and/or reduce loss of life and risk of injury, such as by securing homes against storms or moving to safer areas.
- Seasonal forecasts provide information that allows farmers to prepare for weather trends over the coming months, i.e. for above or below rainfall. This can include planting early maturing varieties or increasing water storage, which in turn increase agricultural production through higher yields or reduce losses from extreme events.

These benefits include the financial or private returns from improved decisions, e.g. yield improvements and profitability for farmers. However, they also include societal or public benefits, such as reduced health risks or environmental benefits. Together these market and non-market effects provide the total economic benefits to society. In the meteorological literature, these are often referred to as socio-economic benefits (SEB).

It is possible to quantify these benefits. To do this, the analysis looks at the activities and outcomes from the use of new or enhanced W&CI services, as compared to a baseline. The difference in outcomes between the 'with service' case and the baseline represents the benefits that can be attributable to the W&CI service. By using economic analysis, these benefits can then be valued (or monetised) and compared to the costs of setting up and running the service, to look at the overall net benefits delivered by a project or programme.

There are a number of important benefits from undertaking SEB studies:

- SEB studies provide a direct tangible estimate of the achievements of a programme or project. They are extremely useful in quantifying and communicating the overall impact of activities, as well as justifying current and future investment.
- SEB studies can help to develop an improved understanding and better articulation of a project's efficiency and effectiveness, and provide quantitative information to help demonstrate and report on Value for Money (VfM).
- The incorporation of SEB thinking during the design of a W&CI service study can help to enhance benefits and maximise impact. Similarly, SEB studies can be used to improve existing services, helping to identify where and how to increase impact.

The Weather and Climate Information Services for Africa (WISER) programme, funded by the UK's Foreign, Commonwealth & Development Office (FCDO), has an impact indicator to capture and report on SEB, and projects are encouraged to quantify such benefits. To support these activities, this document provides guidance on undertaking SEB analysis.

INTRODUCTION TO THE GUIDANCE

What does this guidance do?

This guidance provides a summary of the steps needed to assess the SEB of W&CI services and to undertake a cost-benefit analysis (CBA). The main focus is on ex post evaluation methods. The guidance also provides advice on how to use SEB analysis to provide information for assessing VfM.

Who is it designed for?

1. Project staff of implementing agencies who want to include SEB studies in their project design, or commission SEB studies.
2. Researchers and consultants who will undertake the SEB studies on behalf of projects.

What is included?

The guidance presents seven steps, set out below. It provides information on the overall concepts and approaches for each step, as well as tips and further resources.

This guidance is accompanied by three 'How to Notes' that provide more detailed information for:

1. Project staff who are commissioning SEB studies;
2. Project teams, researchers or consultants undertaking SEB analysis; and
3. A primer for National Meteorological and Hydrological Services who want to build a regional or national level SEB case.

The seven steps of socio-economic benefit analysis

1. Identify the type of socio-economic benefits and value chain
2. Review and decide on the methods
3. Develop a baseline for the current situation
4. Assess the change with the W&CI service in place
5. Assess the costs of the project
6. Compare to benefits (and undertake cost-benefit analysis)
7. Explore how benefits could be enhanced

KEY CONCEPTS FOR SEB ANALYSIS

The benefits of W&CI services are only generated if users make better decisions as a result of the information they receive. This means that SEB studies need to consider the generation of information and its accuracy, the communication and reach achieved, and the uptake and effective use of it by end-users.

These steps can be considered using a W&CI service **value chain**, shown in the blue arrow below.

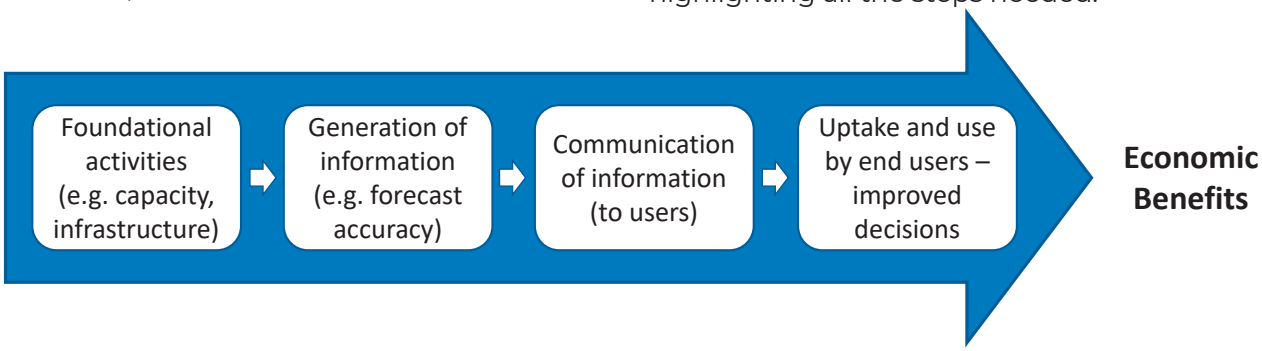
The chain starts with foundational activities that underpin the service, e.g. meteorological infrastructure and observations.

It includes the generation of information, e.g. the production of a forecast or early warning, and the communication of this information to end-users, to reach end-users of the service.

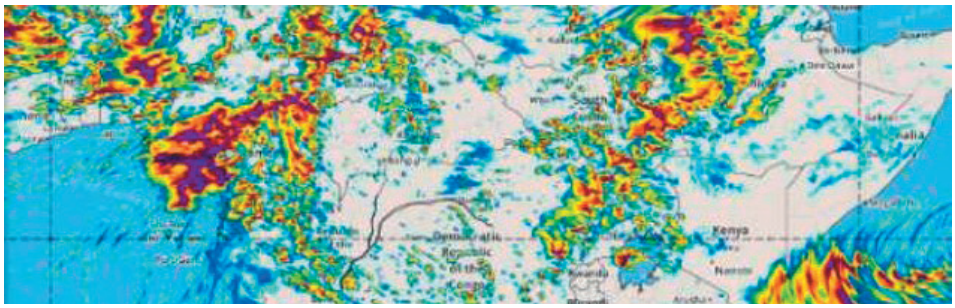
Finally, the value chain includes the understanding and use of the information and the effectiveness of the action undertaken by end-users in decisions, which lead to the actual benefits.

Importantly, there is a drop off at each stage of the chain. For example: forecasts will not be 100% accurate; only a proportion of relevant users will be reached; not all end-users will act on the information; and the final action may or may not reduce weather and climate impacts. The value chain allows an analysis of these 'efficiency losses'.

A key part of a SEB analysis is to map the W&CI service value chain. As well as helping in the estimation of benefits, such analysis can also be used during design to improve services, by highlighting all the steps needed.



W&CI service value chain



GLOSSARY

SEB – Socio-Economic Benefits. A term used in the meteorological literature to describe economic benefits, i.e. the benefits of a policy, programme or project in terms of improved social welfare or wellbeing (i.e. public benefits).

SEB analysis. The quantification and monetisation of the socio-economic benefits of a programme, project, or policy. A SEB analysis ideally includes an analysis of benefits (using appraisal or evaluation) and a cost-benefit analysis.

CBA – Cost Benefit Analysis. CBA is an economic decision-support tool that measures all relevant costs and benefits to society of a project, programme or policy in monetary terms (including non-market effects such as environment or health). The results of a CBA are usually presented as a net present value (NPV) or benefit-to-cost ratio (BCR).

BCR – Benefit to Cost Ratio. A metric used to express the results of a CBA, derived by estimating the total present value of benefits divided by total present value of costs.

NPV – Net Present Value. A term for the sum of a stream of future values that have been discounted to bring them to a present value.

VfM – Value for Money. An approach used by UK Government to assess the optimal use of government spending. VfM is estimated using three criteria: economy, efficiency, effectiveness, alongside a fourth component on equity.

STEP 1: IDENTIFY SOCIO-ECONOMIC BENEFITS & VALUE CHAIN

The first task is to **list the possible benefits** of the new or enhanced W&CI service. This is linked to the outcomes that you are trying to achieve, i.e. the result of improved information in decisions.

For instance, this could be the benefits of improved seasonal forecasts in enhancing crop yields and incomes for farmers. Or it could be the reduction in fatalities and damage to assets from improved early warning. These should be set out in the project Theory of Change (ToC) and Logframe (see Top Tip).

A good place to start is to list the possible end-users or beneficiaries, and then list the benefits of the W&CI service to each of these groups. This should capture all benefits, including both market benefits (e.g. financial benefits to users) and also non-market benefits (e.g. health and environmental benefits).

It should also include indirect benefits that may arise, such as the potential benefits for other organisations or beneficiaries who might gain from the new or improved information. This may include indirect benefits that might arise from spill-overs to other activities, sectors or the wider economy.

Two examples of a beneficiary-benefit list are presented on the next page. The first is an example from a project providing improved W&CI for the agriculture sector. The second is for a targeted marine EWS for fishermen, based on the WISER HIGHWAY project on Lake Victoria.

In each case, a list of beneficiaries is presented, and for each of these, the different types of benefits are identified. The individual benefits, even for the same users, are presented separately. This is because individual benefit streams may require a separate analysis. For example, in the EWS example, reduced fatalities will need to be assessed separately to fuel savings, using different valuation methods, but the two would be added together to look at overall benefits to fishermen.

The next task in Step 1 is to **identify which benefits to focus on** in your SEB analysis. Depending on time, local context and resources available, the analysis may be very comprehensive, aiming to quantify many or even all the potential benefits. Or it may focus on one or two of the most important direct benefits only.

Types of benefits

A SEB study can consider three types of benefits, which together provide overall economic benefits.

Market benefits, e.g. reduced damage to buildings, infrastructure, or crops from early warning systems, or enhanced agricultural yields or avoided losses from seasonal forecasts.

Non-market benefits, e.g. reduced loss of life from early warning systems, or environmental benefits from improved use of scarce resources (e.g. water).

Indirect or spill-over benefits, e.g. reduced disruption to transport and supply chains, or indirect benefits to the food industry resulting from benefits in the agriculture sector.

Top Tip

A SEB analysis can be designed by looking at the project ToC and Logframe. This can identify the intended outcomes and impact – and thus the potential benefits to investigate. The ToC can also be used to develop the questions for the baseline and end-line surveys, to understand the effectiveness of the project in achieving its intended impact.

STEP 1: IDENTIFY SOCIO-ECONOMIC BENEFITS & VALUE CHAIN

 In practice: Example of seasonal forecast benefits for agriculture

Beneficiaries	Expected Benefits
Farmers	• Increased yields and incomes (for farming households) • Improved quality of yields (and improved market value) • Reduced risk of asset damage and loss (to farm inputs and machinery) • Reduced risk of adopting coping strategies (post-extreme events) which reduce wealth/increase vulnerability (such as through selling assets) • Reduced risk on livestock health and productivity • Reduced risk of health impacts • Improved wellbeing/reduced risk for dependants (an indirect benefit)
Surrounding rural areas	• Improved food security and health benefits (reduced risk of malnutrition) • Reduced risk of soil and water contamination
Other sectors	• Improved access to/lower cost of agriculture raw materials (ag value chains) • Improved information on vector borne disease (health benefits) • Improved information for water managers (e.g. on hydroelectricity generation)
National spill-overs	• Improved national forecasts from investment in infrastructure and modelling • Increased food trade balance and exports • Reduced risk of humanitarian response (health impacts, costs of response)

 In practice: Example of benefits from marine early warning system

Beneficiaries	Expected Benefits
Fishermen and boat operators	• Improved marine safety and reduced loss of life and injuries • Reduced loss of assets (boats, nets) / reduced loss of cargo • Improved efficiency, reduced travel time, leading to fuel savings • Reduced impacts from loss of life and livelihoods on dependants (indirect) • Economic benefits (attractiveness of marine transport) (indirect)
Shoreline businesses	• Fish traders – reduced losses from fish drying (avoiding heavy rain) • Tourism operators – improved safety (avoiding storms, strong winds), safer and improved recreational use and benefits • Regional transport networks – travel time benefits
Surrounding urban areas	• Reduced loss of life and injuries • Reduced building damage and infrastructure damage • Reduced traffic disruption (and congestion) • Improved information for water-borne disease (flood information) • Reduced impacts from loss of life on dependants (an indirect benefit)
National spill-overs	• Improved national forecasts from investment in infrastructure and modelling

STEP 1: IDENTIFY SOCIO-ECONOMIC BENEFITS & VALUE CHAIN

The next task in this step is to **develop a value chain** for the new or enhanced service.

This should list the successive steps in the new or enhanced service, that go from the generation of information through to use by end-users (see the value chain blue arrow on page 3).

The relevant steps and considerations – from early activities through to end-use – may include the following:

- Foundational activities, including infrastructure or modelling;
- Generation of information;
- Accuracy of information;
- Timeliness of information;
- Communication of information;
- Access to information among target end-user groups;
- Understanding of information;
- Trust in the information;
- Ability of users to respond;
- Level of use/uptake by end-users;
- Effectiveness of response of users – both positively and negatively;
- Redistribution of benefit.

The exact steps will vary with the type of service and on the planned activities. An example of the main steps for a marine forecasting value chain is shown on the right.

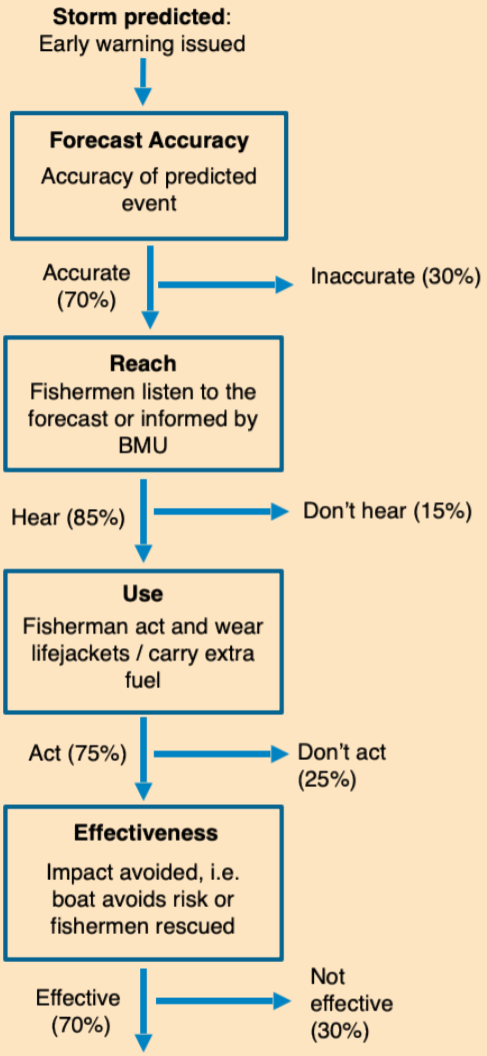
If the project improves an existing W&CI service, the focus should be on understanding and analysing the value chain of the current service, and the potential changes planned.

If the project introduces a new W&CI service, then it is important to develop and map out all the steps in the new value chain.

Understanding the value chain will help define the baseline (Step 3), and estimate the benefits of the project (Step 4). A value chain is also very useful for identifying potential survey questions to ask in surveys and evaluation.

Top Tip

It can be useful to develop a decision tree to map the flow of information from generation through to end-use, to develop the value chain. An example is shown below for an EWS for fishermen from the HIGHWAY project. It identifies the cascade of steps from forecast generation through to user benefits. This was used to subsequently assess the efficiency losses at each step (see % values). These values were derived from discussion with met agencies, as well as surveys and focus groups held with end-users, and were used to estimate the overall benefits. For full details, see the HIGHWAY SEB report.



STEP 2: REVIEW AND DECIDE ON METHODS

The next step is to **decide on the methods** for the SEB analysis. A number of methods have been used for SEB studies of W&CI services. These are listed in the box below.

The choice of method depends on two issues:

- The type of W&CI service and the suitability of various methods to derive benefits.
- The capacity, level of expertise, and the time and resources available for the SEB analysis.

Methods can broadly be distinguished into those that assess:

- The **potential** benefits of climate services, which typically use *ex ante* methods (before the service is introduced), and
- The **actual** benefits after implementation, which use *ex post* analysis (after the service is introduced).

Current SEB guidance is not prescriptive, and there is often not a 'best' or most applicable method. Nonetheless, certain types of service, and limits to resources, do lend themselves to particular approaches. A description of methods, their potential applicability to different W&CI, and the resource and expertise needed to implement them are summarised on the next page.

In the WISER programme to date, the most common approach used for SEB analysis has been to assess actual or perceived benefits with before versus after evaluation using **ex post surveys**, a type of analysis that is aligned to evaluation methods.

The subsequent steps in this guidance focus on this method. The accompanying 'How to Notes' provide detailed information on commissioning and undertaking SEB studies using a survey-based evaluation approach.

Ex ante models
Decision-theory based models that can be applied to estimate potential benefits, for example, using a crop model to assess the possible increases in yield from improved seasonal forecasts.

Integrated economic models
Models that can assess aggregate effects, including cross-economy linkages, or wider economic effects for example, input-output, trade, partial or computable general equilibrium models.

Cost-loss models
Models used to analyse extreme events and EWS. These include probability loss curves based on historical event information, and can be extended to look at non-monetary effects e.g. fatalities.

Ex ante surveys
This approach uses survey-based elicitation of individuals' preferences, to assess their willingness to pay (WTP) for potential new services.

Ex post surveys
These directly survey users to explore actual (or perceived) benefits from climate services.

Statistical and econometric analysis
These use statistical analysis (ex post) to assess impact/outcomes from the introduction of W&CI services, controlling for other variables to attribute benefits.

Impact assessments
These undertake direct measurement of service impact on a group or area, before or after, or relative to a control, e.g. using agriculture field plots.

Value (Benefit) transfer
This method takes estimates developed in one context and applies these in another context, rather than undertaking primary studies, adjusting values for context.

STEP 2: REVIEW AND DECIDE ON METHODS

	Description of Method	Resource & Expertise Needs
Observations	Benefit transfer 'What-if' analysis using simple assumptions	Low. Costs of review and analysis of indicative values. Low expertise required.
	Modelling of benefits, e.g. Observing System Experiments (OSEs), applied to 'what-if' analysis, or modelling of benefits.	Medium to high. Cost of OSE and analysis considerable. High level of expertise involved.
Weather forecasts	Surveys of willingness to pay (ex ante) for new or improved services.	Medium to high. Cost of survey and analysis. High level of expertise involved.
	Revealed preferences studies.	Medium to high. Cost of studies and analysis. High level of expertise involved.
	Survey/questionnaire of likely beneficiaries (ex post), e.g. survey of farmer/farmer representatives.	Medium. Cost of undertaking survey and processing/interpreting results modest, but can be included in the baseline and end-line survey. Low -medium expertise required.
	Modelling of benefit (ex ante decision models), e.g. simulations of effects on agricultural yields and resulting changes in farmer income/revenue.	Medium to high. Time spent on developing model and data analysis. High expertise required.
	Benefits transfer, e.g. transfer from previous studies for similar improvements elsewhere, with adjustments for context.	Low cost. Review previous studies and interpretation to allow transfer to current context. Low expertise required.
Early warning systems	Survey/questionnaire of likely beneficiaries (ex ante or ex post see above).	Medium cost and low-medium expertise required (see above).
	Physical modelling, using simulations or historical analogues of events to calibrate impact costs (cost loss/ avoided losses).	Medium to high. Time spent on developing model and data analysis of results.
Seasonal forecasts	Surveys of willingness to pay (ex ante) for new or improved services.	Medium to high. Cost of survey and analysis. High level of expertise involved.
	Revealed preferences studies, e.g. averting behaviour.	Medium to high. Cost of studies and analysis. High level of expertise involved
	Survey/questionnaire of likely beneficiaries (ex post), (see above).	Medium. Cost of survey and processing results, but can be included in the baseline and end-line survey. Low -medium expertise required.
	Modelling of impacts from seasonal variations (ex ante) and effects on agricultural yields /incomes.	Medium to high. Time spent on developing model and data analysis of results. High expertise required.
	Economic modelling (ex ante) suitable for larger scale change, e.g. computable general equilibrium modelling.	Medium to high. Time spent on developing model and data analysis of results. High expertise required.
	Impact assessments, e.g. agricultural test plots to allow measurement of benefits.	Medium to high. Development and analysis of test plots and data and analysis of results. Medium – high expertise required.
	Econometric analysis (ex post), e.g. quantification of income benefits of improved weather forecasting on basis of regression analysis of data.	Medium to high. Time spent on developing econometric analysis and data analysis of results. High expertise required.

STEP 2: REVIEW AND DECIDE ON METHODS

In summary:

- Evaluation methods look for the changes in outcomes that are directly attributable to a programme or project.
- They can be used to answer specific questions related to design, implementation, and impact.
- They are carried out at discrete points in time and often seek an outside perspective from technical experts.
- They usually require survey work to collect data, both qualitative and quantitative.
- The use of micro-level analysis is typically used to investigate the causal relationship between the project and variables of interest, i.e. the benefits.
- The method chosen to collect information may include survey work, key informant interviews, focus group discussions, and secondary data sources.

In general, two approaches can be distinguished for evaluation:

1) A 'before versus after intervention' evaluation. This requires a baseline that describes the current conditions before implementation, and then compares this to the outcomes, focusing only on the groups that potentially benefit from the service. The benefits are then estimated by a simple subtraction.

Advantages: Conceptually straightforward and generally cheaper.

Disadvantages: Lack of a comparator, i.e. it does not control for all the other confounding factors that might influence outcomes.

2) 'With versus without intervention' analysis (controlled studies). This approach requires a counterfactual, i.e. a different group to compare the impact of the intervention against. The difference between the project and the comparison group provides the impact. This does not require a baseline, but does need to control for selection bias. A double-difference approach (D-i-D) can be used to compare the difference in the change for the intervention and non-intervention groups.

Advantages: Focuses on change rather than absolute levels. Can account for change due to factors other than the intervention.

Disadvantages: Greater complexity, time and resources needed. The approach cannot be used if the composition of groups pre/post change are not the same.

Most WISER studies to date have used the first of these approaches, i.e. the before and after.

Top Tip

A good rule of thumb is to look at previous SEB studies for similar W&CI services, to review the methods that were used, and the level of detail involved. For example, if your project is for seasonal forecasts for agriculture, look at previous applications of SEB analysis in this area. Previous projects and method sources are included in the additional resources on the next page.

Further resources

There is more detailed technical guidance on methods in the WMO Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services.

There are also more technical descriptions – and reviews of previous applications for different project types – in Soares et al. (2018), Vaughan et al., (2019), and in the Asia Regional Resilience to a Changing Climate (ARRCC) report on Valuing climate services (Suckall and Soares, 2020) which includes consideration of advantages and disadvantages of different approaches.

STEP 3: DEVELOP A BASELINE FOR THE CURRENT SITUATION

For survey-based evaluation, a key early task is to develop a **baseline**.

Such a survey will often be undertaken for other reasons, for example, as part of M&E activities. While it is sometimes necessary to develop a separate SEB baseline, it may also be possible to integrate SEB aspects into other planned baseline activities.

The baseline provides a snapshot of the conditions before project implementation. This information needs to be collected **before** the new or updated service is introduced. To design or integrate SEB considerations in the baseline, the following is recommended with an example on the next page:

1) Map the W&CI service value chain (see Step 1) and use this for developing baseline design.

- When a W&CI service already exists, the baseline should identify and assess the characteristics of each step of the value chain, i.e. in terms of accuracy, uptake and use of information, including the end-user decision and benefits that arise.
- Similarly, if a completely new service is being developed, it is important to develop a new value chain (see Step 1) in order to understand the overall steps from information generation through to end-users, and ensure data is gathered on each step, before the service is introduced.
- The value chain provides insights on what the baseline needs to investigate, for example, a survey questionnaire (and complementary analysis) will need to assess current forecast accuracy, how many people are currently reached, the existing level of use by end-users, to develop a baseline for SEB.

2) Describe and analyse the most significant current weather and climate impacts affecting users (of existing W&CI service) or target users (of the new service).

- If a W&CI service already exists, this should quantify the social, economic and environmental impacts of climate-induced events on users across sectors (e.g. households, private and public sector), before the service is enhanced.
- If a W&CI service does not exist, the focus will be on how the target (future) users of the new W&CSI service are currently affected by climate-induced events.
- In the case of using a *with vs. without intervention* method, i.e. approach 2 on the previous page, a counterfactual is needed. Information should be collected for both the *intervention* and *without-intervention* groups before the service starts (e.g. to allow for double-difference technique).

The baseline should be defined at the start of the project. A baseline can also be built retrospectively, e.g. by asking people to report on past conditions, though this tends to to under or overestimate impacts.

One **key lesson** from the completed WISER projects is that the baseline and survey questions must be specific to the service. In some cases, surveys asked about the use of all forecast information, rather than specifically about seasonal forecasts developed by WISER, making it difficult to undertake SEB analysis.

Top Tip

- *Use a value chain analysis to produce your baseline, making sure information is specific to the W&CI service that will be targeted by the project.*
- *Derive baseline information (e.g. survey questions) for ALL the steps in the value chain.*
- *Make sure survey baseline information is described, quantified, and if possible monetised (e.g. value of yields, value of losses).*
- *If a survey method is used, make sure the sample is of a statistically significant size.*

In practice: Example project to enhance an existing seasonal forecasting service for farmers

Map the existing W&CI service value chain and link it to the baseline

Who does the existing W&CI service target?
- Geographical focus (e.g. specific region or province)
- Number of farmers reached by the W&CI service
- Average number of dependents per farmer

How many use the service?
- Number of farmers that actually use the W&CI service
- Decisions taken upon receiving the information
- Costs of actions taken
- Reasons for not using the service (information on barriers)

What are the socio-economic conditions of those targeted by the existing W&CI service?
- Annual income/yields/profit
- Subsistence agriculture vs trade (percentage split)
- Food security (e.g. number of months with food shortages)

How often are they currently affected by climate events?

How are they currently affected by climate variability or extremes?
- Annual income/yields/profit
- Subsistence agriculture vs trade (percentage split)
- Food security (e.g. number of months with food shortages)
- Loss/damage of household assets (costs of repairs)
- Loss/damage of communal assets (e.g. roads) (cost of repairs, knock-on impacts)
- Specify if losses and damage are after taking preventive action (or not).

What is the new or enhanced service going to do and which value chains steps will this affect? E.g. broadening reach of an existing service will change numbers accessing (and may require new socio-economic information for new areas or users).

Decide on evaluation approach

Before vs After intervention	With vs Without intervention
Map baseline value chain + information on target group only	Map baseline value chain + information on target group and counterfactual

Design the survey questionnaire

General guidance on information to be collected on the W&CI:
- Both qualitative and quantitative
- For users and non-users
- Information specific to the W&CI service targeted by the intervention
- On current socio-economic conditions
- On current use of W&CI information and costs of actions
- On reasons for not using information
- On current climate change events frequency and impacts
- Specify if losses and damage are after taking preventive action (or not)

PLEASE NOTE: every baseline will need to be tailored to the unique characteristics of the project. The example above provides questions to gather key information but is not meant to be an exhaustive list.

STEP 4: ASSESS THE CHANGE WITH THE SERVICE IN PLACE

The **impact of the intervention** will need to be measured to compare the baseline ('before vs. after' approach) or counterfactual ('with vs. without' approach).

This requires identifying, measuring and if possible monetising the benefits directly resulting from project activities.

To assess benefits – relative to the baseline or counterfactual – the analysis needs to look at:

- The changes that have arisen due to the W&CI service along ALL steps of the value chain, relative to the baseline. Many projects enhance several steps, e.g. improved reach and more targeted user information.
- Assessing these changes quantitatively, for example, in terms of increased % accuracy of forecast, or numbers of additional people reached.
- For the final step in the value chain, assessing the improvement in decisions and the associated socio-economic benefits, for example, the reduced loss or damage, increased yields and income as a result of the project (see also Benefits box on the right).

There is also a need to assess:

- **Causality.** The role of a W&CI service in affecting outcomes along the value chain needs to be clearly justified through the use of a sound methodological approach.
- **Attribution.** The presence of other programmes or factors which might have affected the outcomes must be considered, to attribute the change to the project only.

When surveying information on economic benefits directly, it is important to be aware of the limitations of self-reporting, which can lead to perceived rather than actual changes. Methods to deal with such limitations should be considered (i.e. verification, triangulation).

The evaluation findings will provide the benefits of the W&CI service (new or enhanced) for the target population compared to the baseline or counterfactual.

Benefits

Benefits are positive (or negative) changes in outcomes resulting from the project.

Benefits should be mapped to specific categories of affected individuals. The benefits of the intervention per person or household reached by the W&CI service should be clearly identified, quantified and if possible monetised (examples are given in the table on the next page).

Initially, benefits should be identified and measured in the units in which the impact is directly expressed, for example, through yield increase or lives saved. Benefits will then need to be valued using market prices. If markets are distorted or market prices are not available, shadow prices can be used, which provide estimated values.

For non-market benefits, such as environmental, health and educational outcomes, economic techniques can be used for monetary valuation. This includes revealed and stated preference methods (see further resources). The valuation of non-market benefits is often challenging, and can require additional expertise (and resources if primary studies are needed). Although it is often possible to provide indicative estimates through the use of value transfer (see Step 2).

The SEB study should ideally try to investigate the effect of the W&CI service on all the intended outcomes. However, it is likely that only a sub-set of outcomes will be the subject of quantitative analysis.

It is noted that in many SEB studies, the tendency is to only assess the positive outcomes from the use of W&CI services. However, it is also noted that as services are never completely accurate, and users may not always act effectively, there is the potential for decisions or activities from the use of W&CI services to

be negative. Ideally these outcomes should also be included in the analysis, and thus the net benefits should be calculated.

Finally, project evaluation focuses on micro-level impact. For large projects or programmes, there are potential effects on other sectors, on even economy wide effects (macro-economic effects). These can be analysed, but require methods such as Integrated economic models (see Step 2).

In practice: Examples of benefits and associated physical and monetary values

Type of benefits	Description	Unit value (e.g. £/)
Increased agriculture yields	Tonnes/year	£/tonne
Increased quality of yields	Tonnes/year	£/tonne (mark-up price for high quality)
Avoided or reduced asset losses and damage	Type and quantity of assets saved	£ reconstruction/repair cost savings
Reduced number of fatalities and injuries (number of lives saved)	Number of lives saved	£ value of statistical life
Increased food security/reduced risk of malnutrition	Reduced number of undernourished people	£ health cost savings
Reduced incidence of pests and diseases	Crop or livestock losses avoided due to pests and diseases	£/tonne or cattle saved

Further resources

There is more detailed guidance on valuation methods in the WMO Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services and in UK economic appraisal guidance in the Green Book. These include guidance on valuing non-market benefits. There is also guidance on environmental valuation available from the OECD.

STEP 5: ASSESS THE COSTS OF THE PROJECT

Once evaluation results are available, they can be combined with information on costs to answer the question of how do the costs of the new or enhanced service compare to its benefits?

What costs should be considered? The costs of a project or programme are not just the value of the funding (i.e. the project cost). They include a range of other costs associated with the set-up and delivery of the service across the value chain (see Cost categories box on the right).

How to assess costs? This involves capturing all the various cost elements, and building up the cost streams (over time) for the project.

This should include the investment in new or additional meteorological stations and the costs of operating the service. It should also take account of the additional costs for communication and uptake of information, and finally, any costs associated with end-user decisions or activities.

Cost categories

It is important to capture all the relevant categories when assessing W&CI services. This includes:

Project costs. Including project funding borne. This might include both capital and operating and maintenance costs:

Capital costs
The investment costs, such as the capital investment in new meteorological station infrastructure. As well as the capital costs, there may be set-up costs associated with training or technical assistance support.

Operating and maintenance costs
This includes all activities associated with running the service. This includes recurring/operating costs such as staff costs, modelling and forecasting, and maintenance.

Third-party costs. Including any co-financing provided by other donors and/or government and national institutions (e.g. meteorological authorities), and costs borne by intermediaries responsible for communication (e.g. radio stations).

Value chain costs
Costs will be incurred at various stages along the value chain, and these should be included. For example, the costs of communication and outreach.

End user costs
There are costs associated with the decisions or actions taken by end-users. These may involve direct costs, e.g. costs of material to fix a roof before a storm, or the costs of changing to different crop varieties. These actions also include resource and opportunity costs. For example, the time taken to fix a roof as well as the materials, or the time to attend workshops. It is more challenging to capture these end-user costs, but if they are excluded, costs will be underestimated relative to benefits.

STEP 6: ASSESS BENEFITS AND UNDERTAKE A CBA

The next step **compares the costs and benefits** of the project, by undertaking a cost-benefit analysis (CBA).

CBA is a standard economic appraisal technique that assesses a programme or project by estimating the economic benefits it produces over time, and comparing these to the costs over time, both from a societal perspective.

The CBA uses the information gathered in the survey work (baseline and follow-up surveys), in particular the incremental costs and benefits resulting from the project over time.

However, the costs and benefits that arise in different time periods (in different future years) have to be assessed in equivalent terms, in so-called present value terms. This adjusts the values using discount rates (see box on the right).

Once the present value of costs and benefits has been assessed, these can be used to estimate an overall net present value. This is the difference between the present value of benefits and the present value of costs over the evaluation period. Alternatively, the benefit to cost ratio (BCR) can be estimated, which is the total present value of benefits divided by the total present value of costs.

If a W&CI service project has a positive net present value, or a BCR of >1, this demonstrates that benefits outweigh the cost. The higher the NPV or the greater the BCR, the more positive the project is considered.

It is important when developing the CBA to develop an accurate profile of costs and benefits over time, which align with a realistic set-up and delivery of the project.

Costs and benefits in future time periods

Costs and benefits in economic appraisal are estimated in 'real' base year prices, which means the effects of inflation are removed.

Costs and benefits that arise in different future years are adjusted to provide equivalent, directly comparable values using **discount rates**, and expressed in present values terms.

This is the standard approach in economic appraisal methods, and takes account of the fact that individuals and society prefer to receive goods and services now rather than later. The choice of the discount rate will depend on the context and country. In WISER a discount rate of 10% was used, as a typical rate used in economic appraisal in developing countries, with a sensitivity based on the 3.5% rate used in domestic UK public policy.

For example, costs are likely to be borne in the early years as the project is set-up, but benefits will normally not start for a year or two later, i.e. there will be a delay between costs and benefits.

At the same time, benefits will usually extend beyond the period of the project funding, i.e. in future years. However, the level of benefits in these years may be reduced if the project activities are not fully sustained.

The annual benefit profile should therefore reflect these aspects, for example, to phase up at the start, to deliver fully during project funding, and then (depending on sustainability actions) to phase down in later years.

Further resources

There is more detailed guidance on cost-benefit analysis in the WMO Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services and in UK economic appraisal guidance in the Green Book. There are also examples of cost-benefit analysis spreadsheets, that provide templates for undertaking analysis.

STEP 6: ASSESS BENEFITS AND UNDERTAKE A CBA

In Practice. Analysis of Benefits and CBA in WISER

A SEB and CBA analysis was undertaken for eight of the WISER East Africa projects. These projects led to new or improved weather and seasonal forecasts, as well as EWS, at the national and regional level. These provide examples of the analysis and valuation of benefits.

An analysis of market benefits was undertaken for the Strengthening Weather and Climate Information Services in Uganda. This project developed downscaled and local language seasonal forecasts for farmers and undertook surveys to assess changes in yields. The SEB analysis used a value chain approach to identify the effectiveness of the service, then combined survey results with data on rural earnings to estimate the overall increase in incomes and thus total project benefits.

An example of non-market benefits was undertaken for the marine EWS developed under the HIGHWAY project. The SEB analysis used surveys and focus groups, combined with a value chain approach, to estimate the potential reductions in fatalities on Lake Victoria. These were monetised using estimates of the value of a prevented fatality from the literature (benefit transfer) adjusted to the East African context. These were combined with market benefits, such as improved fuel efficiency for boats, to estimate the overall project benefits.

For each of the projects, a CBA was undertaken, comparing the discounted benefits generated from the project over time, with the discounted costs. The results found positive benefit to cost ratios for all eight projects.

In each case, a sensitivity analysis was also undertaken to check the robustness of the results (see Step 7). This primarily tested the potential impacts on the CBA for key benefit streams and discount rates.

Further information on these case studies is available in the report on Socio-Economic Benefits of the WISER Programme. A more detailed worked example of how to undertake a cost-benefit analysis is provided in How to Note 2 on undertaking SEB analysis.

Gender Equity and Social Inclusion

There are differences in needs, access to, and use of, climate information by gender, and by different groups in society, including the young, the elderly, people of different ethnic, social and income groups, and abilities.

To address this, the WISER programme has produced information and guidance on taking gender equity and social inclusion into account when designing and developing W&CI services.

These issues are also relevant for SEB analysis. For example, it is useful to take account of people's social and economic roles, and the differences of gender, income, age, or ability, when looking at beneficiaries and benefits.

It can also be useful to provide and report more disaggregated information, e.g. analysing SEB by income group (using distributional analysis), as this can help target services to the most vulnerable, where relative benefits are likely to be highest.

These GESI issues link to the VfM framework (see page 22) and the consideration of Equity. For interventions to be equitable, for example, additional activities (and costs) may be needed to ensure marginalised or hard to reach populations are included.

STEP 7: SENSITIVITY ANALYSIS AND ENHANCING BENEFITS

The final step is to test the robustness of the SEB analysis, and to look for further improvements.

Ideally, a SEB study should consider biases and uncertainties, potential omissions, and undertake sensitivity analyses for key variables, testing how these affect the results. This analysis can also be used to explore how benefits could be increased.

There are three key aspects to this step:

1) To **describe all the methodological limitations and biases of the method used.** This provides a transparent description of the potential caveats, and the limitations, potential omissions and quality of the information used. These should be presented clearly, including with an analysis of how these might affect results (e.g. leading to potential over- or under-estimates).

2) To **test how the results would differ if some of the key assumptions or outcomes are changed, using sensitivity testing.** This can include a number of tests to see how robust the results are:

- It is good practice to run a sensitivity analysis on the CBA by changing some of the underlying assumptions. Sensitivity testing can be around outcomes (e.g. lower benefits than reported in a survey) or methodological (use of a lower discount rate).
- It can also be used to look at the profile of costs and benefits over time and how this might affect the CBA. For example, it is possible to model decreasing benefits over time, after the initial period of project financing has ended, or to investigate the impact of different discount rates on the CBA results. These tests can show how robust a project is, e.g. if the NPVs remain high and BCRs positive even under different assumptions, this gives greater confidence in the positive aspects of the project.
- All sensitivity tests should be clearly explained and the results transparently presented, for example, documenting how the sensitivity tests change the BCR or NPV, and if they alter the overall conclusions.
- Switching values can also be investigated. These are assumption values which lead to a switch in the NPV from positive to negative, or reduce a BCR to below 1. For example, this can identify the lowest level of benefits that can be produced from a seasonal forecast that still gives a positive economic return, and assess whether the project is likely to generate higher benefits than this minimum level.

3) To **use the findings of the SEB analysis to explore how benefits could be enhanced.**

The information from a SEB analysis can be used to identify how to further improve a project, especially when combined with sensitivity testing.

For example, the sensitivity analysis might reveal which steps of the value chain have the most influence on the overall size of benefits, or the pinch points in the value chain where a small additional improvement might lead to large benefits.

This information can be used to target any follow-on resources, or subsequent project phases, and help deliver higher overall benefits and impact.

BEFORE YOU START

This guidance should be used as early as possible in the development of a W&CI service project.

Ideally, an initial consideration of SEB should be included at the **concept stage**, to identify potential users, understand possible benefits and to develop the value chain (see Step 1).

There should be a detailed consideration of SEB at the **proposal stage**, to ensure all the activities and resources needed for the analysis are included and budgeted, before the project starts.

Some key aspects to help you integrate SEB into concept and proposal development are:

- Does your project Theory of Change and Logframe include objectives and indicators at outcome and/or impact level for socio-economic benefits? If not, these should be considered.
- Have you included a project activity line for SEB analysis? As the project moves to the proposal stage, it is useful to include a separate component (or sub-component) in the work-plan that captures SEB activities, with clear outputs.
- Have you considered the time and resources needed for assessing benefits and integrating these into the project activities and budget? If not, these should be included.
- Has the analysis of SEB been integrated into your survey plans and baseline analysis? There is often an opportunity to undertake relevant activities together, but this requires planning to ensure that aspects are integrated.
- Have you identified who will do the SEB analysis? If this is internal, does the team have the relevant skills and resources available? If external, have you identified relevant skills or has the contracting process been considered and built into the timetable and resource plan?
- Have you identified the links between the SEB work and the VfM analysis? The results from a SEB analysis generate highly relevant information for reporting project results, and the effectiveness and cost-effectiveness components of a VfM analysis.

Have you considered dissemination activities? It is worth thinking about how to use the results of a SEB study. This could include the production of relevant policy briefs and news items, that would enhance the impact of your project. It is worth including these activities in your proposal.

Further resources

There is more detailed technical guidance on valuing weather and climate services published by the World Meteorological Organisation (WMO) in their 2015 report on Valuing Weather and Climate: Economic Assessment of Meteorological and Hydrological Services.

For more general information on climate services, see the Global Framework on Climate Services.

QUESTIONS TO ASK TO HELP INTEGRATE SEB ANALYSIS

This checklist can help to ensure SEB is built into an existing process of project design and implementation.

At the Concept Stage
What socio-economic benefits is the W&CI service intended to generate?

What are the steps along the value chain to deliver these benefits?

Does the project intend to undertake SEB analysis?

At the Proposal Stage
Have you listed the socio-economic benefits for different users, including direct benefits (market and non-market) and indirect benefits?

Have you mapped out a value chain showing the steps from foundational knowledge and information generation through to the use of the information by end users?

Has the project developed a clear ToC that is consistent with the expected benefits along the W&CI service value chain?

Does your proposal include a Logframe and have you included socio-economic benefits as an outcome or impact indicator for the project?

Have you allocated budget to undertake the SEB analysis?

Have you included the activities related to the SEB analysis in your workplan?

Are you allocating sufficient time to undertake the baseline work before the project starts?

Before Project Implementation. Commissioning the SEB analysis
Does the project team include personnel with the technical competence to implement evaluation methods and cost-benefit-analysis?

Will the project team also be in charge of supervising and quality checking the baseline work and reports?

Does your baseline survey include investigation along the value chain? Are you assessing all steps?

Is the method proposed for the evaluation robust?

Is the baseline survey going to gather both quantitative and qualitative information on a statistically significant sample?

Does the baseline survey investigate all costs (including users costs) of the existing W&CI service?

Does the baseline survey investigate current coping strategies and related costs and benefits?

Does the baseline survey investigate the current impacts of climate change events on current or future users, or on the counterfactual group?

Can the baseline survey be used to generate unit-value estimates of socio-economic conditions and metrics that can be monetised (e.g. incomes, yields) for the cost-benefit-analysis?

After Project Implementation. Finalising the SEB analysis
Are all the intended benefits along the value chain being looked at and assessed ex-post?

Has a sufficient time-lag elapsed to assess the impact on end-users?

Are the follow-up surveys consistent with the baseline surveys, and allow for a direct comparison and estimation of incremental costs and benefits resulting from the project?

Could other projects or programmes have affected the outcomes? If so, does this affect attribution?

Does the information gathered allow a quantification of the incremental (net) benefits of the project?

Are all the categories of costs and benefits being assessed and monetised in unit-values?

Have all the data and assumptions that underpin the cost-benefit analysis been clearly explained?

Has a sensitivity testing been performed?

Have areas of improvement of the service been identified and articulated?

SEB INDICATORS FOR LOGFRAMES

It is recommended that WISER projects include a SEB outcome or impact indicator in their Logframes. This indicator should be specific to the main type of beneficiaries and the outcomes that the project is targeting.

For example, **for an EWS targeting communities**, this could be an indicator on reduced losses (or amount saved) from the use of the information.

Similarly, **for a seasonal forecast for the agriculture sector**, this could be an intermediate SEB indicator, such as improved crop yields, or an economic indicator, such as increased incomes for farmers.

The SEB analysis set out in this guidance can be used to develop these indicators and help to measure them.

During the project design, activities in Step 1 will identify the key benefits from the W&CI service. This can be used to identify potential SEB indicators for the Logframe.

At the start of the project, Step 3 will provide quantitative information on baseline conditions, allowing these indicators to be refined in quantitative terms.

As the project nears completion, the SEB analysis will provide the quantitative estimates of benefits, which can be reported against the indicator.

SEB AND VALUE FOR MONEY

SEB studies can help to develop an improved understanding and better articulation of a project's efficiency and effectiveness, and provide quantitative information to help demonstrate and report on VfM.

FCDO guidance frames VfM at three levels which are clearly linked to the ToC and Log-frame: Economy, Efficiency and Effectiveness (the 3Es), and a fourth component on Equity (see GESI box on page 17).

Economy (inputs, i.e. spending less). This refers to ensuring the lowest cost use of goods and services within a project. It focuses on making sure that input unit costs are benchmarked against market norms and thus that value is maximised through strong procurement processes.

Efficiency (inputs to outputs, i.e. spending well). This refers to ensuring that the quality and quantity of inputs are appropriate to achieve the envisaged outputs and that inputs are managed in an efficient way during project delivery. The input to output ratios are the key consideration.

Effectiveness (outputs to outcomes/impacts, i.e. spending wisely). This refers to what extent programme outputs are likely to result in the desired outcomes, whether a programme can demonstrate that the chosen outputs are the most effective way to achieve these outcomes, and how these outcomes can be measured.

The results of the SEB analysis provides key results for the effectiveness component of VfM, notably from the BCR. A high BCR is an indicator of high VfM efficiency.

The results of the SEB analysis also feed into effectiveness, by allowing comparison of the economic benefits (and BCR) of investing in W&CI services, as compared to alternatives.

There are a number of benefits of linking SEB studies and VFM.

- Including SEB during project design, and undertaking a SEB analysis for a project, shows that you understand costs and benefits of relevance for VfM, and can ensure that resources are prioritised to where they have the greatest impact.
- SEB analysis provides detailed insight into the economic returns of W&CI service programmes, creating a stronger justification for investment.
- SEB analysis can generate evidence on the most effective approaches, and this can help support transfer knowledge to other programmes.

SEB-VfM aspects are shown in the table below.

3E	VfM	Metrics
Economy	Ensuring lowest cost procurement of goods and services. Cost-benchmarking to assess the unit costs for a given input	Cost per input, e.g. Day rates (£/day) £ per meteorological station
Efficiency	Ensuring the training, communication and use to deliver outputs. Efficiency of the choice of investment	Cost per output, e.g. £/workshop, £/ per forecast product developed Benefit to cost ratio (BCR) of the investment
Effectiveness	Choosing the balance of investment between equipment, capacity, dissemination, user uptake, etc. to result to ensure desired outcomes. Identifying the most cost-effective investments	Cost per outcome, e.g. £/beneficiary reached, £/avoided £impact BCR of investing in W&CI services versus other areas

WISER
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Supported by:
UKaid
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