



Document title	Analysis of cost-effectiveness of new measures
Code	3-1
Category	CMNT
Agenda Item	3 – Cost-effectiveness analysis of new measures
Submission date	19.11.2020
Submitted by	ACTION WP6

Background

The update of the HELCOM Baltic Sea Action Plan will be supported by analyses which estimate the sufficiency of existing measures and the cost-effectiveness of new measures in achieving the good environmental status of the Baltic Sea. The results of assessing the sufficiency of existing measures are described in [document 5-3](#). This document describes the method and progress of the cost-effectiveness analysis of proposed new measures for the updated BSAP. The cost-effectiveness analysis is conducted by the HELCOM ACTION project, with guidance from the SOM Platform.

SOM 3-2020 took note that the cost-effectiveness analysis is focused on the costs for the whole Baltic Sea region and not the costs of individual countries, but national information on costs will be utilized and cost estimates may be transferred across countries with appropriate adjustments ([Outcome](#) of SOM 3-2020, para 6.8). Data on the costs and effectiveness of potential new measures have been compiled from the synopses, via literature reviews and using data collected for the SOM analysis by the ACTION project. In addition, as agreed by GEAR 22-2020 ([Outcome](#), para 4.31), EN ESA supported the data collection by providing national cost estimates ([Outcome of EN ESA 9-2020](#)). Estimates of the effectiveness of proposed new measures collected by the ACTION project have already been provided to the BSAP UP workshops (see e.g. [Document 2-4](#) for BSAP UP WS-HZ 2020).

HOD 58-2020 took note that the cost estimates and results of the cost-effectiveness analysis for new measures would likely be available in October-November 2020 ([Outcome](#), para 4.39). GEAR 23-2020 took note that the results of the cost-effectiveness analysis might be used in the further drafting process for the actions for the updated BSAP that are not yet agreed in principle by HOD 59-2020 ([Outcome](#), para 4.25).

This document provides a description of the approach and progress of the cost-effectiveness analysis and the status of cost and effectiveness data collection. It also includes the cost database ([Attachment 1](#), excel) and information on how the cost estimates compiled from various sources are used to estimate the costs of the proposed new measures for the cost-effectiveness analysis (Appendix 1).

Action requested

The Meeting is invited to:

- consider and discuss the progress of the cost-effectiveness analysis
- discuss the potential use of the results.

Analysis of cost-effectiveness of new measures

In addition to analyzing the sufficiency of *existing* measures (SOM analysis), the work plan for the BSAP update includes analyses of potential *new* actions in the updated BSAP (costs and effectiveness). The aim is to re-run the analyses of sufficiency of measures including proposed new HELCOM actions and prepare analyses of cost-effectiveness of potential new HELCOM actions.

The cost-effectiveness analysis of new measures builds on the assessment of sufficiency of existing measures to reach good environmental state in Baltic Sea. If the existing measures are not sufficient to close the gap between the current and the good state, then new measures are required, and information on their cost-effectiveness can support the BSAP UP process. The cost-effectiveness analysis studies and compares how effective new measures are in closing the gap between the BAU scenario(s) estimated in the SOM analysis and the good state, when also the costs of the new measures are taken into account. In principle, cost-effectiveness analysis can be used to define a set of measures that is adequate to reach a certain environmental objective with the lowest costs, or to define a set of measures that performs best in reaching an environmental objective, given a budget-constraint on the maximum costs. Cost-effectiveness of new measures will be analyzed following the steps and methods described by Kontogianni et al. (2015) and Oinonen et al. (2016). See below for more detailed information of the approach and steps for the cost-effectiveness analysis. The cost-effectiveness analysis is focused on the costs (and effectiveness) for the whole Baltic Sea region and not the costs of individual countries. However, information on costs from different countries will be utilized to estimate the regional costs, and cost estimates may be transferred across countries if needed with appropriate adjustments.

This document outlines the ongoing cost and effectiveness data collection process and describes how these data will be used in the analysis, as well as possible results of the cost-effectiveness analysis. The collected data will be used in a way that allows the comparison of costs for variety of measures, when different types of costs are included in the analysis. Probabilistic methods and cost categories will be used in the analysis and to present the results. Cost data contributors include EN ESA, ACTION WPs, SOM topic teams, and the same parties who have taken part in filling in the synopses on measures and most of these have already contributed to the cost collection. Also, experts responsible for the cost-effectiveness analyses for national MSFD POMs are encouraged to contribute, since there can be synergies between national and regional work.

The data on the effectiveness of new measures has been collected mainly through ACTION WPs, SOM topic teams, literature and from the synopses on potential new actions. The data were combined from all these sources as a document to the BSAP UP workshops in August-September 2020. Further, expert-based data on the measure type effectiveness that is used in the SOM analysis and in the cost-effectiveness analysis of new MSFD programmes of measures in Finland could potentially be applied also to estimate the effectiveness of new measures for similar measures/measure types.

The cost-effectiveness analysis builds on the same model as the analysis on the sufficiency of existing measures (SOM) and thus the results are produced either for the HELCOM sub-basins or for the Baltic Sea level. The analysis can in principal be conducted regionally, by sub basin, or nationally and thus it can also support the update of national programmes of measures (PoMs) and vice versa. However, the use of different spatial levels may require aggregation of data for a regional, Baltic-wide, analysis, or that aggregated data weighted by, for example, sizes of national marine areas is used for more disaggregated spatial areas. These issues have to be taken into account especially when interpreting or comparing the results of cost-effectiveness analyses. The extent of implementation cannot be explicitly defined for many of the proposed new measures, and therefore the effectiveness and costs are analyzed using low-medium-high scenarios for the extent of implementation.

Approach and steps for the cost-effectiveness analysis

- a) Identification of potential new measures based on synopses (incl. existing but non-implemented ones) (finished);
- b) Effectiveness of new measures: Building on the method framework for the sufficiency of measures analysis, the effectiveness of new measures is defined in a similar way as for the SOM analysis (i.e. reduction % of a pressure from an activity) (ongoing) (see next section);
- c) Joint effects of new measures: The joint effects of new measures are estimated by evaluating two kinds of overlaps:
 - Thematic overlap in measure types due to their existence on different policy levels (global, EU, HELCOM, national) or overlapping content (e.g. MPAs in general vs. fishing closures in a specific area);
 - Chain effects of measure types in reducing pressures. Assuming that measures take effect in a chain, a measure can only impact the pressure share that remains after the preceding measures. As the pressure reductions are in percent (%), the chain effect needs to be taken into account.;
 - More detailed method presentation of the joint effects in the SOM analysis is given in the [SOM methodology document](#), section 14.
- d) Cost collection and estimation: See a separate section;
- e) Scaling the effectiveness and costs of new measures based on the scenarios of the extent of implementation;
- f) Analyzing cost-effectiveness of individual new measures and sets of new measures: a cost-effectiveness analysis will be conducted for the proposed measures covered by the cost and effectiveness estimates. The cost-effectiveness results are primarily given for (optimal) sets of new measures but cost-effectiveness of individual measures excluding the joint effects can also be produced. The method in Oinonen et al. (2016) is used as the basis, but inspiration is sought from Kontogianni et al. (2015), Saikkonen et al. (2018) and ongoing and recent projects. New measures may be assessed in terms of their cost-effectiveness with respect to reaching good environmental state and possible budget constraints, certainty and other relevant aspects. Since the same approach is used for the cost-effectiveness analysis as for the SOM analysis, possible results could include:
 - effectiveness of individual measures in reducing pressures from activities with respect to costs;
 - total costs of all measures or subsets of measures with respect to improvement in state or probability to reach good state (averaging over state components per topic, or relying on other methods of aggregation);
 - cost database of the collected cost data.

Cost estimation

Steps to cost estimation for proposed measures for the updated BSAP are summarized in Table 1.

TABLE 1. CONCRETE STEPS TO ESTIMATE COSTS OF PROPOSED NEW MEASURES	
1.	List the proposed new measures that will be included in the analysis. (finished including identification of overlaps and dependencies among the synopses to prevent double counting in the cost and effectiveness estimation for groups of measures)
2.	Create causal pathways for implementation of the proposed new measures included in the analysis to understand who are affected by the measures and how (from expert workshops, synopses, descriptions of existing measures, reports...). (mainly disregarded due to time constraints)
3.	Identify the types of costs for proposed new measures based on causal pathways (from CEA reports, cost-guidance). (finished, the relevant information is stored in the cost database)
4.	Considering the cost types for proposed new measures, review available cost estimates and existing data sources that can be used to define the costs of proposed new measures. (ongoing, the cost database is described in more detail in "Cost data collection")
5.	Cost transfer and estimation: Categorical costs and/or probabilistic approaches will be used for calculating and presenting the costs due to multiple sources of uncertainty along the cost estimation process. The differences between countries and basins will be considered when transferring the collected cost estimates for different areas in order to estimate the total and basin/country specific cost estimates. Cost and effectiveness estimates will be scaled based on the extent of implementation scenarios (ongoing).
6.	Data validation and data gaps in existing cost data. Additional actions: expert opinion etc. (likely disregarded due to time constraints)

Effectiveness data collection

ACTION WP6 has already collected effectiveness data from the following sources:

- 1) Synopses of the proposed new measures (finished);
- 2) References listed in the synopses, with the types of sources listed below (finished);
 - a. peer-reviewed literature;
 - b. grey literature such as project reports;
- 3) ACTION project outcomes (finished);
- 4) Expert-based data collected for the SOM model, and identification of the links of new measures to the measure types in the expert surveys (finished);
- 5) Update the effectiveness estimates with the outcomes/notes from the BSAP workshops (finished).

The data above was combined from all these sources as a document to the BSAP UP workshops in August-September 2020 (see e.g. see e.g. [Document 2-4](#) for BSAP UP WS-HZ 2020). The following will be considered for further collection of effectiveness data depending on time/human resources:

- 1) Use the literature reviewed for the cost data collection when it includes suitable effectiveness estimates (ongoing).

Cost data collection

ACTION WP6 has developed a database template to support the collection of cost estimates and to use these estimates to assess the costs of new measures. Database will be applied for the collected data for storing and estimating the costs for the Baltic Sea. A draft of the database including cost estimates will likely be provided as a late document.

ACTION WP6 has already collected cost data from the following sources (in parentheses details on the progress and timing):

- 1) the cost descriptions in the synopses of the new measures (finished);
- 2) references listed in the synopses (finished);
- 3) The literature that have been reviewed for the effectiveness of existing and new measures (includes notes if cost data exists) (finished);
- 4) Cost data provided from ACTION WP2 estimation (finished);
- 5) Reviewing the cost estimates and relevant studies conducted for the Finnish Water Framework Directive (finished);
- 6) Finding synergies with the Finnish cost-benefit analysis for MSFD POMs. A survey to collect the costs of new measures for the Finnish MSFD POM is currently open. At minimum 53 of the proposed Finnish MSFD measures overlap at least partly with the new BSAP measures, and the collected costs may be used to assess the magnitude of the costs of new BSAP measures. Such synergies may also exist with other contracting parties;
- 7) Data collection for national and other estimates from other project partners, contracting parties and HELCOM EN ESA representatives. A simplified version of the costs database was created to facilitate the data collection. Cost estimates were provided by Finland, Estonia, Latvia, Lithuania and Sweden.

The following sources and approaches are still considered for further collection of cost data depending on time/human resources:

- 1) Searching relevant databases of scientific and other literature with the economic terms (e.g., “cost” or “value”), likely combining them with the search strings and terms that have been used for effectiveness of measures;
- 2) Conducting joint searches for the effectiveness and costs of new measures. In principle, the costs and effects of measures can be separate inputs to the cost-effectiveness analysis, but the use of the cost data that can be acquired from the same literature as effectiveness data is prioritized (ongoing, included in the estimation of implementation extent);
- 3) Checking the peer reviewed cost estimation studies that have been included in the systematic literature reviews in the BONUS ROSEMARIE project and going through grey literature that was collected in the same project but excluded from the reviews (partly disregarded due to time issues and overlaps with other data sources);
- 4) Conducting specific literature searches for proposed measures where the causal pathways were described concretely enough in the synopses to define cost items (ongoing, included in the cost estimation).

Timeline for the analyses of new measures

In the workplan for the BSAP update, the analyses have been planned for the fall of 2020. Previously, it was anticipated that results of the cost-effectiveness analysis could be submitted to the Working Group fall meetings, but this was not possible. HOD 58-2020 took note that the cost estimates and results of the cost-effectiveness analysis for new measures would likely be available in October-November 2020 ([Outcome](#), para 4.39). When ready, the results of the cost-effectiveness analysis will be sent to Working Groups for intersessional review.

References

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Oinonen, S., Hyytiäinen, K., Ahlvik, L., Laamanen, M., Lehtoranta, V., Salojärvi, J., & Virtanen, J. (2016). Cost-effective marine protection-a pragmatic approach. *PLoS one*, 11(1), e0147085.

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Appendix 1. Cost database and collected cost estimates

This appendix explains the database template (version 1) that ACTION WP6 has developed to store the collected cost data and the first version of the data collection results ([Document 3-1, Attachment 1](#)). The database contains two main sheets: “Input Info” sheet and “Database” sheet. The former one includes all the collected cost references, and the latter one processes the cost data listed in the former one for the cost-effectiveness analysis. In addition, the cost database contains a “Summary” sheet, which summarizes the cost calculation results from the “Database” sheet, a sheet with “Drop-down lists” that is used for “Input Info” and “Database” sheets, and two supplementary sheets (“Suppl_Calculations” and “Suppl_Cal_CPI”) that provide coefficients to process the cost data in the “Database” sheet. The “Input Info” and “Database” sheets are described in detail below.

“Input Info” sheet

The costs of measures can be defined from different perspectives. From the perspective of a whole economy, the economic costs are assessed based on the impact on total welfare of a society, whereas the costs for an individual agent (e.g. firm), an institution (e.g. body responsible for implementing a measure) or a sector (e.g. agriculture) do not include the economic effects encountered by others.

The “Input Info” sheet in [Attachment 1](#) stores all the cost data that have been collected from the sources that are listed in the cost data collection section. In this version, more than 300 cost estimates and relevant information have been reviewed and filled into the table. Additionally, around 90 potential references and cost estimates been identified (rows that currently have information filled only in columns A–E). ACTION WP6 will continue refining the table and updating the cost estimates and relevant information from these potential references by the end of the project. In addition, some rows provide only the identified cost type of the proposed new measures (see [Attachment 1](#), Input Info sheet), but no cost data were found during the cost data collection process.

The information restored in the “Input Info” sheet is explained below:

- Column A: ID of each cost data estimate. More than 1 row can be filled in for the same synopses. The number is used as a reference in the “Database” sheet. Three digitals are used for the ID. The first digital identifies the synopsis, based on the IDs given to all synopses submitted before the end of July. The second digital in the ID is for the cost estimate for the synopsis. Costs from different sources have different second digital numbers. The third digital number is for different cost estimates from the same source.
- Column B: theme of the synopsis. Same in the effectiveness data, which was identified when effectiveness assessment was prepared for the HELCOM BSAP workshop organized in August and September.
- Column C and D: name of the (sub)measure and description of the measure from the synopsis document.
- Column E: cost item gives the description of the cost information of this row.
- Column F: the actors affected by the cost
- Column G: the cost type of this cost item, which are further classified as below:
 - Financial – Capital costs of a measure, fixed one-off expenses incurred by the purchase of some tangible or intangible goods that can be used over a longer time period. For example, a capital cost can be the cost to purchase a boat for fishing monitoring.

- Financial – Operation and maintenance (O&M) costs of a measure, for the institution that is implementing the measure and for the sector/agent that the measure is targeted to. For the implementing institution, financial costs include direct costs, such as labour costs of monitoring and fish stock assessment.
 - Financial – increase in daily business/operation costs, referring to the increase of original daily business cost due to the implementation of new measures. For example, increasing transportation cost to go further as original fishing grounds are transfer to no fishing areas.
 - Financial - Indirect costs of implementing a measure, such as overhead costs of the whole institution or the depreciation costs of general multipurpose monitoring equipment when implementing the new measures.
 - Financial – Other costs
 - Opportunity costs – foregone revenues, for example, a measure that restricts fishing in a certain area can decrease the profitability of the fishing sector, and this economic loss is an opportunity cost resulting from such a measure.
 - Cost saving – Decrease (save) in daily business/operation costs, referring to cost saving from the daily business due to the implement of measures.
 - Cost saving - others
- Column H: provides comments on whether indirect costs are relevant and whether they are included in the estimate/assessment. For capital costs, provides also lifetime and discount rate used for calculating the annual costs.
 - Column I: references (sources) for the cost estimates
 - Column J: cost estimate (assessed cost). The cost estimate included in the database can be: (1) quantitative estimate (any type, e.g. point or interval value, absolute or relative value, e.g. % of actor's revenues). Provides the estimate, currency and time unit (per year or other), and any other relevant information concerning the estimate (e.g. cost unit); (2) semi-quantitative assessment (categories with quantitative intervals); (3) qualitative assessment (categories e.g. low, high).
 - Column K: temporal scope of the costs and the year of estimation.
 - Column L-N: additional notes on the methods, uncertainty of the cost estimation, and additional data on taxes, subsidies and other economic incentives.
 - Column O: ID of the proposed measure for which this information can be used for estimating the costs (according IDs in the “Database” sheet).

“Database” sheet

The “Database” sheet in [Attachment 1](#) aims to (1) put together relevant background information for developing cost estimates for new measures, and (2) support calculations and provide the final cost estimates, which are used in the cost-effectiveness analysis of new measures.

The development of cost estimation for new measures uses the collected cost information stored in the “Input Info” sheet. Only the proposed measures that have been identified in the step one in Table 1 will be processed in this “Database” sheet. In this version of the database, some examples are provided to explain the approach to developing the final cost estimates for new measures (see below, after explanation of the sections in the “Database” sheet).

Each section in the “Database” sheet is explained below:

- Section (1) Characterisation of measures: This section provides the basic information of the proposed measure. The proposed measures are listed in the grouped ID: GX, based on the overlap and dependences among the synopses identified in the step 1 in Table 1. Second digital (e.g. GX.X) in the ID is given if different cost estimations (e.g. cost of the assessment and cost of the technical measure if the measures are grouped from different synopses) or sub-measures within the proposed measure can be identified (based on the description of the synopses). Three digital IDs (GX.X.X, marked in grey shade in the “Database” sheet) are used for cost information from different sources for the same cost estimation/sub-measure (have same numbers in the first and second digital in ID). This section also includes information of the covered synopses (original IDs of the synopses before grouping), as each proposed measure used for cost estimation may contain multiple synopses, and thus the name and description of the measures are made based on the covered synopses for the cost estimation purpose. The application extent in this section provides an assumption of the extent of the application of the proposed measure in the Baltic Sea, which corresponds to the effectiveness assessment. It is needed for the cost calculation described below. The other information of the measure is based on the synopses or the technical review by HELCOM Working Groups.
- Section (2) Used input information on costs (e.g. estimates, source(s), certainty): This section summarises the input information related to costs which is used for deriving the cost assessment/estimates for the cost-effectiveness analysis. This section is filled for each measure based on collected input information in the sheet “Input Info”.
- Section (3) Affected actors – assessment: Columns with the main groups of actors.
- Section (4)-1 – (4)-7 Types of costs – assessment: This section includes the developed assessments/estimates and related explanatory information concerning types of costs. The seven sub-sections are divided based on the cost type described in the section for “Input Info” sheet. The aim of this section is to derive and provide quantitative estimates (as far as possible). The estimation may require some calculation from the original cost data from the sheet “Input Info”, and thus the approach and other variables used to derive the estimation need to be clearly documented. The grey shaded rows with 3 digital IDs provide the details of the calculation process in this section. If the costs are not quantified for a measure, they can be described in other ways in column “Description”.
- Section (5)-1 – (5)-3 Total costs – assessment: This section contains the estimation of the total cost of each sub-measure or each cost estimation. Section (5)-1 will be estimated if the collected cost in the “Input Info” sheet is presented in total cost but not in different cost types. Section (5)-2 contains the derived quantitative estimate of the total costs based on assessment of each type of cost in sections (4)-1 to (4)-7. Section (5)-3 provides information about potential double counting for the costs of different proposed measures, if the costs of all measures or a sub-set of measures will be estimated. The results of this total cost assessment will be used for cost-effectiveness analysis.

The development procedure on cost estimation varies across proposed measures, depending on the characteristics of the proposed measure and the estimation unit of the collected cost. The following approach has been used to calculate the cost estimates for the Baltic Sea scale. Information about some of the calculations and some values used in the calculation are provided in the two supplementary sheets (“Suppl_Calculations” sheet and “Suppl_Cal_CPI”).

1. If the cost estimate is country-based or at the national scale (expressed as costs of country X), the cost estimate will be first transferred to other countries that do not have information for such a cost item, and then the costs of nine countries surrounding the Baltic Sea will be summed. Some measures may only apply to specific countries, and then only the costs of those countries will be considered. The costs are transferred according to this procedure: the collected cost is:
 - i. adjusted with consumer price index (CPI) to 2019 level
 - ii. transferred to EUR if the collected cost was not in EUR

- iii. adjusted with gross domestic product (GDP) per capita ratio between the study country and the target country.

IDG2.1 in the “Database” sheet is an example of this type of cost input. However, consideration of the extent of different measures between the countries during such cost transferring is still under development. The activity-pressure contributions of each country related to that measure may be used.

2. If the cost estimate is not country-based but expressed per unit (e.g. EUR per hectare), the cost is:
 - i. adjusted with CPI to 2019 level
 - ii. transferred to EUR if the collected cost was not in EUR
 - iii. adjusted with GDP per capita ratio between the reference country and target country. This will be the unit cost for the Baltic Sea.
 - iv. the unit cost for the Baltic Sea will be multiplied by the application extent of the measure.

ID G57.1.1-G57.1.2 (section (4)-5) in the “Database” sheet are examples of this kind of cost transfer. In some cases, the cost unit from the collected cost is not area-based but in some other quantity (e.g. EUR per ship). Other quantity information is needed to estimate the cost for the entire Baltic Sea. ID G2.3 (section (4)-3)) and G2.4 (section (4)-1) in the “Database” sheet are examples for the quantity information that can be collected and the quantity information not available, respectively.

3. If the collected cost is already estimated for the entire Baltic Sea or unit cost of the Baltic Sea, the cost is
 - i. adjusted with CPI to 2019 level
 - ii. multiplied with the quantity information (e.g. application extent of the measure or total amount at the Baltic Sea level) if the cost was estimated as unit cost. Otherwise, the calculation stops at the step i.

G2.4 (section (5)-1) in the “Database” sheet shows an example for this case.