Document title	Proposed methodology for assessing effectiveness of measures and pressure-state response
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Reference	

Background

HOD 56-2019 endorsed the approach for analysing sufficiency of measures and its use to support the BSAP update as contained in document 2-3 to HOD 56. The approved approach is based on a proposal presented and discussed at HELCOM SOM Platform 1-2019, intersessional adjustments by the HELCOM ACTION project, commenting by SOM Platform representatives, and the endorsement by GEAR 20-2019 (para 5.20). Comments to the approach by HOD 56-2019 and GEAR 20-2019 are included in document 2-1.

The approved approach specifies the required data and information, main steps, and a framework for the SOM analysis. The methodology has however not yet been detailed for all steps, including step 4, estimation of effects of measures, and step 6, linking reduced pressure to state. This document includes:

- a description of the assumptions of the SOM model and how available information governs the units and methodology of the SOM approach as a whole and of steps 4 and 6 in particular,
- a proposed methodology for step 4, estimation of effects of measures,
- a proposed methodology for step 6, linking reduced pressure to state.

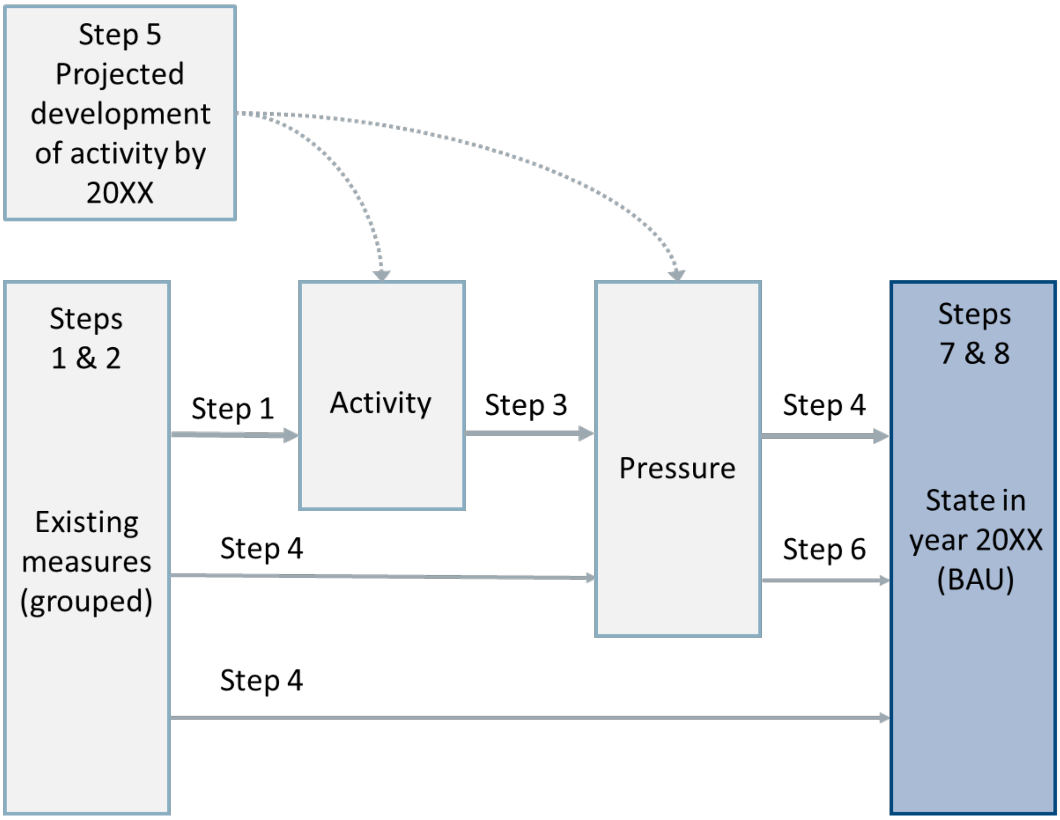
To facilitate the understanding of the full SOM approach, the proposed methodology for steps 4 and 6 has also been inserted into the approved approach as contained in Attachment 1. Examples of the surveys that are outlined as part of the methodology are also included in Attachment 1. An approach outlining how uncertainties are integrated into the model will be presented to the Meeting.

Action requested

The Meeting is invited to:

- discuss and guide the further development of a methodology for steps 4 and 6, taking note of the assumptions and limitations to the SOM approach as indicated in this document,
- support the use of the methodology for steps 4 and 6 at upcoming HELCOM workshops and meetings in autumn 2019.

Recollection of the main steps of the SOM approach



Step 1. Existing measures, including activity-measure links
Step 2. Estimating time-lags for measure effects on pressures
Step 3. Identifying main pathways for pressures using activity-pressure linkages
Step 4. Estimation of effects of measures
Step 5. Projected development of human activities/pressures
Step 6. Linking reduced pressures with state components
Step 7. Comparison of BAU and GES and assessing sufficency of measures
Step 8. Assessment of the effect of time-lags to recovery on state components

Figure 1. Main components and steps of the SOM approach, for further details see Attachment 1.

The SOM approach is based on seven main steps as outlined in the approved SOM approach. The current status of implementation is indicated below.

Step 1: Lists of existing measures have been compiled and are currently being reviewed by the Contracting Parties (document 3-1).

Step 2: Estimation of time-lags in the effect of measures on pressures is integrated into the compilation of measures lists (step 1). SOM Topic Teams will review and supplement the time-lag data following responses from the Contracting Parties. Contribution will also be requested from HELCOM expert networks as needed. Methods development in WPs 5 and 6 is on-going on how to best include the estimate of time-lags in the SOM model.

Step 3: Identifying main pathways and also the contribution of activities to pressures is ongoing by SOM Topic Teams and HELCOM expert networks (documents to be submitted under agenda item 3).

Step 4: The method for estimation of the effect of measures is outlined in this document. The expert evaluation portion will be implemented through online surveys or through workshops and sessions at HELCOM meetings in autumn 2019 (document to be submitted).

Step 5. Collection of information on projection of human activities/pressures will begin in September/October. Methods development in WP6 is on-going on how best to include this information into the SOM model.

Step 6. Methodology to link reduced pressures with state components is outlined in this document. The expert evaluation portion will be implemented through online surveys or through workshops and sessions at HELCOM meetings in autumn (document to be submitted).

Step 7. Comparison of BAU and GES and assessing sufficiency of measures is the final step of the approach, to be carried when first results are ready in early 2020.

Step 8. For increased clarity, this step has been separated from Steps 6 and 7 and is indicated as the 8th step in the model. Time-lags in recovery of the state components will affect the interpretation of the SOM results. WP5 of the HELCOM ACTION project will contribute to this step, with additional support from select SOM topic teams.

The proposed SOM model in European context

The SOM approach builds on the conceptual model developed in the HELCOM SPICE project, applies state of the art methods from scientific literature (Kontogianni et al, 2015 and Oinonen et al, 2016) and is in line with how some of the HELCOM Contracting Parties analysed the effectiveness of measures for the first round of the Marine Strategy Framework Directive Programme of Measures (MSFD PoMs). Examples of the Contracting Parties' effectiveness analyses were presented and discussed in the Second Meeting of the HELCOM Expert Network on Economic and Social Analyses (EN-ESA 2-2018)(see presentations by Sweden, Latvia and Finland). The same meeting also suggested the use of national experiences to select the best practices for the regional analyses to be further elaborated by the SOM Platform for use in the BSAP update. Methodologically the approach presented here rests on previous analyses, but at the same time it takes a significant leap forward by attempting to assess measure effects through activity-pressure-state linkage chains for a sea area consisting of multiple sub-basins. The approach also considers predicted future changes in the activities that cause pressures to the Baltic Sea, whereas most of the previous analyses have assumed that these activities stay unchanged.

The main purpose of the SOM-analysis in conjunction with the upcoming cost-effectiveness analysis is to support the update of the new BSAP by indicating both thematically and spatially where new measures are needed, and by suggesting how to optimize the new BSAP actions taking into account both environmental objectives and economic aspects. The purpose of the SOM analysis is not to retrospectively assess the implementation of BSAP and other related policies for different countries. The results of the presented approach move away from country level analysis to assess the measure effects on whole Baltic Sea.

Assumptions and simplification of the SOM model

This section clarifies how the results of the SOM model can be interpreted and what assumptions are used in the model. It also introduces some new lines of thinking i.e. how to group the measure into measure type. The assumptions and limitations that are outlined below have influenced the proposed methodology for steps 4 and 6.

Assumptions of the SOM model

The SOM approach agreed in HELCOM has made the major assumption that all the measures (i) will be implemented by the end year of BAU period, e.g. 2030 and (ii) they will have sufficiently time to influence pressure reduction.

The level of implementation of some of the HELCOM agreements included in the analysis is low and this may cause a source of error in the SOM model. Due to this, the SOM model will be run also with the current implementation status to see what the urgency for implementing the remaining BSAP actions is.

Implementation of the national measures under EU MSFD has been reported to EU Commission, but no summary reports have been planned to be included to the HELCOM SOM model. The assumption for full implementation will remain.

The spatial coverage of a measure covers all the marine areas in countries where it is implemented, unless there is more specific data on the spatial coverage of the measure. Total effects on sub-basins/spatial units will be estimated using spatial weights based on the proportion of national marine areas of the total areas of the basins.

Simplifications of the SOM model

The SOM model will cover a majority of human activities and pressures and the HOLAS II state components and attempts to capture all measures agreed in the Baltic Sea. This means that the model is wider than any previous model of this field and, hence, requires some generalizations.

Standard relative working units. Due to the wide coverage of measures, activities, pressures and state components, no common metrics can be found for the model. Therefore, the model builds on the principle of pressure reduction (%), which can be linked to improve the state.

Measure types instead of real measures. Hundreds of existing measures in the Baltic Sea region are too much to analyse even in longer processes than HELCOM BSAP UP. To simplify the catalogue of measures, the SOM approach groups them to ‘measure types’ which aim to capture the main elements of the measures but still remain on relatively abstract level. This has the limitation that the measure types and real measures are not equal (i.e. the former are abstractions and the latter are closer to reality). In a hypothetical example, a measure type ‘apply pingers in gillnets to reduce bycatch of harbour porpoise’ does not say how many pingers are being used in gillnets, how widely this is applied in different parts of the Baltic, is this enforced or how frequently this requirement is not followed (or how frequently a pinger prevented an animal drowning).

Relative scale of effectiveness of measures. The effectiveness of measure types will be surveyed using a relative scale (no effect-highest effect). Estimating the relative effectiveness of a measure type will allow for ordering of the effectiveness of measure types in reducing pressures from certain activities or in improving certain state components, and also provide a data set applicable to the inclusion of new measures at any point in the process.

To transform the survey responses to the % scale, it is proposed to use existing studies as ‘anchors’ i.e. reference points. In addition to these external numbers of effectiveness, the planned survey will ask how much the experts estimate the most effective measure type to reduce a pressure (see step 4 b and c). The total effects of measures on pressures will be calculated by summing the effects of individual measures on pressures. The individual %-effect of a measure depends on effectiveness of a measure type, activity pressure contributions and the spatial coverage of a measure. The absolute effect depends also on the actual pressure-level of the sub-basins that the measure affects.

Pressure –state linkage. Dependency of state on pressures is the basic assumption in environmental science. In reality, many of these links have not been established in quantitative way. In the SOM model, the expert-based pressure-state link (Step 6b, see below) is therefore essential, but it can in some cases be compared or even replaced with the established pressure-state links (e.g. nutrient inputs, fisheries).

General. The SOM model will not give the final answer with a single number of the general sufficiency, but instead all the model outputs must be interpreted. The benefits of the model use are, however, numerous, as outlined below.

Benefits of the SOM approach

The sections above described assumptions and limitations which are good to keep in mind when interpreting outputs from the SOM model. The approach also has benefits (also beside the fact that the model is possible to run and significantly improves the methodology that has been used in the previous analyses).

Use of effectiveness results for new measures. As the measure types are not too specific, it is possible to use them for estimating effectiveness of the new measures. This can be done two ways: (i) if a measure is considered new but still falls under the description of the measure type, its effectiveness can be taken directly from the survey outcome, or (ii) if the new measure is between two measure types, its effectiveness can be placed between effectiveness of the two related types. This will greatly simplify the BSAP UP process in 2020, when the new actions for the updated BSAP are discussed.

Use of pressure-state linkage. The pressure-state linkage is a precondition for many environmental analyses and tools and not very often shown for marine assessments. The expert-based suggestions for these linkages (with uncertainty ranges) can be later validated by specific data and (if found adequate) used for further analyses. For example, preliminary analyses of the HELCOM TAPAS sensitivity scores show relatively good agreement among experts of the sensitive features of the Baltic Sea ecosystem.

Proposed methodology step 4, estimation of effects of measures

In attachment 1 the proposed methodology has been inserted in the approved SOM approach.

This step links the ‘Existing measures’ block of Figure 1 (above) into ‘Pressures’, and in some cases also to ‘State’.

In this step, one will estimate how much measures will jointly reduce each pressure from an activity (i.e. pressures from each activity are handled separately in order to have a clearer link to measures and mainly to use the activity pressure contributions in calculating the effects on pressure). In the case of restoration measures, this step will entail estimating how much measures will affect the state components and be used in Steps 6 and 7.

4 a. **Survey**. Surveys for different topics will be carried out both online and in physical workshops. The survey will be implemented by Webropol software where effectiveness of the measure types is given for each activity-pressure combination (only main activities contributing to a pressure). The effectiveness of existing measures is first surveyed among HELCOM experts on the level of ‘Measure types’. The response is on a scale (no effect –> highest effect) where the effectiveness of measure types are surveyed relative to each other and level of certainty is asked for each response. Figure 4 illustrates the survey question for an activity causing a pressure. As several activities can contribute to same pressure, the survey will have several questions for a pressure and hence will be limited to the main activities linked to a pressure (based on the ACTION activity-pressure survey outcome).

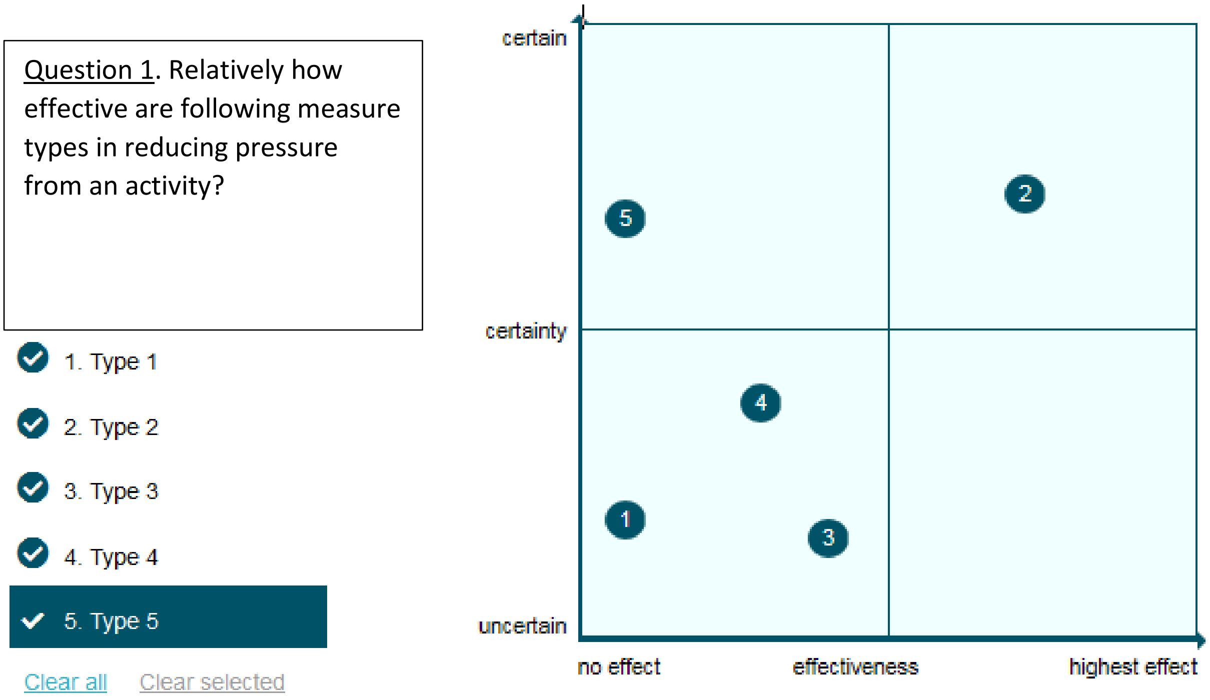


Figure 4. Schematic presentation of the effectiveness of measures survey. The survey question is limited to an activity causing a pressure. Effectiveness of measure types in reducing a pressure is estimated on the horizontal axis and the level of certainty on the vertical axis.

4b. **Reference points.** The pressure reduction in Step 4a was estimated on a relative scale and this needs to be transformed into reduction %. Therefore, the survey will also include a second question how much the most effective measure type is expected to reduce the given pressure (from the given activity). This estimate can be given in categories 0%, 1-3%, 4-6%,71-10%, 11-15%, 16-20 21-30%, 31-40%, 41-60%, 61-80%, 81-99%, 100%. One estimate is sufficient as it gives a reference point to the effectiveness scale (Step 4a), where effectiveness of other measures can be calculated from only one reference point.

4c. **External studies as reference points**. The effectiveness of measures can also be found from independent research outputs. Such data sources have been identified for all pressures and are listed in Annex 2.

These reference points are compared by the ACTION project with the ones from Step 4b.

Step 4d. **Integration**. Pressure reductions from the measure types can be summed to see the total pressure reduction but this reduction is still from one activity. Based on Step 3, one knows estimates of the activity contributions (%) in producing a pressure. By using this information, one can integrate all the pressure reductions. This is the final figure which can be used to (i) compare against pressure targets (e.g. nutrient reduction targets) or (ii) which goes to Step 6.

In addition, some deviations from the general model are planned for the following topics:

- Spatially restricted measures: some measures are not covering the entire Baltic Sea or the assessment area. These are, *inter alia*, national MSFD measures implemented in one country only, restrictions to trawling which cover a small area of the sea, or marine protected areas. Effectiveness of these in reducing a pressure requires spatial weighting in order to not overemphasize their effectiveness. Support is asked from ACTION WP3 (MPAs).
- Marine litter: the effectiveness will depend on litter type and this may require some modifications to the survey and the analysis.

- Specific legal requirements over the EU Member States: some EU legal requirements are very specific in their pressure reductions. The litter-related directives set numeric pressure reduction targets for single-use plastics and packaging waste are require measures to meet the targets by 2025. As these are assumed to be implemented (as all the measures in BAU period), the litter inputs to sea can be assumed to decrease according to the requirement and not effectiveness survey is needed for these measures.

Information needed	**Data sources**	**Main contribution**
Data on effects of measures	National data	Reporting by countries
	Research projects (e.g. BONUS, BLUE2) Scientific literature, studies and models EU MSFD Programmes of measures Sources listed in the SPICE project deliverable on Business-as-usual scenarios EC DG ENV databases (e.g. ARCADIS 2012)	Input from SOM Topic teams[1], ACTION project on existing measures Input from SOM synopses on potential new actions and measures
	Expert evaluation/validation	Working Groups, Expert Groups, ACTION project, SOM Platform

Proposed methodology step 6, linking reduced pressure to state

In attachment 1 the proposed methodology has been inserted in the approved SOM approach.

The SOM approach will build on the same state components as in the State of the Baltic Sea report (HOLAS II). Some of these state components have associated threshold values or pressure targets or both, but the SOM approach is flexible to include also those components where no thresholds have been established.

Pressure-state link will be based on an expert survey which is described below.

6a. **Prioritizing pressures**. ACTION project will define the most significant pressures for each state component by using the information in HELCOM core indicators and Baltic Sea Impact Index. Using the pre-selected pressures (based on MSFD Annex III), a survey is carried out to ask the most significant pressures for each of the state components. The pressure ranking is done on a relative scale (Figure 5) which allows for estimating the contributions of the pressures for the state component. It is possible to add other pressures to the response if necessary.

6b. **Needed pressure reduction.** After the ranking, the survey asks for the most significant pressure what the needed pressure reduction % is in order to reach good state assuming that other significant pressures are decreased the same amount. This is done by asking for the minimum, most likely and maximum reduction (Figure 6). The ranking of pressures allows the scaling of the other significant pressures to the most significant one. It is also assumed that the uncertainty for all the other pressures is proportional to the most significant one.

[1] 'SOM Topic teams' refer to teams of national experts that will contribute to the analyses for topics covered by the SOM Platform.

As the relations of pressures are known from this step, it is possible to assess what is the probability to reach good state given that the pressures are reduced the amount resulting from step 4. It is also possible to approximate the reduction needed on one pressure to reach good state assuming that the reductions on other pressures are known.

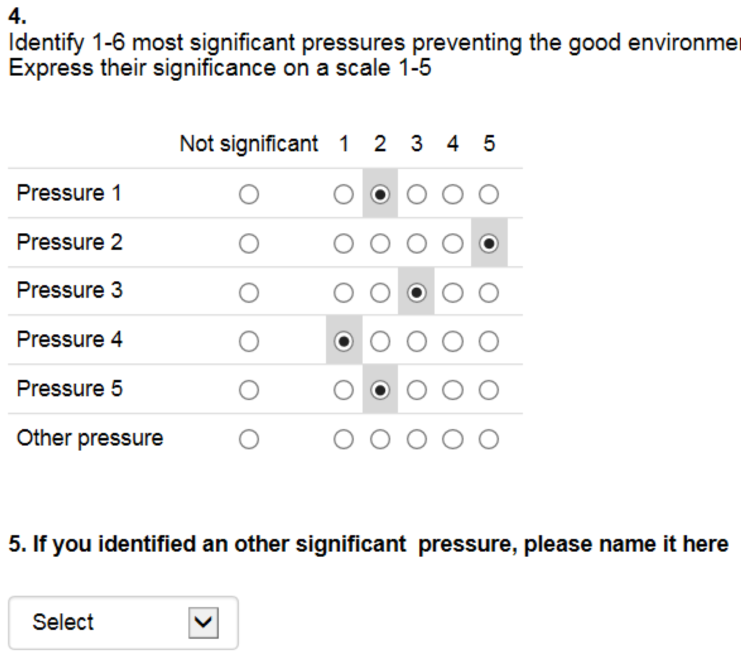
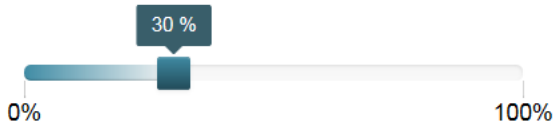
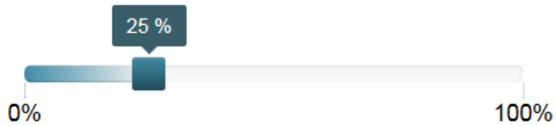


Figure 5. Survey of the pressure importance. The pressures have been pre-selected (see text) but one free choice can be added if necessary

6. What is the most likely %-reduction of significant pressure that is required to reach the good state for the given state variable assuming that other identified significant pressures are reduced the same %-amount?



7.
What is the minimum %-reduction of significant pressure that is required to reach the good state for the given state variable assuming that other identified significant pressures are reduced the same %-amount?



8.
What is the maximum %-reduction of significant pressure that is required to reach the good state for the given state variable assuming that other identified significant pressures are reduced the same %-amount?

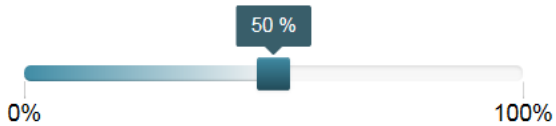


Figure 6. Needed pressure reduction to reach good state for the most important pressure (min., most likely and max.). Survey asks these three scores only for the most important pressure, while the rest can be calculated from the replies in Figure 5.

Information needed	**Data sources**	**Main contribution**
Spatial data on pressures and impacts	HELCOM map and data service	Secretariat
Spatial data on state components	HELCOM map and data service	Secretariat
Information for selecting relevant pressures	Baltic Sea Impact Index (BSII) Core indicator reports, ODEMM framework	Secretariat/ACTION project
Responses of indicators/state components to changes in pressures	Previous research projects and reports Scientific literature Existing models	Input from SOM Topic teams[2], ACTION project
	Expert evaluation/validation	Working Groups, Expert Groups, ACTION project, SOM Platform

[2] 'SOM Topic teams' refer to teams of national experts that will contribute to the analyses for topics covered by the SOM Platform.

Proposed methodology step 8, time lags in state recovery

Reductions in pressures during the BAU period do not necessarily mean that the state will become good before e.g. 2030. The lags in recovery may result from multiple reasons which are identified in the ACTION project.

In the context of SOM analysis, the issue with time lags could be resolved by focusing on pressure reductions and possible effect on state (even if the state recovery takes place much longer time).