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As many countries have already included in their legislation the obligation to perform cumulative impact analysis and management (CIAM) and to implement a cumulative impact mitigation plan to manage undesired aggregated impacts generated by past, ongoing, and reasonably foreseen future projects on specific valued ecosystem components (VECs), a valid question arises: Are these instruments a one-shot exercise aimed at acquiring the necessary permits or authorizations to move forward with a specific project, or should they be a living process that must be constantly updated throughout the project's life cycle?

This paper will analyze the convenience of updating a CIAM, the resources needed for that purpose, and the time frame for doing such revisions, even when local legislation does not require it.

When does Cumulative Impact Analysis and Management need to be updated?

To begin with, it is important to refer to the genesis of CIAM: the Environmental and Social Impact Assessment (ESIA). As has been widely accepted, an ESIA is nothing more than a set of analytical, participatory, coherent, reproducible, and interdisciplinary procedure carried out by a team of specialists to predict the future material changes in the environment due to the implementation of an action in the present. To achieve this, ESIA's typically include of following key components:

- **Project Description**, which includes information about the proposed project, including its location, size, scope, objectives, expected outputs, development phases, construction or implementation methods, volumes of work, etc., and that identifies actions that are likely to generate effects (positive and negative) on the environment.
- Identification of the Project's **Area of Influence**, or a delimitation of the territory where the project effects (positive and negative) are expected.
- **Baseline Conditions**, an assessment of the existing environmental, social, and economic conditions of the project's area of influence, focusing on those environmental components that are prone to be affected by the foreseen activities.
- **Impact Assessment**, an evaluation of the potential impacts (positive and negative) that the project may generate.
- **Management Measures**, a list of actions aimed at avoiding, reducing, minimizing, or compensating for undesired or enhancing positive impacts.
- **Management Plans**, a description of how and when the management measures will be implemented.

The analysis of each of these six components entails some degree of uncertainty that depends, among other, on the level of information available, the construction or implementation methods that will be used,

and the resources available to predict the future conditions of the environment. Table 1 summarizes the degree of uncertainty involved in the analysis of each of these basic components.

Table 1: Degree of uncertainty in developing the most important components of an ESIA.

Component	Degree of uncertainty*	Comment
Project Description	Negligible	Project details are usually known beforehand, as they are part of its final design.
Area of influence	Slight	However, if a well-experienced team is appointed to undertake this task, this uncertainty can be practically nullified.
Baseline Conditions	Negligible to slight	This depends on the type of information used (e.g., primary-secondary; old-new; detailed-general).
Impact Assessment	Slight to material	This depends on how the previous components have been performed.
Management Measures	Slight to material	This depends on how the impact assessment has been done.
Management Plans	Slight to material	This depends on how the management measures have been developed.

*Negligible; slight; material; important; high.

Even though the previous analysis shows the degree of uncertainty embedded when preparing the main components of an ESIA, it is still not clear when to update such assessment. To solve this problem, a second analysis has to be made, this time considering the probability on of its components needing an up date (see Table 2).

Table 2: Probability of an ESIA's components requiring updates.

Component	Probability of needing an update*	Comment
Project Description	Very unlikely to unlikely	This is very unlikely as any modification in the project design has associated transactional costs that are usually not welcome. However, when major modifications are introduced, it is likely that the whole environmental and social analysis will have to be redone.
Area of influence	Unlikely to likely	Even if some minor project characteristics are introduced, this area tends not to vary.
Baseline Conditions	Likely to very likely	This is very common when there is a material lapse between the time in which the ESIA is completed and the time the project is executed; when better information becomes available, or when there has been a substantial in the behavior of the environmental components initially identified.
Impact Assessment	Likely to very likely	If the proposed project and/or baseline conditions change, it is likely that the impact assessment needs to be updated.
Management Measures	Likely to very likely	If the impact assessment has been updated, it is likely that the management measures will also need to be updated as they depend directly on the impact analysis.
Management Plan	Likely to very likely	If the management measures have been updated, it is likely that management plans will also need to be updated as they depend on the former.

*Very Unlikely, Unlikely; Likely; Very Likely.

In summary, an ESIA needs to be updated whenever the proposed actions and/or the baseline conditions change.

Now, let's consider cumulative impact analysis and management (CIAM). Since a cumulative impact can be understood as the result of the successive, incremental, or combined effects of a project, added to the

effects of *other* existing, ongoing, or reasonably foreseeable future projects on an environmental component deemed to be *important* (i.e., a *valued ecosystem component*, or *VEC*), CIAM is nothing else than the analysis of incremental effects with respect to a spatial and temporal baseline, experienced by a VEC (or group of VECs), when considering, in addition to the effects caused by an action (project), those caused by past, ongoing, or reasonably foreseen future actions (projects).

CIAM typically includes of following key components:

- Selection of **VECs**.
- Determination of **temporal and spatial boundaries** for the analysis.
- Selection of **past, ongoing, and future projects** that will be considered in the analysis.
- Determination of the (current) **baseline** status of the selected VECs.
- Assessment of the **cumulative impacts** generated by the projects included in the analysis.
- Design of **measures to manage the cumulative impacts** on each affected VEC.

Of these components, perhaps the most challenging to develop is the selection of the set of future projects. However, a project can be considered as reasonably expected to be carried out in the future when, among other indications, it is known that:

- Its sponsor or representative has **initiated the environmental licensing** process.
- It is included in the **inventory of priority initiatives** that the authorities plan to carry out in the coming years.
- It is **part of the political speech** of the highest authorities.
- It has the necessary **financing**.
- The **authorities have submitted a credit request** to a financial institution to finance it.
- There is **strong community support** for the project.
- A **procurement timetable is available** for the acquisition of goods and services that will be required to implement it.

Even though a set of future projects that meet these criteria can be identified, it might be difficult to establish *when* they will be implemented. Furthermore, this list is not written on stone as future projects can just “pop out of the blues” and begin execution without any previous sign.

In a similar way to the ESIA, the development of CIAM components entails a degree of uncertainty (see Table 3).

Table 3: Degree of uncertainty in developing the most important components of CIAM.

Component		Degree of uncertainty	Comment
Selection of VECs		Negligible	VECs are usually selected by the authorities, through public consultation, by the team performing CIAM, or a combination of these.
Determination of temporal and spatial boundaries	Temporal boundaries	Negligible to slight	The future timeline boundary is usually set by legislation or by common agreement (not more than 15 years), while past timeline is commonly set by how the VECs have behaved in the past (usually no more than 5 years).
	Spatial boundaries	Negligible to slight	Spatial boundaries are usually set by the authority requiring CIAM. When the analysis is performed from a project perspective, the spatial boundary is the project's area of influence.
Determination of past, ongoing, and future projects, activities, and external stressors	Past, projects, activities, and external stressors	Negligible	If their effects are not already factored into the baseline analysis, this identification is simple and has a very high degree of confidence.
	Ongoing projects, activities, and external stressors	Negligible	This identification is simple and straight forward: projects are there and, in the worse-case scenario, can be visited if needed.
	Future projects, activities, and external stressors	Important to high	This is the activity that involves the highest uncertainty of the process, since determining when a project will be executed in the future depends on so many variables that are beyond the control of CIAM.
Determination of the baseline status of the selected VECs		Negligible to slight	Just like an ESIA, an update to the baseline may be needed when new information becomes available, or when there has been a substantial change in the behavior of the VECs.
Assessment of cumulative impacts		Important to high	The uncertainty generated by the identification of future projects to be considered in CIAM is carried out to this process.
Design of measures to manage the cumulative impacts		Important to high	The uncertainty generated by the identification of future projects to be considered in CIAM is carried out to this process.

*Practically none; slight; material; important; high.

Just like it happened with the ESIA, even though the previous analysis shows what degree of uncertainty is embedded when preparing the main components of a CIAM, it is still not yet clear when it must be updated. Again, to solve this problem a second analysis has to be made, this time considering the *probability* on of its components to be updated (see Table 4).

Table 4: Probability of the most important components of CIAM needing updates.

Component		Probability of needing an update*	Comment
Selection of VECs		Very unlikely	VECs are usually selected by the authorities, through public consultation, by the team performing CIAM, or a combination of these and normally do not change.
Determination of temporal and spatial boundaries	Temporal boundaries	Very unlikely	The future timeline (not more than 15 years) and past timeline boundaries (not more than 5 years) and normally do not change.
	Spatial boundaries	Very unlikely to unlikely	Spatial boundaries are usually set by the authority requiring CIAM and normally do not change. However, when CIAM is performed from a project perspective, and having in mind that the spatial boundary is the project's area of influence, it is unlikely to be changed.
Determination of past, ongoing, and future projects, activities, and external stressors	Past projects, activities, and external stressors	Very unlikely	If their effects are not already factored into the baseline analysis, this identification is simple and has a very high degree of confidence. Unless new information is available, the list of past projects does not change.
	Ongoing projects, activities, and external stressors	Unlikely	"Ongoing projects" may change to be "past projects" as time passes. However, their effects are usually already considered in CIAM.
	Future projects, activities, and external stressors	Likely to very likely	The list of future projects needs to be updated as new information is available. Even in the best-case scenarios, where the list has been determined with a very high degree of certainty, it is often very difficult to determine when such projects will be implemented.
Determination of the baseline status of the selected VECs		Unlikely to likely	Just like an ESIA, this depends on the type of information available (e.g., primary-secondary; old-new; detailed-general). When CIAM is performed from a project perspective and has not been done as a part of an ESIA or immediately after it, depending on the circumstances, it might be necessary to update the baseline.
Assessment of the cumulative impacts		Likely to very likely	As the assessment depends on the baseline conditions of the VECs (which is somehow likely to change) and the projects to be considered (likely to very likely), changes in these requires the assessment to be updated.
Design of measures to manage the cumulative impacts		Likely to very likely	As the design of these measure depends on the assessment of cumulative impacts, changes in the latter require the former to be updated.

*Very Unlikely, Unlikely; Likely; Very Likely.

In summary, CIAM needs to be updated periodically, at least every two or three years, to capture any baseline condition changes, or whenever any of the future project considered or not in the analysis but with direct connection to any of the selected VECs changes is status. This convert the CIAM is a living document.