

# ***Interactive comment on “Assessing economic impacts of environmental research infrastructures: overview of methodological tools”*** **by Régis Kalaydjian**

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Response to RC2

General comments

1. Comment 1

Give more argumentation in several parts of the paper, in particular in the introduction. Cite existing works, e.g. the OECD report on the impacts of RIs.

Response to comment 1

C1

It is necessary to strengthen the argumentation in several parts of the paper, in particular in the introduction. It is important to refer to the European Strategy Forum for Research Infrastructures (ESFRI) : its views motivated the ENVRI PLUS research project and the work summarized in the paper. It is also important to refer to OECD's analysis of RIs' impacts on science and economy. It must be noted that the field covered by the OECD report overlaps, but differs from, that of the paper. The OECD is especially useful to cover the impacts on research and education. Its methodology must be mentioned.

Changes in manuscript

In the introduction, explain more in details the motivations of the paper. Refer to the ESFRI Roadmap and to the OECD report on RI impacts and its methodology. Among the topics addressed by the ESFRI Roadmap, explain the focus on climate change and other environmental hazards, and the need for more knowledge in this area. In the downstream impact section, mention the OECD approach to assessing impacts on research.

2. Comment 2

Explain the reason for the selected classification of impacts. Explain the impacts in terms of categories of players. A figure would be a useful contribution. Clarify the formation of downstream impacts.

Response to comment 2

The best option is to explain the classification of impacts in the introduction. This classification is an original contribution, motivated by my own understanding of ENV RIs. The ESFRI Roadmap is also an important motivation. Figures 1 to 3 must be clarified or replaced by a more general figure including all impacts. It is feasible and useful to indicate the different categories of players. The formation of downstream impacts must be clarified in the introduction, in the beginning of section 3.2 and in a

C2

figure.

Changes in manuscript

In the introduction, explain the motivations of the impact classification and refer to ESFRI. Modify and clarify figures 1 to 3 or replace them by another figure. Clarify the description of downstream impacts by indicating the different categories of actors.

3. Comment 3

Clarify the paper by indicating the generally applicable parts and the specific aspects of the case study. Improve sections 3.1.4 and 3.2.3 by a paragraph on findings applied to the case study. Add a summary on feedback impacts.

Response to comment 3

A clarification is necessary throughout all the text to distinguish between general features and Argo specific features. It is useful in particular to focus on the section summaries to clarify this.

Changes in manuscript

Revise sections 3.1.4 and 3.2.3 to clarify what is related to environmental impact assessment and to the Argo case study. Add a summary for 3.3.

4. Comment 4

The language is confusing and not precise enough. Language checking is necessary.

Response to comment 4

The text is being edited.

Detailed comments

5. Comment 5

Abstract. The abstract must be redone. Explain why the study is made and its value

C3

for readers.

Response to comment 5

It is necessary to redo the abstract and clarify the text. It is necessary to explain the general context of the study, the importance of ENV RIs and the need for analyzing the economic aspects of their data supply chain. The need for reliable methods to do so must be stressed. Introduce Argo and its relevance as a case study.

Changes in manuscript

Abstract : modify abstract accordingly.

6. Comment 6

Improve introduction. Clarify the wording. Clarify the objectives. Specify the actors involved in downstream impacts. Clarify the context of the development of ENV RIs. Add a discussion on earlier RI assessment methods.

Response to comment 6

The introduction must be strengthened and the context of the study must be explained more in details. Reference must be made to the ESFRI Roadmap, in particular in relation to environmental issues. Reference must be made to the OECD approach to RIs' impacts. The motivations for the proposed impact classification must also be explained. It is however preferable to be brief about the actors involved in the downstream impacts and give details in section 3.2.

Changes in manuscript

Modify introduction accordingly.

7. Comment 7

Section 2 in general and section 2.1. Clarify section 2. Give reference. Clarify wording.

Response to comment 7

C4

The Argo section must be improved, based on recent publications. This will not fundamentally change the description, but it is necessary to clarify some aspects of Argo and the supply chain. Figure 5 must be improved to better describe the supply chain.

Changes in manuscript

Modify section 2. Add literature references. Better describe the supply chain and the actors involved. Add a figure describing the supply chain.

8. Comment 8

Section 2.2. Staff cost comparison is not precise enough.

Response to comment 8

In order to have a homogeneous table and avoid blank cells, only Argo cost elements will remain in Table 1. So Euro-Argo specific costs must be removed.

9. Comment 9

Subsection 3.1.2. The SBS method has the same limitations as the Barrow study of section 3.1.1.

Response to comment 9

The ad-hoc inquiry-based method proposed by Barrow (section 3.1.1) is feasible if respondents accept to give business information. If yes, this permits to make a targeted analysis of the upstream supply companies. Barrow did it by limiting the business information that respondents had to give.

The structural business statistics give a considerable amount of business data per class of activity. The problem is that the activity classes are wide (i.e. each includes many enterprises) and not targeted enough ; the data which can be extracted are not very accurate for our purpose : assessing upstream impacts based on SBS is a second best method.

C5

Changes in manuscript

More clearly explain the difference between the methods presented in 3.1.1 and 3.1.2.

10. Comment 10

Page 7, row 26. Clarify the explanation.

Response to comment 10

Using the CPA is valuable for data accuracy. The CPA includes more than 3000 categories (products and services) while the NACE has 615 classes. If RI investments are known in details and can be broken down by CPA category, it is feasible, in principle, to evaluate the impacts of investments in terms of value added increase, based on the branch accounts of the National Accounts. A condition is that branch accounts are available at class level.

Changes in manuscript

Give more detailed explanations in section 3.1.3 about the transition from the CPA to the National Accounts.

11. Comment 11

Page 8, row 6. Reformulate comments of Table 3.

Response to comment 11

Indeed, Table 3 does not inform about competition.

Changes in manuscript

Remove remarks on competition in comments on Table 3.

12. Comment 12

Section 3.2. Downstream impacts are covered through a KPI analysis, not impact assessment methods.

C6

## Response to comment 12

In the downstream impact section, as a first step, the paper focuses on the performance of ENV RIs in terms of environmental observations. This step is required for an approach to downstream impact assessment methods, because such performance is a major driver of the quality of research products and of the competitiveness of value-added services.

But it is true that such approach would miss the target if it included the above components only. Without losing sight of the main focus of this paper, the downstream impact section must discuss the methods used to assess impacts on research and education and on value-added service markets (value-added services include customized services for monitoring and predictions). The free-of-charge principle applies to the supply of observational data products and first stage monitoring services (Copernicus services) with suppliers being public entities. But value-added services may often be provided on competitive markets.

Note however that the indicators mentioned in the beginning of 3.2 partly contribute to a methodology for downstream impact assessment: the KPIs include, inter alia, "number of downloads" which measures the downstream demand for observational data. Further downstream, to focus on the case study, ocean models use data from the observing systems (after first stage processing), and help to increase knowledge on environment for different research fields and for operational purposes including monitoring and forecasting: this is partly measured by OSEs (presented after the KPIs), which are another component of downstream impact method. So, such indicators also concern the downstream impact assessment issue.

### Changes in manuscript

Redraft and improve section 3.2 by adding a subsection on downstream impact assessment methods, covering impacts on research and education, and impacts on value-added service markets. In terms of Earth observation, Copernicus Marine Environ-

C7

ment Monitoring Services (CMEMS) is a key component. The downstream markets generated by CMEMS must also be addressed in this subsection. Finally, raise the issue of correlations between the (first step) performance indicators and the downstream impact indicators addressed in the additional subsection.

## 13. Comment 13

Page 9, row 4. Are there tools for "valuing the performance of observation data products"?

### Response to comment 13

Incorrect formulation. Read : "assessing the performance of data from ENV RIs". This assessment is made by the assembly centres which produce the KPIs mentioned in comment 12.

### Changes in manuscript

Redraft beginning of 3.2.

## 14. Comment 14

Page 9, row 11. Unclear sentence.

### Response to comment 14

The beginning of 3.2 must be revised and clarified. The different types of downstream impacts must be briefly outlined, including performance indicators and impacts on value-added markets. Then the Argo case study must be mentioned.

### Changes in manuscript

Modify accordingly. Outline downstream impacts in the general case of ENV RIs. Then address the Argo case study in broad terms.

## 15. Comment 15

C8

Subsection 3.3. Add a summary with information on CBA for Argo.

Response to comment 15

A summary is necessary for 3.3. It would be preferable to treat separately the lessons drawn from the CBA examples in a summary, and address the Argo issue in a separate subsection after the summary. This is because a methodological classification of the CBA examples can be presented in the summary and help to identify the main issues concerning an Argo CBA.

Changes in manuscript

Make three subsections in 3.3 : a) description of the CBA examples ; b) summary on the CBA examples ; c) the issue of feedback impacts from Argo.

16. Comment 16

Paragraph 1. The approach to feedback impacts in terms of environmental risks and uncertainty limits the scope in which ENV RI activities can create impacts.

Response to comment 16

It is true that the formulation is misleading and must be modified. The term of uncertainty was intended to express the idea that more ocean and weather knowledge is made available to players, so that their uncertainty (about the state of the environment) is reduced. But this term is confusing and must be changed.

Changes in manuscript

Modify paragraph accordingly, and insist on impacts in terms of knowledge increase.

17. Comment 17

Paragraph 2. The idea of improved forecast is a limitation of scope and ignores other beneficial objectives such as monitoring and archival.

Response to comment 17

C9

It is true that the formulation is also misleading.

Changes in manuscript

Redraft accordingly, along the lines adopted for comment 16.

18. Comment 18

Page 12, row 28. What does SAR stand for ?

Response to comment 18

Search and rescue.

Changes in manuscript

Check and explain all acronyms.

19. Comment 19

Conclusion. Give recommendations on the treatment of RIs, e.g. Argo, in terms of methodology.

Response to comment 19

The conclusion must be improved, using the summaries on each type of impacts and the discussion of the Argo case in the feedback impact section. The main methodological issues must be emphasized, including data availability and accuracy ; assessment consistency, i.e. correlations between the metrics used for the different steps of the impact assessment ; and treatment of players' and data users' adaptation capacity to knowledge increase.

Changes in manuscript

Modify conclusion accordingly.

20. Comment 20

C10

Figures 1 to 3. The figures are unclear and confusing. Limit description to actors. Change captions.

Response to comment 20

As said in comment 2, the figures must be changed or replaced by another one. Limiting the description to actors would help to avoid confusion.

Changes in manuscript

Modify figures accordingly.

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