Work package 4

Deliverable: 4.1 Report proposing impact indicators and programme-level impact monitoring mechanisms

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The main outcomes

- Here proposed impact assessment strategy builds on the BONUS experience and the best practices identified among the BANOS CSA partners as well as in current literature.
- The strategy encompassed impact assessment at both the programme- and at an individual project levels, including assessments of academic and societal impact.
- The impact assessment is proposed to be based on the principles of *research impact pathway*, tracking project activities, outputs and outcomes during project implementation period.
- To assess the long-term impact, a post-project impact assessment is critically needed.
- The academic impact assessment is suggested to focus on the scientific quality and excellence whereas the societal impact assessment is suggested to focus on the contributions that research and innovation make to the society, policy, economy and environment.
- Twenty performance indicators are proposed. In addition, open questions, which take into account project specific aims and objectives, are proposed to be used as part of the impact assessment strategy to allow more flexibility in reporting.
- A stakeholder communication and engagement plan will ensure early engagement of end users.
- The programme level impact assessment is proposed to be based on the BONUS experience and carried out by an external panel and/or group of experts. Although, this approach requires resources, it is considered the most reliable and impartial evaluation method available at the time.

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Description of task: (i.e. as in the Description of Work)

The task will take stock of existing parallel initiatives on providing alternative and diverse metrics for monitoring both the academic and societal impact of research. The review will include indicators developed spanning all 6 pillars of responsible research & innovation1 (RRI) from public engagement to governance, H2020 co-creation 2016-2012 portfolio on indicators beyond standard bibliographic and patent counting, as well as commercialisation of research via open innovation and traditional pathways. The task will (i) identify practical indicators that scale up from individual project application to the programme level and seek input from stakeholders (Task 3.2), and (ii) offer recommendations and guidelines to empower future applicants to the joint Baltic Sea and North Sea research and innovation calls to design research proposals around practical indicators of success and measurable contribution towards contribution to UN Sustainable Development Goal 14 targets.

The work on impact monitoring mechanisms will commence as soon as the scope of the future programme is delineated (M8). In M16, timely for being included into the SOW input materials, the proposal on impact indicators and programme-level impact monitoring mechanism will be produced. By completion of the proposed action (M30) this task will also produce guidelines for project Applicants on integrating practical Impact Indicators in project design.

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Contents

1 Executive summary

Globally there is a growing demand to understand the impacts of research and innovation projects. Reasons for this growing demand are multiple, including the increased interest in the implementation of evidence-based policies and government appraisal of the returns of their investments in science, innovation and technological development. Impact evaluations help governments and R&I funding institutions to decide where to channel the future investments in order to maximize the returns and public benefits. Therefore, effective impact monitoring and assessment protocols should assist in evaluating the societal benefits of public investment in research, innovation and other related development.

A systematic approach, which builds on the experience of BONUS, the Joint Baltic Sea Research and Development Programme, and the best practices identified among the partners of the Baltic and North Sea Coordination and Support Action (BANOS CSA) and in literature, is proposed to ensure a successful impact assessment of the future Baltic and North Sea Research and Innovation Programme (BANOS) and its funded projects (as is planned in the BANOS CSA). The proposed strategy will be discussed with the BANOS Steering Committee and updates incorporated into the final strategy published as part of BANOS deliverable *D4.2 Guidelines for Applicants on integrating practical Impact Indicators in project design* due in April 2021.

The proposed strategy will encompass:

i. assessment of the academic and social impact of R&I
ii. impact assessment at both the programme- and individual project levels
iii. impact monitoring in real time during project implementation as well as ex-post impact assessment allowing certain time lapse for impact to materialize

The ***project impact assessment*** is proposed to be carried out periodically, primarily as part of the project reporting to prevent any unnecessary additional burden on project coordination. The reported data is suggested to be quality controlled by a BANOS officer to ensure consistency in reporting.

The following criteria and measures have been identified to date to be important aspects of future project impact assessment methodology and are proposed to be incorporated into the final assessment practises:

- The impact assessment will follow the concepts of the Research Impact Pathway, which provides a logical framework for recording of activities, outputs, outcomes and ultimately project impact.
- The assessment is proposed to be based on a set of performance indicators as well as open self-assessment questions, which can provide more details on concrete project outputs, outcomes and impact. In this report, 20 indicators are proposed. However, a selection may be adapted to best serve a specific project type, e.g. research- and/or innovation-focused projects.
- Strategic, specifically targeted and tailored communications and stakeholder engagement is a recognised, critical step in delivering impact. Hence, projects will need to develop clear communications and stakeholder engagement plans at the proposal phase, to be carried out throughout the lifespan of the project. In addition, some of the proposed indicators have been formulated based on principles of productive interactions.
- To assess the long-term impact, a post-project impact assessment strategy is critically needed as it may take years for impact to materialise after a project has ended.
- To ensure high-quality reporting, appropriate guidance should be provided to project coordinators to make sure that they understand the principles and importance of the impact assessments. To further minimise the burden on project participants, the reporting should be made as simple and straightforward as possible.
- Genuine orientation towards societal impact is proposed to be embedded already at the proposal stage and be supported accordingly through the proposal evaluation and selection process.
- Provisions for systematic collecting and reporting of impact shall be embedded in the grant agreements with the Programme beneficiaries.

The ***programme level impact assessment*** is proposed to be based on and modified from the BONUS experience. For social impact assessment, a panel assessment is favoured as this approach can be considered one of the most reliable and impartial evaluation methods, able to take into account the programme level aims and objectives. For assessment of scientific excellence, a bibliometric analysis may be considered for specific research calls, or groups of calls, where appropriate.

2 Introduction

Globally there is a growing demand to understand the impacts of research and innovation projects. Reasons for the increased interest are multiple, including the growing demand for evidence-based policies, governments wanting to understand returns of their investments in research and innovation (R&) as well as their societal benefits. In addition, impact evaluations help governments and funding bodies etc. to decide where to channel the future investments to maximize the returns and public benefits. Therefore, effective impact assessment protocols should assist to evaluate the societal benefits of public investment in research and innovation, and other related development. In addition, the impact assessments should drive to understand how the public investments contribute towards overcoming global challenges, such as generation of sufficient sustainable energy, and solutions for combatting global security threats and climate change, while delivering on current and emerging policies.

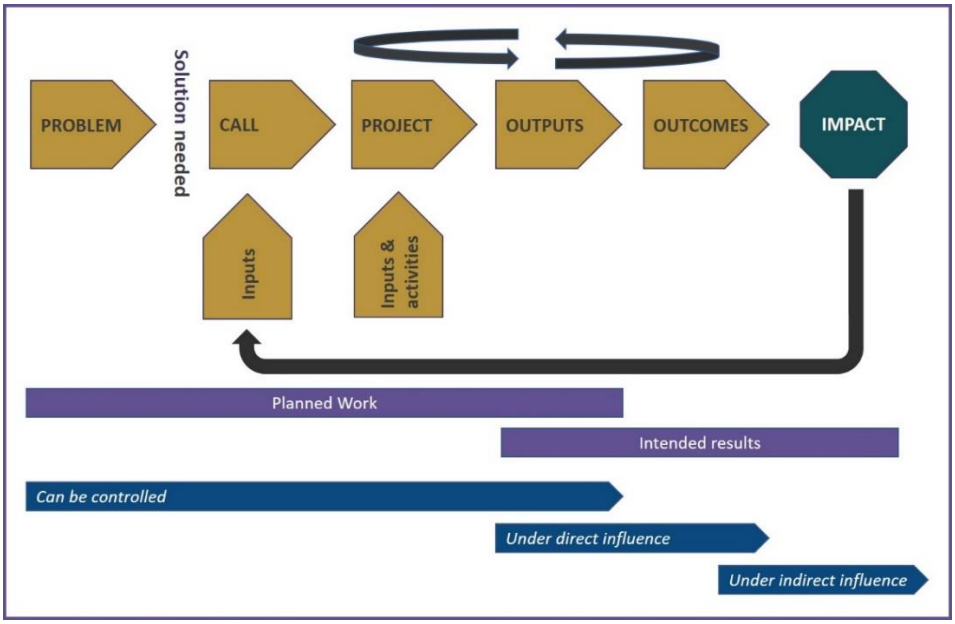

Figure 1 Research impact pathway, modified from Fryirs et al. 2019[8], is a sequence of steps by which impact is accomplished. This process is typically nonlinear and cyclic processes may occur. Here as an example, the pathway can illustrate how a societal challenge or a problem, which has been identified and described in detail in the BANOS strategic research and innovation agenda (SRIA) will deliver impact. A solution is needed to solve the problem and a BANOS call for project proposals is opened. The call provides the inputs and the financial resources, for the project and the most competitive proposal is funded. During the project cycle, multiple work tasks and activities are carried out, which in turn result in outputs. These outputs, such as scientific publications, new skills or experiences, will on a relatively short timescale lead to outcomes, including knowledge transfer, input to policy documents, strategy development, spin off companies etc. However, the real impact, such as global academic development, commercialization, wealth creation, impact on the environment, is not immediate and typically is not seen until a significant time has passed. The real impact usually occurs years after a project has ended. Therefore, the original project participants typically have no direct influence on delivering impact. See Table 1 for more details on the definition of impact and the related concepts, including concrete examples relevant for the future BANOS programme.

Assessing the impact of research and innovation, however, is not a straightforward practice. There are complications related to temporal decoupling between the project life cycle and the subsequent uptake of the project outputs, or results, by users (for definitions see Table 1). Evidence shows that a significant time-lag separates the completion of the project and the uptake of knowledge or benefits by society. Also, a likely chance exists that before projects have a societal effect, multiple research and/or innovation interactions as well as parallel societal developments have occurred, thus obscuring attribution of a specific impact to a particular project or programme.

Although the goals of the impact assessments of different R&I programmes and projects are often universal, no ready-to-use formula exist that would serve every case. Therefore, when designing impact indicators and mechanisms, it is important to take into account the specific objectives and aims of a programme. Without a proper alignment of the objectives and goals of the assessment and the aims of the programme, it is not reasonable to expect that the impact assessment can deliver to its full potential. In addition to overall objectives, it is important to understand the appropriate policy framework of a project/programme

Table 1. Impact definition and the related concepts. See also Figure 1 for more details. Content modified from Fryis et al (2019)[8] and the League of European Research University (LERU) position paper[9]

Concept	Definition	Areas of application	Examples relevant to BANOS programme
Input	The resources a research funder or institution spends in the research process.	People (funding, staff), infrastructure, knowhow, background intellectual property and support structures (e.g., administration, facilities).	
Activities	Actions taken or work performed as a result of research inputs.	Teams established, research undertaken, networking, attending courses, workshops, conferences, and engaging with stakeholders etc.	
Outputs	Outputs are the accomplishments and results of inputs and activities.	Publications, reports, databases, new research leadership skills and experience for (less-connected) researchers, new research collaborations, new intellectual property, patents and inventions, policy briefings, media, and new courses or teaching materials.	Identification and isolation of new marine biochemical compounds with potential industrial application. Development of a new complex ecosystem model with enhanced predicting capacity.
Outcomes	Tends to be more immediate than most forms of impact and generally occur under direct influence of the researcher(s) with intended results. Knowledge transferred and/or the changes that occur as a result of a programme/project. A distinction can be made between scientific outcomes, societal outcomes (e.g. contribution to policy debates or documents, strategy development), and economic outcomes (e.g. start-ups, spinoffs, increased productivity in a certain field).	Career advancement for (less-connected) researchers; new research infrastructure and programmes on societal challenges; coordination of standards, procedures and methods; approved common research projects on interdisciplinary research , commercial products and licences, job creation, new contracts, grants or programs, citations of work, new companies or spin-offs and new joint ventures and collaborations	Successful defence of PhD thesis/ acquiring new academic degrees Adoption of a new indicator by OSPAR to assess the environmental status of the North Sea, delivering on the goals and needs of the Marine Strategy Framework Directive. Adoption of marine spatial planning strategy based on scientific evidence by some competent government institution. Commercial scale-up of a new product based on the marine biochemical compound isolated during the previous project
Impact	Occurs on a long-time scale via uptake and use of an innovation or initiative by independent parties under indirect (or no) influence from the original researcher(s) The contribution that research makes to the economy, society, environment or culture beyond the contribution to academic research	Environmental sustainability, protection and impact; wealth creation, economic prosperity and regeneration, enhancing cultural enrichment and quality of life; worldwide academic advancement; commercialisation and exploitation; improvements in environmental health, quality of life; changes in industry or agency philosophy and practice; implementation or improvement in policy, improvements in monitoring and reporting, cost-savings to the economy or industry; generation of a higher quality workforce, job creation, improvements in community knowledge, better interpersonal relationships and collaborations, beneficial transfer and use of knowledge, technologies, methods or resources, and risk reduction in decision making	Reach the good environmental status of Baltic and North Sea as specified in the MSDF. Achieve the sustainable fishing targets in Baltic and North Sea as specified in the Common Fisheries Policy. New marine technology jobs. Input to delivering the goals of the SDG 14. Enhance public ocean literacy

allowing the inclusion of the policy impact into the assessment practise. For example, in the case of BANOS, it will be important to understand how the projects and the programme will deliver towards achieving the UN Sustainable Development Goal 14 Life under water[1] and the fulfilment of the European Green Deal[2]. In some circumstances, it may also be desirable to enable the comparison of performance between organizations or programmes, to quantify potential differences in their impacts. In such comparisons, the anticipated impact should be predefined and at least some of the applied impact indicators, used by both entities, should be the same.

To measure research impacts accurately and skilfully, it is also crucial that researchers and funding organisations understand what type of impacts can be reasonably expected from a project or a programme. To achieve this, it may be necessary to invest in educating all the parties on the process, nature and timing of the anticipated impact. In the case of the academia, it is especially important to move beyond the impression that research outputs and outcome equals impact, which is clearly not the case (Figure 1).

This report aims to deliver the appropriate impact indicators, and both project and programme-level[3] impact monitoring mechanisms for the future BANOS programme. To deliver this aim, the current best practices were evaluated and assessed (Section 3). The evaluation focused on current practices of BONUS, the joint Baltic Sea Research and Development Programme[4], the organizations and initiatives involved in the BANOS CSA, and a literature research including approaches applied by other relevant initiatives, organizations and programmes. Focus was also given on future trends and needs in respect to impact assessment.

2.1 Theoretical background overview

To ensure that the impact assessment is beneficial, it is important to clearly define what is meant with impact. Multiple definitions of impact exist in literature. In this report we have adapted two definitions:

- **Societal impact,** based on the commonly applied definition of the Organisation for Economic Cooperation and Development (OECD)[5], is "*the contribution that research makes to the economy, society, environment or culture, beyond the contribution to academic research*."
- **Academic impact,** based on the definition of the UK Research and Innovation, is "*the demonstrable contribution that excellent research makes to scientific advances, across and within disciplines, including significant advances in understanding, method, theory and application*".

A conceptual framework and model, *Research Impact Pathway* (Fig. 1)[6],[78], is often used to describe the different steps of project impact delivery. In addition, this pathway assists to document, measure and

[1] https://sustainabledevelopment.un.org/sdg14
[2] https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf
[3]Project-level refers to a single project assessment versus programme level assessment refers to assessment of multiple projects all funded through a single research programme, like BONUS.
[4] https://www.bonusportal.org/
[5] Organisation for Economic Cooperation and Development (OECD). Enhancing Research performance through Evaluation, Impact Assessment and Priority Setting (Directorate for Science, Technology and Innovation, Paris, 2009). This is a 'go-to' guide for impact assessment in Research and Development, used in OECD countries
[6] Springer-Heinze, A., Hartwich, F., Simon Henderson, J., Horton, D., & Minde, I. (2003). Impact pathway analysis: An approach to strengthening the impact orientation of agricultural research. Agricultural Systems, 78(2), 267-285. doi:10.1016/S0308-521X(03)00129-X
[7]Morgan, B. Income for outcome. Australia and New Zealand are experimenting with ways of assessing the impact of publicly funded research. Nat. Outlook 511, S72–S75 (2014).
[8] Fryirs, K.A., Brierley, G.J. & Dixon, T. Engaging with research impact assessment for an environmental science case study. Nat Commun 10, 4542 (2019) doi:10.1038/s41467-019-12020-z

assess environmental, social, economic and cultural impacts of research. Its concepts can also be applied to track academic research impact. For details and definitions, see Table 1[9] and Figure 1 caption.

Potential impacts may occur at multiple moments in time, as is the case also for project activities, outputs and outcomes (Figure 1). These cycles, including the generation of potential impact, can occur during an extensive period in time, typically exceeding a project lifetime. Also, it should be noted that this process is non-linear, with some moments in time being more important than others and some outcomes leading to high impacts, others to dead ends.

Although project outputs and outcomes do not necessarily translate directly to impacts, the likelihood of knowledge transfer and uptake of research results by other projects or management practises is likely to increase if these results are actively promoted, discussed and in other ways brought to the attention of relevant end-users of knowledge and wider stakeholder communities. Such, preferably reciprocal interactions and dialogues can take place in a vast array of different fora, either in face-to-face or online locations to ensure the most desirable engagement and uptake in key end-users at all times.

With regard to approaches to predict and assist in measuring the social impact of R&I projects, the concept of *productive interactions,* defined as "the exchanges between researchers and stakeholders in which knowledge is produced and valued that is both scientifically robust and socially relevant", has been put forward[10]. In this approach the interaction is typically considered *productive* when it clearly leads to efforts by stakeholders to uptake the research results or practical information or experiences. Three types of productive interactions have been identified in the SIAMPI Project[11]: (i) *Direct interactions*: 'personal' interactions involving direct contacts between humans, interactions that revolve around face-to-face encounters, or through phone, email or videoconferencing; (ii) *indirect interactions*: contacts that are established through some kind of material 'carrier', for example, texts, or artefacts such as exhibitions, models or films; (iii) *financial interactions*: when potential stakeholders engage in an economic exchange with researchers, for example, a research contract, a financial contribution, or a contribution 'in kind' to a research programme. As such, applying the concept of productive interactions and developing specific indicators to measuring project or programme activities with stakeholder involvement can be applied as ex ante impact assessment approach. Examples of indicators of direct interaction include, for example, assessing numbers of face-to-face contacts and communications events with user communities and peer groups, as well as recording the numbers of memberships of relevant advisory committees and presentations given for specific audiences. Examples of indirect interaction indicators could include assessment of interest to specific reports and publications produced by a project and their citation for example in policy documents. Potential financial interaction indicators could include, for example, assessment of numbers of contracts and project grants, sharing of (research) facilities and infrastructure, other scholarships and funding, including PhD funding by industry.

To prevent the assessment of productive indicators becoming just a list of attended conferences and workshops and a counting exercise, careful consideration should be given to appropriate stakeholder identification and engagement from the very first step of the project, including the proposals writing. Serious thought should be given to the ways the stakeholders are engaged at different phases of the project, taking into account that the new stakeholder may enter in different maturity level of a project. At the research programme level, steps should be taken to ensure that project results are communicated effectively. However, the respective landscape of such programmes consists of very varying resources to

[9] Definition based on LERU (2018). Impact and the next Framework Programme for Research and Innovation (FP9). Leuven. Belgium. https://www.leru.org/files/Publications/Impact-and-the-next-Framework-Programme-for-Research-and-Innovation.pdf

[10] Jack Spaapen, Leonie van Drooge, Introducing 'productive interactions' in social impact assessment, Research Evaluation, Volume 20, Issue 3, September 2011, Pages 211–218, https://doi.org/10.3152/095820211X12941371876742

[11] Social Impact Assessment Methods for research and funding instruments through the study of Productive Interactions between science and society (SIAMPI). EU FP7 (2007-2013) funded project led by the Royal Netherlands Academy of Arts and Sciences (KNAW) together with Rathenau Institute (the Netherlands), CSIC (Spain), MSH (France) and University of Manchester (UK). http://www.siampi.eu/

make it possible to meet such aspirational goals. For instance, in the case of BANOS, the delivarables *D3.2 A holistic map of programme's stakeholders* and *D3.3 Report on mapping the relevant cross-border initiatives, analyzing the cooperation potentials and proposing the cooperation mechanisms with the BS/NS research and innovation programme* overlayed with the principles of the *D3.5 BANOS communications and stakeholder enagagement strategy* shape the overall landscape of the programme's future approach in the area of communications and stakeholder enegagement. Consequently, one of the key aims in BANOS programme level communications and engagement effort is to enhance the use of scientific knowledge and innovation generated in the BANOS funded projects across policy and socio-economic landscape. This is achieved by establishing dialogues and transferring aims, progress and results to end-users and other stakeholders for their action and practical application. Nevertheless, an underlined responsibility of the bespoke, project specific stakeholder engagement lies with the projects themselves. By taking the full benefit of the framework, resources and tools that the research programme can offer, the projects are still in drivers' seats in steering their results to their specific, key end-user groups with the aim of ultimately creating impact. Also, the role of professional information officers and communicators (e.g. of the research programmes and consortium members' home institutions etc.) as intermediates in transforming the valuable new knowledge and information to accessible, stakeholder group specific formats, be it for direct or indirect interactions, is a valuable asset not to be neglected. Examples of practices aiming to enhance the overall good practices and ultimately work towards increasing the achieved impact are manifold, ranging from setting up events and knowledge hubs where project leaders and appropriate stakeholder (e.g. from policy and industry) can meet and exchange views to of collaboration with other programmes and initiatives to increase jointly the future impact that can be generated. FInally, worth a particular and far-reaching consideration is the timing of all efforts as this may well be the crucial element for high impact to occur. For instance, the lack of investment in communications and stakeholder enagegement resources, among other, many years after the projects' implementation finish can be a valid consideration given that many key findings become available far later than the end date of a project (see 3.2.2 and 3.2.3) and therefore, also the generation of the potential related impact and efforts to reach this are necessitated far later than perhaps generally considered.

3 Current Impact Assessment Practices and Future Needs

3.1 Assessment and monitoring of R&I impact envisaged in the new European framework – Horizon Europe

Impact assessment will be a key component of the Horizon Europe, the 2021-2027 EU Framework Programme for Research and Innovation[12]. The new Programme will be an evolution of the Horizon 2020, focusing on various design improvements to further increase openness and impact of research and development programmes funded through the European Commission. In practise this means that the three-pillar structure (including Pilar 1 - Open Science, Pilar 2 - Global Challenges and Industrial Competitiveness and Pilar 3 - Open Innovation) will be continued, but redesigned for more coherence, both between and within pillars, in support of the Programme objectives. In addition to the three pillars, the new Programme aims to strengthened international cooperation, ensuring access to talent, knowledge, facilities and markets worldwide, for effectively tackling global challenges and for implementing global commitments.

The new Framework Programme sets to achieve high added value through strengthening the EU's scientific excellence through competitive funding; the creation of cross-border, multidisciplinary networks; the pooling of resources to achieve critical mass for tackling global challenges, and developing the evidence-base to underpin policymaking. More specifically nine areas of added value have been identified.

[12] A new horizon for Europe Impact assessment of the 9th EU framework programme for research and innovation, June 2018 https://op.europa.eu/en/publication-detail/-/publication/00d78651-a037-11e8-99ee-01aa75ed71a1

i. Strengthening the EU's scientific excellence through competitive funding
ii. Creating critical mass to address global challenges
iii. Reinforcing the EU's human capital
iv. Building multidisciplinary transnational networks for more impact
v. Increasing the EU's competitive advantage
vi. Creating new market opportunities through collaborative multi-disciplinary teams and dissemination of results
vii. Strengthening the evidence-base for policymaking
viii. Leveraging private investment
ix. High additionality[13]

Table 2. *Key data expected to be collected by the Commission Services from all funded programmes during the implementation period of Horizon Europe[12].*

Inputs and activities	Data collected according to	Profiles of beneficiaries and proposal evaluators	Project implementation issues	Other data monitored and/or collected
Number of proposals and applications submitted, EC contribution requested and total costs of submitted proposals (by source of funds)	Types of action	Gender balance (in projects, evaluators)	Time-to-grant	The financial contribution that is climate-related
Number of proposals reaching the quality threshold (funded/not funded)	Types of organisations, including Civil Society Organisations (with specific data for SMEs)	Role(s) in project*	Time-to-pay	Communication of R&I results
Number of retained proposals	Countries and regions of applicants and participants (including from associated and third countries)	Share of newcomers to the Programme	Error rate	Dissemination of R&I results
Success rates of proposals	Sectors		Satisfaction rate	Exploitation and deployment of R&I results, including through monitoring the funding allocated for uptake of R&I results through the other proposals for the long-term EU budget.
EC contribution and total costs of retained proposals (by source of funds)	Disciplines		Rate of risk taking	
Number of participations and single participants				

*e.g. Research performer; Technology development; Testing / validation; Demonstration (proof of viability); Scale-up; Private buyer of solutions to be developed; Public procurer of innovative solutions; Finance provider; Provision of the technology basis; Provision of the technology infrastructure; Representative of civil society interests/needs; Co-definition of a research / market need; Training, dissemination activities).

Many of the above-mentioned areas are directly applicable to the ambitions and objectives of the BANOS programme. Therefore, when designing the BANOS programme level impact assessments, the contribution that the programme may have to the EU-added value should be carefully considered and included in the

[13] The EU invests in specific R&I projects, which are unlikely to be funded at the national (or regional) level. This additionality has been very strong in Horizon 2020, for example, and it has been estimated that 83% of the projects would not have been funded without the EU contribution.

assessment practises. To enhance the programme level impact, appropriate resources should be allocated for developing and rolling out effectively programme specific, strategic communications and stakeholder engagement – activities as a prerequisite for achieving impact is directly related to high quality communications efforts.

A set of key *impact pathway indicators* have been developed to track the progress of Horizon Europe towards achieving its goals and ambitions. There indicators are designed to assess the short-term, medium-term and long-term impact, and specific indicators have been developed to track scientific, societal and economic impact, (see Annex 1 for complete list of the proposed key impact pathway indicators). The listed indicators should be carefully considered, to ensure that the BANOS programme level reporting is efficient and that the project data can be further assembled for the programme level assessments.

The Commission also aims to collect key data from each of the funded projects and programmes in order to assess how the programme is being implemented. The data covers the inputs and activities of Horizon Europe, including the European Partnership initiatives, and thus is highly applicable to BANOS. The key data requirements are listed in Table 2.

3.2 BONUS experience and current indicators

3.2.1 Collecting performance indicators from projects

BONUS, the Joint Baltic Sea Research and Development Programme, has developed a list of performance indicators which the projects it funds have been obliged to report on already from the very first BONUS call[14]. In principle the list performance indicators has remained the same during the implementation of BONUS, although a few improvements for more streamlined and simplified projects' reporting were included during the BONUS Art 185. The list of these performance indicators is presented in Table 3 and the results of reporting of 40 BONUS funded projects in Annex 2.

In general, most of the BONUS performance indicators have been useful, and they have successfully enabled the tracking of the project outputs and outcomes[15][16] [17]. However, based on the past experience, some room for improvement has been identified. For example, the projects funded from different calls are inherently different and hence in some cases it may be useful to use slightly different indictors to reflect on the project objectives and aims, e.g. research- versus innovation-oriented projects. Also, when evaluating the project impact, it is essential to take into account the project maturity. It is not feasible, for example to compare a project that has just been initiated, or one that is halfway, with a one that has already finished some years ago. Thus, the future evaluations should be carried out in standardized manner in respect to the project maturity and implementation stage.

Some disparity has been observed among the BONUS-funded projects in respect to the interpretation of meaning of the performance indicators. Use of words like *significantly* or *relevant* in the descriptions of current BONUS performance indicators 1 and 2 (Table 3) can be interpreted in many ways. To assure comparable reporting from projects and minimize discrepancy in the reporting, more guiding materials, especially clear definitions and examples, should be provided in the reporting interface. In general, it may be advisable to avoid using adjectives that can be interpreted in many ways.

[14] BONUS+ call 'Ecosystem approach to management of the Baltic Sea', 16 funded projects running 2008-2011 with total funding of 22 MEUR

[15] BONUS-funded INNOVATION projects: For healthier marine environment and safety on the sea. BONUS Briefing No 29, October 2017.

[16] Outcomes of BONUS Sustainable ecosystem services call: Widespread impact on Baltic Sea management action. BONUS Briefing No 32, June 2019.

[17] Outcomes of BONUS Viable ecosystem call: Widespread impact on Baltic Sea management action. BONUS Briefing No 31, June 2019.

Table 3. Current list of BONUS performance indicators reported by funded projects in the periodic reports

1. List of occasions the project has contributed significantly to the development and implementation of 'fit-to-purpose' regulations, policies and management practices on international, European, the Baltic Sea region or national level aimed at safeguarding the sustainable use of ecosystem's goods and services, in particular the EU Strategy for the Baltic Sea Region, EU Integrated Maritime Policy, EU Marine Strategy Framework Directive (MSFD) and its implementation, as well as the Baltic Sea Action Plan.
2. List of suggestions for designing, implementing and evaluating the efficacy of relevant public policies and governance on international, European, the Baltic Sea region or national level originating from the work of the project.
3. List of scientists working in the project who have served as members or observers in stakeholder committees, e.g. EC, HELCOM, VASAB, ICES etc.
4. List of international, national and regional stakeholder events organised by the project.
5. Joint events/co-operation activities/partnerships of the project with non-Baltic research actors and other European marine basins.
6. Number of persons and working days spent by foreign scientists on research vessels participating in the cruises arranged by the project.
7. Number of persons and working days spent by foreign scientists using other major research facilities involved in the project.
8. Peer-reviewed publications arising from the project.
9. Number of entries to existing openly accessible common databases, storing original data from the entire Baltic Sea system or larger geographical area.
10. Number of popular science papers produced by the project.
11. Number of interviews to media given by the members of the project's consortium.
12. Number of multi-media products and TV episodes produced by the project.
13. Number of other international, national and regional communication, dissemination and public outreach initiatives to disseminate the project's research results
14. Number of post graduate courses organised by the project and number of persons participating.
15. Number of mobility activities (persons; visit days) from the project to the other BONUS projects.
16. Number of PhD students and the number of post-docs funded by the project; Doctoral theses defended.
17. Research staff involved (fully or partly funded or contributed as in kind) by age class, seniority and gender.
18. List of other significant in kind, free of charge research infrastructures used by the project for which no bilateral agreements between the infrastructure provider(s) and BONUS have been concluded.
19. List of other than infrastructure in kind contributions the project has received.

3.2.2 Survey on post-implementation (three years after the projects end) impact

In the end of 2019, a follow-up survey of a putative post-project impact was carried out amongst BONUS projects which had ended 3 or more years earlier. The survey targeted 7 Viable ecosystem projects and 13 Innovation projects [18].

The following four survey questions were asked of each project:

I. Impact on policies *(please describe if some policies/regulations were elaborated/changed using the results of the project in local/national/regional level)*
II. Follow up activities *(has the same or slightly modified consortium continued after the end of project (or planning to do so during two forthcoming years) with a new project or project proposals based on the ideas and results of your previous BONUS project?*)
III. Additional scientific articles published after the end of the project

[18] https://www.bonusportal.org/projects

IV. Exploitation of product/software/procedure elaborated during the project (if any) after the end of the project *(please describe any patents obtained, advancement of technological readiness, take-up by industry, transfer to market etc.)*

From 20 projects approached, 17 responded to the survey. Most projects reported additional outputs, including scientific publications published after the end of project reporting. Amongst the Viable Ecosystem projects, an additional 168 titles were published after the end of the projects, equalling to more than 40% of the total number of publications. Additional outcomes were also reported from 11 innovation projects, including direct exploitation of the process/product in three projects and further innovation development during follow-up activities of four projects. However, four projects reported that the developed product/process had not been taken up by end-users. The lack of end-user interest was mainly attributed to availability of alternative similar products already in the market. Therefore, any future funded innovation projects should carefully evaluate the existing products on the market and to ensure that there is a clear interest from the side of the end-users from the very beginning of the project. To enhance this, a clear stakeholder engagement strategy is needed. The evaluation and selection of innovation proposals shall be clearly guided towards taking into account the market potential.

Policy impact was reported by few projects, although in general it was relatively rare for the innovation projects in question. Some examples included creating tools for complying to the requirements raised by policies – for examples for monitoring, testing, measuring, and direct policy input – for example fisheries advise, designing the network of marine protected areas, elaborating HELCOM indicators for monitoring etc.

An important outcome of the survey in general was that the projects (with an 85% response rate) were willing to report on the additional outputs/outcomes that had been generated in the period of 3 years after the project had ended. The coordinators of projects who did not respond had changed jobs, for example, and hence did not complete the survey. A significant number of additional outputs and outcomes were generated during this time period and it is considered very likely that more outputs/outcomes/impact will be generated in the years to come too. Therefore, mechanisms of incentives to perform post-project impact assessment should be introduced in the future BANOS Programme. The optimum time for post-project impact assessment needs to be still carefully considered as three years after completing projects seems rather short term and real impact is not achieved until typically a decade has passed[5].

3.2.3 Programme level of impact assessments

During BONUS, two programme level impact assessments were conducted of which one focussed on scientific excellence[19] and another on societal impact and stakeholder engagement[20]. Both of the assessments were executed in the end of 2016, before the European Commission carried out the final evaluation of the BONUS Programme (Art 185).

The impact assessments included BONUS+ (2009-2012) which tested the mechanisms of collaboration among the national funding institutions with a total of 16 projects funded for EUR 22 million and involving over 100 research institutes and universities in the implementation of these projects and BONUS Art 185 (for the time period of 2012-2016) which with the mandate from the European Parliament and the Council brings together the research communities of marine, maritime, economical and societal research to address the major challenges faced by the Baltic Sea region with the total funding of EUR 100 million for years 2010-2020. To ensure independent assessments, an international public procurement was launched.

The first assessment, carried out by Pauline Snoeijs Leijonmalm (Stockholm University), focussed on the BONUS impact in respect to its scientific excellence and dissemination. As such, the assessment was primarily examining the peer-reviewed scientific papers in international journals, i.e. the scientific results

[19] Pauline Snoeijs Leijonmalm (2017): *Assessment of the BONUS impact on scientific excellence and dissemination*

[20] Steve Barnard and Mike Elliott (2017): *Assessment of the BONUS impact: BONUS delivery, performance, and stakeholder opinions*

which have been quality-assured externally by other scientists. This bibliometric study was extensive, including all fields of marine research. The assessment methods were based on a similar survey published in 2008[21] conducted within the frames of the BONUS ERA-NET project (2004-2008), thus allowing a direct comparison of the results of both studies. The results and conclusions are presented in the report[16] as well as in an article published in *Environmental Science and Policy*[22]. The assessment approach applied by Leijonmalm is recommendable and applied methods seem robust. Using a similar approach in future would have the advantage that results of the assessments would be directly comparable. However, as the assessment requires resources, it may be more beneficial to carry this type of survey only on selected calls/projects with a specific focus on science, rather than on innovation.

The second impact assessment 'The assessment of BONUS impact: BONUS delivery, performance, and stakeholder opinions' was carried out by *Steve Barnard* and *Mike Elliott* from the Institute of Estuarine and Coastal Studies at the University of Hull, UK. This assessment contained two parts: the first part of the assessment was based on analyses of the thematic coverage of funded projects versus themes listed in the BONUS Strategic Research Agenda (SRA), to assess how successful the Programme's implementation strategy had been and how successfully it had covered the R&I topics listed in the BONUS SRA. In addition, the performance statistics (Table 3) reported by the projects were analysed. The second part of the assessment focussed on the stakeholder views regarding science and policy development, funding, and engagement. For this purpose, three stakeholder groups (*participants*, *funders* and *users*) were identified and approached with a set of questions. The results of the assessment showed that across all three stakeholder groups there was overwhelming agreement regarding the realisation of almost the entire range of benefits and positive outcomes considered in the assessment.

Based on the BONUS experience, a panel review is proposed as the most appropriate and objective way of assessing the programme-level impact. However, if a similar approach as applied in the second assessment is used in the future, the following points should be taken into account in the assessment design and selection of the final methods:

- The timing of the programme assessment should be carefully considered, to allow for impact to materialize. It is recommended that the assessment would be carried out, for example, towards the end of a specific funding period/cycle
- The assessment includes aggregation of projects with different maturity levels, which should be taken into consideration in the assessment methods and interpretation of results. For example, the assessment should not simultaneously cover ongoing projects and ones already completed. However, some heterogeneity is inevitably present in the data, in respect to differences in nature of funded projects and their size (including budget), a weighted standardisation approach could be used to overcome such challenges.
- An appropriate data aggregation method should be chosen for processing and presenting programme's data statistics as the assessment process can have significant impact on the assessment outcomes[23].
- It is advisable that assessment includes specific case study examples. This would allow for more flexibility and highlighting of specific impact examples.

The summaries of the both above assessments were published as the BONUS Briefing No 26[24].

[21] Snoeijs P., K. Kononen, J. Umegård 2008. International Publication of Baltic Sea Science. BONUS Publication No. 9.
[22] Snoeijs-Leijonmalm P, Barnard S, Elliott M, Andrusaitis A, Kononen K, Sirola M (2017) Towards better integration of environmental science in society: Lessons from BONUS, the joint Baltic Sea environmental research and development programme. Environmental Science and Policy 78:193-209
[23] Barnard, S & Strong, J. (2014) Reviewing, refining and identifying optimum aggregation methods for undertaking marine biodiversity status assessments. JNCC Report 536 by the Institute of Estuarine and Coastal Studies, University of Hull.
[24] BONUS making a difference: Impacting on scientific excellence and policymaking in the Baltic. BONUS briefing No. 26, May 2017.

3.2.4 Recommendations based on BONUS experiences

1. Including the performance statistics reporting to the projects' periodic reporting is a good practice and the easiest way to obtain data on the project level.
2. The current set of performance indicators used in BONUS Art 185, elaborated with additional explanations/examples should be included to assure comparable outputs from projects.
3. Introducing differentiated sets of indicators for research projects and innovation projects should be considered.
4. The reporting should be technically easy and the ways of motivating project partners to collect and submit data are to be elaborated.
5. Collection of impact data within a certain time period after formal completion of a project is an important step in properly assessing the impact at project and programme levels.
6. In order to be able to assess the longer-term impact, the methodology of ex-post impact assessment shall be developed and the mechanism of incentives to report project performance metrics also after formal ending of a project should be introduced.
7. Impact assessment (both at project and at programme level) can be used as an opportunity for self-improvement, for example, in terms of the impact assessment practises but also how to make the project or a programme more impactful in the future.
8. A panel approach is recommended for the programme level assessment as it is considered as the most objective and comprehensive.
9. Timing of the programme level assessment should be carefully considered, preferably after a specific funding cycle has ended. However, some heterogeneity is expected in the data due differences in nature, timing and size of the funded projects, for example. Data standardization method may be used to overcome such challenges.
10. Examples of case studies could be included into the programme level evaluation to highlight impact on specific research and innovation areas, or examples of specific impact.

3.3 Best practice among other BANOS CSA partners and the participating states

A questionnaire (Annex 3) was designed to assess current practices of the impact assessment among funding organizations. The questionnaire included aspects of practical approaches and indicators used, scaling up from individual project applications to programme level. The questionnaire was sent to all BANOS members and partners, who were encouraged to forward the questionnaire also to other relevant organisations/initiatives in their countries.

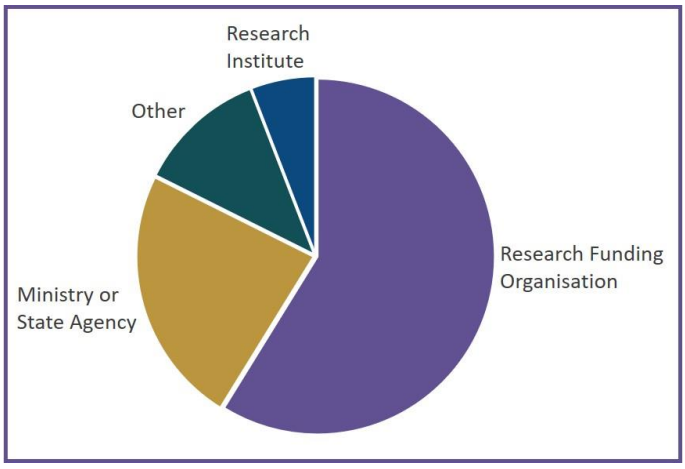

Figure 2 Relative distribution of types of organisations included in the impact assessments survey. In total 17 organisations from 10 countries completed the survey

In total 17 organisations from 10 countries completed the survey. Generally, the questionnaire was primarily filled in by funding organisations, thus reflecting funding organisation's approaches to impact assessment. However, replies were also received from ministries, research conducting organisation and other transnational organisations. (Figure 2). Of the 17 organisations, 11 conducted evaluations both at project and programme level.

For practical purposes the questionnaire was divided into different sections to evaluate the common practises in the assessment of academic, social (including sections on societal, economic and policy) impact. A majority of the involved organizations conducted periodic impact assessments and included both academic and social impact in their periodic assessments. However, in the case of economic and policy related impact assessment, the assessment criteria and practises in some organizations varied between different calls and

funding instruments, and these were not consistently assessed for all projects. Based on the assessments, it was also apparent that assessing the academic impact was considered much easier than assessment of social impact. The difficulty of social impact assessment was related to lack of easy-to-use indicators.

The impact assessment protocols had been updated in six organizations during the last five years. Five organizations were also planning to update their approach in the coming five years. The updates were usually related to incorporating the understanding of social impact of research into the assessments. Some updates were also related to a shift in the evaluation processes away from indicators and pre-identified categories, to base the evaluations on more open questions with the aim of supporting innovation and renewal. It is important though, that these open questions stimulate very concrete answers, to document real impact. The adoption of a *case study approach* was also strongly supported by one organization.

The impact assessments were typically conducted as part of the periodic reporting and the assessments were done during and at the end of the project cycle. Only six organizations conducted post-project evaluations. Of these, three were conducted three to five years after the end of the project. None of the organizations conducted post-project/programme follow up at longer time scales. Therefore, the results suggest that in general long-term impact evaluation of funded projects is currently not conducted, and the impact assessments appear to be focussed on predictive statistics including indicators of activities, outputs and outcomes (Table 4). Resources, as well as commitments from the projects to continue their reporting after the project has ended, would need to be assessed against long-term benefits of research results and innovation projects.

Table 4. Common indicators identified in the impact assessment survey

	Common* indicators			
	Academic indicators	**Societal indicators**	**Policy indicators**	**Economic indicators**
Input	Number of PhD students, postdocs and staff	Number of PhD students, postdocs and staff	Number of PhD students, postdocs and staff	Number of PhD students, postdocs and staff
Activities	Conference attendance, media appearance, presentations given	Arranging events for public	Stakeholder events	
Output	Peer reviewed publications			
Outcome	PhD thesis/degrees	Increase public awareness		Number of patents
Impact		Improve quality of environment, regional development	Input to policy (e.g. to regulations, decision making, recommendation and changes in practice)	

Typically, majority of the indicators used by the organizations can be categorized by the concepts of *research pathway* (Figure 1, Table 1). The main *input indicators* (which are applicable for both academic and social impact assessments) included staff-related statistics (Table 4). Especially the numbers of PhD students were monitored by over a half of the organisations. Also, postdoctoral and permanent staff contributions were typically recorded. Organizations were less interested in the technical performance level and only 35% kept a record of other funding sources.

In general, the results of the questionnaire indicated that the academic evaluations are relatively similar among the organizations and similar indicators are used by many. The indicators, however, appear to be focussing primarily on activities and project outputs instead of real impact (Table 4). For example, over 75% of the organizations kept a track of publication numbers and over 65% also recorded conference attendances and presentations given. Media appearances were also recorded in over a half of the evaluations. In output category, the only common indicator used was the PhD degrees gained. Other

potential output indicators, such as journal impact factor and citations were typically not included in the evaluations. Only one of the organizations specifically highlighted the importance of a bibliometric indicator, which reflects the citation impact (top 10 citation index) of all scientific articles funded by the organization during a specific funding cycle. The lack of interest in citations or other bibliometric indices as such, may be related to changing trends, which highlight the need to assess research on its own merits rather than on the basis of the journal in which the research was published in (San Francisco Declaration on Research Assessment, DORA declaration[25]). No actual long-term impact indicators were identified in this survey.

In the case of the societal impact assessment, the engagement of the public by arranging activities, such as public events, and increasing the public awareness were commonly used as activity and outcome indicators. In respect to impact, the improvement in the quality of the environment and regional development were used by 40% of organisation to assess the long-term impact. Yet the exact mechanisms of the impact assessment were not clearly outlined in the questionnaire results.

The policy related impact was commonly assessed through activity indicators, such as arranging and attending relevant stakeholder events. In respect to long-term impact assessment, many organisations included evaluation of input to policy documents and recommendations as well as changes in practise.

Although the economic impact was assessed among 70% of the organisation, the approaches appeared to be least consistent in this category. The only commonly shared outcome indicator was the number of patents. Other impact indicators shared by at least 30% of organisations included development of new cost-effective practices, spin-off companies and income from intel property, sales and marketing.

A case study approach, use of open questions and independent review panel, were favoured by few organisations as part of their impact assessment strategy. New case study approaches and methods were also highlighted, including the ASIRPA approach (Socio-economic Analysis of Impacts of Public Agronomic Research)[26] and the ImpresS ex post method[27]. In respect to use of indicators, recording of *productive interactions* was also favoured and highlighted by few. Facilitation of these practises as part of the organisations impact assessment were relatively new with the aim to promote and support innovation and renewal more efficiently. The importance of how the open questions are formulated was highlighted by the questionnaire results. The questions should be concrete and clear, asking for specific information, for example, how the project has made concrete contributions towards environmental improvement, including a description of the situation before- and after the project. Similarly, self-evaluation of the project/programme outcomes in relation to the initial proposal was also mentioned as a new impact assessment practise.

3.3.1 Recommendations and common practices among the BANOS CSA partners and the participating states

1. Research impact assessment was typically carried out as part of the project reporting and majority of the used indicators followed the concept outlined in the *research pathway* (Figure 1).
2. The assessment of academic impact was considered relatively easy and the practises were relatively standardized. The most common approach was the recording of scientific publications. Some bibliometric approaches, like documenting journal impact, were not favoured as it was considered that research should be assessed based on its own merits rather than of the basis of the journal in which it was published in (for more details see DORA declaration[21])
3. The assessment of societal impact was considered relatively difficult due to lack of easy-to-use indicators. Many organizations had modified their impact assessment practises in recent years (or where intending to do it in near future) to enhance the societal impact assessment practises. Some

[25] https://sfdora.org/
[26] https://www6.inrae.fr/asirpa_eng/
[27] https://www.cirad.fr/en/our-research/the-impact-of-our-research/the-impress-ex-post-method/principles-and-tools

of the changes included favouring of more open questions and case study approach into the assessment practises with the aim to promote and support innovation and renewal more efficiently. If indicators were used, the ones based on productive interactions were favoured.

4. Assessment practises were often somewhat tailored to different project types. For example, some organisations carried out the assessment of economic impact only for specific projects, e.g. more related to innovation. Thus, tailoring of impact assessment practises to best reflect the objectives of a project in question, should not be overlooked.

3.4 Best practice by other initiatives and states

An interest in the research impact assessment has a relatively long history, although the focus of the assessments has shifted from research utilization at the 70s[28] towards knowledge mobilization in more recent years. Among the universities, the United Kingdom has been performing systematic research assessments longest, starting with the Research Assessment Exercise (RAE) in the mid-80s with the intension to encourage world-class research and drive excellence[29]. In more recent years the RAE has been replaced with Research Excellence Framework (REF)[30] review, in which the focus of the assessment has moved increasingly towards providing accountability for public investment in research and produce evidence of the benefits of this investment. The REF assessment performed in 2014 contained three distinct elements: (i) the quality of outputs (e.g. publications, performances, and exhibitions), (ii) their impact beyond academia, and (iii) the environment that supports research, of which the section on impact beyond academia accounted for 20% of the overall assessment[7]. The next REF assessment is scheduled for 2021 and the weighting of the impact assessment has been increased to 25% of the total evaluation process.

The format of the REF impact assessment is based on narrative style case-studies. For the upcoming REF, the case studies should describe specific examples of impacts achieved during the assessment period (1 August 2013 to 31 July 2020), underpinned by research in the period 1 January 2000 to 31 December 2020. As such, a very specific timeframe is set for assessment. The case studies are submitted thought a standardised template (Annex 4), which includes five specific sections: (i) summary of the impact, (ii) Underpinning research, (iii) References to the research, (iv) Details of the impact and (v) Sources to corroborate the impact.

Case studies and narrative outputs are also favoured by other academic establishments, such as UK National Institute for Health Research[31] and Canadian Academy of Health Sciences[32]. The French National Research Institute for Agriculture, Food and the Environment (INRA) has also developed a case study-based method for Socio-economic Analysis of Impacts of Public Agronomic Research (ASPIRA)[33]. It is conducted according to standardized modalities and uses three analytical tools: (i) a chronology, (ii) an impact pathway, and (iii) an impact vector.

For proponents of the case studies, these are typically the only viable route to assessing impact and they have many proponents due to their many benefits, including the potential to present and evaluate complex information[34]. However, if the research and impact assessment is solely based on narratives and case study approach, the potential pitfalls should not be overlooked. For example, case study approach can be selective, leading to, for example, universities only reporting on the studies with the best impact. In

[28] Weiss, C. H. The many meanings of research utilization. Public Adm. Rev. 39, 426–431 (1979).
[29] https://www.ugc.edu.hk/eng/ugc/activity/research/rae.html
[30] https://www.ref.ac.uk/
[31] https://www.nihr.ac.uk/documents/impact-and-value-report/21427
[32] Canadian Academy of Health Sciences (CAHS). Making an Impact. A Preferred Framework and Indicators to Measure Returns on Investment in Health Research (Canadian Academy of Health Sciences, Ottawa, 2009) https://cahs-acss.ca/making-an-impact-a-preferred-framework-and-indicators-to-measure-returns-on-investment-in-health-research/
[33] https://www6.inrae.fr/asirpa_eng/
[34] Bornmann, L. High Educ (2017) 73: 775 https://doi.org/10.1007/s10734-016-9995-x and references there in.

addition, the review process of the case studies can be very laborious and expensive, requiring relatively more resources than other evaluation approaches.

Use of impact metrics is another evaluation approach to assesses scientific and social impact of research. In a recent study, the US National Science Foundation (NSF) applied various metrics to assess the value of its investments in study reports, workshops, symposia, and other activities developed by the National Academies of Science, Engineering, and Medicine (NASEM)[35]. Four specific metrics were included: (i) number of copies distributed (e.g. downloads, number or copies sold etc), (ii) altmetrics score[36], (iii) number of report citations in NSF Program descriptions and solicitations and (iv) number of mentions in whiteHouse.gov and congress.gov documents. Three clear insights were revealed by the metrics: *1: Impact metrics do not appear to depend on award size*. Some smaller awards had impact metrics greater than many of the largest awards. *Insight 2: Impact metrics vary by audience size*. Broad reports of interest to large audiences typically had higher impact metrics than more narrowly focused reports. *Insight 3: The timing and resilience of topics appears to affect impact metrics.* Reports released when policy interest in the topic was high typically have greater impact metrics. Reports on topics of ongoing policy interest also appeared to have higher impact metrics. Following the metrics analyses, some of the highly ranked reports were looked at more closely, and some factors were identified that most instrumental in creating impact. Four examples of these included: (i) projects with clear, focused project descriptions and charges tended to be more impactful, (ii) significant community interest improves the likelihood of impact, (iii) product timing is very important and (iv) strong, distinguished, and engaged chairs and committee members help create impact.

The use and value of altmetric score to assess social impact of research has in general been questioned [37]. Yet, it seems to have some benefits, including the ability to track interest, for example, in publications in almost real time both within and beyond academia. In addition, altmetrics have the advantage that it could be applied to data sets, blog posts, reviews and many more forms of scientific outputs, so not only peer-reviewed articles typically included in bibliometric analyses. The recent study also gives some confidence in applying altmetric score as part of the impact assessment practise[37]. The study found out that the publication outputs and publications listed in the case studies of REF evaluations had corresponding high altimetric scores. Yet, there was not clear correlation between altmetrics and scores of the REF case study review results.

Use of combination of quantitative and quality indicators is also favoured by many. A recommendation of a set of common monitoring and evaluation practises of the Joint Programming Initiatives (JPIs)[38] was recently designed and published by a specific task force [39]. The aim of the recommendation was to identify a small set of important dimensions of JPIs with their associated indicators that is robust and is supported by all JPIs as a basis for the assessment of the JPIs as a whole. The proposed indicators focussed on five different dimensions of the JPIs, reflecting their shared objectives: (i) Alignment of national and European and/or international research and innovation programmes and resources, (ii) International cooperation or activities, (iii) Enhanced knowledge production/sound knowledge base in JPI area, (iv) Governance and (v) Contribution to the area of the societal challenges. The report highlights that in order to measure progress

[35] Impact Assessments of NSF Awards to the National Academies of Science, Engineering, and Medicine. https://www.nsf.gov/od/oia/publications/NASEM-Report.pdf

[36] Altmetric is a private company that provides digital tools to track online activity around research outputs. https://www.altmetric.com/about-altmetrics/what-are-altmetrics/

[37] Bornmann, Lutz & Haunschild, Robin & Adams, Jonathan, 2019. "Do altmetrics assess societal impact in a comparable way to case studies? An empirical test of the convergent validity of altmetrics based on data from the UK research excellence framework (REF)," Journal of Informetrics, Elsevier, vol. 13(1), pages 325-340.

[38] The Joint Programming process was launched by a Communication of the Commission in July 2008 in efforts to make better use of Europe's research and development resources and tackle common European challenges more effectively. As a result, 10 JPIs were established corresponding to different societal challenges https://www.era-learn.eu/partnerships-in-a-nutshell/type-of-networks/joint-programming-initiatives

[39] Task Force on Monitoring & Evaluation of the JPIs. Final report on Key indicators, August 2018 https://www.era-learn.eu/documents/final_report_task_force_m-e_jpis_dec2018.pdf

both quantitative and qualitative data needs to be gathered, the latter requiring specific data collection procedures such as interviews, narratives, and success stories. A complete list of the proposed indicators can be found in Annex 5.

3.4.1 Recommendation derived from the best practices of other initiatives

1. A recent trend in assessment practises is moving towards favouring of case studies and reporting of more narrative style of project outputs, outcomes and impact, which allows for more flexibility, in respect to taking into consideration project/programme specific aims and objectives, and possibilities to present complex information.
2. If conducting case studies, a template used should be clear and concise and a very specific timeframe should be set for the evaluation period.
3. Inclusion of some quantitative and qualitative (narrative) performance indicators into the assessment practises are also favoured.
4. Although the effectiveness of the altmetric scores to track social impact has been questioned, it does seem to reflect the general interest in, e.g. publications and other project outputs etc, in almost real time and it includes both academic and non-academic audience. An advantage of altmetrics to other bibliometric indicators is that it can also be applied to datasets, blog posts, reviews etc other project outputs, typically not included in the other approaches.

4 A proposed strategy for R&I impact assessment in future BANOS programme

The proposed strategy builds on the BONUS experience and the best practices identified among the BANOS CSA partners as well as in literature. The strategy will encompass impact assessment at both the programme- and individual project levels, both including assessments of academic and societal impact. The assessments will be based on tracking project/programme activities, outputs and outcomes and on a long term track of the individual projects' impact and the programme as a whole. More specifically, the academic impact assessment will focus on the scientific quality and excellence whereas the societal impact assessment will focus on the contributions that research and innovation make to society, policy, economy and environment (for exact definitions see section 2.1).

The project impact assessment is proposed to be done in real time during a project implementation and the appropriate statistics and data can be collected during the regular project monitoring. In addition to assess the long-term impact, an ex-post impact assessment is proposed to be conducted allowing a certain time lapse for impact materialising. The programme level evaluation is suggested to be executed in cycles that are coherent with the SRIA implementation and update process. The assessment results could then be taken into account in the update and SRIA implementation and the actual impact assessment updated and modified as seen most appropriate.

The following section outlines the components that are proposed to be incorporated into the future BANOS impact assessment practises. The components will be further discussed among the BANOS Steering Committee, and where needed with additional appropriate experts, to finalise and agree on the impact assessment strategy prior to submission of the BANOS deliverable *D4.2 Guidelines for Applicants on integrating practical Impact Indicators in project design* due in April 2021.

4.1.1 Proposed components of project level impact assessment

The following components have been identified to be crucial for the successful project level impact assessment.

The impact assessment follows the concepts of the *Research Impact Pathway* (Figure 1). This approach provides a logical sequence of steps (i.e. inputs, activities, outputs, outcomes) by which impact is realised. The periodic reporting aims to tracks the project progress towards (predefined) project R&I outputs, outcomes and impact, of which some are already identified at the proposal stage.

The assessment contains predefined performance indicators of which some are narrative in style. The BONUS performance indicators are used as a basis for formulating the BANOS performance indicators. The proposed indicators are outlined in Table 5. Some of the listed indictors are based on principles of '*productive interactions'*, leading to identification of efforts by stakeholders to uptake the research results or practical information or experiences. Differentiated set of indicators may be used to optimize the assessment of research and innovation focused project and to accommodate the differences in objectives of these types of projects. These final indicators will be agreed with BANOS Steering Committee and some adjustments to the proposed indicators are likely prior to identification of final ones, which will be incorporated in the report D4.2 due in April 2021.

The assessment contains some open (self-assessment) questions, allowing more flexibility in project reporting, taking into account project specific aims and objectives and thus providing more (yet concrete) details of a project impact, including but not limited to interdisciplinarity and contribution to application of ecosystem approach, as well as assessment of the added value delivered at the BANOS sea basin scale. This is considered especially important for assessment of environmental and economic impact, which seems to be especially difficult to assess based on predefined performance indicators.

A post-project impact assessment is critically needed to assess a long-term impact. A significant time-lag can be expected between end of a project and for impact to materialize. For BONUS projects (Section 3.2), it was evident that 3 years after end of a project many outputs and outcomes where still materializing. In the study of Fryirs et al.[8], first environmental impact was observed 10 years after the initiation of the project. Thus, an assessment should be carried out at a specific point in time after the end of a project. The time-lag is likely to be project specific, thus identifying the optimum time for an assessment is not easy. The post project assessment could be made sometime between 5 and 10 years after the end of a project. To ensure that the project coordinators will follow through with the reporting, a statement could be incorporated into the grant agreement about the post-project impact assessment.

Clear guidelines are needed to ensure high-quality and consistent project reporting. Clear guidelines will ensure minimum discrepancy in the interpretation of the performance indicators and open questions by project consortiums. In addition, ambiguous language (e.g. significant or relevant) should be avoided that can be interpreted in many ways. Clear guidelines and straightforward wording will also make the reporting easier for the project coordinators, thus lessening the burden of reporting. Providing educational materials on the importance of impact assessment and what it entails, may also be considered, as this may motivate coordinators and project partners not only to collect and submit date consistently but also drive the project's impact.

Genuine orientation towards societal impact is embedded already at the proposal stage and is supported accordingly through the proposal evaluation and selection process. The projects will be asked to outline and identify the expected societal impact already at the proposal phase. This part will weight significantly toward the total proposal assessment. The final percentage is proposed to be somewhere between 20-25 % of the total evaluation, this aligned with the upcoming UK REF assessment.

Provisions for systematic collecting and reporting of impact shall be embedded in the grant agreements with the Programme beneficiaries. This practise will ensure that the project coordinators will follow through with the reporting during and after the end of the project.

A strategic communications and stakeholder engagement plan is expected to enhance impact. Stakeholder engagement is considered crucial for projects to deliver impact and the engagement should take place from the very beginning of a project. Where appropriate, the project goals and outputs should be clarified and planned with the stakeholders (i.e. to ensure that needs of consumers and society, for example, are met). Unnecessary burden to end users should be minimized through prudent and aggregated management of engagement as many organizations and initiatives (e.g. HELCOM or OSPAR) may not have a capacity to follow multiple science projects at a time. All projects will need to develop clear stakeholder engagement plans already at the proposal phase. These plans must identify the key actors that are needed for the successful completion of a project. They will be evaluated and updated during the periodic reporting including a description of interactions with the key stakeholders and how they are

relevant for project progress and goals, and list of new collaborations and their relevance for project objectives will also be recorded.

Mobility plans and infrastructure sharing is encouraged among the BANOS projects. A description of a mobility plan is proposed to be included in the project proposal, encouraging mobility of PhD students, postdocs and early career scientists to increase cross-sectoral mobility. In addition, a record of significant in kind, free of charge research infrastructures used by the projects for which no bilateral agreements between the infrastructure provider(s) and BANOS is kept.

The project reporting is monitored, and the collected data subsequently evaluated periodically by BANOS staff. The reported data must be evaluated, and quality controlled by BANOS staff to ensure systematic reporting between different projects. In case of discrepancies, project coordinators must be approached, and data resubmitted. In addition, the project evaluations are proposed to be done periodically in a standardized manner, taking into account the project maturity and implementation stage (i.e. it is not feasible to compare a project that has just been initiated, or one that is halfway, with a one that has already finished some years ago). Brief summaries of BANOS project outcomes can be produced on call-by-call cases as it was previously done in BONUS[11, 12, 13, 14]

Table 5. The proposed BANOS academic and societal performance indicators, including both numeric and narrative indicators. The societal indicators are further sorted into policy, society, innovation and overarching performance indicators. The proposed indicators follow the principles of Research Impact Pathway model (Figure 1), which identifies the sequence of steps by which impact is realized.

Academic performance indicators	**Research Impact Pathway step**
1. Number of PhD students and the number of post-docs funded by the project	1. Input
2. Number of research staff involved (fully or partly funded or contributed as in kind) by seniority and gender.	1. Input
3. List of international and national scientific events organized by the project	2. Activity
4. Number of attendances at international and national scientific events with presentations (oral/poster)	2. Activity
5. Number of academic training courses organized by the project and number of persons participating	2. Activity
6. List of co-operation activities involving project partners from other European marine basins or internationally	2. Activity
7. List of peer-reviewed publications arising from the project	3. Output
8. List of datasets to openly accessible common databases arising from the project	3. Output
9. List of known R&I project collaborations that have verifiably utilized the results of BANOS project	4. Outcome
10. List of doctoral theses defended (career advancement)	4. Outcome
Societal performance indicators	
Policy related performance indicators	
11. List of suggestions for designing, implementing and evaluating the efficacy of relevant public policies and governance on international, European, the regional sea basin or national level originating from the work of the project. (The list will indicate what has been suggested to whom, when this took place and in which form)	2. Activity
12. List of stakeholder committees, e.g. EC, ICES, HELCOM, OSPAR, VASAB etc., the scientists working in the project are members or observers in. (the list will contain the name of the committee and who in the consortium is involved in it)	2. Activity
13. List of occasions the project has verifiably contributed to the development and implementation of 'fit-to-purpose' regulations, policies and management practices on international, European, the Baltic Sea region or national level aimed at safeguarding the sustainable use of ecosystem's goods and services, in particular input to HELCOM and OSPAR strategies, EU Integrated Maritime Policy, EU Marine Strategy Framework Directive (MSFD) and its implementation.	4. Outcome

Society related performance indicators	
14. Number of interviews given to media by the project consortium members. (the content of the interviews should have a verifiable relation to the funded project)	2. Activity
15. List of project activities related to citizen science and enhancing ocean literacy (examples will be provided in the detailed instructions based on strategy developed in BANOS D4.8 Measures stimulating citizen science).	2. Activity
16. Number of popular science papers and books produced by the project.	3. Output
17. Number of multi-media products produced, and TV episodes featured by project consortium members (both should have a verifiable relation to the funded project)	3. Output
*Innovation related performance indicators**	
18. List of industrial internships involving PhD students, postdocs and early career scientists involved in the project (the internship should have a verifiable link to the funded project)	2. Activity
Other cross-cutting performance societal indicators.	
19. List of international, national and regional (non-academic) stakeholder events, and outreach and dissemination activities organized by the project consortium members (with a verifiable relation to the funded project).	2. Activity
20. List of non-academic training courses and education activities organized by the project consortium members related to professional skills development (with a verifiable relation to the funded project). In detailed instructions, specific examples will be provided.	2. Activity

*Additional innovation performance indicators may be further considered, or alternatively the innovation impact will be assessed based primarily on narrative open questions.

4.1.2 Proposed components of programme level impact assessment

The programme level impact assessment is proposed to be based on the BONUS experience and carried out by an external panel and/or group of experts. Although, this approach requires resources, it is considered the most reliable and impartial evaluation method.

Two evaluations are proposed to be carried out on programme level with two different focus areas:

i. **Scientific excellence**: This programme level assessment aims to establish the scientific quality of BANOS R&I project outcomes and outputs, and how the scientific quality and dissemination of results have progressed science in the BANOS region. The assessment is proposed to be primarily based on literature and possibly including some bibliometric indicators. In addition, evaluator(s) will have access to the academic performance indicator data collected as part the periodic projects' reporting. Methods used by Pauline Snoesjis Leijonmalm[17,18] may be consulted and updated where appropriate.

ii. **Societal impact**: This programme level assessment aims to establish the impact of BANOS generated outputs and outcomes beyond academia. More specifically, the assessment focusses on practical use of BANOS-funded research and innovation, how the programme has contributed and supported, for example, relevant regional and EU policy goals, (open) innovative industries, and scientific evidence-based practises in the BANOS region. The assessment will also take into account the involvement of citizens in the BANOS region and value impact of the programme on education beyond academia. The assessment panel will have access to projects' concrete data collected during the periodic reporting. Also, where appropriate more details on specific case studies may be provided.

In addition to proposed programme level assessment practises outlined above, the BANOS impact assessment practices and project data collection will be designed to complement the practises of HORIZON Europe[9].

5 Annexes

Annex 1. Key impact pathway indicators proposed for the progress monitoring of Horizon Europe funded programmes

Set of indicators have been identified for scientific, societal and economic impact assessment[40]

Scientific key impact pathway indicators

Short-term	Medium-term	Longer-term	Scientific impact
1 Message: Horizon Europe generates world-class science, as shown by the high-quality publications that become influential in their field and worldwide[1].			
Publications Number of FP peer reviewed scientific publications[2]	**Citations** Field-Weighted Citation Index of FP peer reviewed publications	**World-class science** Number and share of peer reviewed publications from FP projects that are core contribution to scientific fields	**Creating of high-quality new knowledge**
Data needs: identification of publications co-funded by the FP through the insertion of a specific DOI for the FP (funding source code) when publishing, allowing follow-up tracking of the perceived quality and influence through publication databases and topic mapping.			
2 Message: Horizon Europe strengthens human capital, as shown by the improvement in skills, reputation and working conditions of participants[3].			
Skills Number of researchers having benefitted from upskilling activities in FP projects (through training, mobility and access to infrastructures)[4]	**Careers** Number and share of upskilled FP researchers with more influence in their R&I field	**Working conditions** Number and share of upskilled FP researchers with improved working conditions	**Strengthening human capital in R&I**
Data needs: collection of unique identifiers of individual applicants to the FP at proposal stage, allowing follow-up tracking of their influence in their field through publication and patent databases, awards and prizes, as well as evolution of working conditions through salary levels and benefits.			
3 Message: Horizon Europe opens up science, as shown by research outputs shared openly, re-used and stimulating new transdisciplinary/trans-sectoral collaborations[5].			
Shared knowledge Share of FP research outputs (open data/ publication/ software etc.) shared through open knowledge infrastructures	**Knowledge diffusion** Share of open access FP research outputs actively used/cited after FP	**New collaborations** Share of FP beneficiaries having developed new transdisciplinary/ trans-sectoral collaborations with users of their open FP R&I outputs	**Fostering diffusion of knowledge and Open Science**
Data needs: Identification of research outputs (in particular publications and research data) co-funded by the FP through the insertion of a specific DOI for the FP when publishing or sharing openly (e.g. OA journals/ platforms (publications) and open FAIR repositories (data)), allowing follow-up tracking of open access performance in terms of active use/citations and collaborations.			

[40] A NEW HORIZON FOR EUROPE Impact Assessment of the 9th EU Framework Programme for Research and Innovation, June 2018 https://op.europa.eu/en/publication-detail/-/publication/00d78651-a037-11e8-99ee-01aa75ed71a1

Key societal impact pathway indicators

Short-term	Medium-term	Longer-term	Societal impact

4 Message: Horizon Europe helps addressing EU policy priorities (including meeting the SDGs) through R&I, as shown by the portfolios of projects generating outputs which help to tackle global challenges.

Outputs	Solutions	Benefits	Addressing EU policy priorities through R&I
Number and share of outputs aimed at addressing specific EU policy priorities (including meeting the Sustainable Development Goals (SDGs))	Number and share of innovations and scientific results addressing specific EU policy priorities (including meeting the SDGs)	Aggregated estimated effects from use of FP-funded results on tackling specific EU policy priorities, including contribution to policymaking and legislation	

Data needs: Projects classified according to the specific EU policy priorities (including the SDGs) pursued and follow-up tracking of their outputs, results and impacts. Portfolio analysis on effects from scientific results & innovations in specific EU policy priority/SDGs areas, text mining.

5 Message: Horizon Europe produces knowledge and innovation that contribute to achieving missions of EU interest[6].

R&I mission outputs	R&I mission results	R&I mission targets met	Delivering benefits and impact through R&I missions
Outputs in specific R&I missions	Results in specific R&I missions	Targets achieved in specific R&I missions	

Data needs: Projects classified according to the missions pursued and follow-up tracking of their outputs, results and impacts according to the target set. Portfolio analysis on effects from scientific results & innovations in mission areas.

6 Message: Horizon Europe creates value for European citizen, as shown by the engagement of citizen in the projects and beyond the projects by improved uptake of scientific results and innovative solutions[7].

Co-creation	Engagement	Societal R&I uptake	Strengthening the uptake of innovation in society
Number and share of FP projects where EU citizens and end-users contribute to the co-creation of R&I content	Number and share of FP beneficiaries with citizen and end-user engagement mechanisms after FP project	Uptake and outreach of scientific results and innovative solutions co-created in the FP	

Data needs: Collection of data at proposal stage on the roles of partners (incl. citizen) in the projects, structured survey of beneficiary entities and tracking of uptake and outreach through patents and trademarks and media analysis.

Key economic impact pathway indicators

Short-term	Medium-term	Longer-term	Societal impact
7 Message: Horizon Europe is a source of economic growth, as shown by the patents and innovations that are launched on the market and generate added value for businesses[9].			
Innovative outputs Number of innovative products, processes or methods from FP (by type of innovation[10]) & Intellectual Property Rights (IPR) applications[11]	**Innovations** Number of innovations from FP projects (by type of innovation) including from awarded IPRs	**Economic growth** Creation, growth & market shares of companies having developed FP innovations	**Innovation-based growth**
Data needs: Reporting of beneficiaries on innovative products, processes or methods from FP and their practical use, and insertion of a specific DOI for the FP (funding source code) when filling IPR applications, allowing follow-up tracking of the patents through patent databases and trademarks ("follow the investor approach").			
8 Message: Horizon Europe generates more and better jobs, initially in the projects, and then through the exploitation of the results and their diffusion in the economy[12].			
Supported employment Number of FTE jobs created, and jobs maintained in beneficiary entities for the FP project (by type of job[13])	**Sustained employment** Increase of FTE jobs in beneficiary entities following FP project (by type of job)	**Total employment** Number of direct & indirect[14] jobs created or maintained due to diffusion of FP results (by type of job)	**Creating more and better jobs**
Data needs: Collection of information on individuals involved in FP projects at proposal stage, including their workload (Full Time Equivalent) and job profile allowing follow-up tracking of employment in beneficiary organisations. Longer-term indicator will be an estimate based on a dedicated study.			
9 Message: Horizon Europe is leveraging investments for R&I in Europe, initially in the projects, and then to exploit or scale-up their results[15].			
Amount of public & private investment[16] mobilised with the initial FP investment	Amount of public & private investment mobilised to exploit or scale-up FP results	EU progress towards 3% GDP target due to FP	**Leveraging investment**
Data needs: Data on co-funding in FP projects by source of funds including other EU funds (e.g. ESIF), collection of unique identifiers of applicants to the FP at proposal stage (e.g. VAT), allowing follow-up tracking of their capital. Longer-term indicator will be an estimate based on a dedicated study.			

Annex 2. Performance indicators reported by BONUS Art 185 programme projects[41]

Indicator	BONUS calls				TOTAL
	Viable ecosystem[42]	Inno-vation[43]	Sustainable ecosystem services[44]	Blue Baltic[45]	
Number of times the project has contributed significantly to the development and implementation of 'fit-to-purpose' regulations, policies and management practices on international, European, the Baltic Sea region or national level aimed at safeguarding the sustainable use of ecosystem's goods and services , in particular the EU Strategy for the Baltic Sea Region, EU Integrated Maritime Policy, EU Marine Strategy Framework Directive (MSFD) and its implementation, as well as the Baltic Sea Action Plan.	84	13	27	24	148
Number of suggestions for designing, implementing and evaluating the efficacy of relevant public policies and governance on international, European, the Baltic Sea region or national level originating from the work of the project.	72	22	58	11	163
Number of times the scientists working in the project have served as members or observers in stakeholder committees, e.g. EC, HELCOM, VASAB, ICES etc.	837	68	180	260	1345
Number of international, national and regional	77	28	112	37	254

[41] As presented by the projects in the reports by the end of 2019
[42] Seven projects with duration of four years and total funding of 26.1 MEUR
[43] Thirteen projects with duration two or three years and total funding 7.3 MEUR
[44] Eight projects with duration three years and total funding 17.4 MEUR
[45] Twelve ongoing projects after second reporting period.

stakeholder events organised by the project.					
Number of joint events/co-operation activities/partnerships of the project with non-Baltic research actors and other European marine basins.	103	49	61	53	266
Number of persons (above) and working days (below) spent by foreign scientists on research vessels participating in the cruises arranged by the project.	89	5	4	28	126
	662	21	15	211	909
Number of persons (above) and working days (below) spent by foreign scientists using other major research facilities involved in the project.	77	1	26	33	137
	1413	10	160	755	2338
Number of peer-reviewed publications arising from the project research	417	64	158	101	716
Among those with authors from, at least, two different participating states.	188	44	84	49	345
Share of Open Access publications	50%	61%	63%	51%	56%
Number of entries to existing openly accessible common databases, storing original data from the entire Baltic Sea system or larger geographical area.	94	41	31	395	561
Number of popular science papers produced by the project.	119	35	63	34	251
Number of interviews to media given by the members of the project's consortium.	301	50	61	128	791
Number of multi-media products and TV episodes produced by the project with dissemination purpose.	50	20	31	56	157
Number of other international, national and regional communication, dissemination and public	1092	220	520	291	2123

outreach initiatives to disseminate the project's research results.					
Number of post graduate courses (above) organised by the project and persons participating (below).	13	0	18	12	43
	268	0	263	177	708
Number of mobility activities (persons, above; visit days, below) from the project to the other BONUS projects.	113	44	21	21	199
	422	84	98	96	700
Number of PhD students (above) and the number of post-docs (middle) funded by the project as well as the number of doctoral thesis defended (below).	66	38	63	63	230
	81	20	47	54	202
	33	6	11	3	53
Number of staff included to the project implementation Professor etc level	75	50	69	72	266
Associate professor etc level	167	69	126	170	532
Assistants, lecturers etc level	202	166	182	224	774
Post-docs	102	26	48	61	237
PhD students	87	46	70	73	513
Share of female staff involved, %	49	40	44	47	46
Amount of significant in kind infrastructures used by the project, other than those reported according to the bilateral agreements between infrastructure providers and BONUS EEIG, kEUR	698	205	876.3	1299	3079
Amount of other than infrastructure in kind contributions the project has received, kEUR	4773.7	343.9	1584	1370.8	8072.4
- among this personnel cost	4243.7	278.8	1506.1	1328.1	7356.7

Annex 3. A questionnaire sent to BANOS organizations to assesses their impact assessment practices

Questionnaire: Evaluating research and innovation impact

This questionnaire is part of BANOS CSA Task 4.1 Developing mechanisms for impact monitoring. The output of this task will inform the strategy for monitoring and assessing both academic and societal impact of the future BANOS[46] programme, as planned in BANOS CSA. To this end we seek practical impact indicators that scale up from individual project applications to programme level. Impact monitoring and assessment strategy will be integrated in the BANOS strategic research and innovation agenda, thus providing guidelines for applicants of the research and innovation calls to ensure delivery of a strong impact by projects. This questionnaire intends to investigate impact monitoring approaches, including indicators used by the BANOS CSA consortium members. The results will be analysed in detail to identify best practises for the impact monitoring assessment of the future programme. The results from the survey will be accompanied with a detailed literature research on the topic.

Name of the organisation:	
Country:	
Contact person and contact details (email):	
Short **description** of the organisation	Please include type of research funded (i.e. basic research, applied research, innovation). Is funding mainly targeting academic institutions, public research organisations or also include enterprises

1. GENERAL INTRODUCTORY QUESTIONS

Does your organisation conduct a periodic impact assessment of the research projects it funds?	☐ Yes ☐ No
Is the assessment carried out during the lifetime of the project and/or at the end of the project? (please tick all the relevant boxes)	☐ During the project (1 time only) ☐ During the project (multiple times) ☐ At the end (within a year of project ending)
Do you conduct any post-project follow up (i.e. after the project is completed)? If yes, when is this done (please tick all the relevant boxes)	☐ 1-3 years ☐ 3-5 years ☐ 5-10 years ☐ >10 years
Please describe briefly how is the post-project follow up conducted (if any):	

[46] The joint Baltic and North Sea research and innovation programme; title accepted by the BANOS CSA Steering Committee on 6 June 2019.

Which of these staff-related statistics are part of the impact assessment?	☐ Permanent staff numbers ☐ Postdocs numbers ☐ PhD student numbers ☐ Master student numbers ☐ Technical expertise of staff/skills level ☐ Other funding sources of staff ☐ Gender of staff ☐ Ethnic background of staff Other (*please specify here*)

2. SCIENTIFIC IMPACT AND DISSEMINATION

Which of the following are included in the scientific impact monitoring practises of your organisation? (please tick all the relevant boxes)	Assessment of ☐ Number of publications ☐ Journal impact factor ☐ Number of citations Other: *please specify here*
What aspects of dissemination and knowledge transfer are assessed as part of the impact monitoring practises within your organisation? (please tick all the relevant boxes)	Assessment of ☐ Conferences and seminars attended ☐ Presentations ☐ Teaching ☐ Media appearance ☐ Social media Other: *please specify here*
Does the organisation that you represent encourage dissemination of scientific results beyond academia? If yes, please describe here briefly how this is done:	
Is open access publishing and open data policies actively encouraged by your organisation? If yes, please describe briefly how this is done.	
What other indicators are included in the assessment of scientific impact within your organisation? (please thick all the relevant boxes)	☐ Master thesis ☐ PhD degrees/thesis ☐Awards/Grants/Scholarships Other: *please specify here*
Are international collaborations and mobility between academic organisations valued as a part of the impact assessment within your organisation?	☐ Yes ☐ No If yes, which indicator is used? (*please indicate here*)

Are interdisciplinary research approaches valued as a part of the impact assessment within your organisation?	☐ Yes ☐ No If yes, which indicator is used? (*please indicate here*)
Please describe here briefly anything else that is part of the scientific impact assessment including indicators used, in your organisation:	

3. INFLUENCE ON POLICY MAKING AND STAKEHOLDER ENGAGEMENT

Is stakeholder engagement strategy a compulsory part of the initial project proposal?	☐ Yes ☐ No
Is a policy-related output (e.g. input into regulations and policy, involvement in decision making and recommendations, changes in practises) evaluated as part of the project impact assessment within your organisation?	☐ Yes ☐ No
Is stakeholder engagement part of the impact assessment practises? If yes, which of the following indicators are assessed (please thick all the relevant boxes).	☐ Industry collaboration ☐ staff mobility (among industry/NGOs/government bodies etc) ☐ Arranging stakeholder events Other: *please specify here*
Briefly describe how policy input and stakeholder engagement are assessed, including types of indicators used, as part of the impact assessment procedure and how highly it is valued (if applicable).	

4. SOCIAL IMPACT

Is social impact included in the project impact assessment by your organisation?	☐ Yes ☐ No
Which aspects of social impact are included as part of the assessment (please thick all the relevant boxes)?	☐ Increase public awareness (e.g by arranging public events) ☐ Increase literacy (incl. blog entries and popular scientific articles) ☐ Citizen science ☐ Use of social media ☐ Media appearances (i.e. interviews)

	☐ Increase in wellbeing/health ☐ Improvement in quality of environment ☐ Regional development[47] ☐ Knowledge transfer to regional actors[48] Other *(please specify)*
Please describe briefly how the social impact, including types of indicators, is evaluated (if applicable).	
Do you monitor efforts towards improving and achieving gender equality? If yes, please specify here how this is done and what indicators are used.	

5. ECONOMIC IMPACT

Is economic impact included in the project impact assessment within your organisation?	☐ Yes ☐ No
Which aspects of economic impact are included as part of the assessment?	☐ Number of patents ☐ Attracting economic R&D investment ☐ Income from intellectual property, development of sales and marketing ☐ Spin-out companies ☐ Job creation ☐ New improved/cost-effective practises (reduction in production costs etc) Other *(please specify)*
Please describe briefly how the economic impact of funded projects, including indicators used, is evaluated (if applicable).	

6. LESSONS LEARNT (including changes in practise)

Have the impact monitoring and assessment practises changed in the recent past (i.e. within last 5 years) with in your organisation?	☐ Yes ☐ No
If yes, please describe briefly how and why the assessment has changed.	

[47] Regional development here refers to, for example, improvement in local/regional infrastructure and facilities, employment opportunities and development of the environment.
[48] Regional actors here refers to, for example, local authorities and members of municipalities.

7. IMPACT ASSESSMENT AT A PROGRAMME/ORGANISATION LEVEL

Does your organisation conduct impact assessments at a programme/organisation level, or only a project level?	☐ Yes, also at a programme level. ☐ No, only at a project level.
If yes, please describe briefly how programme/organisation level impact assessment is different to project level assessments, including which types of indicators are used.	

8. FUTURE DEVELOPMENT IN ASSESSMENT PRACTISES AND UTILISATION OF ASSESSMENTS RESULTS

Are the assessment practises likely to change in the near future (i.e. next 5 years)	☐ Yes ☐ No
If yes, please describe briefly how and why the assessment practices are about to change (please describe especially new categories or indicators that are likely to be included as part of the assessment, or if the weighing of the existing categories or indicators are likely to change (for example, if an indicator is likely to become more valued that previously, or vice versa)	
Please describe briefly how the impact assessment results are utilised and disseminated.	
Please describe any challenges, in respect to quantification of impact, evaluation of output and outcomes, in the current approach applied by the organisation that you represent. You may also include suggestions on how to overcome any exiting challenged or how to improve future practices in respect to impact monitoring.	
You may wish to suggest other research and innovation (funding) organisations in your country or beyond with rich expertise in monitoring and assessing the R&I impact. Please provide contact details if known.	

If you have any questions about the questionnaire, please do not hesitate to contact Karoliina Koho (karoliina.koho@bonuseeig.fi) from the BONUS Secretariat for more details.
For more information on BANOS CSA, please visit https://www.banoscsa.org

This questionnaire is part of ***Baltic and North Sea Coordination and Support Action, BANOS CSA***, and has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817574.

Annex 4. Impact case study template for UK REF assessment planned for 2021

1. This annex provides the template for impact case studies, annotated with guidance about the information required in each of its sections. This should be read alongside the definitions and eligibility criteria for impact case studies in Part 3, Section 3 of the 'Guidance on submissions', and alongside the 'Panel criteria'. The case study template for use in preparing submissions will be provided in Word, along with templates for REF5a and REF5b, on the REF submission system

2. Each case study should include sufficiently clear and detailed information to enable panels to make judgements based on the information it contains, without making inferences, gathering additional material, following up references or relying on members' prior knowledge. References to other sources of information will be used for verification purposes only, not as a means for panels to gather further information to inform judgements.

3. The information fields in Section A are mandatory and will be made available to panels.

4. The additional contextual data fields are mandatory, where applicable. They will be entered separately and will **not** be routinely provided to panels. They will not count towards the page limit.

5. Each completed case study template will be limited to **five pages** in length (see Annex F). Within the annotated template below, indicative guidance is provided about the expected maximum length limit of each section, but institutions will have flexibility to exceed these so long as the case study as a whole remains no longer than **five pages** and the guidance on formatting in Annex F is adhered to.

6. When presenting numeric data, submitting units are strongly encouraged to adhere to the guidelines set out in the 'Guidelines for standardising quantitative indicators of impact within REF case studies' (available at www.ref.ac.uk under Guidance). This will enable more effective analysis of the data in post-assessment evaluations.

Section A The fields in this section are mandatory.		
Institution:		
Unit of Assessment:		
Title of case study:		
Period when the underpinning research was undertaken:		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Period when the claimed impact occurred:		
Is this case study continued from a case study submitted in 2014? Y/N The definition of continued case studies is provided in the 'Guidance on submissions', paragraph **Error! Reference source not found.**.		
Section B		
1. Summary of the impact (indicative maximum 100 words) This section should briefly state what specific impact is being described in the case study.		
2. Underpinning research (indicative maximum 500 words) See paragraphs **Error! Reference source not found.** to **Error! Reference source not found.**.		

This section should outline the key research insights or findings that underpinned the impact, and provide details of what research was undertaken, when, and by whom. This research may be a body of work produced over a number of years or may be the output(s) of a particular project. References to specific research outputs that embody the research described in this section, and evidence of its quality, should be provided in the next section (section B3).

Details of the following should be provided in this section:

- The nature of the research insights or findings which relate to the impact claimed in the case study.
- An outline of what the underpinning research produced by the submitted unit was (this may relate to one or more research outputs, projects or programmes).
- Any relevant key contextual information about this area of research.

3. References to the research (indicative maximum of six references)

This section should provide references to key outputs from the research described in the previous section, and evidence about the quality of the research. Underpinning research outputs may include the full range of types listed in the output glossary (Annex K) and are not limited to printed academic work. All forms of output cited as underpinning research will be considered equitably, with no one type of output being preferred over others.

Include the following details for each cited output:

- author(s)
- title
- year of publication
- type of output and other relevant details required to identify the output (for example, DOI, journal title and issue)
- details to enable the panel to gain access to the output, if required (for example, a DOI or other URL), or stating that the output is listed in REF2 or can be supplied by the HEI on request.

All outputs cited in this section must be capable of being made available to panels. If they are not available in the public domain or listed in REF2, the HEI must be able to provide them if requested by the REF team.

Evidence of the quality of the research must also be provided in this section. Guidance on this is provided in the 'Panel criteria'.

Where panels request details of key research grants or end of grant reports, the following should be provided:

- who the grant was awarded to
- the grant title
- sponsor
- period of the grant (with dates)
- value of the grant.

4. Details of the impact (indicative maximum 750 words). The 'Panel criteria', Annex A, Table 1 provides an illustrative list of evidence that could be provided.

This section should provide a narrative, with supporting evidence, to explain:

- how the research underpinned (made a distinct and material contribution to) the impact;
- the nature and extent of the impact.

The following should be provided:

- A clear explanation of the process or means through which the research led to, underpinned or made a contribution to the impact (for example, how it was disseminated, how it came to influence users or beneficiaries, or how it came to be exploited, taken up or applied).
- Where the submitted unit's research was part of a wider body of research that contributed to the impact (for example, where there has been research collaboration with other institutions), the case study should specify the particular contribution of the submitted unit's research and acknowledge other key research contributions.
- Details of the beneficiaries – who or what community, constituency or organisation has benefitted, been affected or impacted on.
- Details of the nature of the impact – how they have benefitted, been affected or impacted on.
- Evidence or indicators of the extent of the impact described, as appropriate to the case being made.
- Dates of when these impacts occurred.

5. Sources to corroborate the impact (indicative maximum of ten references)

This section should list sources external to the submitting HEI that could, if requested by panels, provide corroboration of specific claims made in the case study. Sources provided in this section should not be a substitute for providing clear evidence of impact in Section B4; the information in this section will be used for audit purposes only.

This section should list sufficient sources that could corroborate key claims made about the impact of the unit's research. These could include, as appropriate to the case study, the following external sources of corroboration (stating which claim each source provides corroboration for):

- Reports, reviews, web links or other documented sources of information in the public domain.
- Confidential reports or documents (if listed, these must be submitted to the REF team by 29 January 2021).
- Individual users/beneficiaries who could be contacted by the REF team to corroborate claims*.
- Factual statements already provided to the HEI by key users/beneficiaries, that corroborate specific claims made in the case study (if listed, these must be submitted to the REF team by 29 January 2021)*.

* Where the sources are individuals who could be contacted or have provided factual statements to the HEI, the submitted case study should state only the organisation (and, if appropriate, the position) of the individuals concerned, and which claim(s) they can corroborate. Their personal details (name, position, contact details) must be entered separately on the REF submission system and not on REF3. Details of a maximum of five individuals may be entered for each case study; these data will not be published as part of the submission.

Additional contextual data The fields in this section are mandatory, where applicable. The information will be used in post-assessment evaluations and will **not** be routinely provided to panels. This information should be provided in a separate web form and is not included in the five-page limit.
Name(s) of funder(s):
Global Research Identifier of funder(s) (https://www.grid.ac/):
Name(s) of funding programme(s):
Grant number(s):
Amount of grant (in GBP):
ORCID for each named researcher, where held:
Name(s) of formal partner(s):
Country/countries where the impact occurred:**

** Where the impact occurred specifically within one country that is part of the UK (for example, Wales), this country rather than 'UK' should be specified in the country/countries field.

Annex 5. Proposed set of indicators for the evaluation and monitoring of JPIs[49]

Dimension	Indicator	Description/measurement	Methodology/data sources
Alignment of national and European and/or international research and innovation programmes and resources	Committed SRIAs	-Number and type of joint actions to implement SRIA -Regular updates of SRIA -Participation of external partners in actions (number and share of funding/resources)	-Data held by JPI (hubs, calls etc) -Procedures and changes -Data held by JPI
	Adaptation of national priorities towards JPI SRIA	-Dedicated funding on national level -Integration of SRIA in national policies and strategies/programmes	-Budget data held by national funding agencies -Information gathered through interviews, narratives, qualitative data
	Shared or coordinated use of R&I infrastructures	-Joint budgets/projects for shared or coordinated use of R&I infrastructures -Cost savings for shared or coordinated use of R&I infrastructures	-Project data, relative to type of infrastructure -Estimates by JPI/projects
International cooperation or activities	Engagement with countries beyond Europe	-International expansion of JPI actions -Committed international partnerships (with allocated resources) -Third countries as full members of JPI	-Participation from countries outside Europe in JPI actions -Number and size of partnerships with other global initiatives -Number on non-EU/AC countries
	Influence on global agenda	-Visible participation in global/international fora /events -Influence or uptake in global institutions	-Attendance with contribution -Reference of JPI in political statements /narratives

[49] Task Force on Monitoring & Evaluation of the JPIs. Final report on Key indicators, August 2018 https://www.era-learn.eu/documents/final_report_task_force_m-e_jpis_dec2018.pdf

Enhanced knowledge production/sound knowledge base in JPI area	Productivity and quality of R&I community	-Number of publications in peer reviewed or highly ranked journals from JPI actions -Number and geographical scope of patent applications -Number and type of other outputs	-Bibliometric data (including gender distribution), JPI data -Patent data, e.g. European Patent Office, JPI data -E.g. doctoral degrees, products, technologies. Quantitative data when possible, data from project reports
	Size, structure and diversity of R&I community	-Number of participating countries, researchers and institutions/teams in JPI joint actions -Multidisciplinarity in projects -Gender balance -Number and size of networks	-Data collected by JPI -Project data from JPI -Project data from JPI -Thematic coverage and relevance to challenge, data from JPI
	Integration with user sectors	-Number and share of JPI actions involving private sector -Number and share of JPI actions involving public sector	-Project data by JPI -Project data by JPI Comment: Can also be co-producers
	Research and innovation management policies	-Established Open Access policy -Established joint policy for Intellectual Property Rights -Gender policy	-Documents by JPI -Documents by JPI -Documents by JPI

Governance	Administrative efficiency	-Effective implementation of SRIA -Harmonised timing, peer-reviews, reporting for joint actions -Transparent and effective governance structures	-Timely execution of joint actions through implementation or operational plans -Interviews, document reviews -Interviews, narratives, governance documents
	Representative efficiency	-Commitment and resources from all partners -Relevant engagement from JPI member countries -Established coordination systems on national level	-Data on participation rates and modes in joint actions (relative to size and ability) -Status and participation in Governing Boards with decision making power -Interviews, case studies
	Relational efficiency	-Involvement of users or stakeholders -Joint actions or initiatives with other JPIs, PPPs, P2Ps	-Data collected through interviews, documents, JPI and project data
Contribution to the area of the societal challenges	***Influence on factors contributing to tackling the area of societal challenge***[3]	-Established intervention logics and identification of contributing factors -Measured changes in identified factors	-Influence specific to individual JPIs, information from JPI documents -Case studies, narratives, including information from stakeholders etc, awareness of attribution problems
	Impact on policy relevant to the area of the societal challenge	-Uptake in national, European or international policy -Regulatory changes	-Revision or launch of new policies or strategies -Revision or launch of new regulations or by-laws -Dissemination activities

[3] Several types of impacts can be foreseen, many are specific to each individual JPI. In most cases there are significant attribution problems, so that JPIs have to define specific outcomes as proxies for impact. Hence, specification of intervention logics is necessary by which to define these factors/outcomes.