ARIS

Advancing Research Impact in Society

EVOLUTION OF BROADER IMPACTS

Abbreviations Used

- ARIS – Center for Advancing Research Impact in Society
- BI – NSF Broader Impacts Review Criterion
- IM – NSF Intellectual Merit Review Criterion
- NSB – National Science Board
- NSF – National Science Foundation
- OSTP – White House Office of Science and Technology Policy

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Greetings!

In January of 2018, the National Alliance for Broader Impacts (NABI) published the *Current State of Broader Impacts* report based on a series of listening sessions hosted over the course of 2017. The report discussed the infrastructure and resource needs of the Broader Impacts community, as well as the capacity building necessary to enhance the BI criterion within and beyond the National Science Foundation. It called for the creation of a national center for BI support. In fall of 2018, the Center for Advancing Research Impact in Society was founded with support from NSF (OIA-1810732) and strived to provide the infrastructure and resources mentioned in the report. Five years later, ARIS has reexamined the current state of BI. The recommendations for enhancing impact in this report reflect the current thinking of the BI community, and we are grateful for their expert insights and continued collaboration.

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Action Plan for Enhancing Broader Impacts

INTRODUCTION

All proposals submitted to NSF are evaluated on two criteria: intellectual merit (IM) and broader impacts (BI). Intellectual merit refers to the potential for the research to contribute to the scientific discipline, and broader impacts refers to the societal benefits of the research. Intellectual merit is clearly understood by the research community, but BI continues to be challenging in definition and implementation.

Therefore, the Center for Advancing Research Impact in Society (ARIS) convened more than 100 members of the impact community to discuss the current state and desired evolution of NSF's BI criterion.

The subsequent conversations form the basis for this action plan and accompanying report, which are designed to inform and engage the ARIS community, the NSF, other federal agencies and organizations that support scientific research to generate solutions that positively benefit society. This section presents recommendations for enhancing BI in three priority areas:

- Strengthening Implementation of the BI Criterion
- Elevating Societal Impacts of Research Within and Across Agencies
- Cultivating Organizational BI Infrastructure

RECOMMENDATIONS FOR STRENGTHENING IMPLEMENTATION OF THE BI CRITERION

The National Science Board states that BI must be reviewed with the same rigor and intentionality as IM. Although processes for BI in proposal development, review and reporting have improved in the past decade, clarity and consistency around the relative weighting of IM and BI, degree of innovation needed in BI continue to be a challenge.

We recommend that the NSF:

- Integrate BI resources directly into program solicitations, reviewer materials and webpages.
- Expand the appointment of BI experts to all review panels and Committees of Visitors.
- Charge Committees of Visitors to evaluate the quality of reviewers' comments about BI.
- Create separate sections for reporting accomplishments, publications and impacts of IM and BI.
- Request supplemental documentation, such as a partnership plan for proposed BI activities to document the history, sustainability, reciprocity, roles and responsibilities of each partner.
- Align policy and practice for how criteria are reviewed.

RECOMMENDATIONS FOR **ELEVATING SOCIETAL IMPACTS OF RESEARCH WITHIN AND ACROSS AGENCIES**

The NSF has used the BI criterion to ensure that funded proposals are societally relevant, engage the public and advance positive societal outcomes. While all federal science agencies are required to conduct research that benefits the American people, most do not integrate societal impact or public engagement requirements into their funding strategies. When societal benefits of research are systematically built into the grant-making process, agencies' ability to maximize scientific investment and value to the American public is enhanced. We recommend that:

- Federal science agencies beyond NSF do an assessment of their societal impact work and construct agency-specific frameworks for integrating impacts beyond research products into their funding strategy.
- OSTP hosts a biannual summit and reports on the integration of societal impacts of research into agency research strategies.
- The General Services Administration convenes and supports a federal community of practice to facilitate co-learning, collaboration and problem-solving and exchange promising practices on societal impacts of research.

RECOMMENDATIONS FOR **CULTIVATING ORGANIZATIONAL BI INFRASTRUCTURE**

Many investigators require significant support to plan, execute and disseminate BI activities.

Organizations play an important role in enabling and sustaining societal impacts of research by investing in BI infrastructure responsive to the unique context and investigator needs at each organization.

We recommend that organizations:

- Develop and implement action plans to create sustainable BI infrastructure.
- Create centralized mechanisms to disseminate the results of BI activities and, where appropriate, aggregate evaluation data across BI activities.
- Form collaborative partnerships across organizations with shared affinities (e.g., geographical proximity, mission alignment, strategic partnerships, etc.) for capacity building and resource sharing.

Evolution of Broader Impacts

INTRODUCTION

ARIS is committed to expanding research and its impacts for the betterment of society.

To advance this mission, the center, with facilitation support from Nick Viele, Amelia Pape, and David Ehrlichman, engaged the impact community in a participatory process to identify actionable steps toward expanding and enhancing BI.

The intended outcomes of this process were to elevate BI's current strengths, identify opportunities to strengthen NSF's BI criterion and its implementation and elevate the case and conditions for effective organizational BI infrastructure.

The process was conducted from March to November 2022.

Across an in-person convening in Durham, North Carolina and two virtual listening sessions, ARIS gathered insights from more than 100 community members. The following report describes the findings and recommendations derived from these conversations and builds upon the recommendations for advancing BI identified in the January 2018 report on the current state of broader impacts.

BI'S CURRENT STRENGTHS

Following is a summary of the ways that the community perceives that NSF is currently championing BI with a focus on strengths and good practices to continue.

1. Highlighting and prioritizing the BI criterion

BI is both a practical and symbolic indicator of the importance of using federal funds to make societal change beyond academic circles. By including BI as a funding criterion, NSF has given PIs a call to action.

Moreover, the increased emphasis on BI has pushed PIs to seek out others with expertise needed to accomplish their BI goals, thereby incentivizing relationship building and collaboration among researchers and BI professionals across disciplines and institutions. Highlighting BI resources and stories on the NSF BI website makes them more visible and accessible. This continues to lend credibility to the field because the separate and specific review of BI influences researchers to put more emphasis on it.

2. Emphasizing societal impact through NSF investments

The establishment of ARIS provides important infrastructure to the BI field. NSF's ongoing support of ARIS and investment in the ARIS toolkit demonstrates its commitment to supporting and enhancing the BI criterion. The establishment of the Directorate for Technology, Innovation and Partnerships (TIP) also demonstrates NSF's leadership in this space, as TIP compels the research community to engage those who will use their research to develop solutions. Also, NSF's emphasis on the importance of funding diverse institution types by emphasizing a wider geographic distribution of research and supporting Emerging Research Institutions (ERIs) also promotes

the spirit of BI. Examples of initiatives and programs that demonstrate an increasing prioritization of societal impacts include:

- NSF INCLUDES
- GRANTED
- EPIIC
- CISE BPC Initiative
- HBCU EiR
- TCUP
- Advanced Technological Education
- Regional Innovation Engines
- Convergence Accelerator

3. National policy's influence on BI infrastructure

In a public listening session held in August 2022, a majority of participants indicated that the NSF's BI requirement positively or very positively impacted their capacity to advance their BI work.

Additionally, several participants agreed or strongly agreed that their institution views NSF's BI requirement as a rationale to do BI work.

Specifically, the NSF's BI requirement helps align their impact work with university and national priorities and garner stronger support from university administration. This results in better research outcomes, as it facilitates a clear BI vision from the outset and encourages the engagement of communities and stakeholders.

Participants also noted that research-to-practice partnerships are supported and influenced by the NSF's BI requirement while recognizing that alignment could be improved.

The success of BI relies on more than the NSF requirement, including both institutional commitments and intrinsic motivations. Listening session participants noted that researchers experience a tension between explicitly calling out BI as a separate requirement versus integrating BI throughout their research. Some participants noted that it could be beneficial for NSF to hold institutions responsible for BI rather than only individual investigators. An important evolution in BI work is to think more about BI as a systemic engine rather than as individualistic activities.

> "More inclusive engagement in science benefits the American people, the environment and the economy. Agencies should invest in making Federally funded R&D accessible to the public. Agencies should seek out public participation in R&D programs wherever possible."
>
> —OSTP FY23 Federal Priorities Memo

Participants also expressed that the OSTP FY24 federal priorities document could help them make their case for new or sustained BI infrastructure at their institutions. It provides another opportunity to tell a story and connect with people who could become potential advocates for NSF-funded research in particular and science as a whole. Phrases like "promoting open science and community engaged research and development" and "cultivating an equitable STEM education engagement and workforce ecosystem" offer a strong message for engaging the both the public and research community.

Broader impacts and broadening participation are embedded throughout the OSTP report, which gives NSF, as well as all the heads of other executive agencies, specific knowledge and instructions about public engagement, and helps researchers make the case for funding to support BI efforts.

Inclusion of all sectors across funding agencies can support strengthening of connections and partnerships between universities, NGOs and industry.

4. Proposal and review process strengths

The NSF's emphasis on BI has provided a critical anchor in developing the BI field and inspiring institutions to build capacity to increase the societal impact of research. The fact that proposals require BI sections to be considered at all is a strength, and NSF's provided lists of BI definitions and activities strike a good balance between too narrow and too broad. Even if not obvious, BI exists in many places within NSF proposals.

Examples of such requirements include broadening participation plans, mentoring plans, data sharing and management plans, evaluation plans and discussions of results from previous grants.

Additionally, proposal requirements support a strong alignment between activities and budget. For example, budget line items devoted to participants are difficult to shift, which provides built-in support for those participants. Requiring a link between the BI component of a proposal and the institutional structure for broadening participation also adds weight—BI cannot simply be an afterthought.

Finally, the inclusion of BI experts on Committees of Visitors strengthens the review process. The process is strengthened by robust discussions on the role of BI in the review process and on resources available to support panelists as they review the BI sections of proposals.

STRENGTHENING NSF'S BI CRITERION

The actions taken by NSF have been critical in encouraging a more expansive view of the meaning of "research impact" in ways that move beyond siloed academic communities to the world at large. Following is a summary of suggested opportunities to further strengthen the NSF's BI review criterion for evaluating research proposals for funding.

1. Strengthen guidelines

The existing BI guidelines incorporate important information for proposers. Additional guidance may include:

- Aligning policy and practice between how IM and BI are weighted in proposals and review.
- Placing a greater emphasis on, and evidence of, working ethically and effectively with partners.
- Strengthening requirements for including various roles, disciplines and/or perspectives on the team.
- Advancing consistent evaluation support such as common sets of evaluation metrics.

2. Clarify budgeting

There is an opportunity to provide more clarity about the proportional designation of BI budgets, especially for proposals that include partners.

Suggestions for strengthening budget criteria include:

- Offer guidance for budgeting to fund professional staff such as program management, community engagement, communications and education professionals.
- Offer guidance on requesting no-cost extensions specifically for BI budgets, as many times the impacts of the BI activities do not become apparent until near the end of the grant or may require dissemination past the award cycle.
- Align duration, budget and types of impact with scale of project. Sometimes greater impacts require longer timelines.

3. Strengthen review process

Additional BI guidance and training for reviewers would strengthen the review process. This may include training on use of the BI toolkit or rubric, development of a guide with basic information about BI that is common across directorates or opportunities for future reviewers to connect with ARIS.

Additional suggestions for strengthening the review process include:

- Develop guidance for panelists' expectations during review.
- Apply the BI criterion consistently across NSF directorates and programs.
- Create more transparency around panel review outcomes by implementing use of a BI review process evaluation framework as part of Committees of Visitors (COV).

MEASURING BI SUCCESS

Evaluation is a key component of strong BI plans. Beneficiaries of research, from the public to funders, want—and deserve—evidence that the research has impact. At the same time, measuring the societal impacts of research can be quite challenging and requires a long view of the research process and financial support.

Assessment Categories and Metrics

With the goal of highlighting shared processes for data collection, the questions we should be asking ourselves are:

- How do we provide quality guidance so the things that are measured are authentic and meaningful?
- What are the impact stories beyond the life of the project?

Stories are where the richness lives, but qualitative data gathering is resource intensive. This points to the need for infrastructure, funding and capacity building opportunities to support both qualitative and quantitative data generation—the documentation of impacts that develop over time across multiple projects.

Simple and common metrics are desirable; however, they privilege activity over impact, lack critical context and are rarely transferable to new and innovative approaches to BI.

Still, we can encourage meaningful principles and valid measures of the impacts of research over time. Institutions can monitor and measure the composition of research teams and degree to which they are transdisciplinary, inclusive and equitable. They can support development and evaluate implementation of research-to-practice pathways to ensure that research-based innovations and interventions contribute to the well-being of people, the environment and the economy.

There are opportunities to facilitate aggregate assessment while signaling the importance of building long-term relationships with communities and seeing them as partners, not research subjects.

Clarifying RFP Expectations

RFPs could facilitate aggregate assessment by asking not only for metrics, but also for information on how the measurement will be analyzed by skilled assessment teams. It is not adequate to require evaluation without ensuring research teams have the capacity and expertise to measure impact

in appropriate and meaningful ways. Specifying specific resources for evaluation, including internal and external, would support necessary validity and accountability in measurement.

Following are additional examples of how RFPs could help facilitate assessment of broader impacts:

- Offer choices of different assessment instruments. For example, the agency might offer five different assessment tools to guide assessment depending on local context.
- Use plain language to assuage potential anxiety associated with the term "evaluation." For example, ask, "How will you know if you're successful?"

Reporting BI Outcomes

The best source for the impacts of research in society are the people who are affected by that research and associated BI activities. To facilitate more effective aggregate assessment of BI outcomes, we must ask ourselves, "How do we create vehicles in our institutions to capture stories directly from the communities about the broader impacts?"

Participants again reflected the importance of impact stories in reporting. Outputs are easier to track at the project level, but shifting focus in reporting from quantitative outputs to stories of impact encourages grantees to offer narrative accounts of their BI work. From such accounts, categories and themes may emerge that could facilitate aggregate assessment over time. Providing guidelines for narratives in reporting would help to reduce the inconsistency and cost of qualitative data gathering.

Exploring Aggregate Assessment

At many levels, shared measures in projects tend to benefit from economies of scale. While projects themselves tend to be small, considering project-level metrics and tools in the context of many other projects can illuminate shared processes and data collection methods. A local organizing body to help design a data-generation system that rolls projects up into a broader context, analyzes them at scale and then shares them back would facilitate aggregate assessment. A model for this is NSF ETAP.

Many BI offices are new and focused on proving their investment and have limited resources for evaluation. NSF could create opportunities by offering RFPs and funding for establishing evaluative infrastructure, including building coalitions of universities working to develop assessment expertise, shared processes and consistent frameworks. Evaluation is sustainable when funders understand its value and allocate resources to support it. As one participant put it, "The only reason I'm able to do the evaluation work I'm doing is because the agency believes in it."

DEVELOPING BI INFRASTRUCTURE AND SUPPORT

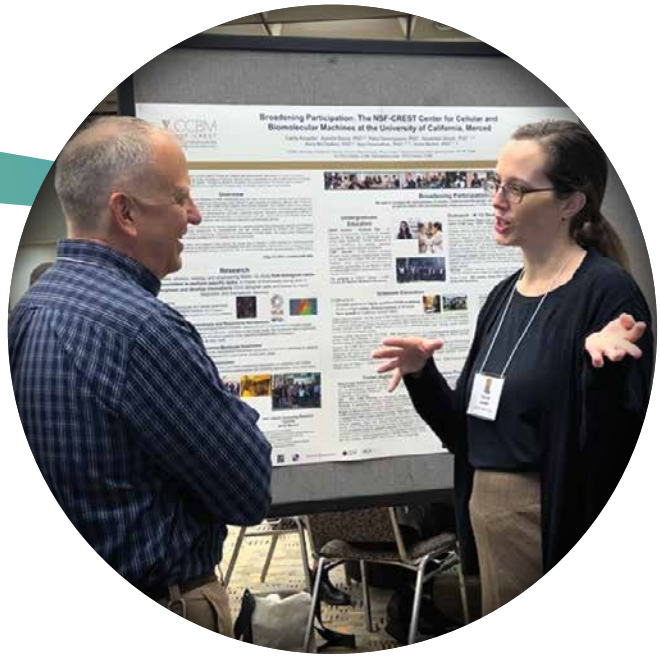
There is no one-size-fits-all model for BI infrastructure. Infrastructure is part of a complex system of people, structures, practices and partnerships all undergirded by the unique conditions of individual institutions. Though infrastructure specifics vary from one institution to the next, there are applicable constructs and tools for intentionally assessing the landscape and designing institutionally situated BI infrastructure. Identifying these tools can support administrators, researchers and professionals seeking to elevate their own higher education institution's coordinated approach to enabling and sustaining societal impacts of research.

Attributes of Ideal Organizational BI Infrastructure

Ideal BI infrastructure includes a well-funded, coordinated and collaborative effort with dedicated staff support that connects many BI stakeholders. This infrastructure advances the impact of research by:

- Assisting researchers and research development professionals in creating and implementing BI plans.
- Facilitating connections and building and maintaining relationships with community partners and/or institutional resources.
- Supporting the assessment of BI activities.
- Assisting with reporting on and disseminating BI institutionally, across the community, to funders and beyond.
- Building capacity to develop skills to support effective, ethical BI efforts.

There is general agreement that for BI infrastructure to be maximally supportive, institutional buy-in, commitment and vision are essential. Researchers need infrastructure that helps them to access existing programs and resources to pursue their BI



work. In a university setting, this could be a formal office championed by leadership and staffed with trained BI professionals.

It is important to note that there is no one-size-fits-all approach to BI infrastructure. A centralized office might work for one organization but not another. Organizations need to adopt a support infrastructure that fits their context.

Participants noted the importance of having more than one dedicated staff position with expertise in BI best practices, faculty engagement and external partnership development. Some of the specific positions described include a program coordinator to help provide institutional memory and consistency, a consultant to help shepherd people and ideas toward the appropriate resources and dedicated research development and evaluation support.

Participants agreed that institutions have a responsibility to provide BI support for researchers.

Barriers to Establishing Organizational BI Infrastructure

Key to cultivating effective BI infrastructure is providing intentional and clear organizational support. This is in contrast to many participants' current experiences of the work of BI being disparate, self-directed and under-resourced.

In particular, the primary barriers to creating BI infrastructure are resource availability along with a lack of institutional understanding, buy-in and alignment with other priorities. Specifically, participants indicated that there is a general lack of understanding at the institutional level around BI and its value. Without that understanding, university leadership is less likely to champion BI work and to allocate funding for infrastructure development. Similarly, without a high-level advocate for BI, it may be more difficult to align the work with other institutional priorities.

Incentive structures are a notable barrier to embedding BI in institutions. While several institutions have and are currently updating their promotion and tenure guidelines to better account for impact, faculty assessment practices are not well aligned with university values around impact. This reality disadvantages researchers who prioritize high-impact research practices such as inclusive mentoring, involvement of undergraduates in research, collaborative solutions research, public and policy engagement, and innovation and entrepreneurship.

Ideal Conditions for Cultivating Organizational BI Infrastructure

Institutional buy-in is essential for creating strong BI infrastructure. In addition to a campus office, various BI partners such as Cooperative Extension and other existing institutional programs could support university-wide buy-in and facilitate connection across colleges, departments and communities. Examples of such activities include on-campus programs for broadening participation; training programs, mentorship and professional development; and working groups consisting of faculty, staff and practitioners to support BI activities. Aligning incentive structures and institutional policies (e.g., through advancement or P&T) that recognize and reward BI work would help encourage participation and create tangible benchmarks for BI contributions.

To accomplish the ideal infrastructure described above, participants of the listening session described three primary categories of resources needed:

1. **Financial resources:**
   - Seed funding programs with specific goals and evaluation metrics to help track the flow of progress and measure success.
   - Long-term investment in BI personnel and programming by university administration.
   - Supplemental grants to support communication and dissemination of results.
2. **Human resources:**
   - Liaisons to external partners, programs and institutions to establish and maintain connections for possible future BI work.
3. **Communication tools and channels:**
   - A shared narrative on the value of BI work that guides investment and practice.
   - Communication channels that consistently disseminate and recognize BI work, envision future possibilities and facilitate new opportunities.

Participants noted the importance of stronger agency support as a necessary tool for establishing BI infrastructure. Additionally, participants highlighted that clearer guidance from NSF and greater emphasis on BI across other funding agencies would help incentivize BI work and make the case for BI to university administrators and related organizations.

Additional examples of external support needed to create institutional BI infrastructure include shared language for BI work, tools to measure institutional impact, and resources to help build trust between universities and communities.

CONCLUSIONS AND RECOMMENDATIONS

The NSB and NSF are strong supporters of the ARIS community, and the last 10+ years have seen unprecedented growth in relation to broader impacts, beginning with the last merit review task force (2010) and the funding of the National Alliance for Broader Impacts (2014) and continuing today with the funding of ARIS (2018) and the establishment of the latest merit review task force (2023). Innovations in BI activities and organizational infrastructure are evidence of these investments. Still, there is room for growth.

ARIS recommends the following:

- Aligning the policy and practice of the relative weighting of the two NSF review criteria.
- Enhancing guidance for panelists on how to evaluate BI plans and write substantive reviews on BI sections.
- Strengthening reporting requirements for BI activities.
- Diversifying review panelists to include BI expertise.
- Strengthening assessment requirements for BI activities with an understanding that quality evaluation is costly and there is a need for common measures that lend themselves to aggregation.
- Encouraging organizations to build BI infrastructure to support researchers or to make use of national infrastructure.

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APPENDIX

PRINCIPLES OF GOOD BI PRACTICE

According to community members, good BI practice is:

- **Co-creative —** BI practices meaningfully engage communities from project design to research and data collection to dissemination
- **Relevant —** research addresses timely issues that matter to the public
- **Accessible —** language, activities and outcomes are designed to help translate and clarify science for diverse audiences
- **Inclusive —** processes actively engage many points of view, with attention to those that are impacted by the issue and those that have been historically excluded
- **Relational —** projects prioritize activities that build trust between scientists and communities
- **Integrative —** practices are interdisciplinary and engage many ways of knowing
- **Mutual —** projects are structured to intentionally engage and benefit both science and society
- **Sustainable —** projects are equipped with the time and resources needed to scale, and outcomes and stories are effectively communicated to make the case for ongoing BI efforts

ANTICIPATED OUTCOMES AND IMPACTS OF EFFECTIVE BI

- Broader and more **diverse participation** in STEM fields
- Cross-disciplinary **collaboration** that reduces duplication of effort, breaks down silos, and elevates promising practices from varied fields
- Deepened **trust** between scientists and communities
- Enhanced **societal literacy** around current scientific research and practice
- Accessible and relevant **solutions** available to communities
- Expanded **support for public engagement** in science

CHALLENGES AND OPPORTUNITIES IN BROADER IMPACTS PRACTICE

- **Restricted information flow —** because the work is not yet widely integrated, it can be difficult to communicate and synthesize learnings across projects, organizations and geographies
- **Differential impact —** BI activities are not equitably distributed across all groups, which could unintentionally reinforce structural inequities
- **Scope limitations —** some projects are necessarily small, which limits participation opportunities; duration of grant and budget are not always aligned
- **Partnership inequities —** some funding mechanisms that come with projects are not conducive to equitable partnerships; even with best intentions, this can do more harm than good in the long term
- **Complex communication needs —** science communication is not always accessible to more diverse and rural communities, which limits their engagement
- **Narrow age focus —** BI is often focused on students and young people; it would be more beneficial to engage all ages, including adult populations
- **Limited international focus —** the research community can learn from BI-adjacent work occurring in other countries
- **Underlying assumptions —** BI is rooted in the fundamental assumption that everyone agrees science matters, but this may not be universally true
- **Sustainability —** successful BI activities often struggle to continue after federal funding ends, impacting partnerships and communities
- **Limited recognition —** the value of BI activities is not necessarily recognized across institutional reward structures, which can disincentivize scholars from pursuing them
- **Ambiguous review guidelines —** there is persistent confusion in the balance between IM and BI, how innovative BI must be, and how to budget appropriately for BI
- **Inconsistent review process —** lack of clarity among reviewers leads to inconsistency in the review process and, potentially, less impactful BI

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