NSF Criteria:

Communicate Your Broader Impacts Successfully
A Note from the Publisher

Thank you for ordering “NSF Criteria: Communicate Your Broader Impacts Successfully” from the Principal Investigators Association Library. This resource is designed to help you identify, distill and communicate your project’s broader impacts to NSF reviewers, improving your funding chances.

Martin Butler served as co-author of this report. He has led a research grant consulting business for the past 15 years, providing independent advice, writing, mentoring and coaching services to universities, colleges, institutes of technology, research centers and researchers. Butler is an expert in identifying and communicating the broader impacts of research. He successfully trains researchers to integrate the full spectrum of impact into their proposal narratives and communicate the framework through which benefits will be realized. Since 1996, Butler has impacted more than 2,000 researchers from the United States, Canada, Europe, Asia, Africa and Australia. He has contributed to the successful development of grant applications totalling over $1 billion in funding for researchers across all disciplines, and at all career stages.

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Best Regards,

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**Introduction**

The concept of “broader impacts” is tricky for most researchers to understand — much less communicate it effectively in their NSF grant proposals.

The agency even admits that broader impacts is a tough concept for researchers. “Experience shows that while most proposers have little difficulty responding to the criterion relating to intellectual merit, many proposers have difficulty understanding how to frame the broader impacts of the activities they propose to undertake.”

Mainly, the concept of broader impacts has different meanings for different people and disciplines, experts say. Although intellectual merit has always been at the heart of research, integrating broader impacts is much more of a cultural shift.

Another challenge is figuring out how impact enhances — or undermines — intellectual merit. And because broader impact is a somewhat recent concept, you’re facing non-standard approaches to what it means.

One of the universal hurdles for broader impacts is that the NSF requires that you communicate impacts but doesn’t fund all the activities related to achieving these impacts.

So to overcome these challenges, as well as to identify and effectively communicate broader impacts in your NSF grant proposal, you must first understand what the NSF is looking for. Then, you need to write the impacts into your proposal and clearly indicate why reviewers must choose your proposed project over another.
Section I: Define Your Broader Impacts — What the NSF Really Wants

One of the biggest challenges with conveying broader impacts is that the NSF doesn’t clearly indicate what it wants to see in your proposal. In fact, the agency tends to mix up the impact concepts and the mechanisms for achieving the impacts.

For example, the NSF’s “Merit Review Broader Impacts Criterion: Representative Activities” provides five components for defining impacts:

1. How well does the activity advance discovery and understanding while promoting teaching, training and learning?
2. How well does the proposed activity broaden the participation of under-represented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
3. To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks and partnerships?
4. Will the results be disseminated broadly to enhance scientific and technological understanding?
5. What may be the benefits of the proposed activity?

Although first, second and fifth items on the list are certainly clear impacts, the others are slightly more confusing. The third — enhancing infrastructure for research and education — deals more with increasing or extending the capacity for innovation than for achieving impact. Enhancing infrastructure and education isn’t necessarily an impact, but instead a mechanism by which your project would generate impact.

The NSF also mixes its concepts in the fourth item — disseminating the results broadly. Dissemination isn’t a broader impact, but rather a method to realize impact.

Understand Broader Impacts — What They Mean to You and the NSF

There are two main phases to generating your broader impacts: understanding and communicating.

- Understanding:
  1. why the concept of broader impacts exists
  2. what “impact” means to funding agencies and reviewers
  3. what “impact” means to the discipline and the researcher, as well as the relationship between impact and
intellectual merit within the discipline.

- Communicating:
  1. the full breadth and depth of your research’s potential impacts
  2. how your project will realize the impacts
  3. impact in your proposal narrative
  4. embracing impact beyond the proposal development process.

The NSF’s thinking behind the broader impacts concept is “to create a federal government that is responsive and accountable to its citizens,” the agency stated in its 2003-2008 Strategic Plan. “NSF is responsive to these mandates, in a way that is careful to do no harm to the R&D system.”

Consequently, there has been a shift from research as end unto itself, to the federal granting agencies seeing R&D as an investment. The research-investment criteria by the Office of Science and Technology are quality, relevance and performance — the three key factors for convincing federal agencies to fund your research project.

In terms of broader impacts, the NSF wants to know that your project will provide the maximum return for its investment. You must write into your proposal exactly how a “ripple effect” will occur from your research.

**Mixed Messages: Deal With Conflicting Instructions in the Grant Solicitation**

Depending on your discipline and the grant solicitation, you might receive confusing instructions from the NSF and sometimes additional instructions for illustrating broader impacts in your proposal.

Example: In an NSF grant solicitation for the Arctic Social Sciences Program, the synopsis specifies “areas of interest” for broader impacts, which include economic change and development of social and political institutions, ethnic and regional identities, and knowledge systems. But the solicitation’s “additional review criteria” doesn’t address these broader impacts.

As a result, you must consider where the NSF addresses broader impacts — in the solicitation synopsis and the additional review criteria, as well as the grant program guide (GPG).

Further, the NSF changed its approach to broader impacts by overhauling the merit review criteria in response to the 2010 America COMPETES Reauthorization Act. Beginning in January 2011, the agency examines your broader impacts with these eight goals in mind:

1. Increasing the United States’ economic competitiveness
2. Developing a globally competitive science, technology, engineering and mathematics (STEM) workforce
3. Increasing STEM participation of women and under-represented groups
4. Increasing partnerships between academia and industry
5. Improving pre-K through 12 STEM education and teacher development
6. Improving undergraduate STEM education
7. Increasing public scientific literacy
8. Increasing national security.

Aligning your project’s broader impacts with these eight goals is crucial to getting your research funding.

**Align Impact With Your Specific Discipline**

With all these broad, over-arching goals and “impact” definitions, how can you boil it down to fit your specific discipline?

One way to look at broader impacts is to use the framework set out in “Scholarship Reconsidered: Priorities of the Professoriate 1990,” by Dr. Ernest Boyer. He proposes four main categories: discovery, teaching, integration and application. Although discovery and teaching are fundamental elements of scholarship, integration and application are the components that relate to broader impacts.

Integration and application deal with developing connections between research disciplines and institutions, erecting a framework for disseminating your research’s data. You’re giving meaning and context to your research and discoveries. In this way, your project’s results will address economic and societal problems, which are your broader impacts.

**Focus on 4 Major Areas**

After you have a solid understanding of what the NSF wants to see in your broader impacts and how to frame these in your proposal, you can communicate them effectively. The best way to do so — including the full breadth and depth of your research’s potential impact — is to identify how they fall into one of four categories:

1. Social Impact
2. Environmental Impact
3. Economic Impact
4. Health Impact (NIH)

Don’t think merely in terms of what your research will produce tomorrow, but also how it could impact these areas in the long-term and on a much bigger scale.

Look at these four categories as a cluster concept, instead of separate, discreet groups. Your project may overlap into two, three or all four groups.
Categorize Your Impacts for Clarity

You can then frame your broader impacts in your proposal using specific examples. For some researchers, identifying how the impacts relate to the key areas is difficult.

Social impacts typically result in improving quality of life, such as improving safety and security or reducing poverty. Your research may enhance integration, increase education or literacy rates, advance access to healthcare, or improve cultural health, heritage and social participation. Your project might reduce marginalization, sexism, racism or bullying, or it could enhance participation or decision-making models.

Environmental impacts often involve improving the quality of air, water, land, soil, species and ecosystems. But they can also include impacts like advancing environmental management and stewardship, environmental sustainability, or the speed of recovery from environmental problems.

Your research project may impact the environment by enhancing renewable and sustainable energy or agricultural crop productivity and food supply. Other environmental factors include combating climate change by reducing environmental threats, pollution or emissions, mitigating environmental risks, supporting species with sustainable stocks, tracking or protection mechanisms, and developing environmental policies.

Economic impacts may include growing the gross domestic product (GDP), increasing employment, jobs, and exports, or boosting production efficiency and reducing costs. Your research may produce new technologies, products, patents, licenses, companies or jobs, or it might increase industry competitiveness and market leadership.

Other examples of economic impacts include increasing productivity, exports income or revenue, speed of product development to market, and private-sector investment. Developing economic policies also falls into this category.

Also, keep in mind that economic impacts don’t always involve commercialization. Your project may yield data that you can deliver into the policy framework or improve how an industry competes.

Health impacts can involve reducing disease-incidence and mortality rates or healthcare costs. Your research may improve clinical outcomes, surgical techniques, pharmaceuticals, treatments or therapies. Enhancing patient satisfaction, quality of life, safety or recovery are also health impacts, along with increasing treatment efficiency and developing healthcare policies.

Misconception: Remember that health impacts aren’t always related to drugs and technology.

Look to Generalized Impacts That Fit All Categories

Additionally, you’ll find that several significant effects fit into all of these categories. They’re common to all areas that the NSF wants to see in your broader impacts. These include improvements in:
• Education and training
• Integration of research and education, people, disciplines, sectors, and silos
• Practices in professional fields
• Policies, products, services, processes, technologies, tools, devices, materials, pharmaceuticals, treatments, techniques, policies, procedures, regulations standards, guidelines or codes of practice
• Education, training outreach, mentoring or knowledge-mobilization models
• Partnership and management models
• Models for decision-making, overcoming challenges or reducing the risk of negative impacts.

Often, the broader impacts of your project aren’t easy to identify — even if they fit into the universal category. Example: A proposed anthropology project involves working with Aboriginal communities and takes the team months of discussion to identify the broader impacts. Finally, the main impact identified is that the project would provide a new research model that would overcome the existing European model’s barriers to translate the research outcomes into impact on Aboriginal communities.
Section II: Communicating Impacts: Identify Your ‘Impact Change’

In a basic sense, the impact chain indicates the following: Fundamental knowledge leads to new knowledge, which you then share within your discipline. And then you share that knowledge with collaborators, creating a framework for impact within the discipline. Sharing the knowledge with external partners — such as government, industry, non-profit, community, etc. — will allow them to take the results and translate them into new models or guidelines.

The external partners then implement these models or guidelines so that they will ultimately impact society, the economy, the environment and all human health.

Fundamentally, research leads to new information, knowledge, data and technologies. You can share these through the following “impact vehicles”:

- Publications
- Presentations
- Workshops
- Reports
- Conferences
- Partnerships
- Collaborations.

In terms of your discipline, you can realize your project’s broader impacts through sharing:

- Knowledge, citations and references
- New methodologies and approaches
- New education, teaching, mentoring, training, outreach and research models
- New ways to integrate research, education, disciplines and/or sectors
- New or improved research infrastructure and collaborative models
- Improvements in recruitment
- Increased institutional commitment, accelerated innovation and increased capacity for innovation.
Your collaborators and partners are “vehicles” through which you can maximize your research. They are key people in determining how they’ll deliver and enhance your impacts.

In terms of collaborators, your broader impacts can typically include teaching, informing research and extending collaborative network activities. Because your partners are a vital component of your impact chain, your research’s influence at this level includes translating the new knowledge into:

- New approaches or methods
- New standards, guidelines or codes of practice
- New decision-making or partnership models
- New models for overcoming challenges or problems and reducing the risk of negative impacts
- Accelerating the pace of innovation
- New products, services, processes, technologies, tools, devices, materials, pharmaceuticals, treatments or techniques.

**Scope Out Your ‘Blast Radius’**

Aside from the four impact categories and those that span all categories and disciplines, a winning NSF proposal should identify the research’s “blast radius.” This reflects how the new knowledge or discoveries from your research affects the world at various levels:

- Individual
- Institutional
- Disciplinary
- Community
- State
- Regional
- National
- International
- Global

You don’t need to “save the world,” but you must illustrate how your research will make a significant impact on societal, health and/or economic problems. You can have a major societal influence on just a specific community level, but you must communicate that in your proposal.
Also, think about how the immediate impact could potentially stimulate a ripple effect. For example, your project may seem isolated to a specific community, but think about how its effects may travel to other communities.

**Integrate Broader Impacts Into Your Proposal Narrative**

As you’re explaining your broader impacts in the proposal narrative and delving into the impact chain, you should be specific and use statistics. NSF reviewers don’t want to see an impact of the “greater good,” but instead the challenge’s exact size and scope and how your research will alter them.

Quantifying the impacts is easy for some projects and much harder for others. In some cases, it is obvious, such as the number of people affected by a particular problem or how much money is spent on a particular issue. In tougher cases, you can use independent statistics to help you quantify the challenge and the impact you’re proposing.

You can also look for specific examples of an event that has occurred to help identify the impact’s scale. For instance, environmental examples could include events like hurricanes or earthquakes. You can use data and statistics from these past events for quantifying purposes.

Also talk about the direct and indirect impacts. Who are the users? Who are the impact’s recipients? You may have a more varied answer to the second question than the first.

Identify the exact timelines and deliverables for the broader impacts you’re proposing. Make reviewers believe that these impacts are achievable and logical. Write in proactive language to enhance your communication of these effects.

Describe the specific roles of the researchers, collaborators and partners involved in your proposed project. And finally, remember to show the level of institutional support for your research project and its impacts.

**Take Broader Impacts Beyond the Proposal-Development Stage**

You’ll have limited success with your research project if the concept of broader impacts is relevant to you only because the NSF says its important.

Embracing the concept of broader impacts will empower you to communicate your research to any audience, and then work your way back to how your research will realize that influence.

Understanding how impact relates to your research activities and goals will increase your ability to communicate to multidisciplinary and non-expert audiences and increase the potential for success of your NSF proposal.
## Appendix A:
**Quick Reference Tool: Identify Your Project’s Impacts**

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<thead>
<tr>
<th>Society</th>
<th>Economy</th>
<th>Environment</th>
<th>Health</th>
<th>Universal</th>
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<tbody>
<tr>
<td>Quality of life</td>
<td>Gross domestic product growth</td>
<td>Quality of:</td>
<td>Disease incidence &amp; mortality rates</td>
<td>Reducing negative impacts</td>
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<td>Safety &amp; security</td>
<td>Employment &amp; jobs</td>
<td>• Air, water, land &amp; soil</td>
<td>Clinical outcomes</td>
<td>Regulations standards &amp; policies</td>
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<tr>
<td>Poverty</td>
<td>Exports, technologies &amp; products</td>
<td>• Ecosystems</td>
<td>Treatment efficacy</td>
<td>Training &amp; education models:</td>
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<tr>
<td>Education:</td>
<td>Patents &amp; licenses</td>
<td>• Environmental management, stewardship &amp;</td>
<td>Healthcare costs</td>
<td>• Knowledge mobilization</td>
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<td>• Literacy</td>
<td>Industry competitiveness &amp; market leadership</td>
<td>sustainability</td>
<td>Patient:</td>
<td>• Mentoring &amp; outreach</td>
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<td>• Health</td>
<td>Productivity</td>
<td>• Renewable</td>
<td>• Satisfaction</td>
<td>Disciplines — integration of:</td>
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<tr>
<td>• Opportunities</td>
<td>Income &amp; revenue</td>
<td>• Sustainable</td>
<td>• Quality of life</td>
<td>• Research &amp; education</td>
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<td>• Access</td>
<td>Production efficiency &amp; reducing costs</td>
<td>• Safety</td>
<td>• Safety</td>
<td>• People</td>
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<td>• Integration</td>
<td>Speed of production to market</td>
<td>Agricultural crop productivity &amp; food</td>
<td>• Recovery</td>
<td>• Disciplines</td>
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<td>Cultural health</td>
<td>Private-sector investment</td>
<td>supply safety</td>
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<td>• Sectors &amp; silos</td>
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<td>Societal participation</td>
<td>Economic policy development</td>
<td>Climate change:</td>
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<td>Practice in professional fields</td>
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<td>• Environmental risks</td>
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<td>participation models</td>
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<td>• Pollution</td>
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<td>Products:</td>
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<td>Species:</td>
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<td>• Tools &amp; devices</td>
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<td>Accelerated recovery from environmental</td>
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Appendix B:
Illustrate Your ‘Impact Chain’

**Impacts**
Health
Society
Economy
Environment

**Impacts Partners & Collaborators**
Informing research, teaching and extended collaborative network activities.
Translation of knowledge into new models, technologies, products, procedures, regulations, standards and techniques.

**Impacts Discipline**
Sharing knowledge, citations, references, new methodologies and approaches, education and teaching models, mentoring and training models, outreach models, and research models.
Integration research/education/disciplines/sectors, research infrastructure, collaborative models and recruitment.
Enhancing institutional commitment, and innovation pace and capacity.

**Research: Fundamental**
Research yields new knowledge, information, data and technologies.
Shared via publications and reports, presentations, workshops, conferences, and partnerships and collaborations.