

# NSF Broader Impacts

ENG AdCom

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# NSF Merit Review Criteria

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.



# A Topic of Great Interest to NSF, NSB, and Congress

- 1974** 11 criteria for NSF review
- 1982** 4 criteria
- 1986** NSF officially utilized “merit” review
- 1996** Intellectual merit and broader impacts
- 1998** Accountability for BI established
- 2000s** “Archived” 5 BI categories
- 2010** America COMPETES Reauthorization (8 BI categories)
- 2011** National Science Board report; new NSF guidance
- 2016** NSF Proposal and Award Policies and Procedures Guide (PAPPG) (9 BI categories)
- 2017** American Innovation and Competitiveness Act (7 BI categories)

# Broader Impacts in Policy & Law

“Archived” List	America COMPETES 2010	AICA 2017	PAPPG current
Advance discovery, training graduate students, mentoring postdoctoral researchers & junior faculty, involving undergraduates	Development of a globally competitive STEM workforce; improved undergraduate STEM education; improved pre-K–12 STEM education and teacher development	Developing an American STEM workforce that is globally competitive through improved pre-kindergarten through grade 12 STEM education and teacher development, and improved undergraduate STEM education and instruction.	Improved STEM education and educator development at any level; development of a diverse, globally competitive STEM workforce; and
Broaden participation of under-represented groups	Increased participation of women and underrepresented minorities in STEM	Expanding participation of women and individuals from underrepresented groups in STEM.	Full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM)
Enhance infrastructure for research and education	Increased partnerships between academia and industry	Enhancing partnerships between academia and industry in the US.	Enhanced infrastructure for research and education; increased partnerships between academia, industry, and others
Broaden dissemination to enhance scientific and technological understanding	Increased public scientific literacy	Improving public scientific literacy and engagement with science and technology in the United States.	Increased public scientific literacy and public engagement with science and technology
Benefits to society may occur when results of research and education projects are applied to ....	Increased national security. Increased economic competitiveness of the United States	Increasing the economic competitiveness of the United States; Advancing of the health and welfare of the American public; Supporting the national defense of the United States.;	Improved well-being of individuals in society; improved national security; increased economic competitiveness of the United States

# IM = Knowledge Creation, BI = Knowledge Mobilization

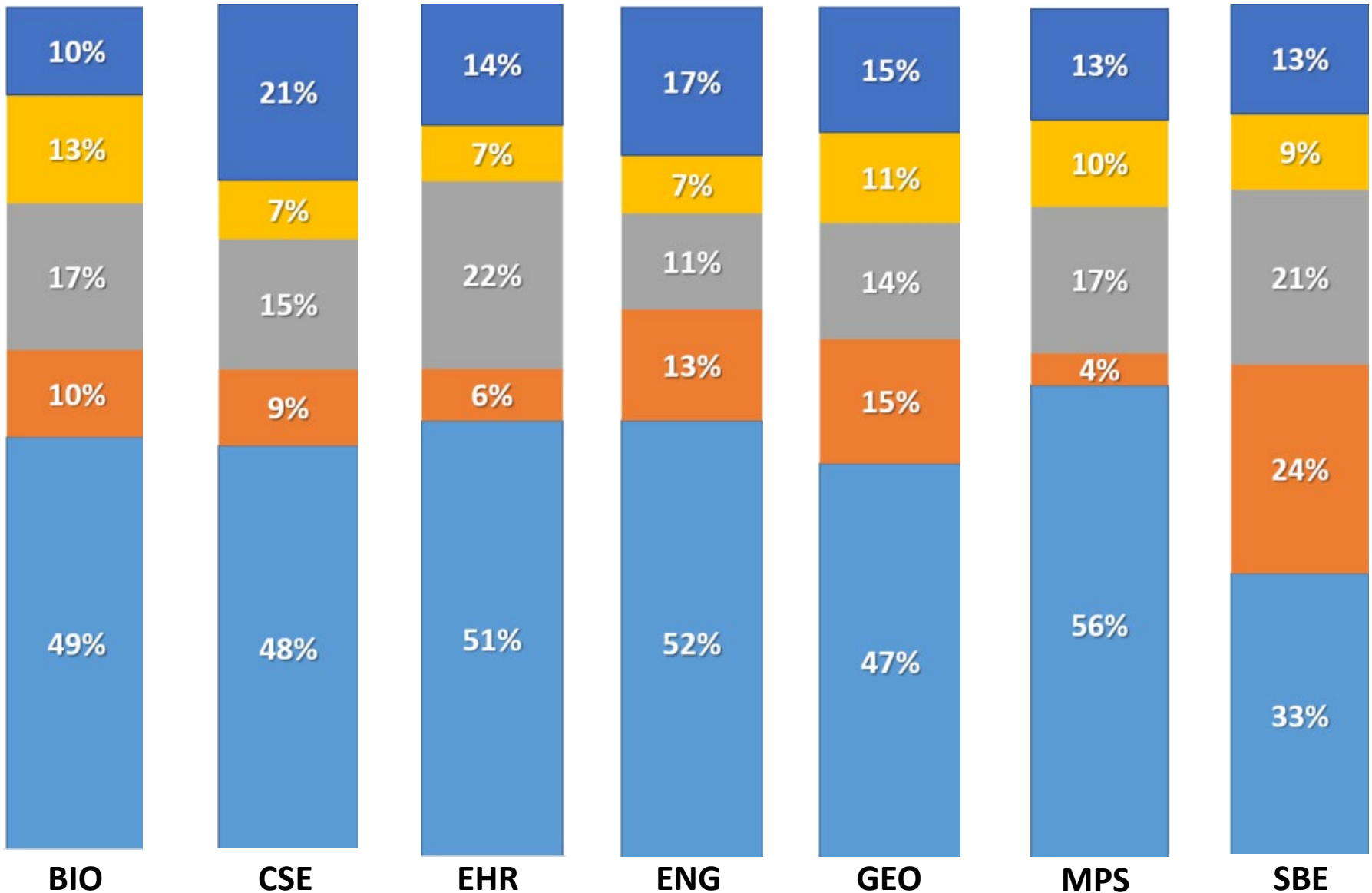
- Increasingly sophisticated view of BI has greatly expanded their scope
- BI is a review criterion for a proposed project
  - Prospective, not retrospective
  - Proposals primarily describe BI activities
- BI does not equal BP; BI is not evaluation
  - The scope is broad and includes BP amongst 9 categories of BI
- BI, like IM, differs:
  - according to the PI's area of expertise
  - according to the program

# NSF BI Re-examination 2015-2017

- Increased understanding of role of BI in merit review
- Funding of NABI, now ARIS – aimed at increasing collective impact of BI
- Reviewer video developed on BI, unconscious bias, and review quality, seen by ~15,000 reviewers
- BI data analysis: Extensive empirical evidence → over 50% of PIs emphasize importance of human capital development in their BI
  - Every year, ~27,000 NSF-funded graduate students & ~4,500 post-docs are trained by PIs to lead the next generation of scientists and engineers
- Informal updates to OMB in December 2015, July 2016, June 2017

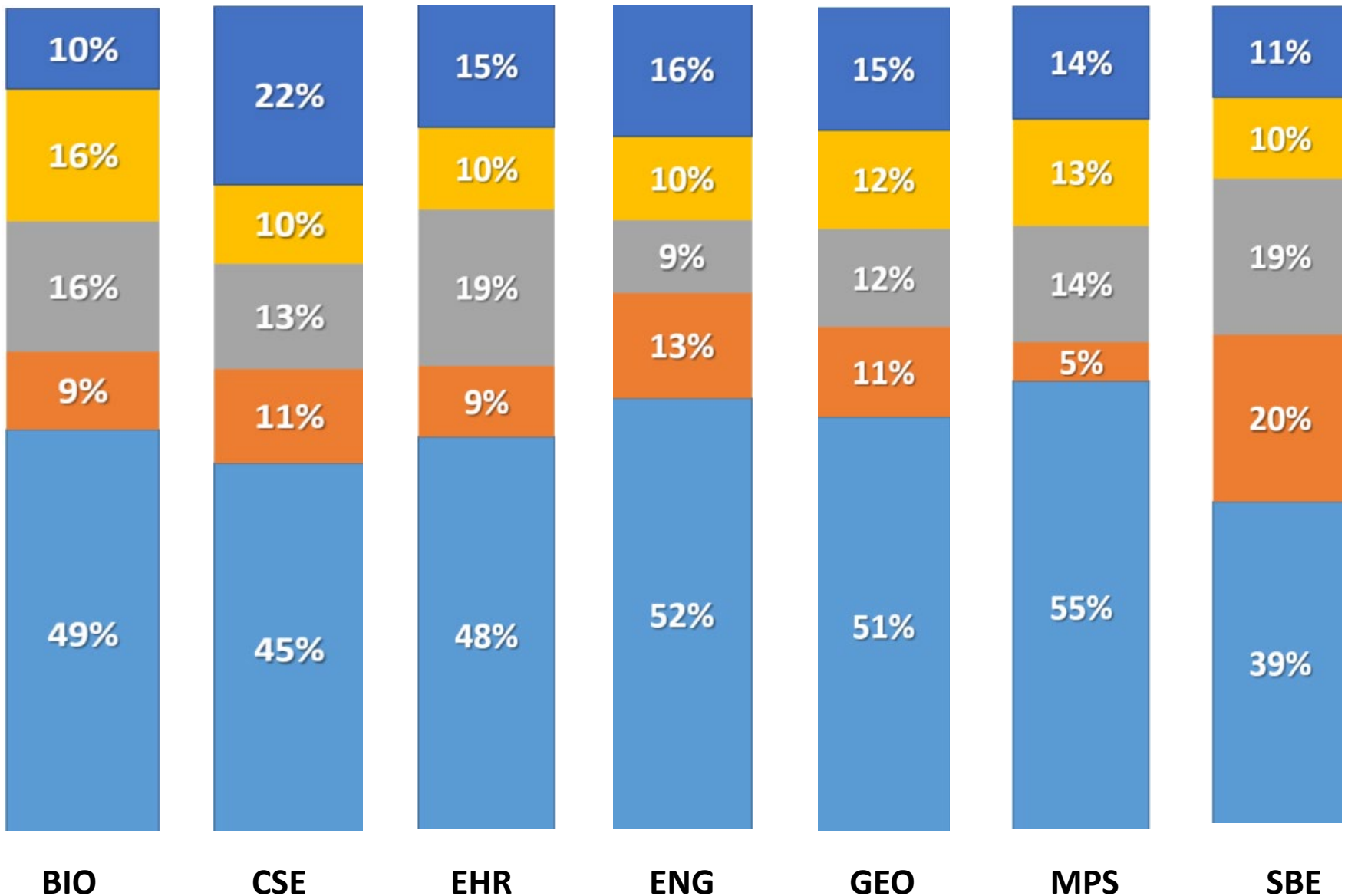
# Directorates: Project Summary FY2018

■ Advance Discovery   ■ Benefit to Society   ■ Broaden Participation   ■ Dissemination   ■ Enhance Infrastructure



# Directorates: Reviews 2018

■ Advance Discovery ■ Benefit to Society ■ Broaden Participation ■ Dissemination ■ Enhance Infrastructure





# Potential Next Steps

- Attend to student mentoring and development across all NSF-funded projects
  - Recommendation in Graduate STEM Education for 21<sup>st</sup> Century (2018 NASEM study)
  - A Congressional focus
  - Societal context
- Continue the data analysis
- Change the wording in the PAPPG
- Do more community/institutional collective impact pilots
- Pilot changes in NSF to better support BI,
  - E.g., put a BI professional on every COV

# Thank You!



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# MERIT REVIEW CRITERIA

**Assessing Broader Impacts:**

In assessing Broader Impacts,

## **In every NSF solicitation...**

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to:

- full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM);
- improved STEM education and educator development at any level;
- increased public scientific literacy and public engagement with science and technology;
- improved well-being of individuals in society;
- development of a diverse, globally competitive STEM workforce;
- increased partnerships between academia, industry, and others;
- improved national security;
- increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

# An Empirical Look at BI -- 2015-2017

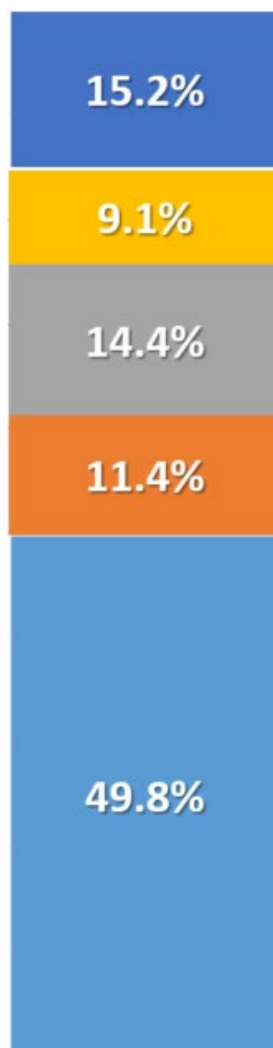
- An almost 2-year process
  - Directorate-wide discussions
    - Internal staff
    - External ACs
  - NSF Leadership Workshop in September 2015
  - Reports to OMB in December 2015 + July 2016
  - Agency-wide strategic review in January – March 2016
  - Report to OMB - June 2017

# IM = Knowledge Creation, but BI = Knowledge Mobilization

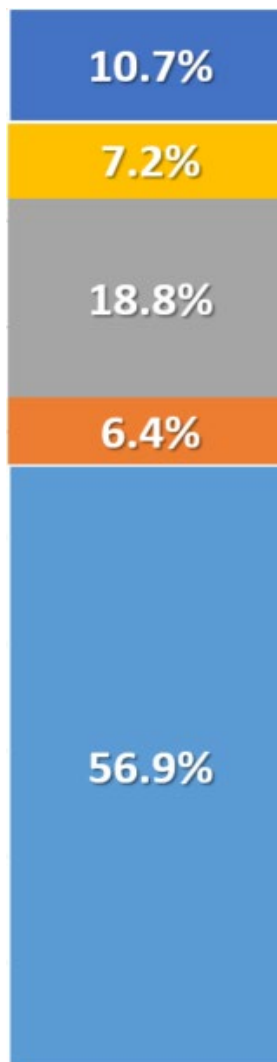
- **Projects:** Produce new knowledge among team members
- **Human capital development:** Students from all sectors **learn**, graduate, **move** to new jobs, work on new projects; the **next generation contributes** to knowledge production
- **Technological know-how development:** Know-how **develops** over the course of the project(s); new artifacts are **produced**; documentation is written; data archives are **built/shared**; **partnerships** are built
- **Cultural capital development:** The project works in a **network of other projects**, i.e., **the community**; **discoveries** are made; **awards** given; **status** is built; doors are opened; others listen and are influenced; PIs **sit on NASEM Boards**; **chair committees**
- **Societal Benefits:** start-ups; patents; new products; industries are built up that bring national security; economic competitiveness; health & well-being, etc.

# Investment Type: Project Summary FY2018 Awards

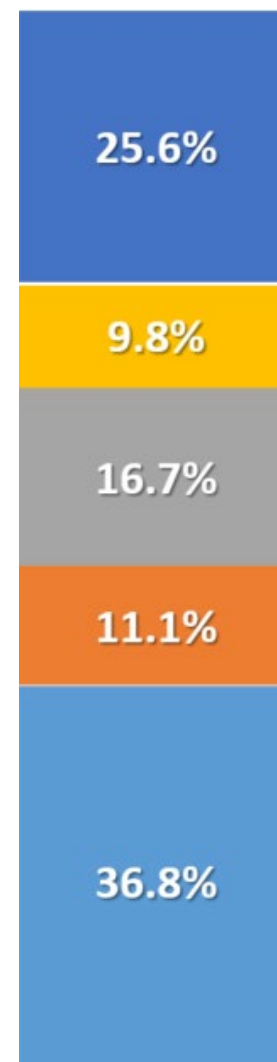
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**RESEARCH**



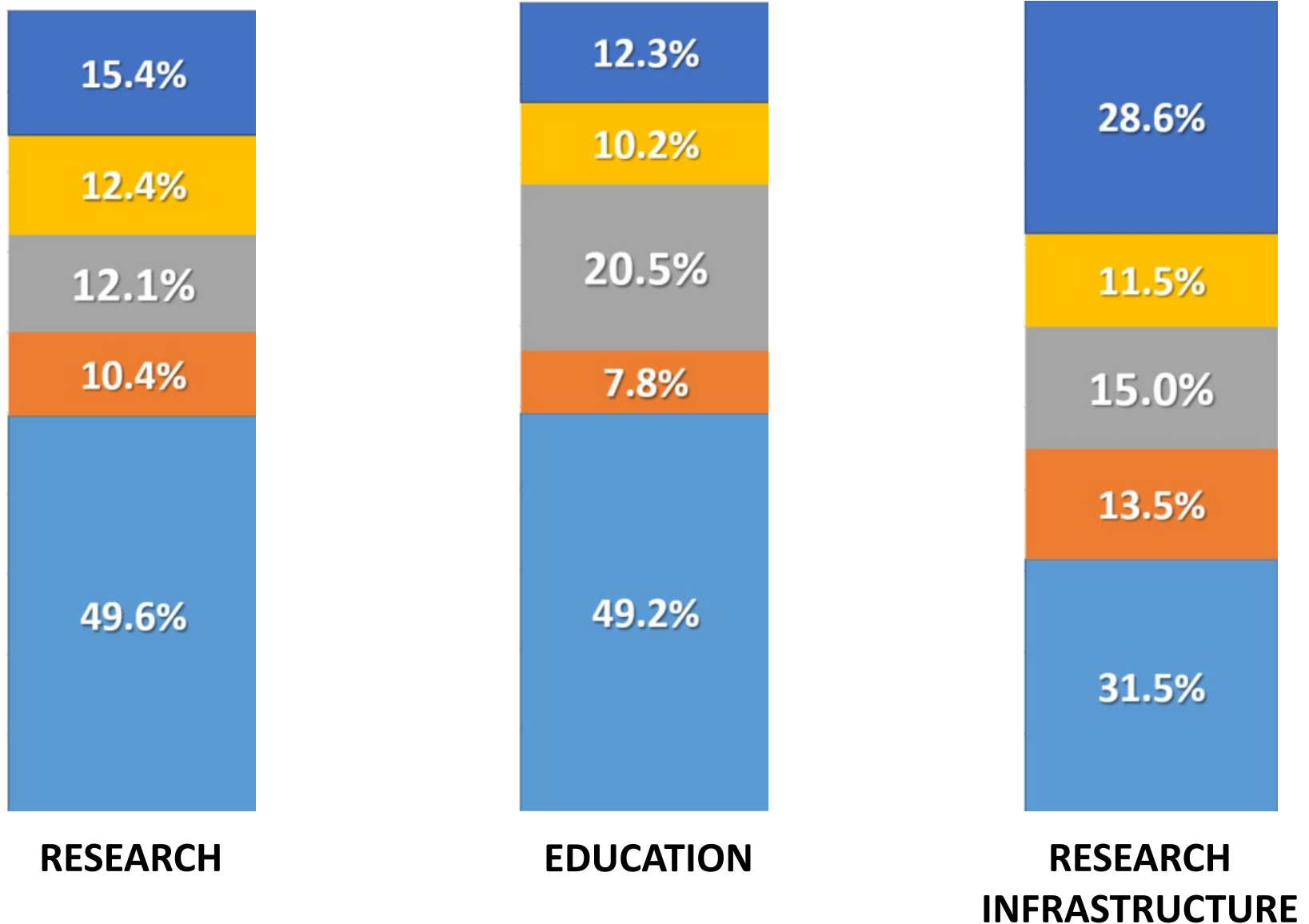
**EDUCATION**



**RESEARCH  
INFRASTRUCTURE**

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# Broader Impacts & Knowledge Mobilization Spiral

