Computing Research Association (CRA)'s Computing Community Consortium (CCC) and CRA's Government Affairs Committee (GAC) Response to [RFI on Developing a Roadmap for the Directorate for Technology, Innovation, and Partnerships at the National Science Foundation](#)

July 27th, 2023

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This is a joint response of the Computing Research Association (CRA)'s Computing Community Consortium (CCC) and CRA's Government Affairs Committee (GAC). CRA is an association of nearly 250 North American computing research organizations, both academic and industrial, and partners from six professional computing societies. The mission of the CCC, a subcommittee of CRA, is to enable the pursuit of innovative, high-impact computing research that aligns with pressing national and global challenges. CRA's Government Affairs Committee seeks to engage computing researchers in helping inform Federal policy and convey the importance of national research priorities to the computing research community.

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This response pertains to questions 3, 4, and 7 from the Request for Information.

Introduction

The Computing Research Association's CCC and GAC commend the TIP Directorate on establishing this effort to identify and fund translational research projects. We acknowledge the need for such an endeavor where community-based needs are rapidly addressed through transformational research, and we hope that our comments will help to inform the structure for TIP. A well-established framework with clear expectations and appropriate support will enable incredible transformational research that can result in revolutionary technological advancements.

Through this response, we highlight several suggestions for the overall structure of TIP, which we will describe in more detail in the sections below. Firstly, we advise broadly disseminating the TIP mission statement to the public, so that TIP can benefit from proposals drafted by a vast range of institutions. This will allow TIP to determine the priorities of the research community by hearing directly from community stakeholders. Because translational research can quickly become very costly, we suggest funding a limited number of projects to begin with to increase the odds of successful completions. To speedily deliver commercially viable products requires teams of dedicated, experienced researchers with a centralized support infrastructure. TIP will need to assign staff dedicated to each funded research project who can help connect research teams with experts throughout the development process (engineers, product managers, marketing teams, etc.). We expect many research teams will need to extend their funding past the proposed 1-3 year funding timeframe, so we suggest avenues for teams to compete or submit for continued funding on a longer time frame. A feedback process should also be created so teams can inform TIP which parts are working well and any improvements that can be made over time.

Question 3: Workforce Development

Understanding AI Applications: We expect a massive demand in the near future for workforce members who possess a strong understanding of AI applications. These workers will not necessarily need to be able to develop these AI systems themselves or even read and understand the code. Still, they will need to be capable of recognizing and understanding edge cases where AI systems are likely to fail or should not be trusted. An example is medical professionals using AI systems to monitor patients' health. Rather than following all of the AI systems' guidance with full confidence, a competent practitioner should be able to monitor a patient's vitals themselves and understand when an AI system may make an erring prediction, possibly due to a patient's underlying condition or other factors. There is great societal benefit in teaching

doctors and other workforce members how to use AI systems, and when to question these systems' outputs. There is also the potential for innovative R&D to identify where and how to introduce such training, both in traditional educational pipelines, as well as part of the professional development activities that are common in many fields.

Increasing AI Literacy: We offer several recommendations for increasing AI literacy amongst the US populace. The first is including curricula in middle and high school classes that focus on how to think about AI. These lessons could possibly be integrated into existing courses on topics where AI is already having real-world impact. These lessons can focus on how AI is trained, common mistakes and edge cases for AI systems, how AI differs from human thinking, etc. The key to these lessons, however, is consistency. If we continue to expose youth to this kind of critical thinking about AI systems, they will learn to question and understand AI systems over time, preparing them for a world in which AI is increasingly abundant.

An example lesson that could be taught to middle and high school students is one that arose during a CCC panel at AAAS 2023. During a presentation on AI, panelist Dr. Melanie Mitchell mentioned a student of hers who trained a neural network to decide whether an image contained an animal. The model had a high degree of accuracy. Still, when Mitchell's student analyzed how the program made its determinations, he realized that the program didn't look at the part of the image containing an animal at all but focused on the background. Rather than learning to differentiate animal and non-animal parts of images, the model had taught itself that most images of animals have blurry backgrounds. Therefore it began to ignore the foreground of images entirely. Examples like this are easily comprehensible to young minds, and the critical thinking skills they bestow can be invaluable down the line.

Administering these lessons, however, also requires K-12 educators to understand AI technology, which may necessitate courses for some educators to learn the fundamentals of AI as well. We recommend also developing a curriculum on AI literacy geared towards teachers, so that educators can effectively teach students the fundamentals of AI technology and be able to answer their questions. These courses could become a part of continuing education opportunities.

Broader Education in AI: These lessons, however, will not benefit those who have already left school and entered the workforce. For US adults who use AI systems every day but have little training in how these systems work we recommend offering supplemental training courses. These courses could have similar aims to the courses designed for adolescents, but likely would be more specific to each adult's applications. For example, if an employee regularly uses an AI program such as ChatGPT to assist

with their work, they could receive training on how ChatGPT scours the internet and generates its answers and in which scenarios ChatGPT is likely to fail or introduce false information. By learning how these technologies function, employees can understand that these systems are meant to assist and expedite their work, rather than act as reliable replacements for workers.

Improve AI Application Development: To help prioritize ethical considerations for those who work intimately with AI systems, we also propose professional certificate programs that teach important ethical considerations for designing and managing these systems. TIP could consider supporting the development of such programs and then require this certification for leads on AI-related projects that it funds.

We also advise some procedural changes at the development level for AI systems that are supported by TIP. We recommend creating standardized best practices for AI model measurement and performance, similar to those we suggested in the [CCC response to the NTIA request for comment on AI Accountability Policy](#). These best practices would include:
- Identifying suitable use cases for a system
- Identifying edge cases where a system is likely to fail or may produce unpredictable results
- Ensuring robustness of the system through fair and transparent practices
- Prioritizing the privacy of end-users
- Investing in high-quality training data
- Ensuring that those contributing training data do so with informed consent

Question 4: Addressing Societal Challenges

Clarify TIP's Mission and Expectations: TIP should create a 1-pager and other "snapshot" summaries which clearly state the project mission and expected outcomes to help applicants structure their proposals. These materials should be distributed widely to give as many interested researchers and organizations as possible the opportunity to submit proposals.

Consult other Federal Agencies: We also recommend that TIP include other federal agencies in the framework of their programs, as is currently done with many large scale programs at NSF, like the [National Artificial Intelligence Research Institutes](#). Agencies, such as the Department of Defense and the National Institute of Health, could provide valuable input during the TIP proposal selection process and help guide teams during the development period without having decision-making authority. The proposal review

process should be two-pronged, with a preliminary review of the application's impact on society, which, if found to be substantive, will be followed by a review of the application's scientific innovation. We recommend that outside federal agencies be included in both review processes to advise the TIP directorate, which would have final decision power. This would allow TIP to operate independently while using the expertise of other federal agencies who have conducted similar activities and would have valuable insight.

Identify and Commit to Research Areas: TIP should engage in a long-term effort to identify research needs in the community and any connections between these needs and existing technologies. Currently, most TIP programs task researchers to identify the community's research needs and research solutions to those needs. Researchers alone, however, are often not the best people to speak for the community's needs, especially when timeframes are tight and their own technical work must take precedence. We recommend that TIP partners with an organization, such as the National Research Council (NRC), to survey both the scientific and broader community to determine the nation's research priorities. This survey could be similar to the Decadal surveys, which look 10 years or more into the future to determine research priorities for many federal agencies, such as NASA. Surveying the community will demonstrate to Congress which research areas ought to be prioritized and allocated continued funding over a longer period. This commitment to long-term funding by the nation will ensure that these translational research products will be sustained long after the R&D process has been completed.

Engage Broader Communities in Research Needs Identification: Continued funding and diverse community engagement are also imperative to building trust within communities that the NSF works with. During the recent Community-Driven Approaches to Research in Technology and Society workshop, held by the CCC, we repeatedly heard stories of researchers going into communities, gathering data, and then leaving, giving little to no direct benefit to the communities they engaged with. This left many workshop participants feeling jaded against the research process and the possibility of engaging with researchers in future activities. By securing continued funding from Congress for certain research projects, TIP can establish lasting relationships between underserved communities, researchers, and government, and ensure that projects are sustained in the long term for the benefit of the community. Consulting underserved communities will also inform the NSF of those communities' research priorities and what challenges need to be tackled first to improve social equity.

Equally critically, TIP should create new funding pathways to identify, attract, and ensure sustained engagement of community stakeholders. Most NSF funding opportunities are geared towards academic and industry professionals who are familiar with NSF program structures and how to draft funding proposals. This requires significant support

and infrastructure, which many academic institutions can provide. On the other hand, community stakeholders have to go out of their way to find these opportunities, and once they have found them, they often have to work much harder to draft proposals since this is often an unfamiliar process. We advise broadcasting funding opportunities more widely to increase community engagement, and we also recommend dedicating more NSF personnel to assisting community members with planning and preparing proposals.

Furthermore, TIP should organize regular webinars for researchers and community members to attend to familiarize themselves with the process of working with TIP and the NSF on grant funded research projects. These webinars could be offered before solicitations are posted and during open solicitations, and could cover drafting and submitting funding proposals, interacting with NSF principal investigators, organizing research teams, coordinating research activities, and generally laying out who to contact with different questions. This would be a fabulous opportunity to engage community members and researchers who may be daunted by the idea of working on government funded projects for the first time and an excellent refresher for those who have engaged in these projects previously. Coordinating regular "office hours" would also benefit researchers who are not sure whom to approach with specific questions.

Question 7: Other Relevant Topics

Deliver functional solutions and retain a trained workforce: We advise a longer time frame for supporting translational research projects within the key technology areas listed in the RFI. This is because large societal, national, and geostrategic challenges, such as climate-driven disasters and quantum technology development, are huge problems, solutions to which are difficult to envision in even 10-20 years. Furthering technology in these areas to a significant degree requires large interdisciplinary teams with a high level of expertise in multiple areas, and these teams would likely only achieve a proof of concept within a 1-3 year time frame. To truly "push the needle" on these grand challenges, we advise longer term funding commitments (5 years or more depending on the scope of the problem being solved), with an additional funding option extending over a longer time frame. Without the option for a longer funding time frame, we envision many strong prototypes will lack the necessary funding to transition from proof-of-concept to implementation. Also, most software requires continued funding to keep it updated and functional, meaning that dedicated staff needs to be retained even after the R&D process has finished.

To expedite these technology developments, a larger degree of funding will be necessary than may be typically allocated toward similar activities TIP has previously funded, such as the Convergence Accelerator programs. To demonstrate the near-term deliverables that TIP hopes to achieve through this proposed funding plan, these teams will need to be composed of dedicated experts working full-time, in addition to more typical NSF project teams that include academic researchers and graduate students. If TIP intends to accelerate technology in all 10 research areas, we recommend funding no more than 1-2 teams each, as the teams will need to be properly resourced.

Respecting Disciplines and Increasing Collaboration: The current TIP team project structure can be optimized to increase productivity and reduce the need for each team member to be an expert in every area. The NSF's current approach to building interdisciplinary teams of academics and industry experts does not consider the vast differences between these individuals' specialties. Instead, every member of each team is expected to possess research, entrepreneurial, and business management skills and be able to handle challenges personally in those areas that may arise. An alternative approach, with one central administrative unit assigned to each team would allow members to focus on their areas of expertise without learning new skills to complete their projects. A company, non-academic organization, or non-profit should act as lead on these research projects. This lead organization would be tasked with duties such as delegating responsibilities to appropriately experienced parties, fostering communication from the group, laying out schedules and deadlines, and other managerial activities which the selected researchers should not be expected to focus on.

Assign Dedicated NSF staff to Research Projects: A clear and concise framework for these key technology programs will need to be developed, with dedicated NSF staff assigned to each project. Historically, the NSF has operated with minimized overhead expenses to maximize the funds allocated to scientific research. For this effort, however, having more NSF staff to support these translational research projects would greatly benefit the teams by allowing them to focus on the research. In contrast, dedicated NSF staff would handle the project's funding, scheduling, and organizational needs.

Industry, government, and academia researchers will be seasoned in developing and demonstrating technologies in these key technology areas. Still, they may have limited business and logistical experience. We also expect that most researchers involved in these projects will lack the training and skills required to transfer their technological innovations to the marketplace. We advise building a strong relationship between the NSF and these program teams, with frequent team check-ins to ensure the teams have the assistance they need to get their projects off the ground and to connect with outside

experts if they encounter problems during the R&D phase and implementation. It may be prudent to require each team to include a managerial member, with business management experience, to ensure proposed timelines are reasonable and achievable.

Conclusion

TIP has made incredible progress towards creating new opportunities since its inception in 2022, and the CCC and GAC are thrilled to have the opportunity to share input for the Directorate's Roadmap. We are excited to watch TIP become a major catalyst of translational research in the United States.