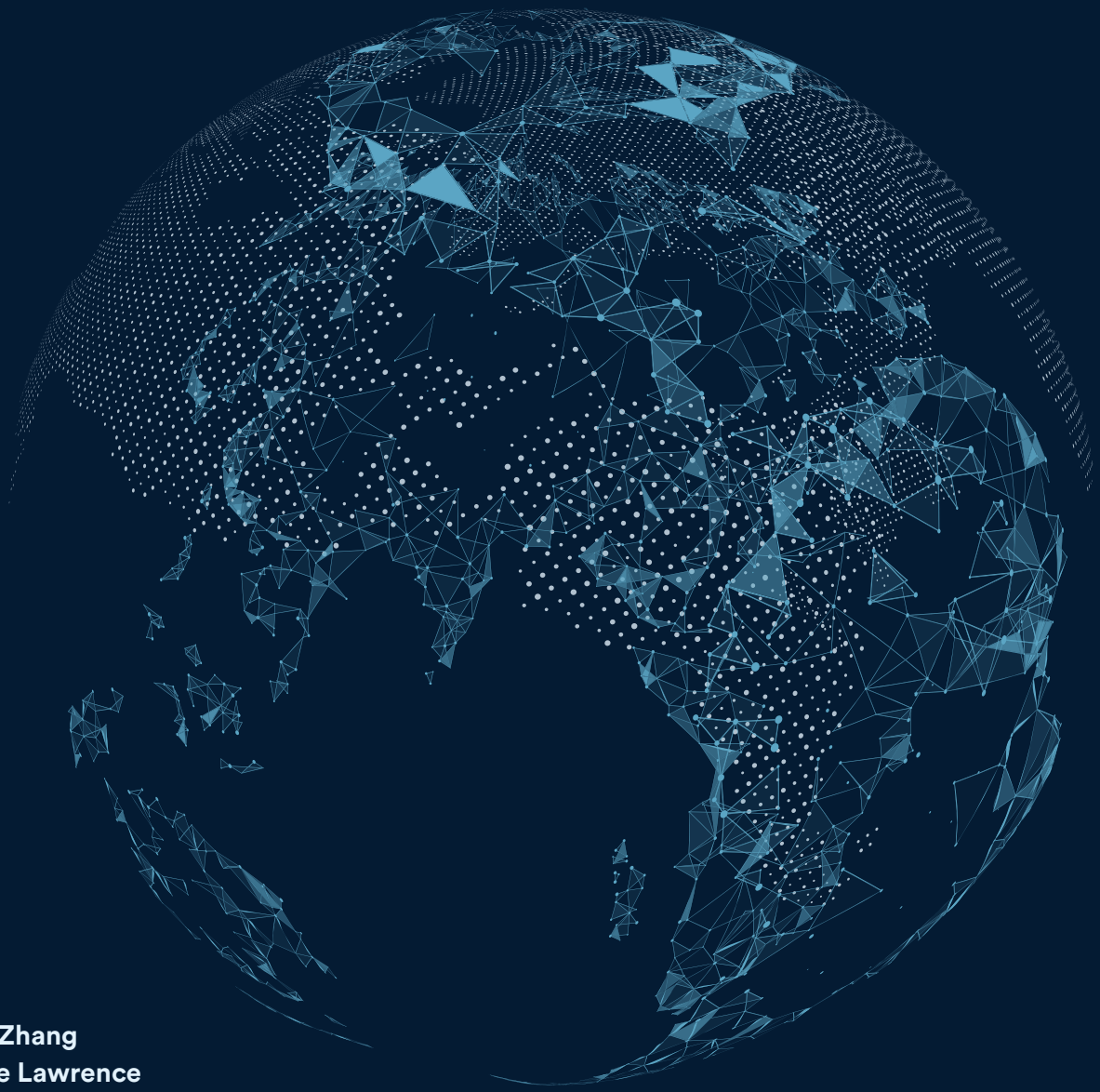
Enhancing International Cooperation in AI Research: The Case for a Multilateral AI Research Institute



Daniel Zhang
Christie Lawrence
Michael Sellitto
Russell Wald
Marietje Schaake
Daniel E. Ho
Russ Altman
Andrew Grotto

Stanford University
Human-Centered
Artificial Intelligence

PRINCIPAL AUTHORS

Daniel Zhang is the policy research manager at the Stanford Institute for Human-Centered Artificial Intelligence (HAI). He develops and oversees HAI's policy research programs, including policy briefs, white papers, workshops, and responses to government requests for information. Previously, he was the manager of AI Index where he led research for its annual report that measures and evaluates the rapid rate of AI advancement. Before Stanford, he worked on global AI talent flows and security risks at the Center for Security and Emerging Technology and public education policy at the Riley Institute Center for Education and Leadership. He holds an MA in security studies from Georgetown University, where he concentrated on technology policy, and a BA in politics and international affairs from Furman University.

Christie Lawrence is a JD/MPP candidate at Stanford Law School and Harvard Kennedy School. She was a director for research and analysis at the National Security Commission on Artificial Intelligence, where she focused on fostering international AI cooperation, tech-related foreign policy and international development, international technical standards, and intellectual property policy. She worked on the initial recommendation to establish MAIRI and foster international AI research and development. Earlier, she worked at the Cyber Project at Harvard's Belfer Center, where she wrote reports on transatlantic AI cooperation and the potential of a U.S.-Russia cyber norms agreement, at the State Department, and as a management consultant. She holds a BA in public policy from Duke University.

Michael Sellitto is the deputy director at the Stanford Institute for Human-Centered Artificial Intelligence (HAI). From 2015-2018, Michael served in the White House as director for cybersecurity policy on the National Security Council staff. In that role, he led international engagement on cybersecurity policy and strategy, promoted international adoption of a framework for strategic stability in cyberspace, and advanced U.S. interests on issues related to the digital economy and internet governance. He holds a master of public policy from Harvard University's Kennedy School of Government and a BS from New York University's Stern School of Business.

Russell C. Wald is the director of policy at the Stanford Institute for Human-Centered Artificial Intelligence (HAI), where he is responsible for leading the team that advances HAI's engagement with governments and civil society organizations. He is the co-author of "Building a National AI Research Resource: A Blueprint for the National Research Cloud," which is the most comprehensive study on a National Research Cloud to date. He previously held various government relations roles at Stanford University. He is a term member with the Council on Foreign Relations, visiting fellow with the National Security Institute at George Mason University, and a partner with the Truman National Security Project. He holds a BA in political science, global studies, from UCLA.

Marietje Schaake is the international policy director at Stanford University's Cyber Policy Center and an international policy fellow at the Stanford Institute for Human-Centered Artificial Intelligence (HAI). From 2009-2019, Marietje served as a member of European Parliament for the Dutch liberal democratic party, where she focused on trade, foreign affairs, and technology policies. In 2019, she was named president of the CyberPeace Institute and continues to serve on its advisory board. Marietje is affiliated with a number of nonprofits, including the European Council on Foreign Relations and the Observer Research Foundation in India, and writes a monthly column for the *Financial Times* and a bimonthly column for the Dutch *NRC* newspaper.

PRINCIPAL AUTHORS (CONT'D)

Daniel E. Ho is the William Benjamin Scott and Luna M. Scott Professor of Law, Professor of political science, and Senior Fellow at the Stanford Institute for Economic Policy Research at Stanford University. He serves as an Associate Director of the Stanford Institute for Human-Centered Artificial Intelligence (HAI), the Director of the Regulation, Evaluation, and Governance Lab (RegLab), and as a Faculty Fellow at the Center for Advanced Study in the Behavioral Sciences at Stanford. He received his J.D. from Yale Law School and Ph.D. from Harvard University and clerked for Judge Stephen F. Williams on the U.S. Court of Appeals for the District of Columbia Circuit.

Russ Altman is the Kenneth Fong Professor of Bioengineering, Genetics, Medicine, Biomedical Data Science, and, by courtesy, of Computer Science, and past chairman of the Bioengineering Department at Stanford University. His primary research interests are in the application of computing (AI, data science and informatics) to problems relevant to medicine and he serves as Associate Director of the Stanford Institute for Human-Centered Artificial Intelligence (HAI). He has chaired the Science Board advising the FDA commissioner, and has served on the NIH Director's Advisory Committee, and as co-chair of the International Organization for Migration (IOM) Drug Forum. He holds an A.B. from Harvard College, an M.D. from Stanford Medical School, and a Ph.D. in Medical Information Sciences from Stanford University.

Andrew Grotto is a William J. Perry International Security Fellow at the Cyber Policy Center and a research fellow at the Hoover Institution, both at Stanford University. Before coming to Stanford, he served in the White House during the Obama and Trump administrations as senior director for cybersecurity policy at the National Security Council. He played a central role in developing and overseeing the implementation of President Obama's Cybersecurity National Action Plan, and he was the principal architect and drafter of the Trump administration's executive order on "Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure." He received his JD from the University of California at Berkeley, his MPA from Harvard University, and his BA from the University of Kentucky.

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The Stanford Institute for Human-Centered Artificial Intelligence
Cordura Hall, 210 Panama Street, Stanford, CA 94305-4101

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Executive Summary

Developing responsible, human-centered artificial intelligence (AI) is a complex and resource-intensive task. As governments around the world race to meet the opportunities and challenges of developing AI, there remains an absence of deep, technical international cooperation that allows like-minded countries to leverage one another's resources and competitive advantages to facilitate cutting-edge AI research in a manner that upholds and promotes democratic values. Establishing a Multilateral AI Research Institute (MAIRI) would provide such a venue for force-multiplying AI research and development collaboration. It would also reinforce the United States' leadership as an international hub for basic and applied AI research, the development of AI governance models, and the fostering of AI norms that align with human-centric and democratic values.

In its final report published in March 2021, the National Security Commission on Artificial Intelligence (NSCAI) recommended that the United States work closely with key allies and partners to establish a MAIRI and called for congressional authorization and funding to allow the National Science Foundation (NSF) to lead the effort. Built upon these recommendations, this white paper outlines a blueprint for an AI research institute that can champion human-centered approaches to conducting AI research, promote multi-stakeholder international R&D cooperation to unleash innovation and economic prosperity, and cultivate AI talent. MAIRI can demonstrate to the world that AI-enabled technologies can benefit humanity, strengthen democracy, and support inclusive economic growth.

We recommend:

- MAIRI should be established in the United States with a physical presence located in a recognized academic institution, potentially to include partnerships with satellite centers, such as NSF National AI Research Institutes. Partnering with an academic institution can expedite the establishment of MAIRI by leveraging existing administrative and research infrastructure and multidisciplinary research approaches while ensuring academic independence and integrity.
- MAIRI should operate an on-site laboratory that conducts cutting-edge multidisciplinary AI research on basic and applied R&D as well as research on AI governance. It should also facilitate a series of research programs—such as conferences, seminars, workshops, residence programs, and fellowships.
- MAIRI should be created as a cooperative agreement-based research institute, with the NSF as the primary anchor in coordination with the Department of State and other federal entities. In the long term, the U.S. government could explore adopting a mature and established MAIRI with developed functions, goals, and agendas as an FFRDC.
- MAIRI should be jointly established, funded, and governed by the United States with like-minded allies and partners. Member governments will jointly fund MAIRI as well as negotiate and commit to a founding agreement that details MAIRI's governance structure, values and guideposts, research security and integrity principles, and research agenda.

Chapter 1: The Theory of Impact for a Multilateral Artificial Intelligence Research Institute

Policymakers around the world have reached the understanding that artificial intelligence (AI) will impact innovation, economic growth, and the fundamental values underpinning democratic governance. Governments have accordingly prioritized policy efforts and funding for the research and development (R&D), as well as adoption and governance, of AI technologies and applications. The United States has substantially bolstered its approach to AI research and application by creating the National AI Initiative Office,[1] implementing recommendations from the National Security Commission on AI (NSCAI),[2] passing AI-related legislation,[3] and prioritizing AI adoption across the executive branch.[4] Over 700 AI policy initiatives from 60 countries, territories, and the European Union (EU) demonstrate that other countries are doing the same.[5]

Motivating this flurry of development is the recognition that AI can transform economies and societies, as well as an ensuing desire not to fall behind. Anxieties about failing to capture the benefits from technological innovation galvanize governments, universities, industry, and other organizations to prioritize AI and associated technologies. Yet, concerns about the implications of advances in AI also demand action. The proliferation of AI-enabled technologies that lack sufficient privacy and data security protections or safeguards against bias, and the use of digital tools to advance authoritarian tendencies, have demonstrated that a "hands-off" approach to the development and governance of AI can undermine democratic values. In response, policymakers from the United States and like-minded partners have called for multi-stakeholder, values-driven collaboration to put forth a "positive vision" of "digital democracy."[6]

A Multilateral AI Research Institute (MAIRI) would answer this call. Our case for MAIRI is grounded in efficiency and distributive rationales, as well as a recognition that international research collaboration and science diplomacy is necessary for fostering global understanding and advancing technology for democracy.[7] First, MAIRI will provide a venue for large-scale and multidisciplinary AI R&D collaboration that enables researchers from like-minded nations to leverage the competitive advantages of participating countries and cultivate their domestic capabilities. Second, MAIRI will allow member countries to demonstrate that AI-enabled technologies can enhance human welfare, spur economic growth, and strengthen democracies by supporting AI research guided by a shared commitment to transparency, privacy, equity, and innovation. Third, MAIRI would reinforce the United States' leadership as an international hub for basic and applied AI research, as well as AI governance.

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This chapter articulates a theory of impact for MAIRI, proceeding in three parts. First, we articulate the importance of international research collaboration across the AI landscape, exploring the benefits international collaboration provides irrespective of the scientific field before focusing on AI research. Second, we outline inadequacies with the current state of international research collaboration that prevent the United States and the international community from realizing the advantages provided by joint R&D efforts. Third, we spell out the role MAIRI would play in demonstrating that AI-enabled technologies can unleash responsible, values-driven innovation and economic prosperity globally.

THE IMPORTANCE AND BENEFITS OF INTERNATIONAL RESEARCH

The U.S. executive and legislative branches have reaffirmed science and technology's prominence within domestic and foreign policy.[8] Correspondingly, calls for cross-border research collaboration on emerging technologies have emerged at diplomatic forums such as the Quadrilateral Security Dialogue (QSD, also known as the Quad) Leaders' Summit, the G7 ministerial meetings, and the U.S.-EU Trade and Technology Council.[9] During the legislative track of the December 2021 Summit for Democracy, lawmakers from around the world urged legislative action to "defend against digital threats, misinformation, and digitally-enabled authoritarianism."[10] Underpinning many of these announcements is the recognition, as the American Academy of Arts and Sciences articulated, that the most pressing scientific challenges and opportunities transcend national boundaries, and, correspondingly, "some research questions" cannot "be addressed by one nation's scientists or facilities alone."[11]

Recognizing the importance of collaborative global research stems from the numerous economic and scholarly advantages it provides. First, joint scientific and technological efforts achieve economies of scale and scope by sharing project costs, pooling resources like data and technical expertise, and enabling researchers to access expensive or unique facilities, tools, and other research materials.[12] Large research projects, particularly those with high fixed costs and vast intellectual challenges, are not economically justifiable without collaboration that allows large numbers of researchers to take advantage of the fixed investments.[13] Although beyond the scope of what is envisioned for MAIRI, the thousands of scientists who utilize the facilities operated by the European Organization for Nuclear Research (CERN), including its Large Hadron Collider (which cost an estimated $4.75 billion to build), illustrates the economic benefits of collaboration at the outer limits of big science.[14]

Second, international collaboration can be associated with higher impact. Joint research efforts capitalize on specialized knowledge developed in specific countries, expanding the scope of research and increasing creativity through the diffusion of ideas.[15] Resulting findings can be viewed as more legitimate and achieve greater visibility within the scientific community.[16] Analyzing the research publication output of 10 countries (Australia, Brazil, Canada, China, the EU-27, India, Japan, South Korea, the United Kingdom, and the United States) from 2010 to 2019, Georgetown University's Center for Security and Emerging Technology found that a higher percentage of research, including computer science research, published through international collaborations were "high-impact," or rather highly cited within their research field, compared to research that involves no international collaboration.[17] Publications with four or more country collaborators had the highest rate of "high-impact" publications, with three-country collaborations coming in second and two-country collaborations having the third highest rate of "high-impact" publications.[18]

The international research community has also achieved milestones not possible without collaboration and pooled long-term investments.[19] Through the Laser Interferometer Gravitational-Wave Observatory (LIGO) Scientific Collaboration (LSC), over 1,000 scientists from 18 countries have analyzed data, contributed to the development of techniques for gravitational wave detection, and supported the operations of associated detectors like the two NSF-funded, U.S.-based LIGO interferometers.[20] The result: Worldwide optical observations and analysis revealed that the collision of

neutron stars can produce heavy elements, answering long-held questions about the origin of elements like gold.[21] Joint research can also impel unintended scientific advancements, such as the development of the World Wide Web in 1989 to facilitate data and information sharing at CERN.[22]

Third, global research cooperation strengthens domestic R&D enterprises by connecting scientific communities, and domestic talent benefits from knowledge-sharing, capacity-building, and maintaining ties to an expanded pool of global research partners.[23] The United States' economic competitiveness and national security are strengthened through this more robust R&D enterprise.[24] Nations that collaborated through CERN benefited from increased industrial capacities, learning spillovers, knowledge transfers, and economic growth.[25]

Benefits afforded by international collaboration are even more acute across the AI landscape as AI R&D becomes increasingly resource-intensive and complex.[26] Models need to be trained with high-quality and diverse data to minimize the sampling bias arising from unrepresentative datasets.[27] For example, equitable AI applications in healthcare will require secure and privacy-preserving access to globally representative data and populations. Progressively more advanced algorithms require greater computing capacity, which can be a substantial barrier to research given the high cost of compute.[28] Difficulties attracting, training, and retaining skilled AI talent also significantly limit research as countries, governments, research institutions, and even private companies compete across the scarce AI labor market.[29] Joint AI research efforts are therefore necessary to leverage countries' comparative advantages, achieve economies of scale and scope, and reduce duplicative investments in AI capacity or infrastructure.[30]

Finally, international collaboration on AI R&D and governance is imperative given AI-enabled technologies pose potentially grave risks to civil liberties and democratic values. Core to these concerns is a recognition that AI R&D, unfettered by a focus on ethics or consideration of the impact of certain technologies, has allowed for the development of AI-enabled technologies that, intentionally or not, further discrimination, violate individuals' privacy, enable surveillance and censorship, and lead to inaccurate outcomes.[31] Moreover, autocracies and illiberal democracies may shape standards and norms that undermine rules-based governance and democratic values.[32]

What's needed to combat these developments? As National Security Advisor Jake Sullivan explains, the United States, together with its allies and partners, must "engineer a third wave of the digital revolution" that responds to the "authoritarian counterrevolution" by forging a "democratic technological ecosystem characterized by resilience, integrity, and openness with trust and security, that reinforces our democratic values and our democratic institutions." Because "long-term U.S. leadership in technology is not assured," Sullivan continued, "making sure that technology delivers—for democratic value[s] and for inclusive prosperity" requires reversing "the decades-long decline in federal R&D in science and technology," "efforts that harness the public, private, and academic sectors," and investments in values-promoting technologies like privacy-preserving machine learning.[33] Similar calls or government initiatives include a proposal by the White House Office of Science and Technology Policy (OSTP) for an AI bill of rights, the National Institute of Standards and Technology (NIST)'s development of an AI risk management framework, the European Commission's proposed AI Act, and the OECD's Framework for the Classification of AI Systems.[34]

Still, policy announcements alone will not counter the spread of digital repression. The United States and its like-minded allies and partners must demonstrate that democracy-affirming technology (i.e., technologies built with democratic values like privacy, accountability, and transparency at their core) can be just as powerful and profitable as technologies that undermine these values.[35] The United States and the United Kingdom recently announced a joint innovation challenge to develop privacy-enhancing technologies to facilitate cross-border and cross-sector collaborations through data sharing that protects privacy,[36] but it will take more than a single prize to address all of the challenges and opportunities posed by AI.

PROBLEMS WITH THE CURRENT STATE OF INTERNATIONAL AI RESEARCH COLLABORATION

Despite calls for increasing research partnerships, international cooperation on AI research faces a number of challenges—starting with joint research efforts that suffer from a failure to launch. Interested countries and researchers can struggle to identify proper co-collaborators, and a lack of adequate forums for exchanging information and research expertise undermines possibilities for connecting complementary researchers and efforts.

At the government level, science can benefit from decentralization—and many credit scientific pluralism as the source of America's great research establishment,[37] but the GAO has noted a need to maximize performance through improved collaboration and interagency coordination across federal research agencies.[38] Many research-intensive countries like South Korea, Canada, Germany, France, and India have one agency with primary responsibility for overseeing government research, but U.S. federal R&D is conducted by dozens of agencies.[39] The Networking & Information Technology R&D (NITRD) Program—the U.S. federal government's primary coordinating body for federal R&D in advanced digital technologies—is itself composed of 25 member agencies and more than 60 participating agencies.[40] The sheer number of relevant research agencies can introduce uncertainty about navigating the federal government research apparatus and identifying the proper government research partner. This dilemma is consistent with broader challenges within the U.S. foreign policy apparatus: NSCAI found that allies and partners regularly expressed uncertainty about U.S. government points of contact for issues related to AI and other emerging technologies.[41] International R&D collaboration that meets the call for action that National Security Advisor Jake Sullivan articulated will therefore require mechanisms, like a multilateral research center, that enable governments, academia, and research partners across the public and private sectors to better communicate and collaborate.

Even after desired collaborators are secured, practical hurdles can stifle implementation. Inadequate or unequal access—both within and between countries—to research resources like compute, data, talent, and funding can hinder collaboration.[42] COVID-19 has further demonstrated the importance of technological infrastructure that enables remote operations.[43] Diverging regulatory frameworks and approaches to research governance (e.g., restrictions on material and data sharing, differences in academic standards, complications around intellectual property) often erect barriers.[44] While no single organization can overcome every challenge on its own, there is a need for international venues that allow foreign researchers—through iterative problem-solving, regulatory sandboxing, and trouble-shooting through pilot projects—to improve approaches to collaboration and establish technical norms. Current mechanisms on the international level are insufficient.

Inaction threatens U.S. security and innovation. The American Academy of Arts & Sciences warns in a report that a failure by the United States to "establish long-term funding and management mechanisms for engagement and support of large-scale initiatives with international partners" will leave the country "ill-equipped both to drive and to capitalize on global scientific advancements," as well as isolated from other countries, the next generation of advanced scientific facilities, and world-class collaborators.[45] The development of AI technologies is becoming such a large-scale initiative as countries around the world continue to prioritize AI R&D and governance. They will increasingly look to international partners to collaborate and provide access to the resources and expertise they lack, assist them in developing domestic capabilities, and address global challenges. Ultimately, U.S. security, innovation, and values are at stake.

ROLE OF THE MULTILATERAL AI RESEARCH INSTITUTE (MAIRI)

MAIRI will address the aforementioned lack of sufficient mechanisms to advance international AI research collaboration. Established, funded, and governed by the United States with like-minded allies and partners, MAIRI

would build on participating countries' strengths and equitably pool resources and talents to catalyze force-multiplying, multilateral AI R&D. A primary purpose of MAIRI is to facilitate scientific exchanges and promote collaboration on AI research, including basic and applied academic research, as well as research on the risks, governance, and socioeconomic impact of AI, that aligns with human-centric and democratic values.

MAIRI will further existing AI policy coordination and strengthen the international AI R&D ecosystem through funds committed by participating governments, a research agenda aligned with members' broadly agreed-upon priorities, and a physical location for conducting research and hosting workshops and other events. The U.S. government should fund the initial startup costs to launch this physical location in an established academic institution in the United States, with future funding coming from participating foreign governments. MAIRI would serve as an on-site laboratory with facilitatory functions that bring together AI researchers from around the world, built on the existing AI research ecosystem with vast academic resources, trusted research infrastructure, and multidisciplinary research approaches enabled by access to talent drawn from science, technology, engineering, and mathematics (STEM), social science, and the humanities. Researchers from participating countries could also participate in research and other activities remotely or in hybrid formats.

Moreover, MAIRI will expedite the launch of discrete projects by relying on an initial founding agreement—jointly determined by participating governments—that delineates default practices and conditions related to research integrity and security, data sharing, the handling of intellectual property, funding, and other research considerations. MAIRI will foster the next-generation AI workforce domestically and globally, provide a model for multilateral research that is equitable and builds the capacities of its members, address commercial gaps in R&D, and promote values-driven innovation and technology competitiveness.

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Chapter 2: Organizational Functions

To realize the goal of MAIRI outlined in Chapter 1, the institute should perform two main functions. First, MAIRI should operate an on-site laboratory that conducts cutting-edge, multidisciplinary AI research on basic and applied R&D as well as research on AI governance. AI research is a multidisciplinary and broadly construed field of studies encompassing not only the discipline of computer science, but also social science, law, medicine, and the humanities where researchers examine the impact of AI on society and apply AI in their work. This lab could bring together international coalitions of researchers across specialties to collaborate on new research, tackle existing problems, and promote collaborations through those research connections. Second, MAIRI should facilitate a series of research programs—such as conferences, seminars, workshops, residence programs, and fellowships—to foster long-term, sustainable partnerships among researchers, relevant civil society and other sectors across like-minded nations. This facilitator function will enable skill development and grow AI talent for participating member countries.

We further recommend that MAIRI be established in the United States with a physical presence in an established academic institution, potentially to include partnerships with satellite centers, such as existing NSF National AI Research Institutes (NAIRIs). Such a physical center can leverage multidisciplinary academic expertise and resources to realize MAIRI's aforementioned objectives of promoting and enabling international research collaboration, scientific diplomacy, and a positive, democratic vision of AI development and governance, while allowing for remote and hybrid participation.

ON-SITE LABORATORY

The first and foremost purpose of MAIRI should be to serve as a global research institute. AI development involves global interconnections and interdependency, including through open-source software toolkits, open-source machine learning datasets, the often freely accessible publication of research papers, and international attendance at major AI conferences. However, there is a great opportunity to develop and expand formal, proactive, and prolonged collaborations internationally. The institute can serve as a place to fill that gap—for leading minds from across the globe to collaborate on projects for both basic and applied research and governance research.

Basic research refers to efforts to expand knowledge and reveal new research questions.[46] Basic research can often involve unearthing new phenomena, developing entirely new concepts, and creating the intellectual or, in AI's case, mathematical and computational basis for driving the development of new AI applications. For instance, basic AI research concerns such questions as the development of model architectures that can take into account long-range dependencies or methods for learning from far less training data.[47] Applied research refers to efforts centered around answering practical research questions,[48] although the separation is not always sharp. Applied AI research develops innovative solutions to the world's most complicated problems, such as predicting earthquakes or enabling better health outcomes through lower-cost, intelligent diagnoses that aid healthcare workers.[49]

There is a greater role for MAIRI in research facilitation and coordination beyond simply conducting basic and applied research. Basic research often lays the foundation for applied research, but the process does not always have to be linear.[50] Historically, some highly impactful research institutions such as Bell Labs have blended investment in both basic and applied research, and where AI is concerned, MAIRI's research directive should balance the need for both types of research to achieve the highest levels of progress and innovation in AI.[51]

AI governance requires understanding the AI in the sociotechnical context in which it is deployed, such

as the technology's interactions with laws, regulatory frameworks, procurement standards, audits, privacy, and broader issues of social and political ethics. Governments, companies, and individuals can use AI to potentially improve social and economic outcomes, but also to surveil, censor, and otherwise contribute to the oppression of individuals and populations.[52] MAIRI would have a unique opportunity to advance research and norms, drawing on the social sciences and humanities, to boost rights-respecting, democracy affirming AI application development, use, and governance. By hosting a permanent on-site lab and staff, MAIRI can lean on its unique nexus in the global research community to produce publications and inclusively set directions on international norms and governance guidelines for the use of AI with like-minded countries.

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FACILITATION FUNCTION

MAIRI should also have a facilitation role that allows this multilateral institution to be a unified platform that brings together researchers, policymakers, civil society, and stakeholders to ensure that the broader impacts of AI research are considered and well managed. The physical MAIRI facilities would allow it to host outside researchers for short-term residence programs, seminars, workshops, and conferences.[53] Such a structure would emulate the model of the Banff International Research Station (BIRS), described in Chapter 3, to grow AI talent and spur organic relationship-building that generates more research partnerships. Short-term visiting programs, for example, could promote the overall number of researchers who can be engaged and encourage more researchers to engage, especially those who could not afford to leave their organizations or be "on loan" by their organization for prolonged periods of time. More forms of interaction, like conferences, would likewise expand the opportunities for researchers to participate beyond (even short-term) residencies. Such venues have a major positive impact on the visibility, training, and networking of researchers, especially early career ones.[54]

If the U.S. government, industry, and civil society are to promote the development of AI that aligns with democratic values, both domestically and internationally, consensus policies, norms, and regulatory regimes that support and enhance such values with like-minded nations must first be established.[55] The conferences, workshops, and summits hosted at MAIRI would provide a mechanism for like-minded nations to advance democratic norms and values to guide AI R&D, and they would conversely provide other countries' participants with insights into how the other members are thinking about and working on similar challenges. MAIRI could then give a unified voice to these nations, setting international norms on the application of AI in governance that foster international human values.[56] This ability to develop international norms around AI would be one of the most important and unique contributions of MAIRI in the global AI R&D field.

A PHYSICAL LOCATION AT AN ESTABLISHED ACADEMIC INSTITUTION

To realize both functions of MAIRI, the institute must have a physical center where an infrastructure with on-site laboratory and meeting facilities would be established. Pooling research resources, fostering collaborative research relationships, facilitating multidisciplinary problem-solving and organic information-sharing, and conducting workforce development programs that invest in an AI workforce all benefit from a physical center of

gravity. In-person communication and spontaneous interactions are essential for individuals to form new collaborative relationships with those outside of their existing networks. We recognize that MAIRI should also have a virtual presence to enable remote collaboration on research projects, particularly given the tectonic shifts caused by the pandemic in terms of how we work and collaborate, and it could also foster partnerships with other AI centers across the United States to expand the broader impact and collective reach of all participating organizations. However, in-person communication and spontaneous interactions are essential for forming new collaborative relationships and to facilitate the transfer of knowledge, a higher quality work product, and innovation.[57]

As technical AI research requires powerful hardware to support compute and data resources used to train AI models, a physical location would also allow MAIRI to build shared, secure compute infrastructure to support its research over the long term. In the short term, researchers could rely on existing commercial cloud and scaling up cloud credit programs for AI research, but a physical infrastructure can help offset the high cost of commercial cloud services and ensure that research is completed on trusted infrastructure with sufficient security safeguards.[58]

MAIRI's physical center should be hosted in an established academic institution (i.e., a research university) in the United States for numerous efficiency advantages. Adequately leveraging existing infrastructure will be essential because establishing an operation with the size and scope of MAIRI could take years if the facilities and infrastructure had to be built from the ground up (not to mention acquiring administrative and other resources). Therefore, to quickly achieve operability once MAIRI has been authorized and funded, it is imperative to have a hosting institution with sufficient capacity and experience in multidisciplinary academic research administer MAIRI.

By funding the initial startup costs, the U.S. government can work with the hosting institution to move expeditiously to establish MAIRI and leverage the existing academic resources, namely the infrastructure, talent, and multidisciplinary approach to AI research across STEM, social science, and the humanities, that already demonstrate a commitment to democratic values and research security. Such a partnership will help support not only the organization's daily work, but also the longer-term goal-setting of the institution, ensuring researchers are striking appropriate balances between basic, applied AI R&D and research AI governance—and guiding them toward those ends. Moreover, partnerships with additional institutions in the United States, such as National Science Foundation (NSF)'s National AI Research Institutes (NAIRIs), would expand researchers' access to MAIRI resources and advance those institutions' missions.

The federal government has a strong history of productive collaboration with research universities to advance scientific research, including various DOE-led national laboratories—such as Lawrence Berkeley National Laboratory at the University of California, Berkeley, Oak Ridge National Laboratory at the University of Tennessee, and SLAC National Accelerator Laboratory at Stanford University. This partnership through MAIRI can provide a framework for public-academic collaboration that drives innovation forward through an international AI R&D ecosystem.

Chapter 3: Institutional Design

Three considerations are key to the institutional design of MAIRI: 1) the time required to establish the institute and achieve operability; 2) the ability of the U.S. government to sustain funding; and 3) the procurement of international support and funding. The main goal of MAIRI is to facilitate international research collaboration on AI among like-minded countries. An institute established in a timely manner with support from both the U.S. and foreign governments is required to achieve that goal.

We draw on an analysis of three existing forms of U.S.-supported research institutions and recommend the use of a cooperative research center and an FFRDC as possible institutional forms of MAIRI. The creation of a cooperative agreement-based research institute, with the National Science Foundation (NSF) as the primary anchor, is the most flexible option to secure the initial startup funding from the U.S. government as well as financial and in-kind support from foreign governments. In the long term, the U.S. government could explore adopting a mature and established MAIRI with developed functions, goals, and agendas as an FFRDC. We believe this path could better support large-scale AI research with stable, long-term funding that AI research needs.

While we have strived to conduct comprehensive research to inform this proposal, it is important to note that there is a dearth of detailed information about these models, including systematic and quantitative examinations of their research outcomes and successes. Furthermore, some of the examples, like the Quantum Leap Challenge Institutes and National Artificial Intelligence Research Institutes (NAIRIs), were recently established, limiting our ability to conduct a cost-benefit analysis based on retrospective examinations. We have therefore filled in the gaps by relying on specific information provided about example institutions, including descriptions of the institutes, government solicitations for establishing the institutes, budget requests, annual reports, and secondary sources detailing their goals.[59]

COOPERATIVE RESEARCH CENTERS

The U.S. government has sought to spur interdisciplinary research requiring "the advantages of scope, scale, duration, equipment, facilities, and students" by establishing research centers that foster collaboration between universities, government, industry, and nonprofit research entities.[60] The NSF has called these research centers "the principal means" by which NSF fosters complex, multisectoral research collaboration.[61] With competitive merit awards, NSF provides institutions of higher education or nonprofit, non-academic organizations (e.g., research labs, observatories) funding to establish these institutes.[62] The institutes are intended to "create national hubs" for multisectoral and fundamental R&D, invest in necessary infrastructure to support long-term research, and train the "next generation" of talent.[63]

NSF often supports the institutes through cooperative agreements. As opposed to grants, cooperative agreements are used when substantial involvement by NSF is expected[64] and are intended to transfer the knowledge and experience of private entities toward a public purpose that is of interest to the federal government.[65] Although NSF does not own the research facilities, and the institutes enjoy very high flexibility in their hiring, NSF is responsible for general oversight and monitoring of the institute to ensure the institute is meeting the performance requirements and responsibilities detailed in the cooperative agreement.[66] Annual reviews emphasize "the quality of research, education, broadening participation, and knowledge transfer activities."[67]

For example, NSF uses cooperative agreements to fund the National AI Research Institute (NAIRI) program, which aims to maintain and grow U.S. leadership and competitiveness in AI by supporting multidisciplinary

advances on critical challenges in both basic and applied research, as well as supporting the next generation of AI talent.[68] The NSF rewards helped establish 18 NAIRIs across 40 states and the District of Columbia in the United States in 2020 and 2021, each funded up to $4 million per year for up to five years, with the possibility of a competitive renewal in the fifth year for another five years.[69] This program is a joint government effort between the NSF and more than 10 other federal agencies, including the U.S. Department of Agriculture (USDA), the National Institute of Standards and Technology (NIST), and the Department of Defense (DOD), that provide partial or full funding to select institutes.[70]

NSF also facilitates international research and development through grant-based agreements. For example, NSF awards grants to the Banff International Research Station (BIRS), an independent mathematics research institute whose creation was led by research institutes and mathematics centers of excellence from the United States and Canada.[71] Today, BIRS is funded by NSF and government agencies from Canada and Mexico. The center aims to "bring together people from a wide range of mathematical, scientific and industry backgrounds and to create a forum for the exchange of knowledge and methods between these specialists."[72] BIRS developed a range of professional development programs, including workshops, focused research groups, research residency, and summer training camps to facilitate collaboration among researchers in North America and to provide a space for them to concentrate on their research.[73] NSF awards standard grants to support symposiums and workshops hosted at BIRS, as well as U.S. researchers' travel to and participation in the programming.[74]

Benefits and Limitations of Cooperative Research Centers

NSF cooperative agreements provide institutes a great degree of flexibility. Although NSF solicits calls for research centers founded around certain themes, the institutes have a great degree of discretion in deciding their specific research projects. Furthermore, as a central impetus for the research centers is fostering multisectoral collaboration and serving as "nexus points for academic, government, and industry interaction," the ability of the research center to promote linkages between various partners is a key criterion by which NSF chooses award recipients.[75] Institutes are also able to collaborate across agencies.

For example, the NAIRIs capitalize on fulfilling their mandate to advance both fundamental and use-inspired research by capitalizing on flexibility in their research agenda and partnering with the best teams regardless of sector. Of the 18 current NAIRIs, 10 are jointly funded by NSF and another government department, including the Departments of Agriculture, Homeland Security, Defense, Education, and Commerce.[76] External partners can also support research at NAIRIs: For the second NAIRI solicitation, NSF announced that Accenture, Amazon, Google, and Intel contributed more than $160 million.[77] Choosing even one NAIRI is illustrative of the breadth of their collaboration: The NSF AI Institute for Learning-Enabled Optimization at Scale (TILOS), led by the University of California–San Diego, has five additional universities as principal organizations and 23 nonprofit, industry, and research collaborators from California, Texas, Washington, New Hampshire, Pennsylvania, North Carolina, and Massachusetts.[78] Finally, NSF cooperative agreements allow foreign organizations to collaborate with these initiatives by providing research staff to work on specific projects and participate in workshops.[79]

These agreements also tend to require less startup funding. This is due in part to the comparatively simpler procurement process than the Federal Acquisition Regulations (FAR) that FFRDCs must follow, posing a far smaller administrative burden. As the Banff International Research Station exemplifies, grant awards can be quite attractive to international partners seeking to get involved. While the scale of NSF grant-based cooperative agreements makes them easier to establish and administer, the smaller-scale funding can limit the scope and impact of such efforts. For example, the NAIRIs are each awarded up to $4 million annually[80] while BIRS received $10-$12 million over a five-year period from the U.S., Canadian, and Mexican governments combined.[81]

Finally, the research undertaken is often unclassified.[82] This often stems from the fact that NSF, and its funded research centers, have historically had more experience

conducting fundamental and basic applied research, rather than developing operational technology.[83] We believe this poses both drawbacks and benefits to the model. On the one hand, this may limit the ability of the United States and its allies and partners to work together on certain research questions. On the other hand, a lack of classified information at the center may operate as a net positive. In the absence of sensitive and classified research,[84] and the personnel restrictions that often entail, the center will be more open to international researchers and other individuals who may not have official U.S. government security clearances but have completed other risk-based review and approval processes, like enhanced disclosures and other requirements developed through the implementation guidance for National Security Presidential Memorandum (NSPM)-33, that ensure research integrity and security.[85] The research center will therefore be able to capitalize on the best AI talent from countries participating in MAIRI, with any appropriate academic or professional background, subject to the research integrity principles the participating governments commit to through the initial MAIRI agreement (see Chapter 4). Access to broad talent supports MAIRI's mission of conducting multidisciplinary AI research.

We have focused here on research centers primarily funded and managed by the NSF, given the nature of the research we believe MAIRI should undertake and NSF's extensive use of research centers and institutes as a vehicle to support research and innovation in science, engineering, and technology. That said, we note that entities across the federal government provide funding and support research centers to address a variety of challenges. For example, the Department of Energy recently announced it will award $420 million to support clean energy research at their Energy Frontier Research Centers. In 2021, NIST awarded $2 million to support their existing Manufacturing Extension Partnership Centers.[86] This broad experience across the federal government is an advantage of this model: Departments and agencies can leverage their familiarity with such programs and provide additional support to MAIRI. Indeed, we think it is necessary given the multisectoral reach of AI that the expertise and resources from across the entire government research apparatus support MAIRI.

FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTER

FFRDCs are private research institutions that work closely with the U.S. government to conduct research for the public interest.[87] Starting in the 1940s, the U.S. government sought to mobilize scientific and engineering talent to support the U.S. war effort by addressing national security challenges and developing related technologies.[88] To overcome the lack of flexibility in the government and challenges it faced in attracting and retaining talent, U.S. departments began to contract with outside research institutions to enlist expertise on important R&D challenges. For example, the DOD established the Lincoln Laboratory to develop radar as well as Oak Ridge National Laboratory (ORNL) to develop nuclear reactors.[89] FFRDCs have expanded research focus to include not only national security challenges, but also research areas such as cancer, astronomy, cybersecurity, and energy.[90] As academic or not-for-profit institutions, FFRDCs are often viewed as central to government research, technology development, and technology acquisition.[91] Today 12 federal agencies sponsor or co-sponsor 42 FFRDCs and in fiscal year 2020 alone contributed $15.4 billion to R&D performed at FFRDCs, representing over 10% of the total U.S. government's R&D expenditures.[92]

Fundamentally, FFRDCs represent a long-term strategic partnership with the U.S. government.[93] They may take one of three forms: a research and development laboratory, a study and analysis center, or a system engineering and integration center.[94] The federal government owns the FFRDC but contracts with a university, consortium of universities, not-for-profit or nonprofit organizations, or an industrial firm to operate and manage the FFRDC.[95] Although multiple federal agencies may sponsor the FFRDC or fund specific research at the FFRDC, a primary sponsoring agency establishes the strategic direction of the research as well as monitors, funds, and oversees the work performed at the FFRDC.[96] The FAR governs the establishment, use, and termination of FFRDCs and mandates that FFRDCs provide "some special long-term research and development needs which cannot be met as effectively by existing in-house

or contractor resources."[97] In exchange for providing their federal sponsoring agency with private sector resources to support the agency's mission, the FFRDC receives access to government and supplier data, employees, equipment, and property beyond the normal contractual relationship for which the government enters.[98]

For FFRDCs, collaboration with domestic and international partners often occurs through funding specific projects, formal R&D agreements, technology licensing from the FFRDC, or the commercialization of R&D. The ability of an FFRDC to work with foreign government entities is governed by the rules and regulations of the sponsoring agency. For example, the Department of Energy (DOE) awarded a contract to Stanford University to manage and operate the SLAC National Accelerator Laboratory, an FFRDC administered by Stanford University, received $1.73 billion in funding over a five-year period.[99] DOE allows SLAC to maintain a broad program of collaboration with foreign and domestic private companies, universities, nonprofits, other Federal government agencies, and state and local institutions. For international collaboration specifically, foreign entities can engage with SLAC through participation in visits, assignments, and staff exchanges, in areas of research interest to SLAC and DOE.[100]

Benefits and Limitations of FFRDCS

There are several benefits to establishing the MAIRI via the FFRDC model. First, FFRDCs can support large-scale research with stable, long-term funding that AI technical research needs. Applied AI research, for example, would require sustainable and long-term funding and FFRDCs can provide such a capacity and address the needs of government agencies over a comparatively long time, typically in increments of five years.[101] Of the $150.9 billion spent by the federal government on R&D in 2020, $15.4 billion (10.2 percent) was spent on R&D performed by FFRDCs.[102] Moreover, FFRDCs have been instrumental in scientific advances and making innovations more widely accessible. Examples of FFRDC contributions include: the Jet Propulsion Laboratory's designing, managing, and monitoring of "robot geologists" on Mars, supporting the expansion of GPS into civilian life, and the development of the first programmable nanoprocessor.[103]

In exchange for their special relationship with their federal agency sponsors, FFRDCs come with a few limitations as a model for MAIRI—specifically, their inflexibility to operate outside of their directive.[104] First, while the FFRDCs are designed to help meet special R&D needs that existing in-house or contractors cannot easily address, such a benefit could be a challenge in the context of MAIRI. For example, as AI research often demands large-scale training data, FFRDCs provide access to sensitive and proprietary data of government agencies—beyond the access common to the normal contractual relationship,[105] but MAIRI's foreign researchers may not be able to access such data resources. One way to overcome this challenge would require providing tiered data access for different groups of researchers. Moreover, the Federal Acquisition Regulation (FAR) prohibits FFRDCs to respond to the federal government's request for proposals and to compete with any non-FFRDC concern in response to a federal agency. This solidifies FFRDCs as quasi-governmental institutions, whose primary client will always be the U.S. government. This distinction can raise concerns about the independence and objectivity of FFRDC research. Finally, because FFRDCs are intentionally designed to solve problems with long time horizons, they can lack agility and flexibility to conduct short-term, task-oriented research, which the rapidly changing AI research landscape may require.

BINATIONAL RESEARCH ORGANIZATIONS

Binational research organizations provide a third model. Founded through international agreements between the United States and a partner foreign government, these autonomous, not-for-profit organizations seek to catalyze long-term scientific partnerships between the two countries; promote academic research; facilitate public-private partnerships across government, academia, and industry; and foster mutual trust and understanding through increased information exchange and interactions between scientists.[106] The primary vehicle for achieving these goals is providing grants—on a competitive, peer-reviewed basis—to support research and development undertaken by teams of scientists from both the U.S. and the partner country. These partnerships must

demonstrate both outstanding scientific merit as well as strong, clear collaboration between the two countries.[107] These binational organizations also support the creation of bilateral scientific networks through the provision of workshops and professional training programs and supporting the creation of virtual networks by linking and strengthening existing infrastructure.[108]

These binational organizations are jointly funded and operated by the two countries. After the two countries establish and equally contribute to an endowment fund, the binational organization primarily funds its programs and administration costs through the annual interest derived from the endowment.[109] The governments can also provide direct support for grant programs focused on specific projects.[110] The U.S.-Israel Binational Industrial Research and Development Foundation (BIRD) further receives annual income from repayment on conditional grants it provides to companies that commercialize technology developed through the grant.[111] A board of governors, with equal membership between the two countries, determines the financial and policy issues for the binational. Although each binational has a slightly different governance model, generally there is a co-chair from both countries or the chair and vice chair of the board rotate between the two countries.[112]

To date, the U.S. government supports four binational research organizations. Three binationals were created with Israel in the 1970s. The U.S.-Israel Binational Science Foundation (BSF) promotes collaborative research between the U.S. and Israel, including through the collaboration with NSF on awarding competitive, peer-reviewed grants.[113] The U.S.-Israel Binational Agricultural Research and Development (BARD) Foundation supports jointly conducted agricultural research.[114] BIRD seeks to foster mutually beneficial collaboration between U.S. and Israeli startups by providing conditional grants to support technology development and eventual commercialization.[115] Since BIRD's establishment, the U.S. and Israeli government have collaborated to form a BIRD Energy Executive Committee, a U.S.-Israeli Center of Excellence in Energy, Engineering and Water Technology, as well as the Binational Industrial Research and Development Homeland Security Program (BIRD HLS).[116]

Most recently, in the 2022 National Defense Authorization Act (NDAA), Congress appropriated $6 million to the Department of Defense to support grant programs at BSF and BIRD for cybersecurity research and development and the commercialization of cybersecurity technology.[117] Finally, the U.S. and India collaborated in 2000 to create the Indo-U.S. Science and Technology Forum (IUSSTF), which is the secretariat for the U.S.-India Science and Technology Endowment Fund created in 2009.[118]

Benefits and Limitations of Binational Research Organizations

The binationals have also supported an impressive number of joint projects. Since 1973, BSF has supported over 13,000 grantees conducting foundational research on computational geometry, cancer diagnostics, stem cell therapy, Alzheimer's disease, and Nobel Prize-winning research on critical cell functions.[119] With a net investment close to $190 million between 2002 and 2018, BIRD has generated more than $750 million in sales, created almost 10,000 jobs, and raised $5,500 million in funds.[120] BARD has awarded more than $310 million to over 1,300 projects since 1979, supported over 250 postdoctoral fellows, and hosted more than 50 scientific workshops.[121] Further, endowment-funded foundations are designed to operate from the interest generated by the original endowment, therefore becoming self-sufficient without continued government funding. Contributions to endowments also require less administration, lowering the government's overhead costs—as evidenced by the BSF allocating 95% of its annual budget to research grants.[122] This may be appealing to foreign government members and can facilitate international contributions to the fund.

There are, however, limits to this endowment-driven binational model. The low administrative costs suggest that the primary function is to support on-site research. As we discuss in Chapter 4, participating governments should provide funding for administrative and overhead costs of MAIRI as well as initial startup costs for project-based research grants. Additionally, operational and R&D costs can often outpace the rate of investment income produced by the endowment. The BSF identifies its greatest current challenge as meeting the "ever-rising

costs of innovative research . . . with an endowment that has not been increased since 1984."[123] This illustrates how endowment-funded foundations may need additional, continuous financial support from U.S. sponsoring agencies.

FUNDING MODEL ANALYSIS FOR MAIRI

The establishment of MAIRI requires the balancing of several objectives, some of which can compete with each other. To further facilitate Congress' enactment of the NSCAI report recommendations, the following section evaluates each funding structure against four criteria critical to the successful establishment of MAIRI. These criteria are:

1. The ability of the U.S. government to sustain funding;
2. The time required to establish the institute and achieve operability;
3. The procurement of international support and funding.

U.S. Funding

Cooperative research centers are the most optimal model to administer among the three discussed. This is in large part because they are not subject to FAR that FFRDCs must adhere to. The government can much more directly control the scope of the program and can provide as much or as little oversight as required. With additional regulatory requirements and typically large price tags, FFRDCs face heavy administrative hurdles, in part because FFRDCs are quite effective at maintaining funding. The large up-front investments are a political liability, but once established, FFRDCs have a long history of sustained success in research and development. Similar to the trade-off to FFRDCs, cooperative agreements are more lightly regulated, at least in part, because the associated funds are typically much smaller in size than FFRDCs. Research endowment funds to support binational research organizations may be the easiest funding mechanism to administer, but they come with additional risks. In an ideal scenario, endowment contributions lead to R&D institutes that are self-sustaining and produce consistent, beneficial research. The reality is that sustainability is dependent upon success, returns on investments, and proper program administration. The government is only able to influence administration through conditions placed on future financial contributions.

The cooperative research center model allows for R&D efforts to be established more quickly because they place less burden on both the U.S. government and the grantee.

For MAIRI, significant funding will be required to achieve its mission. However, this funding can be iterative. Personnel and additional computing capabilities can be woven into the institute over time. For example, as described in Chapter 2, MAIRI may establish a compute infrastructure to support the needs of AI research, but researchers can rely on commercial cloud services in the short term as funding builds that would allow the construction of a physical compute facility. Therefore, the benefits of an FFRDC are likely outweighed by the administrative burdens for MAIRI, and the agility of cooperative agreements and research endowments are likely more appropriate to MAIRI's use case—at least in the short term as the institute gets established in due course.

Time to Establish

Time is of the essence when it comes to advancing AI research and establishing norms in AI. The cooperative research center model allows for R&D efforts to be established more quickly because they place less burden on both the U.S. government and the grantee. Cooperative agreements can stipulate that certain actions should be completed within a given timeframe, facilitating timely establishment. Due to the regulated procurement

process, FFRDCs take time to be established. Even while they are administered by existing institutions, FFRDCs require the administering institution to create tangentially related organizations or subsidiaries. This is necessary to ensure that administering institutions meet all anti-competitive and conflict of interest requirements outlined in FAR. When the government contributes funding to a research endowment fund, discretion is afforded to the recipient institution. Therefore, the government concedes any influence over the timeliness of R&D efforts as a result of the funding.

The NSCAI report identifies timeliness as one of the most important factors for Congress to evaluate when considering the creation of MAIRI. Therefore, this consideration weighs heavily in the overall recommendation. An NSF cooperative agreement in collaboration with an established academic institution would allow for Congress to more quickly establish MAIRI, while still retaining control of the timeline. For example, most of the first 18 NAIRIs announced in 2020 and 2021 by NSF are already in operation.[124] Establishing MAIRI as an FFRDC would likely take the longest of the three funding mechanisms given the administrative hurdles inherent in the FFRDC process. An endowment contribution could possibly provide the fastest route but, as discussed earlier, this funding mechanism does not allow for sufficient government oversight and therefore has little control of the project timeline.

Procuring International Support and Funding

Each organizational model is amenable to funding, either monetarily or in-kind contributions, from foreign governments. We discuss the responsibilities and funding details of MAIRI participants more in Chapter 4. It is important that Congress consider the administrative challenges that each institutional design places on international partners as well as on the U.S. government. As a multilateral institution, significant consideration should be given to ensuring the institute can reliably retain funding and support from our partners as well as the U.S. sponsoring agency.

An FFRDC's ability to accept support from foreign entities is governed by the rules and regulations of the sponsoring agency. For example, DOE allows laboratories to collaborate through memorandums of understanding, Strategic Partnership Projects (SPPs), Cooperative Research and Development Agreements (CRADAs), Agreements for Commercializing Technology (ACTs), and other similar legally binding contractual instruments.[125] SPPs enable non-DOE entities and personnel to fund and conduct work at the laboratory, as long as the work is related to the laboratory's mission and does not raise competition or resource burden concerns.[126] CRADAs enable laboratories to accept in-kind contributions from foreign governmental organizations, such as visits, assignments, and staff exchanges, to conduct research work and share generated intellectual property.[127] As previously mentioned, the FFRDC model raises concerns over rules against sharing data of affiliated federal agencies with foreign researchers. Any federal data access would need to be stratified based on the sensitivities of the data in question, data owner, and researchers who will have access. NSF cooperative agreements, by contrast, would allow more flexibility in granting the U.S. significant involvement while still allowing for financial and in-kind contributions to the institute. Again, endowment funds offer the fewest barriers to international involvement.

Chapter 4: Governance Structure

MAIRI must have a coherent and effective governance structure to execute our recommended functions of operating an on-site laboratory, facilitating research collaboration, and promoting the next generation of AI talent through workforce development and training programs. The U.S. government and foreign government members will determine the ultimate contours of MAIRI's leadership, operating model, and processes and policies governing membership expansion, funding and budget decision-making, research collaboration criteria and priorities, intellectual property, data sharing, and research security.

We are confident that the U.S. government—through the OSTP, NSF's leadership as the anchor partner, and in coordination with the Department of State and other federal entities—will successfully establish MAIRI in the United States and work with key allies and partners to support its operation. The successes of binational research organizations, as well as other multilateral efforts like GPAI and the Open Government Partnership,[128] provide ample evidence for this assertion. However, in anticipation of logistical concerns arising from our recommendations about MAIRI's theory of impact, model, and functions, this chapter provides an initial sketch of some of MAIRI's key governance elements. Our proposal draws upon the governance mechanisms we identified across research centers established through NSF cooperative agreements, FFRDCs, and binational research centers, as well as the NSCAI's recommendation.

LEADERSHIP AND MANAGEMENT

MAIRI should comprise four main parties: the lead U.S. sponsoring agency, the academic research institution in the United States that will host MAIRI, the foreign government agencies, and additional research partners that may support MAIRI on a consistent basis or collaborate on an ad hoc, project basis.

The lead U.S. sponsoring agency and the hosting institution are the two most essential parties to establishing MAIRI. The U.S. sponsoring agency is responsible for anchoring the United States' role in MAIRI and acting as the primary contributor of U.S. funding. The sponsoring agency will also work with the White House OSTP and the Department of State—the former for high-level strategic guidance and the latter for expertise on negotiating agreements—to approve and manage foreign government membership to MAIRI. As we note in Chapter 3, we recommend NSF as the lead sponsoring agency given NSF's experience establishing cooperative agreements for centers like the NAIRIs, funding multilateral centers like BIRS, supporting joint research calls through the binational research centers, and existing international research agreements with allies and partners.

The daily operation of MAIRI will be managed by a hosting academic institution that will oversee day-to-day MAIRI operations—including the personnel, facilities, finances, and operations that underpin the organization itself—and research, while ensuring academic independence and integrity. To ensure proper oversight of this process and the relevant resources, facilities, and personnel, the hosting institution will provide regular updates to the sponsoring agency. As the administrator of MAIRI, the hosting institution is responsible for maintaining a permanent research and administrative staff, including recruitment and retention of exceptional talent. The hosting institution is also responsible for staff operations with foreign government members of MAIRI, including visits, staff exchanges, residencies, and other programs. MAIRI facilities will also be maintained by the hosting institution, ensuring sufficient capacities are available to fulfill the organization's mission.

Once MAIRI has been funded and established within the United States, the U.S. government—led by NSF and the Department of State with advice provided by the OSTP and other relevant federal agencies—should determine the initial foreign partners and their participating

government agencies (see our discussion below on founding MAIRI members). Equitable participation from MAIRI members is necessary to maintain international research collaboration, and foreign partners will play a key role in MAIRI's operation and successes. Foreign members' roles will be multifold. First, representatives from MAIRI members will have representation on a governance body that sets the organization's strategic vision, chooses broad research priority areas, decides on whether to expand MAIRI's membership, considers research partnerships with non-members and nongovernment entities, and generally supports the hosting institution. Since the United States would fund the initial establishment of MAIRI, we recommend the U.S. select the chair, but MAIRI members may decide to have a rotating chair. We also recommend the U.S. and other members' governments who participate in MAIRI form a government advisory council that provides advice and guidance. While the governance body will have a role in setting strategic direction, it will not be involved in reviewing or approving specific research projects or results to ensure research integrity and academic independence.

Second, members, defined below, should gain access to MAIRI's research facilities, funded research projects, residence programs and fellowships, the workforce development programs, and other events to be able to directly benefit from MAIRI research. These benefits would differ greatly from those of membership in other global AI organizations, such as the Global Partnership on AI (GPAI), because GPAI and other groups do not actually conduct AI research.[129] As discussed in the "Founding Agreement" section below, researchers involved in MAIRI would still need to complete enhanced disclosures and some additional background screening, likely dependent on their specific involvement and the project in question, to participate. Third, the foreign governments will support the negotiation of the founding agreement (discussed below). Fourth, the government agencies will provide financial support—minimally, through capital funding and grants—to MAIRI's operations, research efforts, and the involvement of their researchers in the projects and programming hosted at MAIRI. While the sponsoring agency and hosting institution are required to initially stand up MAIRI, support from these foreign governments will truly empower MAIRI to be a multilateral research institute.

Finally, MAIRI would require a broader category of partners including non-sponsoring U.S. government agencies, academic institutions, civil society organizations, and industry. MAIRI's ability to engage with additional partners outside of the sponsoring agency and foreign government members is critical for MAIRI to adapt to changing research needs and political contexts, for MAIRI to leverage the best research teams for specific projects, and to ensure broad and diverse participation from across stakeholder groups. For example, MAIRI should be able to support and accept project funding from other U.S. government agencies that would benefit from the application of research from MAIRI. The National Institute of Standards and Technology (NIST) may consider commissioning research via MAIRI around issues such as AI benchmarking or the discriminatory impacts of AI systems. The Department of Energy may leverage its immense technical capabilities and experience with applied research to support efforts involving high-powered computing and quantum computing, or research focused on applications to the energy sector or climate change. The Department of State should contribute resources to facilitate MAIRI's establishment and provide foreign policy or diplomacy expertise. Technical expertise and collaboration can be provided by any of the additional, numerous research agencies.

FOUNDING MAIRI MEMBERS

The success of MAIRI will rely heavily on the ability of the sponsoring agency and hosting institution to secure support from like-minded foreign governments who will support and promote the organization's mission. To become a member of MAIRI, a foreign government must commit to a founding agreement and financial support of MAIRI, which we discuss below. For a consensus on the founding agreement, for the legal and regulatory guidelines to be possible, it is important that nations with shared interests and values constitute MAIRI's membership. Member governments' financial contributions to MAIRI will likely be assessed on a sliding scale to ensure contributions—both monetary and in-

kind (e.g., hardware, rich quality datasets, staff)—are proportional to each nation's resources. A country's ability to contribute expertise and talent to the program should therefore be considered when evaluating membership.

Although the U.S. government, led by NSF in coordination with the White House OSTP and Department of State, will determine the members, we recommend the United States consider the practical and political implications of a potentially slower negotiation process if too many countries are initially consulted. We, therefore, recommend leveraging existing collaborative relationships with key aligned countries to establish MAIRI before including additional members after the founding agreement is in place and MAIRI has officially launched. Although not a recommendation, we note that the United States has existing collaborative relationships with Australia, Canada, France, Germany, Italy, Japan, New Zealand, South Korea, and the United Kingdom that could be readily leveraged to develop MAIRI.[130] Other existing coalitions with member nations that would likely be suitable to MAIRI's mission include the Export Controls and Human Rights Initiative,[131] a recently announced effort to circumvent censorship with support of the Open Technology Fund.[132]

Finally, we note the importance of choosing partners based on their alignment with and commitment to MAIRI instead of their ability to contribute to specific projects. Focusing on specific research projects would likely lead the United States to choose initial partners based on their ability to support those projects. However, we believe such an approach will undermine MAIRI's launch as it may lead the United States to overlook partnerships with countries that may lack expertise in a specific AI use case but are closely aligned with MAIRI's vision and willing to commit to its establishment and long-term success.

FOUNDING AGREEMENT AND FINANCIAL CONTRIBUTIONS

Founding members must negotiate and commit to following a jointly determined founding agreement for MAIRI. We suggest the agreement include: MAIRI's general operating model, criteria for membership, budget and funding guidelines, research security practices, and policies and processes for setting the broad research agenda and for an independent, expert, and academic committee which will agree on specific projects. The member nations' agreement should also include research integrity principles and communal guidelines that set rules around conflicts of law and regulatory challenges such as handling intellectual property, privacy, and data sharing. The research integrity principles will detail the guideposts and values that will guide MAIRI, including transparency, privacy, open data and data sharing with sufficient cybersecurity practices, merit-based competition reviews of proposals, research integrity, equity, and other like-minded values. Research security will be informed by the aforementioned implementation guidance for the National Security Presidential Memorandum (NSPM)-33 and should include training on security risks and agreements to use trusted, pre-approved infrastructure. By negotiating this agreement up-front, we believe MAIRI will be well positioned to address challenges that have to date prevented certain collaborations by aligning participants' expectations and enabling each research project to more quickly launch because the default terms guiding the project have already been established.

The research integrity principles will detail the guideposts and values that will guide MAIRI, including transparency, privacy, open data and data sharing with sufficient cybersecurity practices, merit-based competition reviews of proposals, research integrity, equity, and other like-minded values.

Financial contributions from the U.S. sponsoring agency and foreign government members should be allocated to an operating fund that will cover the administrative and overhead costs of operating MAIRI. Project-based research funds, initially supplied by limited contributions from the operating fund, should secure ongoing support from project stakeholders including government members and any nongovernmental organizations, such as universities, industry, foundations, or nonprofits. This research project funding model follows existing U.S. government research and development practices, such as with NSF's AccelNet program, to support MAIRI.[133] Although each country has different processes and regulations around its contributions to multilateral efforts, we expect that foreign governments will provide funds through grant awards to MAIRI, grants to their own researchers and research teams to support their travel and participation in MAIRI programming, and grants to support specific research projects that require additional funds. Finally, as we believe an endowment fund can provide longer-term stability, as the binational research centers benefit from the interest income from the endowment, the founding members should also seriously consider establishing and contributing to an endowment fund.

RESEARCH AGENDA

As we describe throughout this white paper, MAIRI should foster sustainable, meaningful AI R&D partnerships between countries dedicated to the same vision of force-multiplying efforts to unleash innovation that benefits humanity, strengthens democracy, and fosters inclusive prosperity. However, MAIRI's research priorities cannot be set until the structure, funding, and participating countries are determined. Choosing initial partners purely on their ability to support specific projects may undermine MAIRI's launch, as country capacity is not a proxy for willingness to establish MAIRI.

The broad research agenda should instead be jointly determined by MAIRI members with the goal of leveraging comparative advantages for AI R&D that is guided by a commitment to demonstrating that AI-enabled technologies and applications—built with a commitment to privacy, integrity, trust, equity, civil liberties, and other democratic values—can benefit our societies. In general, specific research projects should be selected for funding based on a competitive call for proposals, with an independent academic committee selecting those deemed most meritorious.

Given the current international momentum around developing responsible AI, initial projects will likely build on recently announced efforts described in Chapter 1, such as the US-UK prize challenge to develop privacy-enhancing technologies. As a central motivation for MAIRI is to provide a mechanism for the United States with key allies and partners to move away from abstract discussions, we recommend that MAIRI's research priorities allow participants to resolve differences (e.g., data sharing practices, regulatory approaches, AI priorities, political interests) through concrete collaboration that embraces agile, iterative experimentation that informs future efforts to expand the scale of collaboration. Building on MAIRI members' strengths and goals will enable long-term, resilient partnerships.

PARTNERSHIP WITH INDUSTRY, INTERNATIONAL ORGANIZATIONS, AND CIVIL SOCIETY ORGANIZATIONS

MAIRI should also consider partnering with civil society, industry, and international organizations that demonstrate a deep commitment to MAIRI's vision and can provide expertise not accessible through government entities alone.

Collaboration between academia and industry has historically been a hallmark of the knowledge economy to scale, implement, and commercialize basic research. Such a collaboration could incubate new ideas that eventually spin off to become commercialized and benefit many people—consider the recent, powerful example of the production of mRNA COVID-19[134] —as well as improve access to private-sector resources such as talent, data, funding, and facilities. That said, there are risks with industry sponsorship of research, such as the potential for conflicts of interest, research transparency, and research independence. Should MAIRI explore industry partnerships, it will be critical to ensure there

are mechanisms to preserve research independence and integrity for any project.

MAIRI should also seek to support other existing international efforts like the GPAI and the OECD.AI Policy Observatory. GPAI was established in 2020 as an international, multi-stakeholder forum "to foster responsible development of AI grounded in these principles of human rights, inclusion, diversity, innovation and economic growth."[135] With a secretariat hosted at the OECD, GPAI's 25 international partners,[136] including the United States, with co-chairs from France, Japan, and Canada, are supported by two centers of expertise: the Paris-based National Institute for Research in Digital Science and Technology (INRIA) and the International Centre of Expertise in Montreal for the Advancement of Artificial Intelligence (CEIMIA).[137] MAIRI should seek to support GPAI, the OECD's efforts, and other international efforts.

Finally, MAIRI should engage nongovernmental and not-for-profit organizations outside the public and private sectors, such as civil society organizations, that bring important perspectives to discussions in AI governance and important AI use. Such organizations have a history of advocating a human-centered approach on behalf of marginalized populations. Developing AI norms and ensuring the safe deployment of AI technologies must include their participation, many of whom stand to lose the most with the proliferation of unchecked algorithms and data.

Glossary of Acronyms

AI	Artificial intelligence
ACT	Agreement for Commercializing Technology
BARD	U.S-Israel Binational Agricultural Research and Development
BIRD	U.S.-Israel Binational Industrial Research and Development Foundation
BIRD HLS	Binational Industrial Research and Development Homeland Security Program
BIRS	Banff International Research Station
BSF	U.S.-Israel Binational Science Foundation
CEIMIA	International Centre of Expertise in Montreal for the Advancement of Artificial Intelligence
CERN	European Organization for Nuclear Research
CRADA	Cooperative Research and Development Agreement
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
EU	European Union
FAR	Federal Acquisition Regulation
FFRDC	Federally Funded Research and Development Center
G7	Group of Seven
GPAI	Global Partnership on Artificial Intelligence
INRIA	National Institute for Research in Digital Science and Technology
IUSSTF	Indo-U.S. Science and Technology Forum
LIGO	Laser Interferometer Gravitational-Wave Observatory
LSC	Laser Interferometer Gravitational-Wave Observatory Scientific Collaboration
MAIRI	Multilateral Artificial Intelligence Research Institute
NAIRI	National Artificial Intelligence Research Institute
MEP	Manufacturing Extension Partnership
NDAA	National Defense Authorization Act
NIST	National Institute of Standards and Technology
NITRD	Networking & Information Technology Research and Development Program
NSCAI	National Security Commission on AI
NSF	National Science Foundation
NSPM	National Security Presidential Memorandum
OECD	Organisation for Economic Co-operation and Development
OSTP	White House Office of Science and Technology Policy
ORNL	Oak Ridge National Laboratory
QSD/Quad	Quadrilateral Security Dialogue
R&D	Research and Development
SLAC	SLAC National Accelerator Laboratory
SPP	Strategic Partnership Project
TILOS	NSF AI Institute for Learning-Enabled Optimization at Scale
USDA	U.S. Department of Agriculture

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22 C.F.R. 120.10, can be considered "exports" subject to U.S. export controls. However, technology or technical data can be excluded from export controls under the Fundamental Research Exclusion (FRE) if the technology or technical data is a result of fundamental research (basic and applied research in science and engineering) and is intended to be published. However, various U.S. government departments and agencies have their own policies for handling sensitive and classified information. For a more extensive overview of the U.S. information security system for science and technology, see Schoff et al., *A High-Tech Alliance: Challenges and Opportunities for U.S.-Japan Science and Technology Collaboration*, 1-2, 7-9, 11-16. See also Lawrence Berkeley National Laboratory, "Foreign Visitors," https://exportcontrol.lbl.gov/foreign-visitors/; Lawrence Berkeley National Laboratory, "Receipt or Generation of Confidential, Sensitive, or Proprietary Information," https://exportcontrol.lbl.gov/receipt-or-generation-of-confidential-sensitive-or-proprietary-information/; Sandia National Laboratories, "Uncleared Foreign Nationals," https://www.sandia.gov/security/home/foreign-nationals/; U.S. Department of Energy, "DOE O 142.3B, Unclassified Foreign National Access Program," January 15, 2021, https://www.directives.doe.gov/directives-documents/100-series/0142.3-BOrder-b; 22 C.F.R. 120, https://www.ecfr.gov/current/title-22/chapter-I/subchapter-M.

85 The U.S. government issues security clearance for military and civilian personnel; an individual's clearance dictates what type of government information they are authorized to access (e.g., classified, secret, top secret). Generally only U.S. citizens are eligible unless there is a "compelling" circumstance to grant clearance to a non-U.S. citizen. However, National Science Foundation (NSF) does not generally conduct personnel security clearance background checks for its grantees. Instead, NSF has created the Research Security Strategy and Policy Group and enhanced disclosure requirements that serve "as a soft security measure." In January 2022, the White House Office of Science and Technology Policy's (OSTP) National Science and Technology Council (NSTC) Joint Committee on the Research Environment (JCORE) published implementation guidance for U.S. agencies per the January 2021 National Security Presidential Memorandum (NSPM)-33 on United States Government-Supported Research and Development National Security Policy. It focuses on five key areas: disclosure requirements and standardization, digital persistent identifiers, consequences for violation of disclosure requirements, information sharing, and research security programs. See National Science and Technology Council, *Guidance for Implementing National Security Presidential Memorandum 33 (NSPM-33) on National Security Strategy for United States Government-Supported Research and Development*, Subcommittee on Research Security Joint Committee on the Research Environment, January 2022, https://www.whitehouse.gov/wp-content/uploads/2022/01/010422-NSPM-33-Implementation-Guidance.pdf; Executive Office of the President, "Presidential Memorandum on United States Government-Supported Research and Development National Security Policy," January 14, 2021, https://trumpwhitehouse.archives.gov/presidential-actions/presidential-memorandum-united-states-government-supported-research-development-national-security-policy/; Consortium of Social Science Associations, "OSTP Releases Guidance for NSPM-33, Long Awaited Research Security Roadmap," January 11, 2022, https://cossa.org/2022/01/11/ostp-releases-guidance-for-nspm-33-long-awaited-research-security-roadmap/; Schoff et al., *A High-Tech Alliance: Challenges and Opportunities for U.S.-Japan Science and Technology Collaboration*, 15; Michael Christensen, "Security Clearance Process: Answers to Frequently Asked Questions," Congressional Research Service, October 7, 2016, https://sgp.fas.org/crs/secrecy/R43216.pdf; Matthew Kahn, "The Law of Classified Information: A Primer," Lawfare, June 25, 2020, https://www.lawfareblog.com/law-classified-information-primer.

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