

INTERVIEW

“How does this country do big things?”

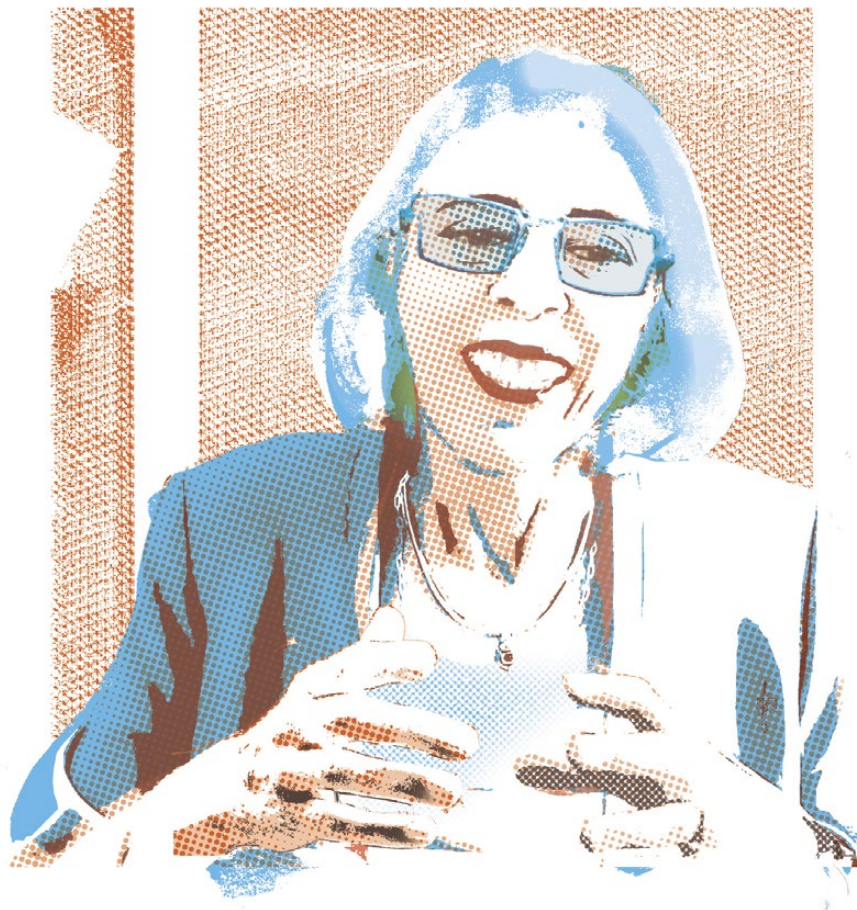


Illustration by Shonagh Rae

Drawing on her four decades in R&D, presidential science and technology advisor Arati Prabhakar talks about how the US innovation ecosystem can help the country and its citizens to flourish.

Engineer and applied physicist Arati Prabhakar is the director of the White House Office of Science and Technology Policy (OSTP) and—as assistant to the president for science and technology—is part of President Biden’s cabinet. A member of the National Academy of Engineering, Prabhakar began her career in 1984 as a congressional fellow during her time at the Office of Technology Assessment. In 1993 she became

director of the National Institute of Standards and Technology, and from 2012 to 2017, she was director of the Defense Advanced Research Projects Agency. For 15 years she was an executive and venture capitalist in Silicon Valley, and she founded the nonprofit Actuate in 2019. In an interview with *Issues* editor-in-chief Lisa Margonelli, Prabhakar discusses the changes in semiconductor policy over the past 40 years, OSTP’s

role in the nation's innovation ecosystem, and why science and technology policy strives to create a future where every child has a path “to flourishing and singing their song.”

In 1984, you came to Washington, DC, as an American Association for the Advancement of Science policy fellow for the congressional Office of Technology Assessment (OTA). What was the focus of science policy for you then?

Prabhakar: That's a great place to start because so much has changed—and some things haven't. The first project I worked on in 1984 was a report on microelectronics R&D. It was just the beginning of the American semiconductor industry realizing that it was going to have global competition from Japan. And, of course, what happened over these last four decades is that semiconductor production globalized, and then got very dangerously concentrated in just one part of the world. For decades, we talked about what the problems with this were for the United States: the national security issues, economic issues, supply chain issues, jobs issues.

After four decades, we finally did something about it. Amazingly, last year, Congress passed the CHIPS and Science Act. It's part of a whole set of things that this administration has accomplished that are really charting a very different course in investing in America.

There was a somewhat laissez-faire idea of letting the ecosystem do the innovation and letting business make decisions. Would you say the United States is now more active?

Prabhakar: Yes. President Biden talks about “Bidenomics,” and his goal of an economy that works from the middle out and the bottom up. Accomplishing this vision requires that we pay attention to these critical industries. Not only because of the jobs in something like semiconductors, but also because of the domino effect that these industries have on supply chains. The pandemic reminded us that when factories in Asia shut down, auto workers in Detroit are affected.

So all of those factors together brought us to a point where a new way of working was necessary. If you think about infrastructure, or semiconductors, or all the clean energy technologies in the Inflation Reduction Act—all of those capabilities are the result of prior R&D. And so on the one hand, we're getting America back on track building things, refreshing our infrastructure, and moving into this clean energy economy. But at the same time, we're also reinvigorating the R&D base because we also know we need to invest for the next generation.

There's a story or cartoon that we tell about the linear model where basic research leads to innovation. Do you have a different metaphor?

Prabhakar: I absolutely agree that that the linear model is too limited to explain how innovation happens. I do think that there are stages of maturity of different research areas or technologies. In 1945, as Vannevar Bush was shaping postwar science policy in the United States, he really emphasized making sure that we had a foundation of basic research. At the time, that was exactly right: the rest of the world was in rubble. And we had always relied primarily on European basic research.

So in 1945, making sure that we built that foundation of basic research was the right thing to do. But that model didn't really focus on how this research would actually turn into commercialization and products and industries.

I think without a deliberate focus on that for many, many decades, we've come to a place where there are gaps in the linear model. Things don't just magically flow from a basic research paper to impact in the world. Today many of the things you're seeing across federal R&D—Biden administration policies, the new legislation, an ARPA for health, and the Technology, Innovation, and Partnerships directorate at the National Science Foundation—these are adjustments that need to be made to make this innovation system effective for our times.

You've been everywhere: at the OTA, the National Institute of Standards and Technology, DARPA, venture capital, and a nonprofit. How have these vantage points informed your sense of the strengths and the weaknesses of the innovation ecosystem in the United States?

Prabhakar: I very much do see it as an ecosystem. And if you step back and you say, how does this country do big things? We've accomplished really big things—winning the Second World War, creating enormous numbers of jobs, lifting people out of poverty, adding years to people's lifespans through advances in health. And we've reshaped geopolitics through work on the national security front.

So we know how to do big things. But every one of those great accomplishments—as much as we love to tell the American hero story about the Lone Ranger who made everything happen—actually these big things happen because our public and private sectors each play their roles and ratchet up together.

Nurturing that ecosystem and making sure that our innovation ecosystem is aimed at the greatest opportunities for this time that we're living in—that is the central work of the Office of Science and Technology Policy and my role as the president's advisor on science and technology.

Would you say OSTP's role within the ecosystem has changed?

Prabhakar: The role for OSTP and for the president's chief advisor on science and technology is always different from one time to the next. Partly because the world changes and science and technology changes. But also because the president changes.

In the Biden administration, we have a president who is deeply anchored in this notion of American possibilities. He frequently talks about how he tells other world leaders about America being the only nation that can be defined in a single word, and that word is possibilities. I think the president very much sees research and development as this engine of possibilities.

That means we actually have to make sure the whole ecosystem is working in a vibrant, really robust way, because it's not just about discovering marvelous new things. Making sure that this investment that we make in federal R&D ultimately changes the lives of Americans—that's the job.

President Biden has described the mission of OSTP as "maximizing the benefits of science and technology to advance health, prosperity, security, environmental quality, and justice for all Americans." Is this a shift in OSTP's priorities?

Prabhakar: National purposes have always been the anchor. Vannevar Bush started *Science, the Endless Frontier* by talking about national purposes: health and national security and jobs. I keep thinking about all those GIs coming back in 1945. And everyone must have been so clear that we had to make sure our economy was cranking so that there were places for all these people to go back into the workforce and to do great things. Which they did.

If you look at the enabling legislation for OSTP, it also enumerates national purposes. And this is why Americans put \$200 billion a year of federal resources into research and development. It is not just to make scientists happy; it's to make sure that we're doing the work that helps create the future.

What I think is different is a recognition that here we are, it's 2023. And there are things on the list of national purposes that didn't get on there until way too late. Climate change wasn't on Vannevar Bush's list. And the work changes even with the things that have always been on the list, like national security, because of geopolitical and technological changes.

Our job is to make real the great aspirations of our time. In every area, our work is to look from a systems perspective across the ecosystem and see what needs to be

strengthened, what needs to be maintained, what needs to be shifted in order to get the robustness in our innovation system that allows us to meet those aspirations.

How does OSTP play a role in fostering innovation across the system?

Prabhakar: I'll give you an example. I was particularly excited about the president and first lady's Cancer Moonshot because I think this is a perfect example of what happens when you set a big, bold, aggressive goal. The Cancer Moonshot aims to halve the cancer death rate by 2047 and to change the experience of those going through cancer. The idea that we could basically double the rate of progress in reducing the cancer death rate—that's a very aggressive goal. But it is one that you can chart a course to.

Once you have a really clear, meaningful goal like that, it could change the lives of millions of individuals and their families. It's a die-happy goal.

That forces you to say, "What would it take to get there?" And again, you have to think in systems. You absolutely have to find better cures and therapies for some of the most devastating cancers. But we also have to be able to detect cancers earlier. And if you solve both of those, you still can't get there because we also have to be able to prevent cancers.

Recently I was at the University of North Carolina, which is doing work that not only includes new therapies and early detection, but is also running clinics that are helping people in rural communities get counseling and the coaching to finally quit smoking. Reducing smoking is still one of our biggest opportunities to stop cancer. That's what prevention looks like.

And so I am really excited about the possibility of a future where millions of people and their families never have to hear the doctor say, "You have cancer."

Artificial intelligence has a different set of challenges that go all across the innovation ecosystem to include industry and society. Without statutory power, how can OSTP lead in AI?

Prabhakar: President Biden sees this as an inflection point in history, where the choices that we're going to make now will determine how the decades ahead play out. AI touches people's lives—the way that we live, the way we work, the way that we interact. Because it's so powerful, we absolutely want to seize its benefits. But we have to start by managing its risks.

One way this manifests is a set of voluntary commitments that the president recently announced with leading AI companies. OSTP initiated a meeting with CEOs of OpenAI, Anthropic, Google, and Microsoft on May 4th. It was a really terrific meeting, chaired by Vice President

Harris. The president dropped by for a few minutes. It was a very open conversation where Vice President Harris held the companies to account and told them that they had not only a legal, but also a moral obligation to make sure their products were safe before they went out into the world.

That meeting culminated in an agreement that the companies would work toward voluntary commitments, including doing “red teaming” to find problems early and watermarking so that AI-generated content can be easily identified. By the time President Biden announced these commitments in late June, three additional companies—Amazon, Inflection, and Meta—had joined. Now the total has grown to 15 companies. These voluntary commitments will not take all the problems off the table. But they are important because industry, for the first time, is stepping up to its responsibilities in an open way.

In parallel, we’re working on an executive order for the president’s signature. This is about mobilizing everything we can across government today under existing law to do a better job of mitigating risks. And then, of course, we’ll continue to work with Congress on new legislation. There’s been very good bipartisan engagement on the Hill. Similarly, we’re talking with our allies and partners around the world because AI isn’t happening just in the United States.

This is a huge set of actions. Our role at OSTP has been first, shining a light on the fact that this was something that required major focus and attention from the White House—which it is absolutely now getting. And then our job is technical ground truth: helping people really understand what the technology is and isn’t, what it can and can’t do, and how it’s really playing out in the world.

Climate obviously wasn’t on the technology agenda in 1984. Today, deployment of new technologies and behaviors is a big challenge. What is OSTP’s perspective?

Prabhakar: There are so many aspects to fully meeting the climate crisis. One major piece was the passage of the Inflation Reduction Act. That is a huge boost to deploying technology at a scale that the climate actually notices. Not a little bit here and a little bit there, but enough to actually change climate outcomes. That’s the job that’s underway.

Another capacity we’re building is the analytical foundation to discern whether we’re on track with those deployments. That is the focus of work that we’re doing here at OSTP. We need to be able to understand where the dollars are flowing and how that is turning into new heat pumps, electric vehicles, and solar installations. We’re also looking at the broader supply chains to anticipate what might slow these mass deployments so we can get ahead of problems before they occur. At the end of the day, the purpose of all of that is to decarbonize our economy in ways that serve environmental justice and mitigate inequities in our society.

Recently, along with the Office of Management and Budget, OSTP announced new ways to value “natural capital,” or natural resources. Back in 1981, President Reagan wrote the executive order that made benefit-cost analysis integral to government decisionmaking, and over the decades this shift has really changed the way policy is made. How will adding the environment to these calculations affect our lives?

Prabhakar: To me this work on natural capital is a great example of taking rigorous research and tying it to practical mechanisms that bring change. Because our economic and accounting systems don’t account for the value of nature, it simply doesn’t get the investment or the protection that it needs. Natural capital accounting is about making the value of nature practical, and it’s integral to how we collect and apply economic data.

As this change is coming into the calculus of policy, it allows natural assets to be weighed in every kind of economic decision. And those millions of individual decisions aggregate into bigger things—like preserving wetlands or a coastal protective reef because they provide real value and resilience against, say, rising sea levels.

You’ve talked about how happy Vannevar Bush might feel if he came back and realized how much of his vision came true. Coming back in 40 or 50 years, what would you be satisfied to see?

Prabhakar: My mom is 93 years old, and that means I’m still going to be kicking—I hope—in 2047, which is the timeline for the Cancer Moonshot goals. So I’m planning on being there to see us cut the cancer death rate in half. And that will also mean we will have changed American health outcomes so that they are exemplary, rather than embarrassing, for the richest country in the world.

And I’ll be satisfied when some of our deep inequality is actually addressed, and every child has a path up and out to flourishing and singing their song. I’ll be happy when all kinds of people, with all kinds of backgrounds and interests and capabilities, have access to jobs that can support families.

That successful future will mean we continue to lead and be a force for peace and stability because of how we create the technologies that support national security. And that will also mean that we’ve wrangled the climate challenge and it’s something that we can manage. In doing that, we’ve rethought our infrastructures, we’ve rethought our communities, and we’ve built a more sustainable way of living much more in harmony with nature.

That’s the future that I know we can build. And I think those of us who get to work on science and technology are the luckiest people on the planet because we come to work every single day to try to make that happen.