BROOKINGS

Report

R&D for the public good: Ways to strengthen societal innovation in the United States

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Executive summary

Investments in research and development are the most important keys to future prosperity. What countries spend on generating new knowledge, products, services, and processes is important for economic growth and technology innovation, and vital for national security and international competitiveness. In many different respects, such financing determines which nations will lead and what ones will lag behind.

Yet there currently are a number of barriers to R&D support in the United States and we need to do more to safeguard our future. There are limitations in terms of vision, strategy, and policies that could keep us from achieving vital national goals. America will not be able to maintain its contemporary leadership role unless it thinks more strategically about how to integrate important objectives into its R&D approach.

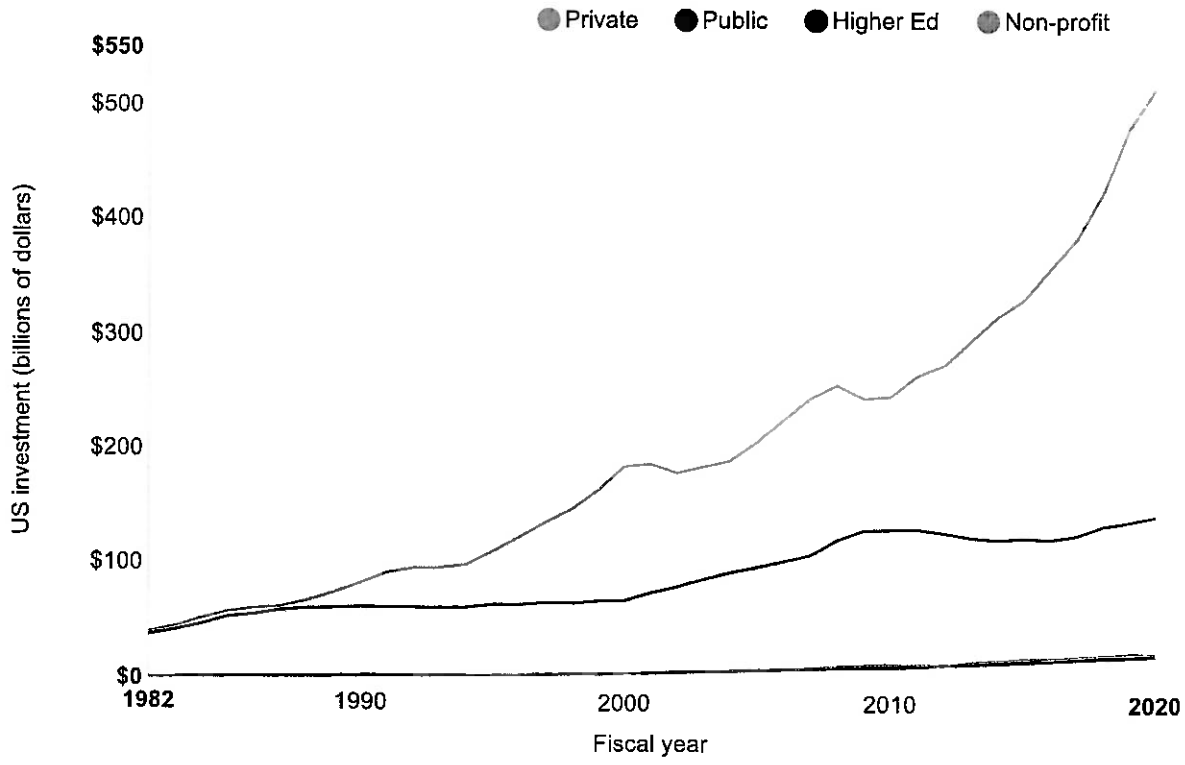
In this report, I outline a number of steps necessary to strengthen R&D in the United States. In particular, I suggest devoting more R&D money for the public good as opposed to the generation of consumer products, using federal money to reduce geographic inequities, financing R&D to help mitigate the consequences of climate change, tying R&D spending to national inclusion and equity goals, supporting critical infrastructure and products, providing greater flexibility for state and local government to prioritize R&D goals, and training the next generation of R&D talent.

The primacy of private investment

In looking at current investments, it is clear that most of our current R&D money comes from the private sector. In 2020, for example, of the $708 billion invested in R&D, $517.4 billion came from businesses, compared to $142.8 from the public sector, $22.6 billion from higher education, and $25.1 billion from nonprofit organizations.

Figure 1 shows the investment trends from 1982 to 2020, and the shift is quite striking. In 1982, the private ($40.7 billion) and public ($37.8 billion) sectors invested roughly the same amount of money. But 40 years later, businesses are investing 3.6 times as much money as the government. In 2020, the private sector provided $517.4 billion in R&D funding, compared to just $142.8 billion by the public sector.

Figure 1. Sources of US investment in R&D, 1982-2020 (in billions of dollars)



Washington, DC: National Center for Science and Engineering Statistics of the National Science Foundation.

At one level, there is nothing wrong with businesses having primacy over government in R&D spending. America has a vibrant private sector that enables business leaders to scan the landscape, decide where there are investment opportunities, and position their firms for future value. It is a virtue of market capitalism that such decisions are privately-made and decentralized across a range of chief executives.

But at another level, there are problems with the bulk of R&D coming from the business community. First, vital national interests may get overlooked to the detriment of the overall country. Second, profitable consumer products likely will get advantaged over unprofitable societal innovations, even if the latter are important for public health and national security. Third, innovations that need to get financed in order to promote longterm public goods may receive short shrift over items that promise a quick payoff. Corporate leaders are under enormous pressure to meet quarterly revenue projections and that can skew their R&D allocation decisions.

In an era of globalization, for instance, we have seen a number of cases where business leaders made decisions to outsource key products and components to other nations, such as China, India, and South Korea. As an example, semiconductor manufacturing largely was outsourced to Taiwan and South Korea despite the vitality of chips to the digital economy. When COVID upended global supply chains, our chip dependency on other countries limited growth in key sectors such as automotives and electronics.

The same thing happened in regard to medical supplies and drugs. Many of these items were made in India and China due to their cheaper production costs, and during the pandemic, it was hard to get personal protective equipment and pharmaceuticals. This harmed our public health responses and made it difficult for health professionals and patients to get the materials needed to safeguard their health.

These are just a few of the reasons why having relatively high business and low government R&D investments can be problematic. It may skew priorities in ways that make complete sense from a business perspective but harm national objectives. Business decisions generally emphasize profitable innovations and major consumer items that will

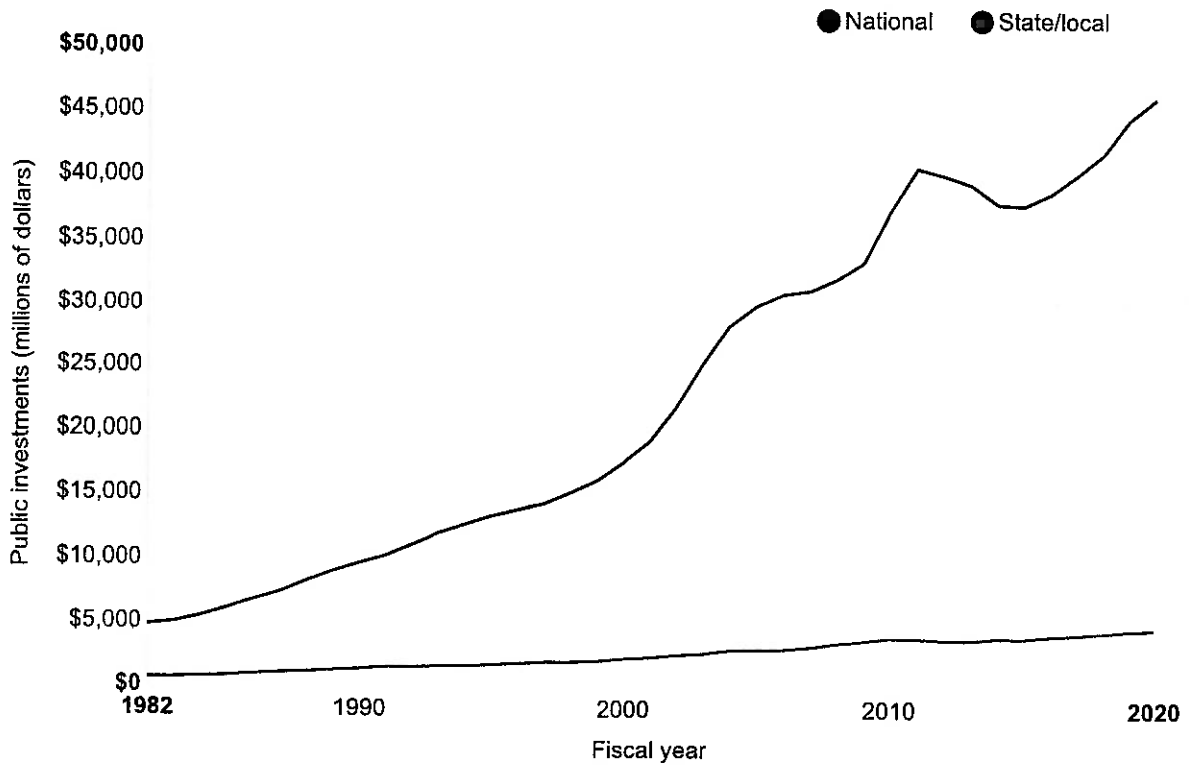
generate corporate value as opposed to R&D investments for the public good designed to fight hunger, deal with income inequality, further national security, or improve public health.

The dominance of national government investment over that of states and localities

It also is instructive to see which level of government is providing the bulk of R&D investment. Figure 2 breaks down the public investment numbers by national versus state/local monies and the numbers show how things have changed since 1982. At that point, the federal government ($4.8 billion) invested more than states and localities ($616 million), but the gap in actual dollars was not that large.

Now, however, that difference has grown much larger in actual dollars. In 2020, the national government provided $46.2 billion in R&D, while states and localities generated $4.6 billion. This gap of $41.6 billion dollars shows that around 90 percent of government R&D comes from the federal government with relatively little activity from states and localities.

Figure 2. Sources of public investment in R&D, 1982-2020 (in millions of dollars)



Washington, DC: National Center for Science and Engineering Statistics of the National Science Foundation.

The dominance by the federal government is not necessarily problematic. If national leaders are making productive decisions and supporting a range of innovations, that approach could be perfectly fine. National leaders may be enabling a wide range of new advances in knowledge, products, and services, and that could be beneficial for the entire nation.

But federal dominance is problematic if the scope of innovation is limited and states and localities have little ability to prioritize based on their community needs and that innovations designed to address important community problems are neglected. In that situation, short-changing the vitality and diversity of local government can skew R&D decision-making and lead to important social priorities being ignored.

Comparisons with other nations

In its overall R&D investments as a percentage of GDP, the US compares favorably to the European Union and China, but not South Korea. Of Organization for Economic Cooperation and Development nations, South Korea invests 4.8 percent of its GDP in R&D, while the US invests 3.5 percent, Japan does 3.3 percent, China invests 2.4 percent, the European Union does 2.2 percent, and Canada invests 1.7 percent.

Table 1. R&D Investment as percentage of GDP, 2020

South Korea	4.8%
United States	3.5%
Japan	3.3%
China	2.4%
European Union	2.2%
Canada	1.7%

Source: Organization for Economic Cooperation and Development, 2020

It is good news that America compares favorably to most other leading countries in R&D spending. These investments are one of the reasons the United States has relatively high prosperity and plays a leading world role. Yet if it aspires to be the best, it needs to be the top investor in the world. Its R&D needs to focus on major priorities and make sure its investments are propelling the public good, is inclusive and diverse in its objectives, and addresses longterm challenges such as geographical inequities, clean energy, and climate change.

Investing in our future

Moving forward, the United States needs to be more strategic in how it invests in R&D, the kinds of priorities being pursued, and the manner in which we make the decisions associated with these investments. There are a number of steps America should consider in order to further important objectives and fulfill key national goals.

Pursue R&D for the public good

The US should not rely just on the private sector for its R&D investments because such a focus likely would place greater priority on consumer products as opposed to items needed for national security, public health, and amelioration of key social problems. The country faces many challenges ranging from income inequality and racial inequity to geographic variations in prosperity and climate change.

If we let business leaders make most of the R&D decisions, as is happening now, there is a risk they will prioritize profitable, consumer goods and services as opposed to innovations that address crucial difficulties. Where the public sector can play an important role is in identifying key problems and making sure that unprofitable but socially-needed innovations are supported and that America has the tools to address vital societal priorities.

Use federal money to redress geographic inequities

One key problem in the United States right now is the high level of geographical inequity. Brookings research shows that most of our nation's GDP focuses on the East Coast, West Coast, and some metropolitan areas in between.

This parallels work that demonstrates most venture capital investments today focus on three states: California, New York, and Massachusetts. There is little money invested in the heartland, and this promotes geographical inequality and exacerbates societal and political tensions.

In its R&D decisions, the federal government should allocate money in a way that reduces geographical inequities and promotes the heartland. In a political system based on geographic representation, these types of inequalities fuel populism, ultra-nationalism, and political extremism. R&D allocations are not neutral but play a role either in reducing or exacerbating important challenges facing our current society. If we continue to put most of our R&D money onto the two coasts and a few metro areas in between, it will increase societal tensions and make it difficult to address important political and economic problems.

We need tax and social policies that ease this transition, but we also need R&D spending that sees equity as an important societal goal and prioritizes new knowledge, products, and processes that are fair and equitable.

Deploy R&D to help with climate change

An important challenge facing every country around the world is climate change, extreme weather, and the transition to carbon-free energy. This challenge is going to affect every nation and require each place to increase its R&D investments to generate new products, processes, and services that mitigate negative effects and enable the transition to a fundamentally different kind of economy.

Both governments and businesses should prioritize R&D that address climate change and help cope with extreme weather, clean energy generation, water management, and the economic effects associated with each of these transformations. Leaders should elevate climate change as a major factor in R&D decisions due to its relevance in transportation, energy, and agriculture.

Tie R&D spending to inclusion and equity goals

Achieving a fair, just, and inclusive society is important for the United States and other places around the world, and in coming years our society and politics will look very different than they do right now. We need tax and social policies that ease this transition, but we also need R&D spending that sees equity as an important societal goal and prioritizes new knowledge, products, and processes that are fair and equitable. This includes AI that is not biased, facial recognition software that is accurate regardless of skin tone, steps to close the digital divide, and digital financial products that are available to all individuals. As one sign of current racial inequities, predominantly Black universities operate at a major financial disadvantage to other schools. Research by

Christian Weller and colleagues at the Center for American Progress has found that Harvard University won more federal grants in recent years than all the historically-black colleges and universities combined in America. This is just one way in which R&D spending needs to become more fair and equitable.

Support critical infrastructure and products

Having strong infrastructure and products will be important for future prosperity and national security. This means not just physical infrastructure such as highways, trains, bridges, and dams, but digital infrastructure that provides high-speed broadband to all, builds an inclusive economy, and ensures that key digital components such as semiconductors and electronics are safe, secure, and plentiful in the United States. Right now, most of our electronics are made overseas and global supply chains are long and complicated. American businesses cannot always count on ready supplies for their "just-in-time" manufacturing processes. For important goods and services, we need either to on-shore or near-shore production in friendly nations so there are few supply disruptions in case of global pandemics or international conflicts. Recent efforts by the national government to finance and encourage US chip manufacturing is a step in the right direction.

Provide greater flexibility for state and local governments

Localities understand their community needs better than the federal government, and it would be beneficial for there to be greater flexibility in how they use R&D expenditures. With most current funds being controlled either by private businesses who can play cities and towns off against one another or national government leaders who may not understand local needs, states and localities are not well-positioned for future innovation. They don't control the money that will propel future changes and they aren't in a position to make sure their priorities are central to allocation decisions. We need to change that so that a greater diversity of R&D needs are met and that community priorities play a greater role in allocation decisions.

Train the next generation of talent

Training the next generation of R&D talent has to be a major priority for governments and businesses. The private sector will need the best talent in order to maintain its competitiveness and government agencies need people with the skills required in a digital economy. This requires money to make sure K-12 schools and higher education have the resources needed to train young talent and governments and businesses to provide adult education for older people who will need to upskill to remain competitive in the future economy. People will have to upgrade their job skills at ages 30, 40, 50, and 60 and there have to be substantial increases in support for adult education and workforce development.