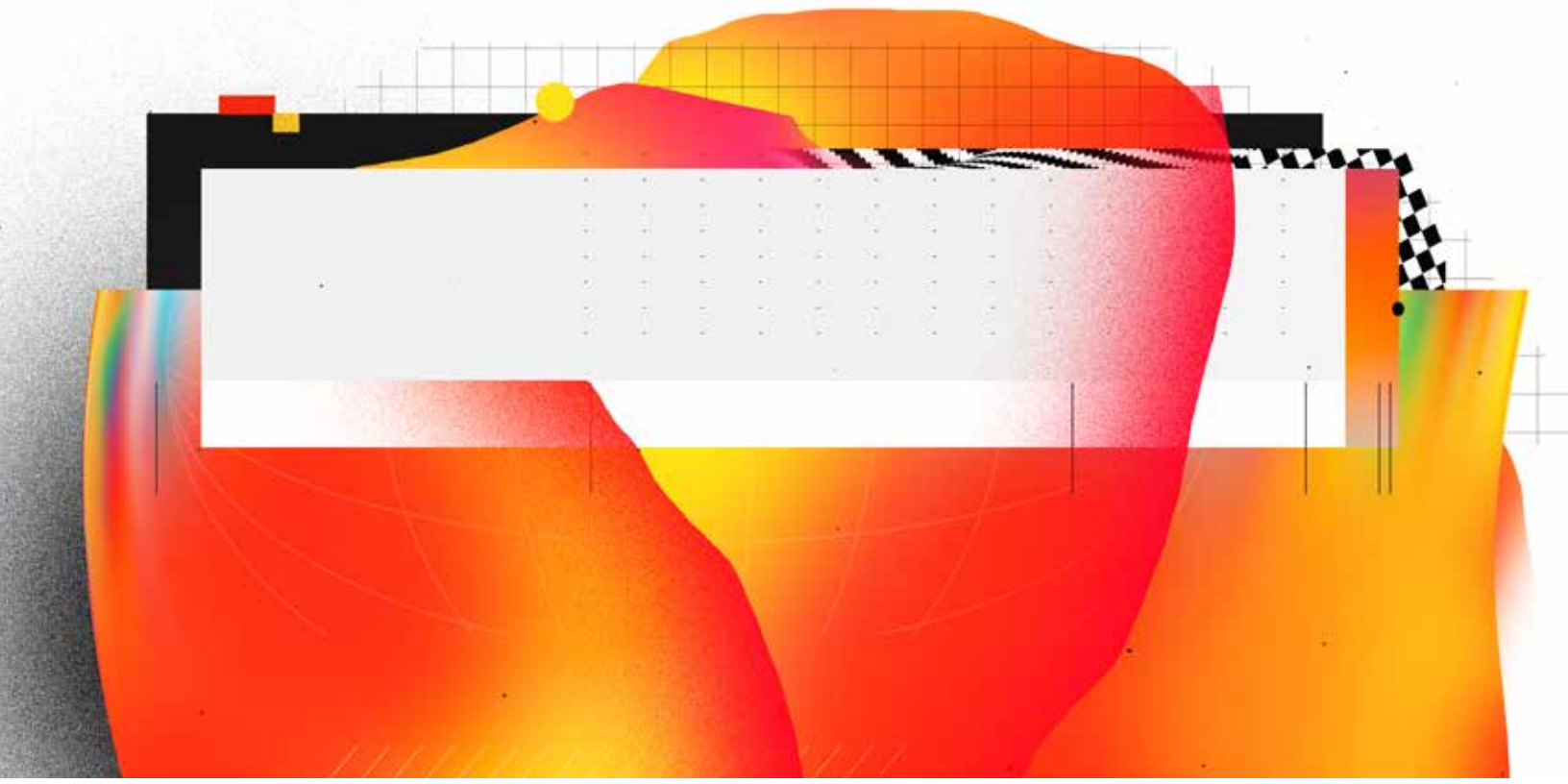
Maximizing the Economic Benefits of the Endless Frontier Act:

A Proposal to Scale-Up the Deployment of Innovative Technologies Across the U.S.

May 2021



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The primary goal of the Endless Frontier Act is to strengthen U.S. competitiveness in critical technologies. To better realize this goal, the bill should not only fund research and development, but also should address later-stage capital gaps, specifically the deployment of R&D technologies at commercial scale. The U.S. is hamstrung today because technology pilots, scale-up and commercial demonstration lack sufficient private sector support.

This stems from two overarching problems:

1. **Technological Uncertainty.** Equity investors typically focus their investments on projects that have been fully derisked technologically. Technological uncertainty remains well beyond the R&D phases that would be funded by the *Endless Frontier Act*. As a result, except for some software projects, funding is often unavailable or too time-limited for the necessary stages to assure and demonstrate technology reliability, performance and lifespan.

2. **Market Uncertainty.** Novel technologies are unable to compete until they have attained production scale, but getting to that point is a capital-intensive process. This creates a chicken-and-egg situation where most later-stage investors providers won't fund a technology without associated guaranteed cash flows but those cash flows carry too high a risk until the technology is demonstrated at scale.

Together, these risks result in chronic underfunding of deployment for breakthrough technologies. The federal government should help fill this gap by creating a new, centralized agency to run deployment grant and loan programs within the Department of Commerce. This funding would complement the Endless Frontiers Act authorizations for regional technology hubs as deployment of technology fundamentally engages workers with different skills than those utilized in R&D alone. Figure 1 in the Appendix lays out the stages of technology development and their funding needs in greater detail. While there are few examples of government agencies supporting scale up funding, they are one-off efforts in siloed agencies (e.g. ARPA-E, DOE Loan Program, NASA COTS). A centralized, consistent approach is necessary.

The *Endless Frontier Act* could remedy this through the following:

1. **Provide funding to validate the commercial potential of technology:** Congress should authorize financing to support capital-intensive prototype and pilot deployments, process development, initial manufacturing plants, and first-of-a-kind commercial projects for foundational tech. We recommend $3.5B to support about 350 projects, or about 35 projects per technology area outlined in the Endless Frontier Act. Prototyping could be supported by grants to technology developers that would require a 20% cost-share as well as a signal from private capital (VCs) about company viability. Pilots could be supported through grants to technology developers and/or a start-up's customers with a cost-share between 30-50%.

   Examples of projects: $10 million for a pilot-scale bioreactor that converts known waste products (e.g. CO2) into value-added commodity chemicals; $10 million for a pilot-scale 3D printer that could cost-effectively be able to print automotive bodies.

2. **Deploy and scale technology:** The private sector is often unwilling to bear the risk associated with a novel technology that hasn't been demonstrated at scale or for a meaningful lifespan. $2.5B of annual funding should be used to support 30 large-scale projects with $40B in loan guarantee authorization. The money would support:

- Process Development/Manufacturing: Grants (50% cost share), or loan guarantees, provided to companies depending on their stage in development.
- First-of-a-kind (FOAK) Commercial Projects: Grants (50% cost share), or loan guarantees to technology vendors to reduce new-technology / lack-of-scale premium.

An example: Domestic foundry solely for the use of advanced semiconductor or micro-electronics technology (e.g., photonics) to advance the speed of deployment and retain economic benefits from the deployment of new U.S. communications infrastructure.

By focusing federal funding on this later-stage deployment of novel technology, $6B in annual funding, including $40B in loan guarantees, could unlock trillions in annual GDP and create millions of good-paying jobs over the next 10 years and beyond. The traditional ROI on infrastructure investments range from about 1.5-3x GDP growth relative to annual spend[1] and 8-16 jobs per $1M in spending.[2] It is reasonable to think that funding infrastructure required to scale novel technologies would outpace this return through the creation of entirely new industries as a result of successful initial deployments.

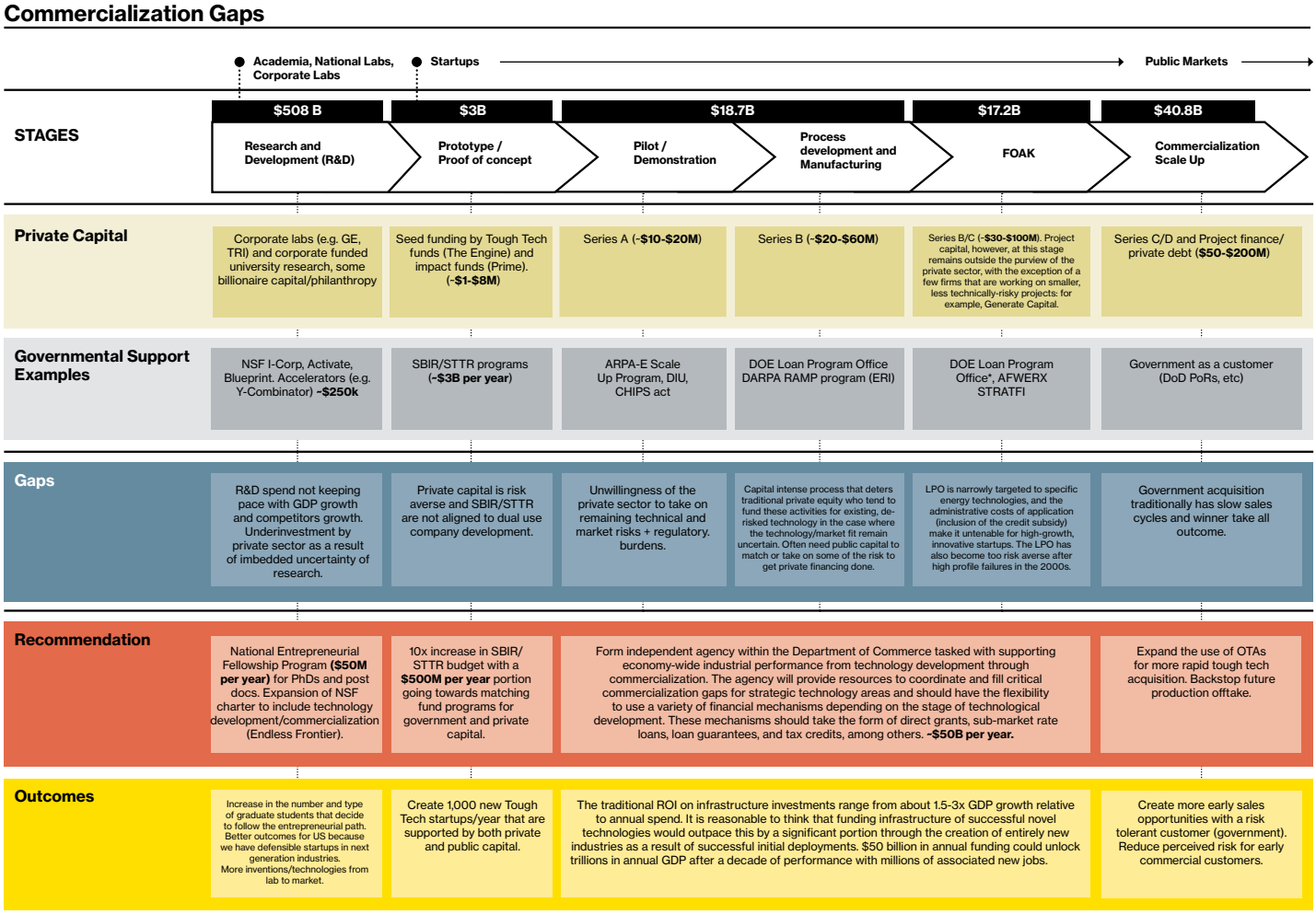
Deployment of foundational technologies could bolster a range of regions historically underserved by innovation investment. For example, biological manufacturing of chemicals could be pushed toward traditional chemical hubs in the Gulf region or advanced manufacturing using 3D printing that could be leveraged in automobile manufacturing in the industrial heartland.

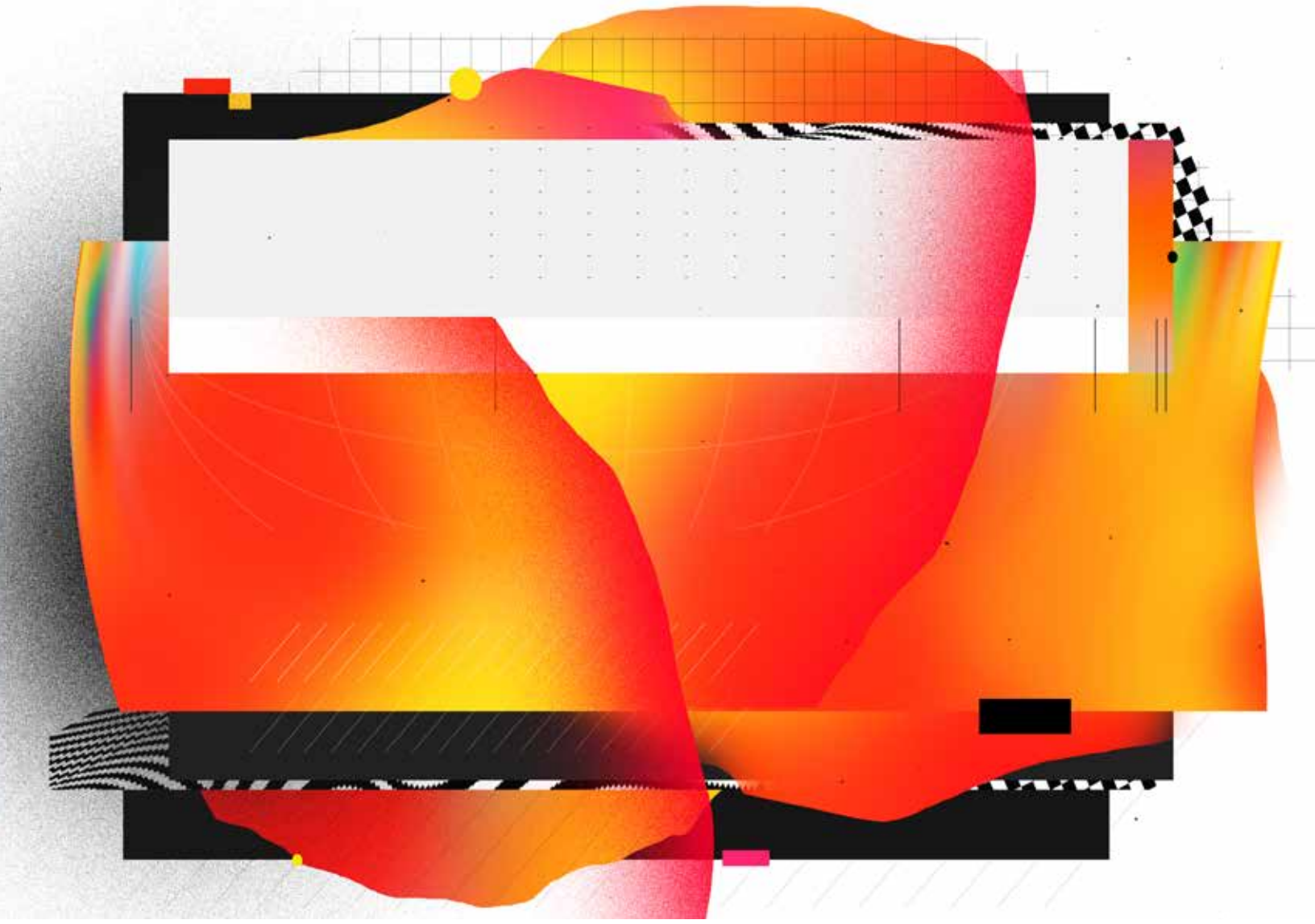
[1] Bevins 2017; International Monetary Fund 2014; Leduc and Wilson 2012; Economic Report of the President (2016).
[2] Wilson 2012; USDOT 2021.

Appendix

Figure 1: Commercialization Gaps

There is a significant shortage of private and public funding for capital-intensive proof-of-concept, pilot, process development and manufacturing, and first-of-a-kind commercial projects in frontier tech. Current federal programs aimed at supporting mid-stage technologies provide limited resources and targeted to only specific sectors.





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