Building a 21st-century American Economy

The Role of Tough Tech in Ensuring Shared, Sustainable Prosperity

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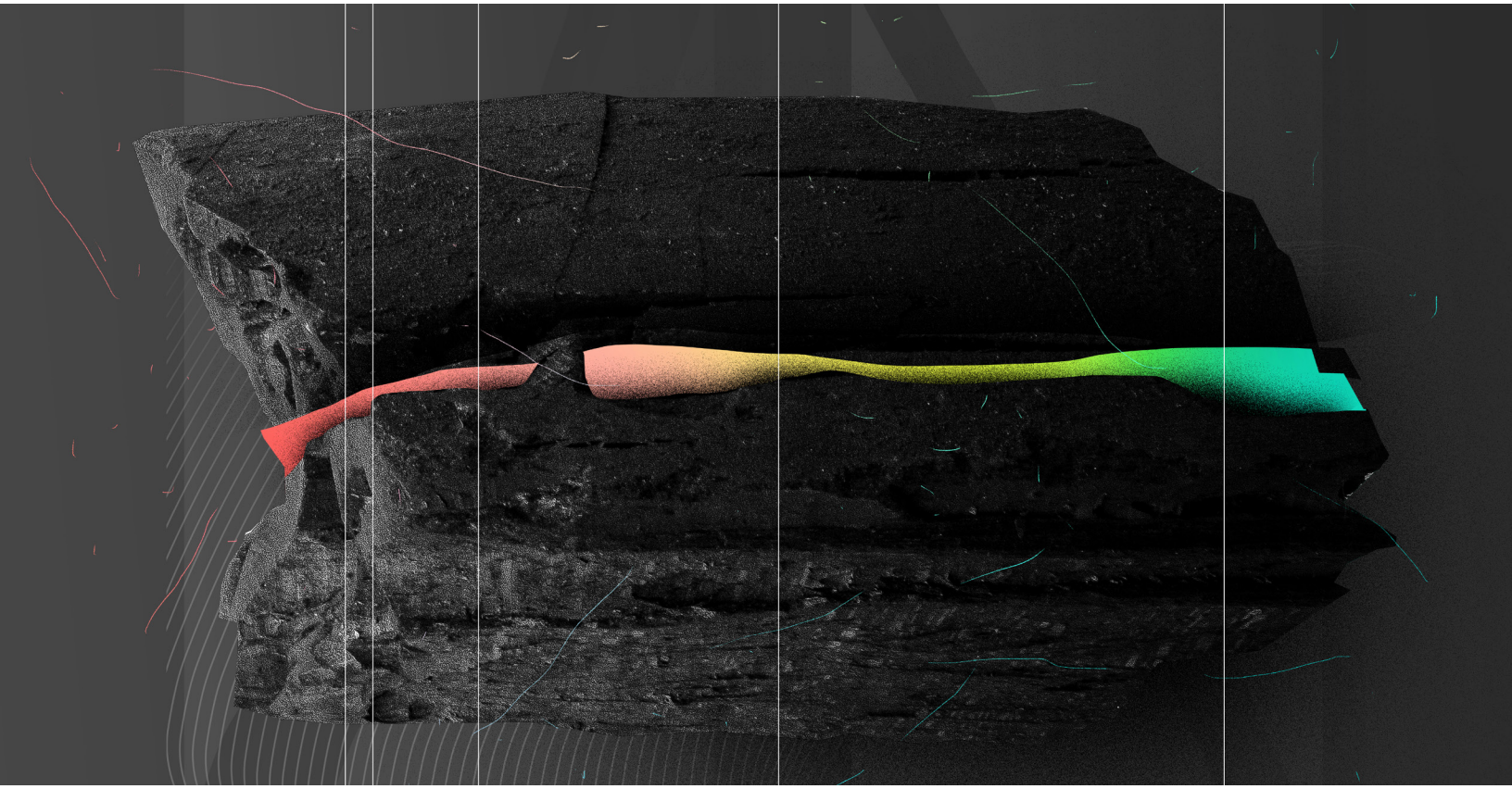

THE ENGINE
Built by MIT

HARVARD Kennedy School
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Preface:

Tough Tech Policy Recommendations
Executive Introduction

The United States was built on the premise of distributed growth and prosperity, but we are at a moment when the foundations of progress are increasingly at risk for the generations to come. 2020 has been a wake-up call to our nation and the world on how swiftly a single threat, such as a coronavirus, can systematically damage our economy and our society. As wildfires have forced thousands to evacuate from their homes across the western states, growing signs of climate threats loom in parallel. These global challenges are occurring against the backdrop of a seismic economic shift to increased automation and offshoring and the disruption of fundamental industrial sectors.

As with the Great Depression and the World Wars, government intervention has always played a role in ensuring technological innovation supports getting the whole country back on its feet. To meet the complex social and economic challenges we face today, the U.S. must rethink our infrastructure and systems at every level and prioritize technological advancements that will require significant time and resources to bring to market. A free market will not choose the right priorities on its own. Like so many technologies that we rely on today, these advancements need the intervention of the U.S. Government to be brought to life--from early discovery and translation out of the labs to the latest stages of funding that current private capital will not support.

Four years ago, with MIT's initiative and support, Katie Rae founded The Engine to bridge this divide with a new model of investment looking at long-term initiatives at the convergence of technology and social impact, which we call Tough Tech, (e.g. new energy production and distribution, advanced manufacturing, synthetic biology, materials, robotics, mobility, space exploration, next-generation semiconductors, etc.). Meanwhile, Ash Carter set up the Belfer Center's Technology and Public Purpose (TAPP) project at Harvard Kennedy School to answer those same questions at the policy level -- how to invest in the most pressing issues surrounding science and technology and prepare leaders of tomorrow to solve them.

Our two teams came together this summer to explore and propose the key programs which could advance the social and economic progress of Tough Tech and allow the U.S. to maintain a leading edge as an economic powerhouse and sound voice in the fight for global solutions. Inherent in these proposals is a strong basis for public-private partnership that will positively impact all Americans.

Together, our expertise spans policy, government innovation, and venture capital investing into frontier technologies, and our network of advisors includes top minds who have been in the trenches to bring tough technology to market for the greater good. In the documents that follow, we have outlined our recommendations for the government to adopt and implement as it sets out to charter a course for our 21st economy.

It is vital to the future American public that we prioritize Tough Tech innovation. If we start building here and now, all of our citizens and the rest of the world will benefit, both economically and socially.

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Part I:

Tough Tech as a Tool for Shared, Sustainable Prosperity

1.1 Introduction

As the world confronts systematic, interrelated challenges from a raging pandemic to devastating climate catastrophes to a growing chasm of inequality, the United States has the opportunity to make deep commitments to new technological foundations that will usher in the next industrial revolution and greater shared prosperity. Or, we can continue along a business-as-usual path, ceding global leadership and the associated economic value creation elsewhere.

In this paper, we introduce the concept of Tough Tech, transformative technological opportunities that, at the dawn of a new industrial age, can provide the foundation for a more inclusive and equitable economy as well as address some of our most urgent global problems. We consider the critical role of government in nurturing the development and scaling of these technologies. And, finally, we provide a framework for optimal government interventions around workforce, regulation, funding, and coordination to ensure the translation of these technologies into globally competitive, foundational companies that will revitalize our manufacturing and industrial sectors, providing shared economic growth and expanded middle-class jobs.

In the 19th and 20th centuries, the most fundamental advances in the human condition were a result of giant leaps in our innovative capabilities. Steel, electricity, semiconductors, the Internet, genetic engineering—all have all taken heroic amounts of collaborative effort and resources to become a reality. Each one of these technologies in its own way has transformed society, representing quantum leaps forward in prosperity. Steel has built our cities to new heights, electricity has powered our world, computers and the Internet have united the globe, and our understanding of DNA has ushered in an era of personalized medicine that promises unprecedented longevity. Importantly, while other historically middle-class sectors have offshored or shuttered, companies founded on these technologies have expanded middle-class job growth and increased quality of life for millions of Americans. However, unlike previous eras, today the U.S. Government no longer dominantly controls the funding or direction of innovation, with government budgets having shrunk dramatically both as a proportion of GDP and, importantly, relative to private capital.

Today, a new generation of Tough Tech is on the horizon. It includes quantum computing, new energy production and distribution solutions, space exploration and communications, advanced manufacturing and materials, genetic engineering, artificial intelligence, next-generation semiconductors, and more.

Most importantly, these technologies are fundamental to solving global problems, and their development sits squarely within the national interest for a variety of reasons:

- **Economic Growth and Sustained Job Creation:** As the U.S. attempts to rebuild from its second catastrophic recession in only a decade, the country must grapple with difficult realities inherent to the U.S. economy today. Notably, the returns to labor have been declining for decades as skills have been replaced by productivity-enhancing automation, and concurrently, increasing inequality is producing an economic system where the returns to that increased productivity are concentrated in the hands of capital owners. Major advances in computing have led to increases in consumer surplus and created significant value in capital markets; but, as a whole, that industry employs almost exclusively high-skilled labor, limiting the degree to which economic value cascades to the entirety of the labor force. Tough Tech holds the potential to modernize and

revitalize our manufacturing and industrial sectors, which will require a diverse labor force made up of individuals across the skill distribution. Like the modern tech industry, Tough Tech holds the promise of significant economic returns but with the added potential of sharing these returns across currently dislocated social, economic, and geographic groups. A recent study by PWC suggests that Tough Tech industries could support the creation of over 3.4 million U.S. jobs and $478 billion in annual economic growth this decade.

- **National Security and Economic Competitiveness:** Global competitiveness in critical innovation areas is increasing, and ensuring continued U.S. technological leadership is critical to advancing national security and economic interests. However, our global competitiveness in critical innovation areas is beginning to lag for the first time in a last century. Through the Made in China 2025 program, China has now become a leading investor in Tough Tech. Similarly, the European Union created the Horizon 2020 plan as a coordinated EU strategy for advancing Europe's global power by investing in R&D and is now pursuing an even more ambitious €100 billion plan called Horizon Europe. Conversely, government R&D spending in the U.S. has dropped from 1960's highs of 2% of GDP to less than .7% of GDP. Worse, almost none of that R&D is directed with the mandate to advance economic competitiveness. In addition to the economic benefits associated with Tough Tech, technological advance is fundamental to the U.S. national security infrastructure and global leadership. Finally, the COVID-19 pandemic has made it clear that to secure domestic economic resilience, the United States must increase domestic capacity to produce critical products and strengthen local supply chains. Tough technologies both enable downstream technological development and increase the resiliency of the U.S. economy and correspondingly support the competitiveness of our current foundational companies such as GE and Boeing among others.

- **Sustainability:** As devastating fires raged across the west coast and an increasingly volatile hurricane season battered the gulf coast, the threat of climate change became concrete for millions of Americans. The threat to individuals and businesses across the world is now ever-present and becoming a drag on companies' bottom lines and countries' economic growth. While deploying existing technologies is critical to meeting the climate challenge, so too is supporting the long shots that will enable the deep decarbonization needed to meet Paris Climate Agreement targets to limit global temperature rise to 2 C. Additionally, Tough Tech broadly, not solely the energy-related opportunities, offers long term sustainability benefits by increasing the efficiency and diversity of economic activity as a whole.

In addition to these benefits, the U.S must course-correct away from the financialization and short-termism of the economy that has arisen over the last 40 years. Never has it been more apparent that financial markets are completely disconnected from the lives of most Americans than during the current COVID-19 pandemic, when unemployment grew to almost 25%, and the stock market rose along with it! As quarterly corporate earnings supercede long-term company viability and performance, firms turn away from critical investments in their workforce and in innovation, the returns for which can be multiple years away. The U.S. requires a systemic change in the way we coordinate efforts across the economy to ensure sustainable prosperity shared by all Americans, especially in those areas where government intervention has enabled that value creation. The reality is that there is no single economic actor that can ensure the retention of the benefits described above. Such fundamental change requires the mobilization of and partnership between a variety of stakeholders, including but not limited to the research community, corporates, government, and capital providers.

In the sections that follow, we argue for a new national strategy for supporting Tough Tech. In the next section (1.2), we explore historical examples of Tough Tech and its impact on economic growth and jobs. In Section 1.3, we propose Tough Tech fields that will be foundational economic infrastructure for the next century, and in Section 1.4, we argue for the urgency of this moment as a time for rededicated effort toward Tough Tech at the national level. Section 2 provides a framework for a national strategy, beginning with a discussion of our current approach and gaps, followed by proposed interventions in our workforce, regulation, funding, and national coordination.

1.2 The History of Tough Tech as an Economic Engine

Throughout recent history, we have witnessed numerous examples of the economic value that policy-driven Tough Tech innovations can bring. In this section, we explore a few of these to illustrate the potential economic growth and job creation associated with Tough Tech both in the U.S. and globally. These examples account for trillions of dollars in U.S. GDP on an annual basis and have resulted in significant job opportunities across the labor skill distribution:

- **The Internet** has spawned entirely new industries and economic sectors while also providing unprecedented global connectivity and access to information. In August 2020, a report by the U.S. Bureau of Economic Analysis estimated the digital economy contributed $1.8 trillion to U.S. GDP in 2018—9% of the total. It also found that the Internet directly contributed 8.8 million jobs, which on average paid $105,473, compared to $70,858 for jobs as a whole.

- **Global Positioning System (GPS)** technology has been

widely used to improve a wide range of sectors, including precision agriculture, financial services, location-based services, mining, surveying, telecommunications, telematics, electricity, maritime navigation, and oil and gas. A 2019 study by the U.S. Commerce Department's National Institute of Standards and Technology (NIST) estimated that private-sector industries have received $1.4 trillion worth of economic benefits from GPS technology.

- **Semiconductors** are fundamental for so many everyday technologies, including radio, computers, mobile phones, washing machines, refrigerators, air conditioners, trains, and more. In 2019, semiconductors were the fifth largest U.S. export, totaling $46 billion, according to the Semiconductor Industry Organization. As of July 2020, the semiconductor industry directly employed 370,000 people. However, for every direct semiconductor job, there are 4.89 indirect jobs--totaling over one million indirect jobs.

- **The Human Genome Project** (HGP), sponsored by the DOE Human Genome Program and NIH National Human Genome Research Institute, sequenced 3 billion DNA letters in the human genome and gave us a blueprint of what makes humans human. The work helped contribute to a flourishing genomics industry and is fundamentally reshaping approaches to diagnosing and treating disease. According to a 2017 McKinsey study, the next-generation genomics industry is forecast to have a $1.6 trillion economic impact in 2025.

Adding to its economic potential, Tough Tech is difficult to reproduce, giving innovators a competitive advantage and creating new U.S. jobs and economic sectors that are hard to transfer overseas.

It can also produce spillover recovery effects for the economy, in which growth in one industry flows into another, enabling subsequent benefits and additional growth.

1.3 Tough Tech Opportunities Today

Many emerging Tough Tech trends have the potential to have similar economic impact with spillovers across industrial verticals. A few examples are:

- **Advanced Manufacturing** of materials and chemicals are upending not only commodity industries and traditional manufacturing but also is creating entirely new products and industries as capabilities become more flexible and cost competitive.

- **Next-generation Semiconductors** will create the compute of tomorrow. Specialized semiconductors are being created or optimized for new applications that will transform communications, cloud computation, and sensing. Next-generation semiconductors will make up the backbone of a broad range of industries which rely on computing, communications and sensing such as autonomous vehicles, smart cities and telemedicine. Perhaps most notably, the large-scale deployment of 5G and AI will require large increases in semiconductor performance and energy efficiency.

- **Clean Energy Production and Storage** such as fusion and geothermal coupled with load following resources including energy storage, along with novel chemical and material production processes will change the direction of climate change while also transforming other industries across the economy.

- **Quantum Computing** uses molecules in "quantum states" to shortcut vast amounts of computations and exponentially multiply computing power. The technology can potentially solve problems beyond current computing capacity, including encryption and cryptography, molecular modeling, autonomous vehicle simulations, and more.

- **Synthetic Biology** could cure previously incurable diseases, radically expand the food supply to feed a planet of 10 billion people, and make previously scarce resources more available.

It should be noted that AI/ML will play an increasingly important component role across emerging Touch Tech sectors and that these multidisciplinary applications will require a support profile different then current highly funded initiatives. These types of Tough Tech investments will enable the creation of custom-designed pharmaceuticals and therapeutic cells, new batteries and solar cells, advanced materials, etc.

The above is by no means a comprehensive list, in part because the Tough Tech industries of tomorrow have yet to be created. Indeed, identifying emerging technology disruptions is a critical role for government as they hold enormous potential for economic growth, social equity, national security, and environmental sustainability--promising to transform our world in new and powerful ways.

1.4 The Urgency for the U.S. to Act Now

The U.S. finds itself in a fragile state. Private capital markets are strong, and our academic labs continue to lead the world in technology development; but our global competitiveness in critical innovation areas continues to fall behind. While the U.S. R&D apparatus is world-leading, the focus on the translation of technology from the lab to commercial impact remains limited.

Technological advancement is one of the keys to success in international economic competition. Yet, while other countries have increased R&D spending, according to a Congressional Research

Services report, U.S. spending has declined from 69% of the world's R&D spending in 1960 to only 28% in 2018. The U.S. venture capital lead has also decreased from 97% of global VC spending in 1992 to only 44% in 2017. This sea change in funding has resulted in private capital pressures largely guiding U.S. technology sector and company creation.

As our nation recovers from the COVID-19 pandemic and associated recession, U.S. leadership in Tough Tech is poised to be a source of significant job growth, both now and for generations to come. Tough Tech innovations in quantum computing, AI, synthetic biology and clean energy are coming--the question is whether the U.S. will be the focal point of this next industrial revolution or whether other countries will take the lead and accrue its associated social, economic, and security benefits.

The U.S. has lost competitive advantage in the past, such as when Japan took over the semiconductor market in the 1980s. In response, the U.S. Government created a public-private partnership called Sematech, with 14 private U.S. semiconductor manufacturers to jointly collaborate and revitalize the U.S. semiconductor industry to become the global leader it is today. Similar government interventions are needed today across multiple technology spaces.

As significant as the positive benefits of action may be, the negative effects of inaction are even more consequential. These technologies are coming and will follow the governments that support them, as will the ultimate applications. Early support enables the United States to affect the direction of innovation to match our national ideals. Failure results in the accrual of benefits outside of the country, further eroding the economic competitiveness of the United States and posing as a threat to our own national security. While we wait to act, countries such as Singapore, India, UK, Germany, and South Korea are already increasing their federal investments in Tough Tech commercialization. Centralized global competitors such as China have engineered an incredibly powerful and integrated support system for their respective Tough Tech ecosystem. Further exacerbating, private capital investments in Chinese, German, and British companies are also rapidly growing.

The impactful history of Tough Tech in the U.S. economy, combined with today's new opportunities and urgent need for action combine to motivate our next section and the policy proposals therein that will hopefully contribute to a new national strategy.

Part 2:

A National Strategy for Tough Tech Development

2.1 Introduction

To realize the many benefits that Tough Tech can deliver to the United States economy, a mix of public/private capital and regulatory support will be necessary as well as interventions to ensure that an economically, racially, and socially diverse set of stakeholders engages in these transformative shifts.

If the U.S. fails to develop its own national Tough Tech strategy, it risks missing out on benefits that will flow both domestically to private companies and internationally to other countries. Domestically, according to Pitchbook, venture capital firms invested over $35.7 billion in Tough Tech in more than 1,600 transactions in 2018. VCs can have a tremendous impact on the way that Tough Tech companies are run, but their investment aperture may not necessarily align with national strategic priorities. Through a national Tough Tech strategy, the government can guide R&D in a direction that benefits the national interest toward mission-oriented solutions, imposes necessary regulations, and deals with ethical concerns that undoubtedly will emerge.

In this section, we review the historical role of government in promoting strategic Tough Tech; we consider what the current framework for support looks like, identify key gaps, and propose a set of key interventions moving forward to realize the potentially massive positive benefits of these technologies for everyone.

2.2 The Role of Government in Tough Tech Development and Deployment

Despite Tough Tech's high potential for economic growth and job creation, it will not flourish without a significant rethinking of the role of government in supporting the commercialization and scale-up of breakthrough technologies. The present system for government financing for the commercialization of Tough Tech is fractured and incremental, making it inadequate for the scale of the challenge.

A Schmidt Futures report found that of $131 billion invested in startups in the U.S., $19.3 billion went to Tough Tech life sciences while only $11.8 billion went to Tough Tech outside of the life sciences. There was a significant gap between government funding for ideas and funding at later stages when commercial viability is more apparent, the so-called "valley of death." Tough Tech involves longer development timelines and unique manufacturing processes, which together require more capital to make it to market. Also, because Tough Tech generally has a hardware component, the marginal cost does not approach zero after the initial development of the technology as it would for a software company, meaning that it requires more sustained funding support throughout its development.

Moreover, the history of technology development in the United States illustrates the very close relationship between government support and industrial development. It is critical to note that all of the innovations referenced above have relied heavily on government funding for their creation and development; indeed, they may not exist today without it.

- The Department of Defense's Defense Advanced Research Projects Agency (DARPA) supported the creation of the first version of the Internet, called ARPANET, in 1969. Subsequent development of the technology was supported by the National Science Foundation (NSF) in the 1980s and 1990s.
- GPS is a government-owned technology, initially developed by the Department of Defense in the 1950s and later by NIST, the Navy, and the Air Force. Without federal support, approval, and funds, it would likely not exist.

- Private sector labs first created the microchips that drove the semiconductor revolution, but U.S. federal agencies such as NASA and the Air Force served as early anchor customers to help drive production. From the 1950s to the 1970s, the federal government directly or indirectly funded an estimated 40-45% of industrial R&D in the semiconductor industry.
- In 1990, Congress established funding for the Human Genome Project and set a target completion date of 2005. The program brought scientists together from across the globe with support from DOE and NIH as well as ally countries that enabled the project to progress quickly at a huge scale.

Moreover, a recent study in Science analyzed patent applications from 1926 to 2017, finding that 33% of U.S. patents relied directly on U.S. Government-funded research. In some industries, such as chemistry and metallurgy, that number was nearly 60%. Another study by the Biotechnology Industry Organization examined technology transfers to industry from universities, which receive significant federal funding. It found that from 1996 to 2010, those transfers created $836 billion in gross industry output, $388 billion in GDP, and 3 million jobs.

The U.S. Government remains rooted in the historical "government first" or "spin-outs" approach to the Tough Tech innovation ecosystem that drove many of the advances of the last century. Today, to compete on the global stage, the U.S. must fundamentally change its perspective and approach to investing in Tough Tech. The government should certainly still encourage "spin-outs," in which government technologies are applied in the commercial market, but also "spin-ins" where the technology starts in the commercial sector and is then adopted by the government or even "spin-arounds" where the technologies are co-developed by both the government and the private sector through novel partnerships and funding models. It can do this by leveraging the power of the free market and utilizing strategic and financial incentives to direct that market to grow our Tough Tech national industrial base. In the section that follows, we consider particular gaps that could be filled by more assertive federal action.

2.3 Key Gaps in Tough Tech Development and Deployment

While the next generation of foundational technologies are ready to scale here in the U.S., the support for, and investment in, foundational Tough Tech falls outside of the exclusive ability of most private sector firms for a few reasons:

- These technologies need more time to mature, with experimentation cycles misaligned to return expectations of private capital;
- Capital gaps exist in multiple locations along the company development timeline;
- Regulatory constraints increase hurdles for startup firms;
- Commodity products that Tough Tech can improve through cleaner, more efficient production processing are sold in markets that generally have weak appropriability regimes, limiting the set of strategic choices for firms.

These challenges manifest at different stages in a company's lifecycle. At the earliest stages, government support is needed to facilitate the translation of technology out R&D labs and into the commercial world and to support R&D activities within startups facing tight financial constraints. Successful Tough Tech companies often emerge from our nation's prolific academic labs. We find that current government approaches are not suited to either select high potential academic founders or provide the initial capital and mentorship required for these founders to translate the technology from the lab to a commercial entity that will scale into a foundational U.S. industrial base company.

Federal support for early-stage Tough Tech today relies primarily on Small Business Innovation Research and Small Business Technology Transfer programs (hereafter SBIR). While $3.8 billion was spent through SBIR in the past fiscal year, commercialization is not directly funded by such programs. Each government agency that uses SBIR has its own program and corresponding priorities for choosing projects to receive awards. This fractious distribution of funds and the high friction involved in winning these awards results in a current system that favors repeat awardees that rarely progress to substantive commercial growth. An SBA study estimated that 60-80% of SBIR-awarded companies require additional investment before they can move to market. This is even more pronounced in Tough Tech, where the capital requirements to reach market requires significant additional private capital. Revisiting the federal approach to supporting early-stage Tough Tech using public capital to incent private capital is a critical first step.

As companies move into later-stage commercialization activities, a different set of challenges emerges. These barriers stem not from the inherent technical challenges of innovation, but rather from the market dynamics in which these technologies have to compete. Companies face three distinct but related barriers:

- **Funding of capital intensive early-stage pilots**: Companies have to balance achieving meaningful technical progress at a relevant scale, while demonstrating market traction, even though, at this scale, a prototype has little market value.

- **Funding first-of-a-kind commercial projects**: Traditional investors in infrastructure projects, for example, are unwilling to accept technical risk of any kind. For first-of-a-kind commercial projects, firms have two dimensions of technical risk: (a) will the product function at scale in the same way it functioned as a prototype, and (b) will the product lifespan predictions come to fruition?
- **Intransigent commercial markets**: Commercial markets

for foundational technology are often hamstrung by two factors. First, competing with conventional industrial players that have the benefits of scale manufacturing reduces the market opportunities for startups in the sector, with associated downstream effects on the investment community that reduce incentives for investment across the innovation pipeline. Second, many of these technologies are regulated themselves or compete in regulatory environments that remain particularly intransigent to new technologies.

Already, certain agencies within the government support some of these efforts, but not at the level of funding necessary to move the needle or with the breadth required to affect the large domain of Tough Tech across multiple industrial verticals.

2.4 A New National Strategy

Creating a 21st-century economy that provides social and economic benefit across the U.S. citizenry while also addressing some of the world's most challenging problems is a daunting task but one that the U.S. must lean into. Tough Tech alone will not create the prosperous and equitable future we as Americans strive for, but it can play a cornerstone role in our new economy, creating economic opportunity for the middle class across diverse geographic areas.

Realizing the benefits of Tough Tech requires a set of government interventions both to ensure the growth of these foundational companies and technologies but also to ensure that the ensuing benefits are shared by all. These interventions will set the stage to facilitate the growth of Tough Tech, ensuring we have:

The Right People:

- Workforce training to provide workers in traditional industries the opportunity to attain jobs in the new economy.
- Immigration reform to allow more U.S. trained international students to remain in the U.S. to create companies based on taxpayer-funded research.
- Expansion of entrepreneurial graduate fellowships and other cohort programs like NSF I-corps and Activate.
- Diversification of stakeholders through increased investment in HBSCUs and Minority Institutions.

The Right Funding:

- Increased early-stage funding for Tough Tech startups that aligns public and private capital.
- Reduced friction in later-stage funding for capital intensive "first-of-a-kind" demonstrations at scale via increases in government direct and indirect financial products at a scale akin to the New Deal era Reconstruction Finance Corporation.
- Expansion of strategic Manufacturing USA centers, with a focus on including underserved geographic locations and HBSCU/MIs.
- Encourage the SBA to experiment with new ways of leveraging the already-successful Small Business Investment Corporation (SBIC) program to encourage investments into Tough Tech.
- Creation of "demand pull" (e.g. procurement or prize guarantees) in addition to "technology push" strategies.

The Right Coordination:

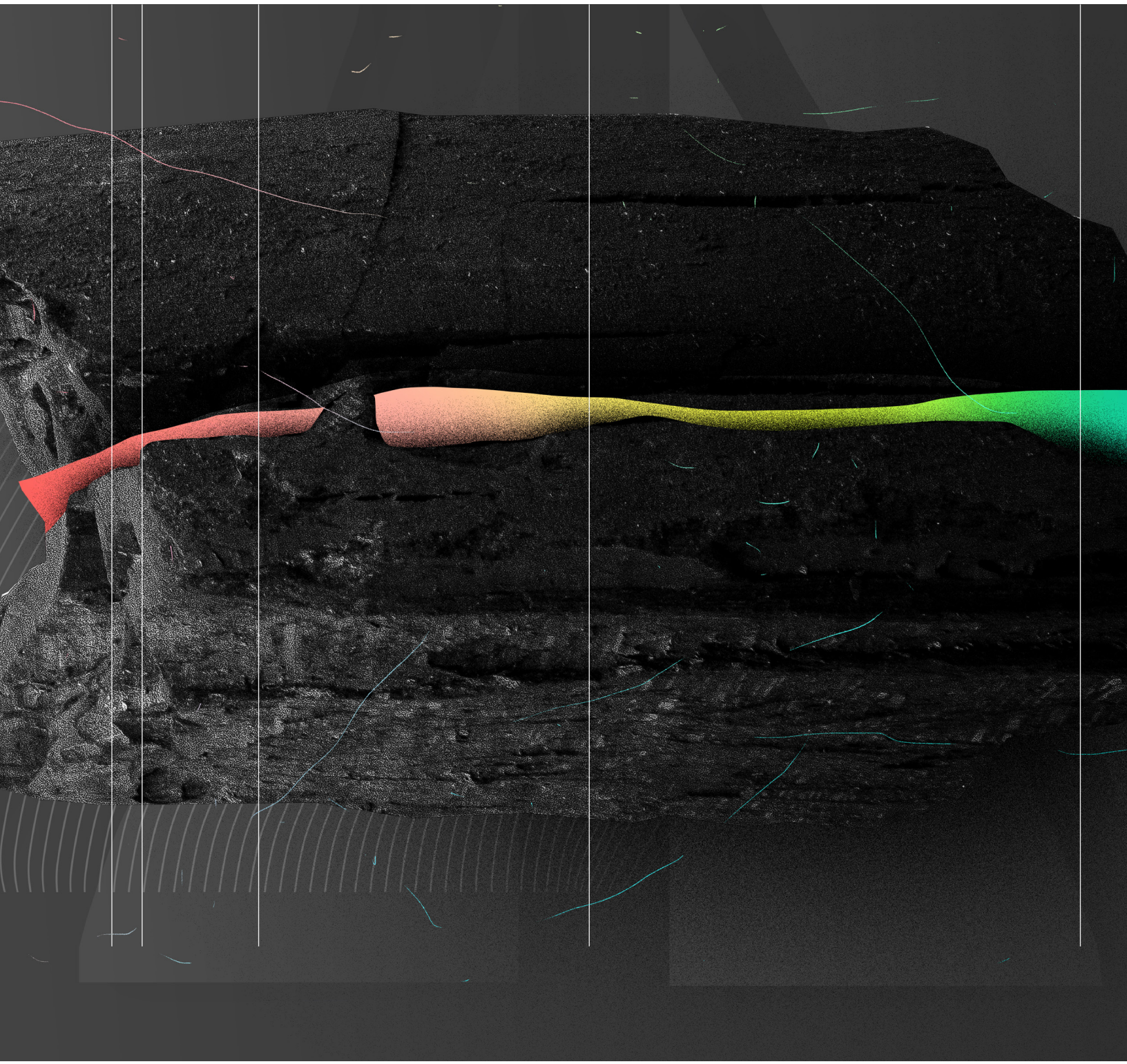
- Empowerment of OMB, GSA, and NEC to ensure Tough Tech R&D expenditures align with national strategy.
- Expansion of public and private capital cooperation, ensuring government programs incentivize trusted capital providers to invest in historically challenging sectors.
- Mobilization of our national lab system to support Tough Tech commercialization.
- Establishment of national strategic moonshots (e.g., cancer, baseload carbon-free energy, food desert, etc.) with specific agency earmarks and authorities.

The Right Regulation:

- Expand mandate of certain agencies to include advancing economic competitiveness (e.g., NSTF) or create new agencies where necessary (e.g., ARPA-M)
- Allow agencies to experiment with commercialization pilot programs that incentivize public-private partnerships (e.g., allocation of portions of the SBIR/STTR budget.)

The above are not specific policy recommendations but rather areas that we must explore as we create a national strategy to promote the impact of Tough Tech on our economy and society. While there are immense challenges to bring these disruptive technologies to global scale and even more challenges to ensure that these technologies positively benefit all of society, we should embrace the opportunity to take action today to affect our shared global future.

Tough Tech holds the promise of creating entirely new industries as well as revitalizing historically foundational sectors such steel, energy, and manufacturing that are under global competitive strain to shutter or offshore. But Tough Tech alone cannot provide this future. The combination of these breakthrough technologies with the right government and private sector interventions holds the potential to impact the challenges that unite us globally. Ensuring the inclusion of all the diverse stakeholders in the development and application of these technologies is critical to realizing the positive impacts to social equity and shared economic growth. The U.S. must act now with a sense of urgency to protect and expand these middle-class jobs across the U.S. while also ensuring continued U.S. global leadership in the 21st-century economy.



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