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Frame the Future Thought Pieces

A Blueprint for Innovation Competitiveness

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A national system of innovation can be defined as "a means by which a country seeks to create, acquire, diffuse, and put into practice new knowledge that will help its people achieve their individual and collective goals." This is a worthy endeavour, where there can be industrial development and economic well-being, all thanks to technological innovation. Such a system involves the process of innovation carried out by a set of interrelated stakeholders. Institutions and organizations, such as government agencies, universities, R&D institutes, industry associations, vocational training centers, and industrial firms, interacting with each other, co-discovering and co-learning, and resulting in the creation of technological products. Technological innovation is the hallmark of economic development in modern economies, and developing countries that seek to compete successfully in the global economy must move rapidly into emerging areas where transformative technologies are used.

The foundations of a national system of innovation were laid over a century and a half ago as a key driver for the wealth of nations. For an innovation policy to succeed, it needs to be driven by central players and authorities that can effect nationwide changes. The United States innovation system, for example, has propelled it to become the most economically prosperous and most secure nation in the world. During WWII, Vannevar Bush headed the U.S. Office of Scientific Research and Development (OSRD), which oversaw wartime military R&D. After WWII, Bush, the first scientific advisor to the president, was asked to design a national program modelled on the OSRD to drive innovation more broadly. In response, he authored a report in 1945 called *Science, the Endless Frontier*, proposing a national model of innovation built on the principle of federal support for basic research and where the flow of scientific knowledge would drive technological progress and advance security, health, education, standards of living, and cultural progress.

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This model went through a golden age, with up to 1.8 percent of the U.S. GDP being invested in R&D, resulting in massive benefits within the space of a few decades and laying the foundation for the dominant position that the United States is in today. Thanks to the partnership of government, academia, and industry, backed by federal funding of R&D, the United States has produced a stellar record of scientific advances, which has seen Americans winning close to half of all Nobel prizes in science since 1950; invented revolutionary technologies such as the computer, Global Positioning System (GPS), integrated circuits, the Internet, LED technology, solar panels, and touch screens; and created new markets, industries, and companies. Bush helped establish a formalized pipeline model of innovation where the government invests in basic research at one end, passes through universities and research institutes that advance research and training, and benefits flow out at the other end in the form of technology creation and new products that are developed and commercialized in the private sector. In recent years, the model has been strengthened by the rise of private R&D funding. Industry technology leaders (Amazon, Facebook, Google, IBM, and Microsoft) spent more than $65 billion in R&D in 2018, which is roughly half that of the federal government. There has also been a rise in global research partnerships, the attraction of foreign student populations, the welcoming of talented immigrants, and the rise in venture capital investment.

In today's world, many countries find themselves confronted by economic, geopolitical, ideological, and military challenges. With globalized access to information and accelerated technology disruption, the time horizon for transformative technologies to change society is shorter than ever before. By capitalizing on the current frontier of innovation characterized by transformative emerging technologies such as artificial intelligence (AI), quantum information science (QIS), advanced manufacturing (e.g. nanomanufacturing), advanced communications (e.g. 6G), and biotechnology (e.g. neurotechnology and synthetic biology), the demands of these challenges can be met, and economic advantage can be gained.

Consider AI, for example, many people have not yet grappled with how the AI revolution will impact our economies, national security, and welfare. AI could contribute USD $15.7 trillion to the global economy in 2030, a game-changing amount. It will be the most powerful tool in ages that can benefit humanity. The rapidly improving ability of machines to perceive, evaluate and act more quickly and accurately than a human is world-altering and is a competitive advantage across all fields. Many advances have already been made leveraging AI in fields such as biology, chemistry, and medicine, which are improving life and unlocking mysteries of the natural world. "Game-changing" is an apt description of the discoveries being made, and as AI is diffusing rapidly and is of dual-use, it is necessary to establish guardrails regarding its development. The technologies at the current frontier of innovation will underpin national competitiveness in the 21st century and will change the world we live in and how we live in it. It is important for nations across the globe to develop and execute a bold plan of action for how they will get an advantage from or leadership through these technologies and not get swept away by the impending changes. Some key aspects to address include the establishment of good-tech principles, funding and national investments, talent cultivation and attraction, organizations created or redesigned, technology access and adoption, alliances, and ecosystems. Public-private partnerships (PPPs) are at the heart of all these aspects.

The past three decades have offered up lessons on the critical success factors for PPPs that have been identified in meta-studies. These include (1) appropriate identification and sharing of risk among parties; (2) involvement of a strong private consortium with well-structured companies that have a good technical, operational, and managerial capacity; (3) political support to approve public expenditure and attract investors; (4) community/public support; and (5) transparent procurement as a PPP is a procurement process. Some common central issues for PPPs on innovation cooperation include an interdisciplinary management committee with academic and industrial representatives, mindful strategies, and contractual terms that enable a seamless procedure to select and add new partners and a sustainable financial agreement. Such PPPs with committed partners and new engagement models that have a frictionless administrative structure and that address intellectual property obstacles will de-risk and help navigate the complexities of basic and applied research against a backdrop of globalization, protectionism, and barriers to market, promoting innovation and national competitiveness, and providing solutions to global problems like the COVID-19 pandemic and climate change.

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