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Assessing the Role of the Federal Government in the Development of New Products, Industries, and Companies: Case Study Evidence since World War II

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ABSTRACT

Based on case studies of 40 major innovations in the post-World War II period, we assess the role of the federal government in the development of new products, industries, and companies. To guide our selection of major innovations, we identify general purpose technologies (GPTs) that were established during this period. GPTs generate substantial positive spillovers and have broad economic and social effects. Given that universities and federal/national labs conduct the overwhelming majority of federally-funded research and have also been heavily involved in the development of GPTs, we focus on the role of these institutions in our analysis of technological diffusion. Two key stylized facts emerge from our analysis. The first is that many innovations with significant commercial applications were initially developed

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and adopted by military and space agencies (e.g., nuclear energy, electronics, computers and the Internet, airplanes, laser technology, biotechnology, and pharmacogenomics). The second is that the role of the federal/national labs in technology development and technology transfer may be understated, given that university technology transfer has generated much more attention in academia and the popular press.

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Introduction

The purpose of this monograph is to assess the role of the federal government in the development of major innovations. We do so in a purely descriptive manner. Specifically, we identify and describe major products, industries, and firms resulting from U.S. government funding of research in the years since World War II (WWII). As noted by Ruttan (2006), military and space R&D during WWII and in the cold-war period in the aftermath of that global conflict, played an important role in the development of numerous civilian technologies, such as nuclear energy, electronics, computers and the Internet, artificial intelligence, lasers, and the development of jet aircraft. It is well known that during WWII and the famous "Manhattan Project" the Los Alamos and Oak Ridge National Laboratories played a key role in the development of the atom bomb and nuclear energy. What is less well known is the role of the federal and national labs in the development of such key technologies as radar, lithium-ion batteries, and computers.

For example, the first electronic digital computer, ENIAC, was developed at the Ordnance Ballistic Research Laboratory of the U.S. Army, working with research from the Moore School of Engineering at the University of Pennsylvania (Burks and Burks, 1981). After WWII,

established the National Science Foundation, which was created to fund basic research in science and engineering. Additional federal investment in science and technology ensued during the Eisenhower and Kennedy administrations with a strong emphasis on the space program (e.g., Project Mercury).

The evidence clearly shows that these investments in military and space R&D ultimately had numerous significant commercial applications. President Nixon launched a War on Cancer and dramatically increased federal funding for biomedical research. After an energy crisis, President Carter launched research programs for renewable energy sources, such as solar energy and fission. Another milestone was the creation of the Department of Energy during the Carter Administration. President Reagan significantly increased expenditures on defense R&D, as part of his Star Wars/Strategic Defense Initiative (Feldman *et al.*, 2002). Congress also weighed in by enacting two landmark bipartisan pieces of legislation relating to technology transfer of federally-funded innovations: (1) the Bayh-Dole Act in 1980, which applied mainly to universities and (2): the Stevenson-Wydler Act in the same year, which sought to streamline technology transfer from federal laboratories to industry. Other legislation followed that established technology transfer offices at federal labs and Cooperative Research and Development Agreements (CRADAs) between firms and federal labs (i.e., the Federal Technology Transfer Act of 1986).

This monograph is organized as follows. First, we outline our strategy for identifying major products, industries, and companies resulting from government funding in the years since WWII. This requires us to define the concept of a general purpose technology (GPT). We conclude with a description of 40 innovations that have had a major impact on our economy and society. Our description of these innovations contains fairly-detailed explanations of how these products were developed and how they made their way from lab to market. The outcomes of these federal investments in technology are quite impressive, both in terms of their economic and social impacts.

Author Biographies

Bio-Sandra Price Dr. Sandra Price is a faculty member in the School of Community Resources and Development (SCRD) at Arizona State University. She received her bachelor's and her juris doctoral degrees from Arizona State University and her doctoral degree from University of Missouri — Kansas City. Dr. Price's career spans 30 years as a policy strategist, lawyer, advocate, and capacity builder. Her clients include organizations in the nonprofit, private, and government sectors, where she has practiced legislative and regulatory law, particularly in environmental, water, and municipal areas. Dr. Price also has expertise in economic and community development, conflict resolution, nonprofit capacity building, strategic organizational diversity and inclusion, and organizational ethics and ethical engagement. Dr. Price is an ASU Piper Fellow for Knowledge Exchange and Resilience, serves as a faculty associate for the ASU Center for the Study of Race and Democracy, as an ASU Sustainability Scholar, and as affiliate faculty for the ASU Lincoln Ethics Center.

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