U.S. Politics, Economy, and Technology

David M. Hart
School of Public Policy
George Mason University

Prepared for *A Companion to Philosophy of Technology* (Blackwell)

Technological change is a social process. Individuals who are the agents of such change are generally embedded in organizations, which are themselves structured by institutions, which are in turn embedded in cultural systems of meaning and value. Together, these layers of governance regulate the pace of technological change and determine its direction. The layers interact continuously, usually reinforcing one another, thereby producing characteristic paths of development at the national level.

In the American context, governance in this broad sense conspires to foster relatively rapid and occasionally radical technological change. American culture tends to be accepting of new technologies and is often enthusiastic about them. These cultural biases and their expressions in law and public policy support what Nathan Rosenberg calls "economic experimentation,"[1] a diversity of private efforts to combine and recombine technological systems with organizational schemes for producing and exchanging new goods and services. The market generally decides which of these "experiments" deserve to be continued and which are to be relegated to the dustbin.

Until the twentieth century, the U.S. federal government did little more than passively countenance this dollar-based process of generating and selecting new technologies. Since the country attained great power status, and especially since World War II, when it assumed a dominant role in the international system, the government has increasingly added to the diversity of experimentation and accelerated the pace of change. Exceptional cases notwithstanding, there are few signs that this acceleration has bumped up against cultural, political, or economic limits in the early 21st century.

American Liberalism

The U.S. is at root a liberal society. Americans tend to value the individual over the collective interest and to privilege negative freedom over positive freedom, "freedom from," as Isaiah Berlin would have it, over "freedom to." Premodern status distinctions eroded more quickly in the U.S. than in Europe and other European colonies; political rights and entrepreneurship trumped aristocracy and guild.

To be sure, these ideals were often abridged, nowhere more so than in the slave-holding South of the pre-Civil War era. Nonetheless, in the context of abundant natural resources and a shortage of labor, they helped to animate a relatively high level of popular engagement in what the patent clause of the U.S. Constitution labeled the "useful arts." "The annals of American invention,"

[1] Nathan Rosenberg, *Exploring the Black Box* (New York: Cambridge University Press, 1994), 87-108.

writes B. Zorina Khan of the nineteenth century, "were not limited to the wealthy, corporate entities, or other privileged classes, but reflected a broad spectrum of society."[2]

The objective of such invention was usually to get rich quick. Machines that could do something new or better than before provided platforms for enterprises that could bank on a taste for novelty among buyers. As the pace of immigration quickened after the Civil War, newly arrived Americans reinforced the receiving culture's openness to novelty, shedding their traditional ways and adopting with alacrity the means supplied by the emerging mass production sector.

The giant corporations that arose in the late nineteenth and early twentieth centuries to feed this mass market aroused some misgivings among Americans. Populists and Progressives gave voice to concerns about the destruction of traditions, livelihoods, and places like John Muir's beloved Hetch Hetchy Valley, near the present day Yosemite National Park. Yet, it was not the technologies *per se* that bore the brunt of these attacks, but rather the firms that produced them. Indeed, the short-lived Technocracy movement of the early 1930s revealed a deep-seated suspicion that big business was suppressing technological change and that solutions to the nation's problems could be found by unleashing it.

The technological enthusiasm of the Jazz Age of the 1920s, with its radios and automobiles, found expression once again in the post-World War II consumer culture. For all the irony of "plastics," as whispered in the ear of "The Graduate" in the movie of that name, American consumers continued to find the pull of the new irresistible. The popular culture of technological production was renewed as well in the postwar period, especially with the appearance of hackers like the Homebrew Computer Club, which gestated the idea of the personal computer in the late 1970s in Silicon Valley.

Hacker culture came into full flower during the boom of the late 1990s, reinterpreting the American liberal creed once again. "Cyberlibertarians" construed the Internet as a new frontier for the imagination that was not simply ungovernable in practice but in principle as well. Even property rights, the collective capacity on which individual effort is based in Lockean theory, presented problems for some of them. Although the juxtaposition of extreme anti-statism and unbridled technological freedom of cyberlibertarianism never won over mainstream America, it distilled powerful tendencies that have always been latent within American society.

The Constitutional System

The institutional framework that nurtured the liberal culture and its zeal for the new – and which was in turn reinforced by that culture – was set in place by the Constitution. The founders of the U.S. polity divided governmental power horizontally and vertically and diluted it by establishing individual rights against the state. These constraints on the federal government fostered political and economic competition that was often expressed in technological form.

The states within the Union competed for business from the start, subsidizing turnpikes and canals and, before long, steamboats and railroads. The federal government was precluded from

[2] B. Zorina Khan, "Technological Innovations and Endogenous Changes in U.S. Legal Institutions, 1790-1920," National Bureau of Economic Research, working paper 10346, March 2004, p. 11.

investing in such “internal improvements” in the antebellum period. For instance, although Congress briefly supported Samuel Morse’s research on the telegraph in the 1840s, it declined an opportunity to acquire and develop the finished invention. The lack of central direction and coordination made for chaos and duplication in the new technologies of transportation and communication, but also sped their deployment and diffusion as alternative approaches were tried out by entrepreneurs and their backers at the state level.

The Civil War removed some constraints on the federal government, as evidenced in 1862 by the beginnings of a unique partnership with the states to create “colleges for the benefit of agriculture and mechanic arts." Building on a tradition of widespread, locally-governed public education, the “A&M’s” brought higher education to a broad stratum of the population. They also became valuable knowledge resources for local industries, engaging in targeted research as well as education. Agricultural experiment stations, which were linked together and supported by the U.S. Department of Agriculture, were joined at many public universities by state-funded engineering experiment stations.

The various “internal improvements” of the postbellum era knit together the world’s largest free trade zone. This market stimulated private investments in productive capacity of unprecedented scale, along the way accelerating productivity growth in one manufacturing industry after another. The financial and legal instruments that evolved to enable and insure such risk-taking were in part products of competition within the federal system. Most notably, the generous laws of states like New Jersey and Delaware brought into being the private corporation as we know it. The long-term security and large-scale capital made possible by this institutional form enabled the creation of the corporate R&D laboratory, the hub of technological development in the early 20th century.

The system of constrained and divided governmental power made it difficult for those harmed by technological change in the age of industrialization to get recompense, and preemptive action to head off such change was nearly unheard of. The courts were the primary venue for these kinds of claims, and they acted after the fact and slowly, if at all. Only at the end of the 19th century, after decades of political agitation, did Congress begin to create a federal administrative structure that even remotely resembled the ideal type of bureaucracy envisioned by Max Weber around the same time. The new agencies were frequently saddled with mixed promotional and regulatory missions and proved vulnerable to “capture” by the industries that they oversaw.

Still, technologies to safeguard human health, public safety, and the natural environment began to attract substantial public interest and support around the turn of the 20th century. New communities of practice in such fields as public health and civil engineering explicitly aligned professional interest with the common good. These progressive engineers envisioned a society operating along scientific principles, reducing the “waste” (a word with diverse connotations) they saw as inherent in the market system that had dominated the century just past.

Federal Patronage

Business in such a scientifically managed society would not be replaced by government, but would instead practice “self-governance” through the creation of a consensus that spanned the

public and private sectors. The leading exponent of this view claimed the Presidency in 1928. Unfortunately for President Herbert Hoover, the Great Depression derailed his attempt to implement such a vision. The New Deal state that emerged in its place under his successor, President Franklin D. Roosevelt, presumed tension, if not hostility, between business and government. And it shattered most of the remaining constraints on federal authority, carrying out programs of "internal improvement" in a variety of technological fields, such as rural electrification and soil conservation.

Although the New Deal drew many technical experts into public service, it was not as extensive nor as focused on science and technology as cognate developments in Europe; the vast bulk of technological capability in the U.S. remained outside the compass of the state. World War II changed that. Under Roosevelt's prodding and with the creative efforts of Hooverites like his science advisor Vannevar Bush, the U.S. military moved from conservatism to a radical embrace of technology during the course of the war. Employing what pioneering science policy analyst Don K. Price later called "federalism by contract," the armed forces engaged the knowledge and skills of the country's most advanced firms and most prestigious universities.[3]

The Cold War that followed sustained these institutional innovations. Yet, they did not amount to a "military-industrial complex" dominated by a "scientific-technological elite" that President Dwight D. Eisenhower spoke of with anxiety in his 1961 farewell address.[4] Military support for new technologies remained decentralized and pluralistic, not least because of the way that the Constitution divided power. The contractors favored by the new federal patrons included start-up firms as well as corporate giants. Technological know-how was widely diffused both for security reasons and because the liberal tradition seemed to demand it.

These policies, backed by a massive amount of federal spending, produced not only the "baroque arsenal"[5] of ICBMs (intercontinental ballistic missile) and MIRVs (multiple independently targetable reentry vehicles), but also the passenger jet, computer-controlled machine tools, and, eventually, the Internet. Such civilian "spinoffs" from military R&D and the academic-venture capital-entrepreneurship complex that they helped give rise to in places like Silicon Valley provided powerful impulses to the American high-technology economy in the postwar period.

Like their military counterparts, the main federal civilian science and technology agencies were born in the early Cold War, and they operated in a similar fashion with similar results. The National Institutes of Health (NIH) is paradigmatic in this regard. Opposition to federal patronage of biomedical research melted away during World War II, and by the 1950s, the executive and legislative branches were competing to see which could propose a larger budget for this purpose. Meanwhile, individual members of Congress scrambled to build up research centers in their home districts. NIH's R&D spending stimulated rapid growth in the U.S. pharmaceutical and medical device industries, spinning off the extraordinary new field of biotechnology in the 1970s and 1980s.

---

[3] Don K. Price, *Government and Science* (New York: Oxford University Press, 1954).
[4] Dwight D. Eisenhower, "Farewell Radio and Television Address to the American People," January 17, 1961, available at http://www.eisenhower.archives.gov/farewell.htm, accessed November 27, 2006.
[5] Mary Kaldor, *The Baroque Arsenal* (New York: Hill and Wang, 1981).

As in the late nineteenth century, technological change in the late twentieth century U.S. was not without its critics. The "affluent society," as John Kenneth Galbraith characterized it[6], provided them with more political resources and public support than their predecessors. In the 1960s and early 1970s, Congress responded to these "new social movements" with pioneering health, safety, and environmental legislation that forced industry to adopt the "best available control technologies" and, in some cases, to develop new ones.

Nuclear power was the focal point of much of this criticism, and its diffusion was halted in the U.S. in the late 1970s by public opposition and skyrocketing costs. But it would be a mistake to generalize from this unique case and this exceptional period to conclude – for better or for worse – that American institutions for governing new technologies had been transformed. Even as the Three Mile Island accident was putting the final nail in the nuclear coffin in 1979, recombinant DNA and the personal computer were capturing public enthusiasm, sparking entrepreneurship, and spawning new millionaires.

Looking Forward

Cross-national surveys conducted between 2000 and 2004 suggest that the U.S. public continues to view science and technology more favorably than the European or Japanese publics. U.S. government agencies, business, universities, and charitable foundations continue to finance R&D at a record pace, still accounting for more than a third of the global total in 2000.[7] American policies and institutions that foster technology-based entrepreneurship are envied and emulated the world over. Even nuclear power is getting a new look, as policy-makers begin to explore the options for addressing climate change realistically.

Voices of dissent have become fainter in recent years, with one prominent exception. Christian fundamentalists have blocked federal funding for embryonic stem cell research, which they see as murder, for several years. Yet, this success is quickly crumbling, as other countries and even U.S. states leap into the void. The liberal regime of international trade, investment, and communication, of which the U.S. has been the primary sponsor, has stripped from this country the power to control the pace and direction of technological change. To understand governance of technological change in the coming century, we will need to understand culture, institutions, organizations, and individual behavior on a global scale.

---

[6] John Kenneth Galbraith, *The Affluent Society* (New York: Houghton-Mifflin, 1958).

[7] National Science Board, *Science and Engineering Indicators 2006* (Washington: National Science Board, 2006), p. 7-23 and p. 4-40.