Choosing Our Technological Futures

by Mark W. Anderson

In post–World War II America, there was an ebb and flow in the way we thought about the adoption of new science and technology. In these attitudinal changes, there is a lesson about how we should think about the stunning new technologies that face us today. We need to ask, what process should we trust to chart our path in the use of technologies such as artificial intelligence? To answer this, remember that just because technology billionaires think an innovation is good for their businesses does not mean that it is also good for society.

In the 1960s, Americans enjoyed a decade of fascination and excitement with scientific research and technological development. We felt a relief coming from two new vaccines to tackle the scourge of polio. We delighted in the prospect of more vaccines to prevent other debilitating diseases. Americans were thrilled by the space race with the Soviet Union and took up the challenge from President Kennedy to win that race. American agriculture was beginning a science-based transformation that would eventually revolutionize global food production, causing a so-called Green Revolution. On every side, science and technology promised a brighter future.

But even in the midst of this optimism in a future of abundance created by scientific research and development, there emerged a healthy cautionary streak in our national outlook. Some scholars identified the roots of this caution in Rachel Carson's book *Silent Spring,* which questioned the widespread use of synthetic pesticides in US agriculture. She characterized pesticide use as far less than the unalloyed good it was argued to be by the chemical industry and by much of the scientific community. From this and other elements of the post–World War II explosion of new technologies came a broad questioning of the pace of technological change and of the adverse environmental, health, social, and economic impacts of new technologies.

Heilbroner (1968: 159) said at the time,

> with few exceptions, we allow the products of this technology . . . to work their social will without hindrance so long as they are economically obedient. As a result, our economic growth steadily adds to our social involvement with technology in a manner that is essentially capricious and haphazard. We have narrowed our control over the incursion of scientific technology into our lives to the main and often to the single criterion of its profitability.

We were allowing market forces alone to chart our technological futures.

At the same time, there was increased interest in the study of the future, variously called futures research, futurism, futures studies, futurology, and forecasting. Ironically, much of this interest came out of the aerospace industry, the source of many of the new technologies being questioned.

One of the manifestations of these two trends was the development of a new technique, technology assessment. The idea was that new or developing technologies were not necessarily good for society. Rather, technology could be seen as a social choice, something whose adoption could be slowed, modified, or even stopped to meet the best interests of society. Making sound public policy decisions required a way to study the broad impacts of new technologies, which was the premise of technology assessment.

Concurrently, economists were refining benefit-cost analysis as a broadly applicable tool for quantifying the impacts of technology and of other changes on the aggregate welfare of society (Anderson et al. 2015). Technology assessment and benefit-cost analysis were competing approaches to assessing future impacts of change on society. A significant difference between the two was that benefit-cost analysis was based on the coherent theoretical foundation of neoclassical welfare economics, coming from the entrenched academic discipline of economics, while technology assessment was a broadly outlined technique, part of the nascent multi-disciplinary approach of futures research.

Benefit-cost analysis differed from technology assessment in the extent of quantification (Encel et al. 1976). In benefit-cost analysis, all benefits and costs were expressed in monetary terms, and projects or new technologies were comparable using a single metric, the present value of net benefits. Factors not expressible in monetary terms were not included in the analysis. Technology assessment included the evaluation of economic, social, political, and ethical factors, but there was no attempt to express results of the analysis in precise mathematical terms.

Technology assessment required two types of forecasting, drawing upon its partial roots in the futures research movement (Boucher 1976). First, a path of technological change needed to be forecast, the realm of technological forecasting (Martino 1972). Once the nature of technological change was

characterized, various elements of social, political, economic, and cultural change needed to be forecast as well. (See, for example, Gordon et al. [1977].) The basic assumption underlying the technique was that change in human society was predictable, a function of social processes. Modeling the past could yield an understanding of the future because the future was a product of the trajectories of events and processes in the past.

For this reason, historians took a particular interest in technology assessment. Medieval historian Lynn White Jr. used his 1973 Presidential address to the American Historical Association to discuss the theme of "Technology Assessment from the Stance of a Medieval Historian," questioning whether technology assessment was even feasible. This interest came in part from the development in the early 1970s of retrospective technology assessment (Segal 1982; Tarr 1977). The idea of retrospective technology assessment first came from the technology assessment community. It was an attempt to validate and improve the incipient tools of technology assessment. The logic was to apply the tools of technology assessment to the early stages of a known technology using only the information that would have been available before that technology was fully developed. Researchers asked, would such an analysis yield a meaningful description of the impacts of a technology so that public policy might have avoided or mitigated adverse impacts? For example, could a technology assessment of nuclear fission to generate electricity have identified policy relevant impacts and avoided problems like the lack of any means of long-term storage for radioactive wastes?

Such retrospective technology assessment meant that historians needed to be included in research teams, from which grew an interest among historians in the use of technology assessment tools to deepen our understanding of the impacts of technological change. In other words, retrospective technology assessment became another approach to doing history, whether or not it helped improve the use of technology assessment for future-oriented research.

The logic of technology assessment was so politically compelling that the United States Congress created an Office of Technology Assessment (OTA) in 1972 (Anderson 1978). The office was charged with providing Congress with studies on the potential impacts of new technology that could be used as part of public policymaking. From the beginning, the Office of Technology Assessment was politicized. It was increasingly seen as a tool to support Democrat liberal policies (liberal in the American sense of that term), and its funding was terminated in 1995 by the new Republican majority in Congress as part of the "Contract With America." Despite attempts since then to reintroduce technology assessment into Congressional decision-making, there has been a waning interest in the approach in both political and academic quarters (Knezo 2005).

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In part, this declining interest reflects a belief, more pervasive in the United States than Europe, that markets are best able to gather and weigh the information needed to determine whether technological change of a given type is good or bad for society. The efficient market hypothesis is an extension of theory applied first to financial markets. In this market-based theory government regulation of new technologies is seen as inefficient, so studies of the potential impacts of new technologies are superfluous. The argument is that well-functioning markets will weigh benefits and costs better than research teams can. This idea is fundamentally different from the precautionary principle, which reflects an assumption that technological change is not inherently good or bad for society. Humans need to exercise caution about new technologies, and one way of doing so is by understanding the impacts of change in ways beyond those that can be quantified in dollar terms and evaluated through market mechanisms.

From its beginnings as part of the futures research movement in the 1960s, technology assessment was an approach that tried to address inter-generational issues purportedly weighed by efficient markets. Because of the complexity of the processes being studied and the emergence of benefit-cost analysis as a politically preferred tool, technology assessment is no longer as common as it was in the 1970s and 1980s. There are, however, other tools with similar approaches. Among these are environmental impact statements as required in the United States by the National Environmental Policy Act, life-cycle assessment, and multicriteria decision analysis.

The choice of which tool should be used to support public policymaking is ultimately a political choice. In many ways, we now rely on the free-market or efficient market idea, even though "free markets" is clearly a misnomer. Markets in real-world America are far from the competitive model taught in introductory economics courses.

Whether it be artificial intelligence (AI) or the blockchain technology behind cryptocurrency Ponzi schemes, there is no significant public debate about the social, economic, or environmental impacts of these new technologies. Current thinking seems to be, if AI

requires huge new demand for electricity to run its server farms, so be it. If unsuspecting novice investors are attracted to shiny new investment types and loose large sums of money, let the buyer beware. The alternative would have been for us to continue with technology assessment based on the precautionary principle, the idea that newness alone is not enough to justify letting the private sector decide what is in the public interest. The public interest is measured in more ways than just the investment returns for technology billionaires.

It is time to think again. The precautionary principle warns us that just because we can do something new doesn't mean we should.

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