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# Technology and Capitalism

BY ROBERT HEILBRONER

**I**F there is one thing we have all learned from these pages, it is that the word *technology* has many facets. Yet, one aspect of this many, many-sided term deserves an examination it has not received. This is the relation between technology and capitalism. In this essay, I would like to sketch out some of the peculiar aspects of this relationship that warrant our attention.

Here I must begin by describing, in desperate brevity, what the word *capitalism* means. Capitalism is a “social formation,” to borrow Marx’s useful term, with three historically unique features: an all-important dependency on the successful accumulation of capital; a wide-ranging use of a market mechanism; and a unique bifurcation of power into two sectors, one public, one private. Together these institutional features serve both to guide the system in its daily workings as well as to maintain or change its long-term historical thrust. In so doing they radically alter the meaning and function of technology within capitalism compared with any other social order.

Before I turn to that central question, however, I must spend a few words discussing the properties of these all-important distinguishing attributes. Here it is usual to begin with the ubiquitous and pervasive presence of markets, both with regard to capitalism’s day-to-day operations and its historic trajectory: indeed, one frequently hears the order called a “market system,” perhaps to avoid having to pronounce its politically loaded real name. Yet, essential though the market is for capitalism, it is not here that we must look for its most remarkable relation to technology.

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A second identifying element of a capitalist formation is its division of authority into two sectors: a public sector charged with the traditional duties and prerogatives of government, a private sector with the responsibility for producing the great bulk of total output. This bifurcation is also of great importance for capitalism, which in fact also likes to call itself the system of private enterprise; but important as the bifurcation may be both for political and economic reasons, it too is not the key aspect of the formation with regard to redefining the function of technology.

That leaves as the strategic point of examination the third unique feature, the pursuit of capital. Here I must begin by emphasizing the difference between capital and wealth. To put it as succinctly as possible, wealth is a thing, capital a process. Wealth consists of objects whose value lies in their symbolic embodiment of the power of their owner, and which are, therefore, never offered for sale except in dire emergencies. In sharp contrast, capital is embodied in commodities, such as coal or wool or labor power, that are unimaginable as wealth. More important, these commodities are thrown onto the market for more money than was spent in bringing them into being—not to pocket the receipts as wealth, but to buy or create more commodities which in turn will be used to repeat the process as long as it continues to generate more value. This is a dynamic circuit that has no counterpart in societies in the thrall of tradition or command. It is here that technology finds its historically unique role.

The nature of this new function must be obvious. In precapitalist social formations, improvements in the command over nature may have considerably improved the well-being of all, or the prestige of a few, but no one could claim that the very continuance of ancient or medieval or Renaissance life was under ever-present threat, or lived in ever-renewed hope, from the outcome of whatever technological change might be going on in its midst. By way of contrast, need I say that the outlook in all capitalist societies is in precisely such a state? Put differently, the invention of the spinning jenny and the steam engine, the steel

mill and the gasoline motor, the generation of electricity and the design of the computer were never merely advances in the control over nature, but elements in an aspect of the enveloping social formation that had no counterpart in any precapitalist order. Prior to capitalism, improvements and deteriorations in material life were brought on by weather, military adventures, occasionally by political acts, but not by the dynamics of capital accumulation, which is to say, by self-generated changes in what would come to be called "economic life."

Technology thus becomes a sociopolitical force within capitalism, not merely a lever of material change. The reason, of course, is that technological change is the chief source of new areas of profitable accumulation. Here the market plays two roles, first in helping to facilitate the complex maneuvers by which the accumulation circuit works; later in bringing about the competition that will eat away at the profitability of these circuits. Capitalist economic history is thus written in bursts of accumulation largely brought on by technological change, followed by periods of slackening expansion as competition erodes profit margins.

This is not, of course, a steady or dependable process. Economic historian Joel Mokyr warns that technology is characterized by long periods of "stasis" (1990, p. 290f.). In addition, technological change can bring strain as well as stimulus: the introduction of new processes of production often renders obsolete the labor requirements of earlier processes: behind every ATM cash-dispensing machine one can make out the ghost of a bank teller. Nonetheless, speaking broadly, the steady search for and introduction of technology has been, and promises to be, the single most important source of capital accumulation, which is to say, of capitalist political security.

In addition, in a capitalist setting, technology also takes on a previously unknown responsibility for determining the social stability of its larger setting. The texture of daily life changes slowly, if at all, in hunting and gathering societies, and only gradually within the more dynamic societies of command. By way of famil-

iar contrast, one of the most striking characteristics of capitalist life is the bewildering rate, and disconcerting depth, of social change—the conversion of *manu*-facture to *machino*-facture, with its immense repercussions on the activities called “labor”; the radical speeding-up of daily life as the telegraph and then the telephone annihilate distance; the lengthening of the day as electric light brings into being nightlife; the creation of a culture of senior citizens as pharmaceuticals extend life spans. All this has endowed technology with sociological repercussions of immense magnitude and sweeping kind, although mostly unintended.

I hope I have made the case that the self-generated forces of capitalism endow technology with a sociopolitical importance far exceeding any it had previously enjoyed. Let me end by posing a much more daring question: What can be said with regard to the position that technology is likely to hold in the next social formation, assuming that capitalism will not last forever? The question becomes less of an excursion into science fiction when we recognize that we already stand within sight—indeed, within touch—of what will almost certainly be the dominant history-shaping force of the century ahead: global warming.

Global warming refers to the result of the steady accumulation of carbon dioxide in the atmosphere, where it serves as an invisible screen preventing the escape of heat generated by the normal reflection of the sun’s rays, as well as that caused by combustion. I shall not stop here to cite the mounting scientific concern with respect to this relentless environmental change. Suffice it to note that the three warmest years since reliable record-keeping began in 1866 took place within the 1990s, with 1995 heading the list. There is growing fear that this unidirectional process could pose serious threats to human life within the coming century, and potentially disastrous ones for the century thereafter (Kennedy, 1993, p. 103; Brown et al., 1997, *passim*).

The thrust of these remarks is simple: technology as a means of extending humanity’s control over nature has radically and irreversibly changed the relation between society and its erstwhile

handmaiden. Capitalism has been the social formation that has brought this change about, but the change itself is today so deeply enmeshed in all societies, modern and would-be modern, that it will not disappear were capitalism itself to give way to some other, ecologically vigilant order. Tomorrow's—more accurately, the day-after-tomorrow's—technology will have to play the role, not only of designing, but of overseeing the operation of society's energy-related activities. As such, it seems likely to become the active locus of a widening human control over the forces of nature. I doubt, however, that it will provide the means to assure a necessary degree of control by society over its own behavior.

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