

Does Innovation Lead to Prosperity for All?



THE WORD “INNOVATION” has become the new mythical silver bullet to fix the world economy.

Without a doubt, exciting new technologies, including in robotics, 3-D printing, and gene therapy, are impressive. Blood markers and the ability to reengineer genetic DNA have achieved fantastic breakthroughs. Nanotechnology and biotechnology have improved living standards significantly. In the future, machine-to-machine interfacing and the use of ultra-powerful quantum computing will know no bounds.

But will these innovative breakthroughs raise real income for average working families? The 1930s saw an outbreak of impressive technological progress. The Great Depression continued anyway.

The battle lines are drawn. Some theorists believe new technological innovations that lead to productivity increases are actually the economy’s growth and job killers. They cite the fears of many families that someday their kids in the workforce could be replaced by a machine.

Others argue that the economy benefits from as many innovative startup jobs as possible. They stress evidence showing that a half million new tech startup jobs produce 2.5 million other new jobs.

Still others argue that there is not enough innovation. The world’s efforts at innovation are on a quality decline, they say, and so therefore is the world economy.

Of course, “productivity,” as the writer Adam Davidson puts it, “is a remarkable thing. Only through productivity growth can a wage-earner’s quality of life improve.” But are wage-earning families seeing the full benefits of today’s revolution in innovation?

The year 2012 produced a startling contrast. Eastman Kodak, once with a payroll of 145,000, filed for bankruptcy. Around the same time, Facebook bought a company called Instagram for a billion dollars. What was Instagram? A photo-oriented business...with only thirteen employees.

This issue is complex. But if you were asked by today’s G-20 leaders for guidance on how best to approach the issue of innovation as it affects the real economy, what would that advice be? Move more cautiously or full steam ahead, the more innovation the better? Then again, do the G-20 leaders have any say in the matter?

Nearly twenty noted observers offer their views.



There are winners and losers. But the answer is not less innovation, but better use of innovative breakthroughs.

MARTIN N. BAILY

Bernard L. Schwartz Chair in Economic Policy Development and Senior Fellow and Director of the Business and Public Policy Initiative, Brookings Institution

A strict answer to this question would have to be no. Workers who are displaced from their jobs can suffer sharp declines in their incomes. Definitely there are losers from most innovations.

There are winners too. A broader answer to the question is that for much of the twentieth century innovation expanded economic growth, raised millions out of poverty, and was the well-spring of our modern economy. There have been different phases of economic development, however. In the nineteenth century there was a plentiful supply of workers willing to leave the farms or willing to leave Europe to work in American factories and offices at low wages with lousy working conditions. As development continued, the demand for workers grew strongly enough to raise wages and by the 1950s and 1960s there was broad-based prosperity. Innovation and capital accumulation were driving up wages for most workers.

That process has changed, with much slower productivity growth starting in the early 1970s (except for a five-to-ten year period after 1995) and a narrowing of the beneficiaries of economic growth. Skilled and educated workers, successful small business owners, and the owners and managers of well-run larger and multinational companies have seen their incomes or wealth rise strongly while hourly wages for a large segment of the workforce have stagnated. The United States is not alone in facing more adverse economic trends. Japan's economy has stagnated since 1990. Europe's growth has been very slow and rising inequality in pre-tax incomes has been held at bay by redistributive policies.

One explanation for this turn for the worse is that the pace of innovation has slowed down. The big innovations

like electricity are behind us and recent innovations like computers and smart phones are of lesser value. I disagree. The pace of technological change seems bewilderingly fast, and Americans seem to value their flat-screen televisions and smart phones very highly indeed.

A different way to look at the trends was triggered by a recent McKinsey study of Mexico which brought out the duality of its economy. It has a very successful modern sector with strong exports, productivity close to best practice, and good jobs. But modern-sector employment is not growing very fast and, as a result, more and more Mexican workers are part of the traditional sector of low-wage jobs where productivity is declining rapidly and real wages are falling. Average productivity growth in Mexico is weak.

The United States is not Mexico, but there is a parallel between the two. There is a "modern" sector here with booming profits, successful innovation, global competitiveness, and good jobs, although not enough of them. More and more of the U.S. workforce is being forced into low-wage, low-productivity jobs, or out of the workforce. In America some of the low-wage jobs are street vendors and such, but many are with big companies in industries such as fast food, retailing, and hotels. The jobs carry little training and the workers typically turn over very quickly and gain little experience. A leading bank CEO told me there is about a 50 percent annual turnover rate among bank tellers, so it is not just the hamburger flipper jobs that have become bad jobs. In the United States, the duality of the labor market is evident within many large companies.

The paradox of the American economy is that the corporate sector is booming, with record profits and a strong stock market. Innovation seems to be everywhere and segments of the workforce are doing very well, especially the top 1 percent. At the same time, median earnings are weak and average productivity growth is slow. The explanation is that the expansion of the low-productivity part of the economy is driving down the averages.

The economic forces driving the shift to a dual economy are skill-biased technical change and increased global competition. If these forces continue and there is a steadily expanding pool of marginalized workers, then I would conclude that innovation is not leading to prosperity for all. The answer is not to have less innovation, but to do a better job of taking advantage of it. There is not enough space to discuss what is needed to do this, but the list includes restoration of full employment, improving skills and education, and making the United States a more attractive location to produce and manufacture. None are easy to do.



Yes, as Solow demonstrated, the ultimate source of sustainable economic growth is innovation.

STAN VEUGER

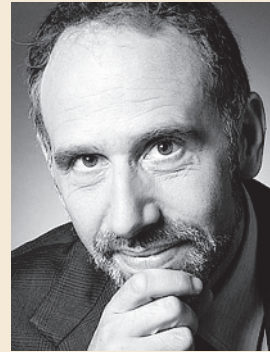
Resident Scholar, American Enterprise Institute

As Nobel laureate Robert Solow demonstrated in the 1950s, the ultimate source of sustainable economic growth is innovation, that is, the development of new technology, of new organizational forms, and of better modes of governance. At the same time, disruptive new ways of producing and consuming goods and services have always encountered opposition. This opposition is sometimes driven by mere fear of the new or anxiety about the tried and trusted ways of the past disappearing, but more commonly by the distributional impact of new technologies. The famous Luddites of nineteenth-century England, for example, worried aggressively about the replacement of their skilled occupations by newfangled machines operated by low-skilled workers.

The same dialectic is central to the innovation debate today. Advances in fields as diverse as nanotechnology, information technology, and global supply chain management hold the promise of unprecedented levels of prosperity for humanity as a whole, but they have led to widely held concerns about the future of the middle class in the West. The past few decades have seen significant improvements in the standard of living of the poorest citizens of the world and solid gains for the planet's most privileged, but the hollowing out of labor markets in developed countries has led some to believe that a dangerous divergence of prospects is unfolding.

This belief underpins an understandable hesitation to embrace "the glory of this latter house," but as in Haggai's prophecy, the benefits of innovation cannot be underestimated. Economist Xavier Sala-i-Martin of Columbia University has found that hundreds of millions have been lifted out of poverty over the past half century, and that rates of extreme poverty have been reduced by some 50 percent. Anyone with an internet connection now has access to a wealth of information unavailable to even the most powerful masters of the universe in 1970s. The rising threats of HIV/AIDS, malaria, and tuberculosis have been stemmed, and child mortality is nowhere near the levels it was a mere twenty-five years ago. All of these blessings

are driven, one way or another, by innovation. The dangers posed by innovation pale in comparison. What political leaders should do is make the case for progress for the many, while helping those whose futures are suddenly a bit bleaker prepare for as painless a transition as possible.



Innovation is getting a bad rap. The problem is with broader economic policy.

DEAN BAKER

Co-Director, Center for Economic and Policy Research

Innovation is getting a bad name these days as many people fear that robots are going to take all of our jobs. This fear is misplaced for a number of reasons, most obviously the fact that productivity growth has actually been rather slow in the years since the downturn. To a large extent people seem to be confusing the effects of bad economic policy with the impact of innovation.

The basic story of innovation on the economy is straightforward: It allows us to produce more and better goods and services with the same amount of labor. That is a good thing for the economy. It means that as a society we are richer.

Of course it is not the case that everyone benefits from each innovation. Doctors will not benefit from diagnostic technology that would allow a technician with a year or two of training to be as effective in recognizing illnesses as a well-established internist. In this story patients and taxpayers would be able to save on the cost of health care (most of which is born by the government), but internists would be left without jobs, or at least be forced to accept lower pay.

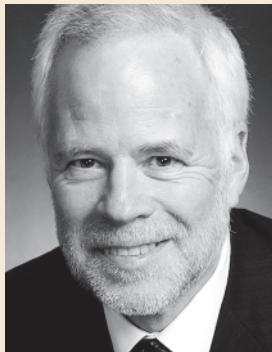
This story of technology displacing workers is more often told with factory workers or cab drivers facing competition from computer-driven cars, but the reality is that technology can often be used to displace the most highly educated and most highly paid workers. The fact that it less often is used for this purpose has more to do with who controls technology than the course of its development.

That is the key point that the public should understand. Technology can be used as a weapon to benefit some groups in society at the expense of others. This has been

the case for the last three decades. The wealthy and powerful have used technology to benefit themselves at the expense of most of the public. This is most clearly the case with patent law, as large companies in many industries, most importantly pharmaceuticals, have pushed to get ever stronger and longer patents. As a result, we now spend \$360 billion a year on drugs (2 percent of GDP or four times the food stamp budget) that would cost 10–20 percent of this amount in the absence of patent protection.

We also could have a full employment policy that generates enough demand to keep most workers fully employed. However, policy is controlled by people who mindlessly proclaim the need to keep down deficits even in a context of low interest rates and high unemployment. And they refuse to even discuss the trade deficit that pulls \$500 billion in annual demand out of the U.S. economy.

It is silly to blame innovation for the suffering that many people are now experiencing. The blame belongs with the people who control economic policy, not the great ideas of innovators in the United States and elsewhere.



Yes, but innovations in technology have unintended consequences.

BARRY EICHENGREEN

George C. Pardee and Helen N. Pardee Professor of Economics and Political Science, University of California, Berkeley

The answers to these questions are pretty obvious (he says) though they are no less important for the fact. First, just as the average family is better off with an automobile than a horse and buggy, it will be better off with a driverless car than a twentieth-century motor vehicle.

To which statement there are two caveats. First, innovations in technology have unintended consequences, including consequences that markets, left to their own devices, cannot adequately address. Just as the internal combustion engine created problems of pollution and congestion, the human genome project and use of genetic markers may lead to the breakdown of insurance markets or lead to undesirable changes in how firms make hiring decisions.

Second, the “average family” to which the question refers does not exist in practice. Just as many families benefited from availability of the automobile but buggy-whip makers and wagon drivers suffered, many families will benefit from driverless cars but taxi and limousine drivers will suffer.

The economist’s traditional answer similarly comes in two parts. First, if there is no demand for taxi and limo drivers, then the displaced individuals can move to other, typically entry-level, jobs in, *inter alia*, the restaurant business. This will put downward pressure on the earnings of restaurant workers, other things equal, but if society views this as undesirable, then there is a government to regulate wage *minima*. Others will pay a price, as anyone who eats out in Australia, where the minimum wage is roughly double that in the United States, will be aware. But those who value social solidarity—those who can recall Karl Polanyi’s classic, *The Great Transformation*—will recognize this as a price worth paying.

The only slightly novel aspect of the current conversation is the suggestion that technological progress—call it “the march of the robots”—may now be capable of displacing highly skilled as well as less skilled workers. If so, more (dare one say much) of society’s income will end up in the hands of those who own the robots (as a greater capital share of GDP). Actually, this aspect of the current conversation isn’t particularly novel either; it was fully developed by John Maynard Keynes in “Economic Policies for Our Grandchildren” in 1930. Neither is the solution novel: it is progressive income and wealth taxation, pure and simple.



Almost certainly not.

MICHAEL LIND

Co-Founder, New America Foundation, and author, Land of Promise: An Economic History of the United States (2012)

Will innovation lead to prosperity for all? History and human nature suggest the answer: almost certainly not.

There is little reason to doubt that technological advances will improve the material conditions of human life in ways that can only be imagined by science fiction. And there is also little reason to doubt that a global technological civilization will be able to cope with problems caused by climate change and other present or possible by-products of industrial activity.

But will the gains of technological progress be reaped by the many? Why would we expect this to be the case? It hasn't been the case in the past. For most of human history, each wave of technological innovation was exploited by parasitic elites seeking to maximize their wealth and power at the expense of the many.

The Neolithic agricultural revolution created stratified societies in which most people labored for predatory warlords and landlords. Many archeologists think that the slaves, serfs, and tenant farmers of the agrarian era were worse off, physically and mentally, than their Paleolithic hunter-gatherer ancestors.

The successive waves of innovation of the industrial revolution made possible modern large-scale liberal democracies like that of the United States. But they also made possible oppressive and racist European colonial empires linked by steamship, rail, telegraph, and aircraft. Had they not been defeated in hot war or cold war, the tyrannical empires of Nazi Germany, Imperial Japan, and the Soviet Union might have endured to this day.

In most places and most times, elites prefer to loot and hoard rather than to produce and share. The twenty-first century is no exception. Today's high-tech civilization is perfectly compatible with parasitic elites of strikingly different kinds—from royal autocrats like the Saudis to African generals who loot their post-colonial countries to China's kleptocratic communist "princelings." Even formally liberal democracies like the United States are increasingly dominated by the rentiers of too-big-to-fail finance and tech tycoons who, having once invented something useful, then try to milk superprofits indefinitely thanks to government-created intellectual property rents.

Edmund Burke wrote, "History consists, for the greater part, of the miseries brought upon the world by pride, ambition, avarice, revenge, lust, sedition, hypocrisy, ungoverned zeal, and all the train of disorderly appetites, which shake the public with the same troubled storms that toss the private state, and render life unsweet." As long as human nature remains the same, many of the powerful, the wealthy, and the well-organized in every society will try to monopolize most or all of the gains from technological progress for themselves and their families, even if the powerful shed royal robes or military uniforms for civilian suits. That means that the struggle to ensure that the benefits of technological innovation and economic growth are widely shared will never be won. It must be fought again and again, in every country, and in every generation.



No, innovation is not a form of Schumpeterian pixie dust.

EV EHRLICH

President, ESC Company, former Undersecretary of Commerce, 1993–1997, and former Chief Economist and Head of Strategic Planning, Unisys Corporation

At one level, the question of whether innovation leads to higher levels of income borders on the absurd. The average person in the developed world today has a higher standard of living than the monarchs of Versailles or the Schönbrunn only because of innovation.

But innovation is not a form of Schumpeterian pixie dust that raises everyone's standard of living on contact.

Standards of living rise because of a three-step process. Innovation produces new products, ideas, and techniques. Investment embodies these, or the ability to produce them—the importance of the capital-labor ratio in growth accounting relies, in part, on the ever-improving technologies embodied in capital. And, finally, social organization must change to accommodate innovation's effects, as barrel stavers, vacuum tube makers, and analog data-hoarding middle managers have learned. (I borrow here from my paper *How Economies Grow*, 2003, available at www.ced.org.)

This framework highlights the inescapable duality of growth and change.

Growth is not "a rising tide that lifts all boats." As research using the Census Bureau's Longitudinal Business Database has shown (the LBD tracks thousands of establishments over decades, the economy's first statistical movie), two-thirds of manufacturing productivity growth occurs because high-productivity plants increase output at the expense of lower-productivity ones, and the bulk of job creation occurs at these plants, including high productivity start-ups.

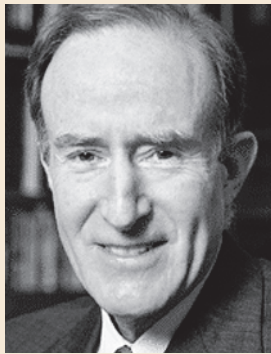
There are many policy options to address innovation proper. I leave these to my colleagues on these pages. But we also need to face up to the importance of the second and third steps of the growth process, particularly if we want innovation to have an immediate and ongoing role in promoting growth.

If we want investment, we need to have a stable economic environment (immediately, abandoning plans for

histrionic fiscal austerity as the deficit already rapidly contracts), a better tax system (starting with aggressive simplification and reduction of the corporate income tax), clarifications of patent law (to combat trolls and punitive suits such as Apple's against Samsung) and financial regulation that refocuses capital markets on marrying funds to their productive uses.

And last, we must make the economy more robust regarding changing social organization and patterns of employment. This means a new emphasis on skills acquisitions, ongoing assistance for displaced workers, and improved education for literacy, numeracy, and STEM-based problem-solving.

Given the absence of this last set of policies, society too often prefers today's jobs to tomorrow's, meaning we will inevitably have more of the former and fewer of the latter. We must build, through policy, a social consensus for the reverse.



When technology eliminates the need for labor, that labor remains key to citizens' ability to consume.

BENJAMIN M. FRIEDMAN

William Joseph Maier Professor of Political Economy, Harvard University

Writing just before the Great Depression, economist John Maynard Keynes expressed confidence that in time, ever-greater productivity would lead to such widespread prosperity that we would consider “the economic problem” to be “solved.” Indeed, our main economic problem—“a fearful problem for the ordinary person,” he thought—would be how to occupy the enormous increase in our leisure time.

By contrast, early in the post-World War II period, James Meade focused instead on the problems of what we have come to think of as technological unemployment—or if not outright unemployment, then lack of opportunities for work at decent pay. Meade saw the modern workforce heading back into “a super-world of an immiserized proletariat of butlers, footmen, kitchen maids, and other hangers-on,” altogether, “a hideous outlook.” Today's prospects may not be as hideous as Meade feared, but for now it's

clear he has the better of the argument, and especially in America. Not only is advancing technology eliminating good-paying jobs more rapidly than it creates new ones, but the replacement of ever more areas of our economy by production abroad—also a technologically driven phenomenon—is increasingly off-shoring high-paying jobs as well as low-paying ones. (Familiar examples are computer programming, legal research, accounting, and reading X-rays.)

What Meade understood but Keynes missed is that when advancing technology eliminates the need for many citizens' labor, their providing that labor remains key to their ability to consume. It's easy enough to imagine a world that divorces consumption from labor income. We have some elements of that world, and applied to some people—most obviously, children and the retired elderly—we gladly accept them. But for the bulk of the population the story is different. We make arrangements to support the indigent, but that's as far as we are willing to go and the support we provide is deliberately pretty modest.

Economists' standard answer to this problem is twofold: Assume that in the long run technology will, as it always has before, create new wants, and that satisfying those wants will create new demands for the labor of our own citizens who will be well paid for it. And in the meanwhile, educate as many of our citizens to be as productive as we can make them in the modern workforce. But our society is strongly resistant to most of the educational reforms that economists recommend, and at the moment the long run for these purposes seems far off. For now, alas, Meade looks strikingly prescient.



The median worker in the innovation economy earns more than twice the median for all U.S. workers.

LISA COOK

Associate Professor of Economics and International Relations, Michigan State University, and Member, President's Council of Economic Advisers, 2011-2012

Two channels through which the innovation economy links to the broader economy are through incomes and jobs. Incomes in the innovation economy are higher than incomes for all U.S. workers. The median worker in

the innovation economy earns more than \$70,000, compared to just below \$35,000 for all U.S. workers. Jobs in the innovation economy have risen more quickly than those in other sectors, including during the recent period of slow economic activity. During the recent recession and period of slow economic activity, the U.S. workforce contracted, but the innovation workforce expanded slightly.

Leaders should pay close attention to the distributional effects resulting from the innovation economy. In the economics literature, the consequences of unequal distribution of income are well known, and extreme differences can lead to social instability, which in turn can be costly to the economy. Individuals calculate their position in society—that is, well-being—relative to others, rather than in absolute terms. Indices of well-being captured growing discontent in countries such as Egypt and Tunisia prior to the Arab Spring, unlike indices of GDP. The seeds of discontent might be sown further by the higher levels of income and wealth that accrue to those in the innovation economy that are large enough to influence elections and undermine democratic participation in the political process.

Work within the innovation economy is also unevenly distributed. Women and ethnic minorities, such as African Americans, lag far behind their counterparts in the innovation economy. While there is variation by occupation, in general they trail other innovation-economy workers in pay, employment, and representation among management, boards, and entrepreneurs.

Economic research on income inequality shows that it is growing in the United States. It has been modest relative to other developed countries, such as those in the OECD. Income inequality is more pronounced in other places such as China, Brazil, Chile, India, and South Africa. Given the globalization of the tech sector, income inequality within and relative to the innovation economy could be exacerbated by trends in the innovation economy.

Is there anything G-20 leaders can do? Yes, there's a role for public policy. First, economies must better prepare students broadly and specifically for jobs in the innovation economy. Of particular importance would be higher achievement in mathematics. Second, the general quality of education will need to rise to keep pace with these jobs in the competitive globalized workplace. Third, policies aimed at greater inclusion of women and underrepresented minorities at all stages of innovation—science and engineering education, invention and patenting, and commercialization—could be implemented. Measures to address child (and elder) care, diminish implicit bias, and increase openness of workplaces, among others, would likely be appropriate. Further, proposals to set targets for female participation among cor-

porate boards in the European Union and United Kingdom have been put forward, and this is the kind of experiment that will inform future efforts in the innovation economy.



There are two types of innovation, so the answer is not that simple. Competition is key.

JAMES PETHOKOUKIS

DeWitt Wallace Fellow, American Enterprise Institute

Not all innovation is alike. Incumbent firms replacing man with machine is a kind of innovation that may lift corporate profits and boost stock prices without necessarily broadly raising prosperity. Such technological advancement and efficiency is already contributing to polarized employment markets in advanced economies. Jobs are created at the top for high-creative workers and at the bottom for high-touch workers. But jobs in the middle—especially those involving routine, repetitive, and rules-based tasks—are automated away. In other words, the executives and janitors at a bank keep their jobs, but tellers get replaced by ATMs.

But there is another kind of innovation, termed “empowering” innovation by business consultant Clayton Christensen. This is the sort of innovation generated by fast-growing startups offering new products and services. Empowering innovation is a job creator, not a job destroyer—though some jobs may shift from uncompetitive incumbents to these aggressive new challengers.

Both sorts of innovation have their place, of course. But right now efficiency innovation may be destroying jobs faster than empowering innovation creates them. So what is the key to generating greater levels of empowering innovation? Competition—and the more the better. As economist Joseph Berliner once put it: “...the effect of competition is not only to motivate profit-seeking entrepreneurs to seek yet more profit but to jolt conservative enterprises into the adoption of new technology and the search for improved processes and products.”

Vibrant economies need plenty of fast-growing startups to generate empowering innovation and to also push incumbents themselves to become more innovative. And

if incumbents can't compete, government needs to let them fail. Free and frequent entry and exit of firms is critical. Government has to make sure tax, regulatory, and spending policy is neither impeding the creation of new startups nor giving incumbents an unfair advantage.

Some politicians think "innovation policy" means spending taxpayer money on promising young firms favored by bureaucrats. Rather, innovation policy means ensuring that the *status quo* is continuously challenged by upstart rivals and threat of failure. Those are the keys to the Schumpeterian "gales of creative destruction" that drive innovation, which in turn drives long-term economic growth and improvement in living standards.



Investments in IT support robust job creation in upturns but enable firms to shed labor in downturns.

CATHERINE L. MANN

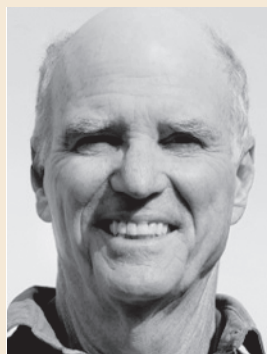
Barbara '54 and Richard M. Rosenberg Professor of Global Finance, International Business School, Brandeis University

Going back to the research that won Robert Solow the Nobel prize, technological progress is the fundamental source of economic growth which creates the capacity for an economy to increase the economic well-being of all its citizens in the long run. But it is not just about new ideas. One of the lessons from research on information technology is that widespread application of IT innovations to introduce new products, as well as change business processes and workplace practices, is the main means by which an economy gains from the innovations. Therefore, G-20 policies should both promote innovation and the uptake of innovation as the foundation for long-run societal benefit.

However, there is another dimension of the widespread use of (at least) IT innovations, which occurs at the business cycle frequency. My research suggests that investments in the information technologies of hardware, software, and IT services complement and support robust job creation in the upturns of a business cycle, but enable firms to shed labor more easily during downturns. For businesses that are relatively more intensive in the use

of the various forms of IT, this pro-cyclicality of job creation and destruction is more pronounced. Moreover, this research also suggests that in the U.S. economy, although all sectors increased the intensity of IT use in the last decade or so, there is a widening divergence between sectors that adopt IT most intensively and those that adopt less intensively. So some parts of the economy will exhibit relatively more innovation-related job pro-cyclicality than others. How workers distribute across the more versus less innovation-intensive and job pro-cyclical sectors, and at what consequence for wages, is not obvious.

Collectively, the research on the long-term benefits of innovation but also the evidence on the innovation-related job dynamics over the business cycle point to policy strategies for the G-20 governments. Both the long-term and near-term economy-wide gains from IT innovations are best supported by a stable and growing macroeconomic environment where the complementarity between innovations and jobs is more likely to be realized. The divergence between the more versus the less innovation-intensive sectors of the economy, given the outcome of more versus less job pro-cyclicality and possible wage differentials, may require more than just macroeconomic management, but redistributive policies as well.



It depends on the economic character of the innovation, and the economic environment.

JEFF FAUX

Distinguished Fellow, Economic Policy Institute, and author, The Servant Economy (Wiley, 2012)

Over the long run, the creation of new products, services, and production processes eventually makes human life better. But in the time frame in which most of us live, we do not necessarily, and perhaps not even usually, see the benefit.

It depends on the economic character of the innovation, and the economic environment in which it is introduced.

Many recent financial market innovations unleashed by deregulation had a negative impact on the overall living

standards of the typical American. They diverted capital from reinvestment in the production of real goods and services. They encouraged excessive speculation and price volatility. And the benefits have been concentrated in the tiny upper reaches of the income and wealth distribution, exacerbating inequality.

The degree to which the benefits of innovations in product and production processes are widely shared depends on whether or not the resulting profits are recycled into more investment within the economy that can re-employ the people and resources displaced by the innovations. In our increasingly globalized economies, much of the increase in profits generated by innovation ends up as reinvestment somewhere else, so that the people displaced by greater firm efficiency typically remain unemployed or underemployed for a very long time—often forever. Without active domestic policies to maintain full employment, the result is often a net reduction in growth.

The benefits of innovation can also be suppressed by overly generous patent and copyright protections, which can be instruments for creating monopolies and stifling the spread of knowledge and the transfer of technology.

Thus, any government policies to encourage (that is, subsidize) innovation should be channeled to sectors that produce new real assets, be accompanied by a commitment to full employment, and permit the diffusion of technology in the shortest possible time. Otherwise, government should stay out of the business of private sector innovation.



No, but innovation never did and it is not supposed to.

JOEL MOKYR

Robert H. Strotz Professor of Arts and Sciences, and Professor of Economics and History, Northwestern University, and Sackler Professor, (by special appointment), Eitan Berglas School of Economics, Tel Aviv University

The short and easy answer is no, innovation does not lead to prosperity for all. The only slightly longer answer is that it never did and it is not supposed to.

Innovation, to paraphrase Schumpeter, is both creative and destructive. It improves the lot of some and worsens that of others. Even more confusing, it may improve your lot as a consumer, a patient, or a shareholder, while at the same time worsening it in your capacity as a worker. The real question is whether on balance innovation is a force for the good, whether the gains outweigh the losses. The answer is again short and easy: yes.

It is hard to think of an important innovation that did not hurt at least someone. The printing press employing moveable type, first used by Europeans in the 1440s, threw thousands of scribes and copyists out of work. A German abbot, Johannes Trithemius, bewailed the fate of the profession in his *In Praise of Scribes* (1492)—and then proceeded to have the pamphlet printed. Would we have been better off without Gutenberg? Whether we speak of the textile machinery of the 1780s or the word processors of the 1980s, innovation made old equipment worthless and trusted skills obsolete. Some people paid a high price for progress. Yet without it, the living standards of humanity would be less than a tenth of what they are now, life expectancy at birth would be in the mid-thirties, and most of us would have wasted away our short lives through years of back-breaking farming with crude manual tools.

Could it be that innovation giveth to us as consumers with one hand and taketh away from us as workers with the other? Innovation has changed the nature of “work” as we know it repeatedly: it established the “factory system” during the Industrial Revolution that made self-employed artisans and peasants into wage or salaried workers, confined to one workplace and subject to discipline and clocks. It took most workers out of agriculture and placed them in manufacturing, then took most of them out of manufacturing again and placed them in services.

Now mechanization is coming to machines that can read, sense, talk, walk, and drive. Will there be anything left for live “workers” to do? One answer is that hitherto unimagined occupations will emerge with the new technology: in 1914, who could have imagined occupations such as video-game designer or nuclear-medicine technician? Another answer is, however, that in a high-tech world in the mature digital age, the nature of work will change radically—once again.

Robots will replace some labor, but in other areas extend and empower it. And if the race between job creation and job destruction turns out to need fewer workers, in the end humans may end up performing less grunt-work and boring toil for their daily bread. There are worse things to worry about.



Innovation is being unfairly implicated. To give up on innovation is to give up on the future.

ROBERT D. ATKINSON
President, Information Technology & Innovation Foundation

The fact that so many people are asking “does innovation lead to prosperity for all” is in itself troubling. As technology historian Robert Friedel writes in *A Culture of Improvement*, “Since the end of World War II, the impressive achievements of technology along with the rapidly expanding scale of Western economies had reduced the influence of technological critics to the fringe of public life.” Indeed, it was this cultural acceptance, even embrace, of innovation, that enabled American innovation to flourish.

But today innovation is being implicated in the ills of the West: global warming, the rise of the “1 percent,” and a generalized sense of malaise. But to give up on innovation is to give up on the future.

Innovation is being charged on at least two counts. It’s disruptive, and it no longer helps average workers. Regarding the first, people always have and always will be hurt by innovation. The invention of the automatic bowling pin setter put tens of thousands of pinsetters out of work after World War II. But it also lowered the price of bowling for tens of millions of Americans. That’s why Joseph Schumpeter coined the term “creative destruction.”

For those who argue that that innovation eliminates jobs, they only see first order effects. They overlook that innovation leads to lower prices and that consumers spend those savings, in turn creating additional jobs. That’s why historically there has been no correlation between productivity growth and unemployment.

With regard to the second charge, as labor economist Stephen Rose has shown, while income inequality has gone up, technology-induced productivity still benefits working Americans. If we really want to tackle the problem of inequality, we should take steps such as reining in the financialization of the economy and increasing taxes on the wealthy. But opposing innovation will hurt the 99 percenters a lot more than the 1 percenters. Besides, wage earners would see even more benefit from innovation if we had more and broader innovations—we need more than Web 2.0 social networking apps to drive prosperity.

What is the alternative to spurring more innovation? We would see slower discovery of life-saving medicines, continued anemic steps toward getting cheap clean energy, and real robotics to automate more work forty years away instead of twenty. Without innovation, living standards and quality of life for future generations will be even worse.

Finally, can G-20 leaders do anything about innovation? They certainly can slow it down through restrictive regulations, as we have seen in Europe. When French Industry Minister Arnaud Montebourg said that when it comes to innovation that can destroy existing companies, “Well, we have to go slowly,” going slowly will mean “growing slowly.”

But policymakers can also speed up innovation by ensuring that the global trading system eschews “innovation mercantilist” policies and that nations expand research and development tax incentives and public funding of research. In short, we need more innovation, not less.



Schumpeter and John Stuart Mill were both correct.

JAMES K. GALBRAITH
Lloyd M. Bentsen, Jr., Chair in Government/Business Relations and Professor of Government, Lyndon B. Johnson School of Public Affairs, University of Texas at Austin, and author, The End of Normal (Free Press, forthcoming)

Does innovation lead to prosperity for all? John Stuart Mill thought otherwise: “It is questionable if all the mechanical inventions yet made have lightened the day’s toil of any human being.” Karl Marx, picking up the theme in *Capital*—for the nineteenth century—wrote: “That is, however, by no means the aim” of innovation. New technology reduces the work required to sustain the workers and increases the share going to the boss.

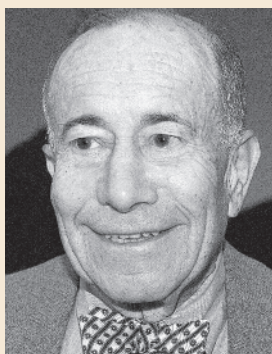
Seven decades later, Joseph Schumpeter challenged this view. Working class living standards were rising, and the rise could continue. Capitalism, he wrote, triumphed not by providing “silk stockings for queens, but in bringing them within the reach of factory girls.” Not for every-

one: capitalism needs failure as well as success. But for most, most of the time.

The difference between Marx and Schumpeter was simple. Marx thought that income would concentrate inexorably at the top, and he saw that this must produce a collapse. But Schumpeter realized that the system was somehow contriving to keep the wage share in total income steady. If so, innovation could find its own markets and would feed, clothe, house and amuse the working class.

This debate rages on over the digital revolution. Schumpeter's shade points to the ease and cheapness of communications, entertainment, social life, and sex on the net. Marx's ghost points to the collapse of bookstores and books, newspapers and news, cameras and film, to the decline of desk workers and checkout clerks, to the rise of robots, and on and on.

Who is right? Both, obviously. Who is more right? That will depend on what happens, going forward, to the distribution of income.



More innovation is preferable, but that doesn't imply that a lot more is better than just somewhat more.

CHARLES WOLF

Distinguished Corporate Chair in International Economics, RAND Corporation, and Senior Research Fellow, Hoover Institution

It's a hard question, with equally difficult corollary questions. I'm inclined to draw on two founts of wisdom for answers: Milton Friedman and Joseph Schumpeter. The cogent witticism that Friedman frequently cited is, "There's no such thing as a free lunch." The Schumpeterian insightful slogan is "creative destruction."

Friedman didn't originate the free-lunch metaphor, but he often used it with reference to an implicit expectation of recompense by the host—the unvoiced *quid* that goes with the evident *quo*. What makes this relevant to the question about innovation is that all, or at least most, changes in technology or in policy have "quids"—costs, drawbacks, shortcomings—associated with the "quos," which are the benefits, gains, advances. So it has been with Microsoft, Apple, and Google. So will it be with big

data, hydraulic fracturing, blood markers, stem cells, robotic cars, and nanotechnology. In theory, if the benefits from innovation exceed the costs, those who bear the brunt of the costs could be sufficiently compensated so that a net benefit accrues to society. In practice, this is seldom if ever feasible. The reality is that trade-offs are inevitable. Growth trades off against equality, profits trade off against wages and salaries in national income, and new investment often displaces rather than enhances employment.

In Schumpeter's theory of economic development, "creative destruction" is integral to the process, and the prime movers of development are entrepreneurs—the "creative destroyers," so to speak. That isn't to say that all creation is destructive—consider a Bach cantata, or the Mona Lisa. Nor is it to say that destruction is creative; it typically isn't. But it is to say that innovators drive the development process—think Bill Gates, Steve Jobs, Larry Page, and Sergey Brin, and Jeff Bezos. In so doing, the innovators typically destroy previously existing firms, industries, and employment.

So what are the bottom-line answers to the questions raised here? My first answer is to move cautiously, rather than full steam ahead, in the interests of modulating the disruptive effects of impending new technology on societal harmony. Second, macroeconomic growth doesn't signify prosperity for all. In general, more innovation is preferable to less, but that doesn't imply that a lot more is better than just somewhat more. Finally, I would suggest the G-20 leaders should be aware of all this, but refrain from doing anything about it. Their efforts are at least as likely to harm as to help the process.



Innovation is not an unqualified good; it taxes society with very high costs.

WALTER D. VALDIVIA

Fellow, Brookings Institution

Innovation is the driver of long-term economic growth and a key ingredient for improvements in healthcare, safety, and security, not to mention those little comforts and conveniences to which we have grown so accus-

tomed. But innovation is not an unqualified good; it taxes society with very high costs.

The market system internalizes only a portion of the total costs of innovation. Other costs, however, are not included in market prices. Among the most important sources for those unaccounted costs are creative destruction, externalities, and weak safeguards for unwanted consequences.

Schumpeter described creative destruction as the process by which innovative entrepreneurs outcompete older firms who unable to adapt to a new productive platform go out of business, laying off their employees and writing off their productive assets. Innovation, thus, also produces job loss and wealth destruction. Externalities are side effects with costs not priced in the marketplace such as environmental degradation and pollution. While externalities are largely invisible in the accounting books, they levy very real costs to society in terms of human health and increased vulnerability to environmental shocks. In addition, new technologies are bound to have unwanted deleterious effects, some of which are harmful to workers and consumers, and often, even to third parties not participating in those markets. Yet there are few financial or cultural incentives for innovators to design new technologies with safeguards against those effects.

Indeed, innovation imposes unaccounted costs and those costs are not allocated in proportion to the benefits. Nothing in the market system obligates the winners of creative destruction to compensate the unemployed of phased-out industries, nor mandates producers to compensate those shouldering the costs of externalities, nor places incentives to invest in preventing unwanted effects in new production processes and new products. It is the role of policy to create the appropriate incentives for a fair distribution of those social costs. As a matter of national policy we must continue every effort to foster innovation, but we must do so recognizing the trade-offs.

Society as a whole benefits from creative destruction; society as a whole must then strengthen the safety net for the unemployed and double up efforts to help workers retrain and find employment in emerging industries. Regulators and industry will always disagree on many things but they should collaborate on a system of regulatory incentives to ease transition to productive platforms with low externality costs. Fostering innovation should also mean promoting a culture of anticipation to better manage unwanted consequences.

Let's invest in innovation with optimism, but let's be pragmatic about it. To reap the most net social benefit we must minimize the social costs, particularly those costs not traditionally accounted. The challenge for policymakers is to do it fairly and smartly, creating a correspondence of benefits and costs, and not unnecessarily encumbering innovative activity.



Innovation leads to a higher standard of living, which is difficult to measure.

HANNS KUTTNER

Senior Fellow, Hudson Institute, and part of Hudson's Future of Innovation Initiative

Does innovation lead to prosperity for all?

Innovation surely leads to a higher standard of living. A standard of living is much harder to measure than something that gets measured as units of money. Any claim about the relationship between innovation and real income for average working families should be viewed with skepticism, with the degree of skepticism rising with the breadth of the claim. Innovation is a broad umbrella. It does not neatly or uniformly map into a narrow metric such as the real income of average working families.

Some examples of innovation show how capital can substitute for labor. Today's examples look different. Big equipment that can take the place of multiple workers no longer looks like a typical example of capital substituting for labor. The declining price of computing power has made information technology a powerful force. New capabilities will bring more surprises. The impact of information technology will continue to reverberate throughout the economy. Much will take place regardless of whether leaders take steps that they think will accelerate its pace or slow it down. Bank tellers are under siege because ATMs and online interaction have taken the place of standing in a teller line to complete a financial transaction. The ranks of those employed by the postal service are thinner.

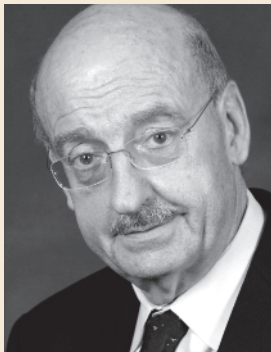
In other cases, innovation has surely increased employment. Change in the age structure of the population, with a growing share elderly, explains only part of the increase in health sector employment in the United States. Far more reflects how innovation has increased what the healthcare sector can do for people. Conditions now get treated that once had "watchful waiting" as their standard of care.

At different times and in different sectors innovation can be associated with increased or decreased employment, increased or decreased wages. Leaders who think about innovation in terms of narrow metrics such as

employment and income may do as well or better trying to develop policies that will be assessed in terms of their influence on the weather a week or ten days out.

Economic accounting systems that generate such familiar statistics as GDP cannot easily count the influence of innovation in improving standards of living. But anyone who has used a smart phone or, more profoundly, looked at statistics showing declining cardiovascular disease death rates knows that standards of living are increasing. Thus G-20 leaders should embrace innovation and learn to smile when short-term values of some easily measured quantity such as income or wages gets cited as evidence “showing” the impact of innovation on the economy or citizens’ lives.

and hardware. The support is an excellent example of the gains from productivity benefiting everyone where the winners compensate the losers through direct transfers.



Everyone benefits from innovation, either directly or through transfers.

JOHN H. MAKIN

Resident Scholar, American Enterprise Institute

Innovation is change that enhances productivity and thereby boosts output per unit of labor. It is a good thing that increases total output with existing resources. Wireless communication and related software/hardware developments (Google, Yahoo, wireless phones, tablets, and laptops, to mention just a few) are all major innovations that have boosted productivity by enabling individuals and firms to shop, travel, and communicate less expensively.

Do all innovations benefit everyone? No. But almost all innovations benefit everyone while providing huge gains to those who develop them. Bill Gates, Mark Zuckerberg, Sergey Brin, Larry Page, and of course Steve Jobs come to mind. But everyone who shops online, books travel online, or works from home, to mention just a few applications for internet use, benefits from enhanced connectivity.

Ensuring access to and fluency in computers/communications literacy represents an important way to reduce inequality of opportunity. Numerous computer fortunes like the Gates Foundation have invested heavily in helping low-income families acquire computer literacy