

cal breakthroughs had taken place and there were some commercial applications, but robots have not become staples of the American economy.

The military, however, has been pumping money into both basic robotics theory and its applications for years. The U.S. military, through DARPA and other sources, has been actively funding robotics development. Building a robotic mule to carry infantry equipment and creating a robotic aircraft that would not need a pilot are but two examples of work in robotics. Deploying in space intelligent robotic systems that don't need to be controlled from earth is another goal. Ultimately, it is a matter of demographics. Fewer young people means fewer soldiers. However, U.S. strategic commitments will increase, not decrease. The United States, more than any other nation, will need robotic support for soldiers as a matter of national interest.

By the time the social and political crisis of 2030 occurs, robotics applications will have been field-tested and proven by the military and thus ready for commercial application. Obviously, robots won't be ready for mass deployment by 2030. And in no way will robots eliminate the need for immigration. This situation will sound familiar to many of us, as we've been here before. Computing was at this stage in 1975; the military had paid for the development of the silicon microchip, and many military applications could be found. Commercialization processes were just beginning, and it would take several decades to transform the civilian economy. So the mass deployment of robotics technologies will not be taking place until the 2040s, and the full transformative power of robotics will not be felt until about 2060.

Ironically, immigrant technologists will be critical in developing robotics technology, a technology that will undercut the need for mass immigration. In fact, as robotics enters the mainstream of society, it will undercut the economic position of those migrants engaged in unskilled labor at the bottom of the economic pyramid.

Once again, the solution to one problem will be the catalyst for the next one. This situation will set the stage for the crisis of 2080. The system for encouraging immigration will be embedded into American culture and politics. Recruiters will continue offering incentives for immigrants to come to the United States. An emergency measure will have become a routine part of government. The problem is that by 2060 or so, the crisis will have passed,

both because of migration and due to new technologies like robotics. The last boomers will be gone and buried, and America's demographic structure will look more like a pyramid—which is what it should look like. Advances in robotics will eliminate the need for an entire segment of immigrants.

Technology has frequently promised to eliminate jobs. The exact opposite has always happened. More jobs have been created in order to maintain the technology. What has happened is a shift from unskilled to skilled labor. That will certainly be one result of robotics. Someone will have to design and maintain the systems. But robotics differs from all prior technologies in a fundamental way: Prior technologies have had labor displacement as a by-product. Robotics is designed explicitly for labor displacement. The entire point of this class of technology is replacing scarce human labor with cheaper technology. The first goal will be replacing labor that is no longer available. The second will be to shift available labor to support robotics. The third—and this is where the problem starts—will be the direct displacement of workers. In other words, while robotics will be designed to replace disappearing workers, it will also create unemployment among workers who are displaced but don't have the skills to move into robotics.

As a result, unemployment will begin rising, beginning around 2060 and accelerating throughout the next two decades. There will be a temporary but painful population surplus. Whereas the problem of 2030 will be coping with a population shortage, the problem by the 2060s to the 2080s will be coping with a surplus population driven by excessive immigration and structural unemployment. This will be compounded by advances in genetics. Human life may not be extended dramatically, but Americans will remain productive longer. We shouldn't discount, either, the possibility of massive increases in longevity as a wild card.

Robotics, coupled with genetics and attendant technologies, will simultaneously replace labor and increase the labor pool by making humans more efficient. It will be a time of increasing turmoil. It will also be a time of turmoil in terms of energy use. Robots, which will both move and process information, will be even more ubiquitous energy hogs than automobiles. This will kick off the energy crisis discussed in previous chapters and the end of hydrocarbon technology rooted in the European Age. The United States will be forced to look to space for energy.