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Manufacturing a Recovery

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THE United States became the world's largest economy because we invented products and then made them with new processes. With design and fabrication side by side, insights from the factory floor flowed back to the drawing board. Today, our most important task is to restart this virtuous cycle of invention and manufacturing.

Rebuilding our manufacturing capacity requires the demolition of the idea that the United States can thrive on its service sector alone. We need to create at least 20 million jobs in the next decade to offset the effects of the recession and to address our $500 billion trade deficit in manufactured goods. These problems are related, given that the service sector accounts for only 20 percent of world trade.

To make our economy grow, sell more goods to the world and replenish the work force, we need to restore manufacturing — not the assembly-line jobs of the past, but the high-tech advanced manufacturing of the future.

Advanced manufacturing relies on the marriage of science and engineering in cutting-edge fields. Cepheid, a company in Sunnyvale, Calif., with a market capitalization of more than $2 billion, designs and manufactures sophisticated instruments that use DNA analysis to detect infectious disease and cancer; its products are used by hospitals for diagnoses and by the Postal Service to screen mail for anthrax.

A young company called Lilliputian Systems has developed handheld chargers for mobile devices. The chargers use a recyclable high-energy butane cartridge to replenish cellphones and laptops more efficiently than wall chargers. The company has a pilot manufacturing plant in Wilmington, Mass., plans to expand its production capacity and uses an Intel component that is also made in Massachusetts.

A decade ago, with help from an Energy Department grant, Yet-Ming Chiang, an M.I.T. professor, made a nanotechnology breakthrough by manipulating lithium battery electrodes. He helped start a company, A123 Systems, that now makes millions of batteries each year for hybrid-electric cars and buses and large-scale energy storage systems. The company recently hired its 1,000th employee. About half the workers at its plant in suburban Detroit were unemployed before A123 Systems came to town.

Like the jet aircraft made by Boeing, one of the country's largest exporters, products like these require sophisticated manufacturing equipment, operated by skilled workers, and benefit from the tight integration of design and production. With goods like these, the United States can reassert an economic advantage. If we can find ways for companies of every size to exploit the possibilities of nanofabrication, advanced materials, robotics and energy efficiency, we can create networks of innovation, joining lab research to new production processes and business models.

The United States remains a top producer of advanced technology products. But our dominance has eroded. Ten years ago, we enjoyed a trade surplus in advanced technology manufactured goods; today, that category accounts for an $81 billion annual trade deficit. Countries that used to make inexpensive goods at low cost have developed the capacity to produce high-value goods, making it ever more tempting for American companies to design at home but manufacture abroad.

This not only destroys manufacturing jobs, but also saps our inventive advantage. Manufacturers conduct 70 percent of private-sector research and development and employ 64 percent of the nation's scientists and engineers. But factories abroad attract design and engineering talent; over time, manufacturing off shore leads to innovation off shore. To make matters worse, as the President's Council of Advisers on Science and Technology recently reported, other nations are investing heavily in manufacturing, while our investments lag.

President Obama asked me and Andrew N. Liveris, the chief executive of Dow Chemical, to lead the Advanced Manufacturing Partnership, a group of industry, academic and government representatives that will find ways to speed up research in advanced materials and processes and increase our pool of skilled labor.

The private sector cannot do this alone. Since World War II, federal investments in scientific research have set off waves of job-creating innovation in aviation, electronics, computing, the Internet and biotechnology.

We need major innovation investment if we are to achieve similar breakthroughs today. But the recent debt-ceiling compromise could compel some 10 percent in cuts to federal research and development money in 2013. That could lead to a

decade of stagnation. We must recommit to innovation if we want to re-energize our economy.

A new era of advanced manufacturing also requires more graduates with greater proficiency in science, technology, engineering and mathematics. The National Association of Manufacturers, together with community colleges, recently announced a program to certify a half-million skilled workers in five years and to connect them with manufacturing jobs. We need more initiatives like this.

The prospect of good manufacturing jobs in the United States is not a fantasy. Germany and Japan enjoy high wages and run major surpluses in manufactured goods; so can we. Our economy will thrive only when we make what we invent.

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