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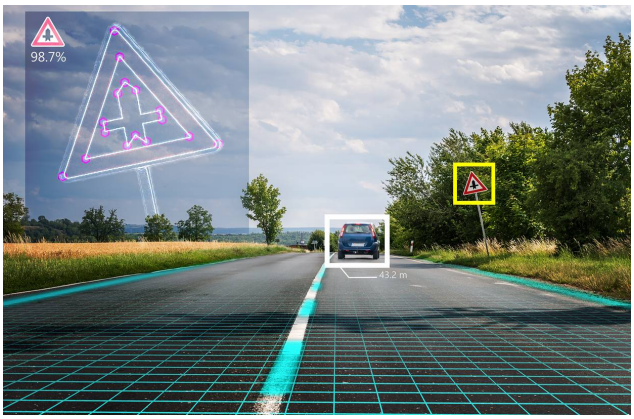
OPINION | COMMENTARY

The Cyber Age Has Hardly Begun

The information sector accounts for less than 10% of GDP and 5% of jobs.



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By Mark P. Mills

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Apparently American companies can be organized now into two camps: smoking-hot tech firms and old economy roadkill. Economists cite soaring tech stock valuations as evidence of a two-speed economy. Yet Silicon Valley magic hasn't benefited most companies or created jobs for most Americans. What's going on?

Amazon's market value is twice that of Wal-Mart and 500-fold that of evaporating Sears. Apple's valuation is twice Exxon 's , and Facebook and Google are each valued at 20-fold CBS . Next come 200 "unicorns," private software-dominated startups each valued at over $1 billion. Uber has a valuation greater than all car rental companies combined, and 8-year-old Airbnb is worth as much as 80-year-old Marriott.

Despite such lofty valuations, the information sector accounts for less than 10% of gross domestic product, according to the Bureau of Economic Analysis. Everyone from infants to seniors is told to learn how to code, but there aren't that many tech jobs. Bureau of Labor Statistics data show the entire information sector accounts for under 5% of employment, with a flat trend line. The productivity and jobs benefits software could produce for the rest of the economy have yet to arrive.

Look around. Most everything critical to daily life—food, energy, buildings, transportation—is physical, not virtual. The fabric of

civilization involves digging up, processing, fabricating, moving and operating gigatons of material composed of atoms, not bits. As amazing as artificial intelligence and the cloud seem today, the world is still in the early days of truly useful, ubiquitous software that can be infused into the physical world's hardware.

The billions of dollars in economic value from information technology has been associated with improvements mainly in information-related activities: mail, news, entertainment, advertising, finance and travel services. That's no accident, as those domains are relatively easy to digitize. Very little of the hardware world is digitized so far. The "smart" objects industry is dominated by monitoring and analysis. That's valuable but doesn't fundamentally alter how objects are created or operate.

Contrary to breathless prose about robots taking manufacturing jobs, the data show underinvestment in automation and information technology in factories. U.S. companies need more robots and software to boost their competitiveness, profits and employee rolls. While spending on information technology remains high in media, banking, education and insurance, it lags far behind in chemical and food processing, energy and transportation.

Infusing software into hardware so that it becomes invisible and reliable is hard. The physical world involves factors like inertia, friction and gravity, all of which present serious safety implications. Cyberphysical systems have to work with near perfection. The real, rather than virtual, world cannot tolerate the equivalent of frozen screens, reboots, video jitter, or iterative upgrades of sloppy software rushed to market.

One iconic cyberphysical system, the self-driving car, has seen many impressive demonstrations, but engineers know much more work remains to be done. Several researchers recently demonstrated how easily self-driving cars are confused by simple graffiti on street signs. Automotive AI systems have yet to achieve the situational awareness of an inebriated college freshman.

Apple appears to be scaling back its self-driving-car initiative. There is little evidence that Apple will soon produce cars—or that Google will build power plants, Facebook will develop pharmaceuticals, or Uber will build aircraft. When more tech companies use their gargantuan cash hoards to acquire traditional enterprises—like Amazon's acquisition of Whole Foods—we'll know the fusion between atoms and bits has really begun.

The dominant players of the cyberphysical age have yet to emerge. The early automobile age provides a relevant analogy. By 1920, several decades after the first cars were introduced, hundreds of U.S. auto makers had sprung up, although less than 10% of the population had a car, according to the Transportation Department.

Conquering the complexities of producing reliable, affordable cars

and developing all the associated industries and infrastructures took time. By 1937 about a quarter of the population had cars. That had risen to nearly 40% by 1957 and around 85% today. America's economy was transformed, stimulating employment across the landscape. Detroit was the Silicon Valley of its day, but the entire nation was boosted by ubiquitous personal transportation.

The U.S. now stands at the equivalent of 1920 for ubiquitous cyberphysical systems. Today's two-speed economy is not permanent. It's a sign that America is about to shift to the next level, driven by cyberphysical software. Economic growth and jobs will follow.

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