INFERENTIAL FOCUS

BRIEFING

IF 4113 September 14, 2020

ESCALATING REWARDS AND ELEVATED RISKS:

PRODUCTIVITY/EFFICIENCY, AUTOMATION AND ADVANCING ARTIFICIAL INTELLIGENCE

CONTEXT & DYNAMICS

Productivity and efficiency *are critical components of any organization hoping to best utilize resources and generate the most effective results. While they are often confused, the two together can produce higher margins and increased profits for businesses or better results from designated resources for public institutions. Automation is the latest practice for advancing both productivity and efficiency. Yet, when productivity and efficiency have been pushed to extreme levels, they have created the possibility for social disruptions and even catastrophic failure. Now, artificial intelligence (AI) is moving these twin economic attributes past their historical models of linear change to mind-boggling levels of exponential change. A different mindset will be required for humans to assimilate into the accelerated pace of change.*

IMPLICATIONS

- *The pandemic has increased the demand for automation, and that means many people currently furloughed will not have a job waiting for them after the pandemic.*
- *Robotics will increasingly be deployed in new industries as well as existing factories, meaning that sales of robots will steadily increase, as will sales of artificial software.*
- *Productivity and efficiency will be accelerated by the application of AI, and that will put more jobs at risk sooner than society has so far anticipated.*
- *Workspaces will be reconfigured to suit the reality of fewer needed employees.*
- *The pace of change will be greatly accelerated with the application of artificial intelligence.*
- *Rampaging Efficiencies have already caused problems, and they will continue to do so.*
- *Humans had to adapt their pace of work to meet the demands of machines in the Industrial Age and of computers in the Information Age; now they will need to adapt to the nonlinear demands of what might become AI Age.*
- *Humans have become accustomed to a linear and analog pace of change, and that could cause conflicts with the exponential pace of change that AI is bringing.*

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Infections and the Economy

The U.S. economy continues to stumble along, suffering from the bad luck of being in the middle of a pandemic caused by a stubborn and crafty coronavirus. Yet national housing prices, despite the historic examples that showed such prices decline during recessions, increased by 4.1 percent in June against one year earlier. Industrial production in July increased by three percent, after a 5.7 percent surge in June. Factory output increased in July by 3.4 percent, pushed higher by a 28.3 percent gain in automobile production and thereby edging the manufacturing index to its highest point since 2018. (*Economist*, 7/4/20 and 8/8/20; *New York Times,* 8/15/20 and 9/2/20)

Much of this kind of positive news flirts with a couple of economic fundamentals: productivity and efficiency. The first of these two mega-terms, productivity, is a metric of the amount of work completed divided by the amount of time needed. The second term, efficiency, measures the quality of that work against the quantity of resources required – that is, it seeks to reduce waste. Often confused, the two terms, when applied effectively in tandem, can increase margins and profits. For the past several decades, these two terms have moved to the center of economic activity and have become, as we have written, "rampaging" in their applications and effects (see **IF 4009**).

In the 1920s, Frederick W. Taylor launched the theoretical focus on maximizing production and increasing efficiency with his concept of Scientific Management, which analyzed and synthesized workflows to eliminate excesses and accelerate processes. His theory eventually led to W. Edwards Deming's Total Quality Management (TQM), which sought to eliminate all waste from production processes while retaining quality in service, and Bill Smith's Six Sigma, introduced at Motorola and later adopted with much fanfare at GE, which tried to reduce costs and everything else in the process, even leading to top performers of Six Sigma being designated black belts!

> Productivity and efficiency have entered a curious era.

Recently, black belt or not, productivity and efficiency have entered a curious era, one in which new tools have made it possible to greatly enhance the performance of both and yet also an era in which obsessive dependence on those tools can add risks that can lead to catastrophic failure. How does such a diverse pair of consequences play out?

"Six Sigma is a system to eliminate defects as this PowerPoint presentation demonstrates."

Pandemic and Automation

"This pandemic has created a very strong incentive to automate the work of human beings," explained Daniel Susskind, professor of economics at Balliol College, Oxford University, and author of *A World Without Work: Technology, Automation and How We Should Respond* (2020). "Machines don't fall ill, they don't need to isolate to protect peers, [and] they don't need to take time off work." (*Time*, 8/17/20)

Based on a cursory examination of recent deployments of technology, Susskind makes a valid point.

◆ AMP Robotics, which manufactures robots that use artificial intelligence (AI) for the recycling industry,

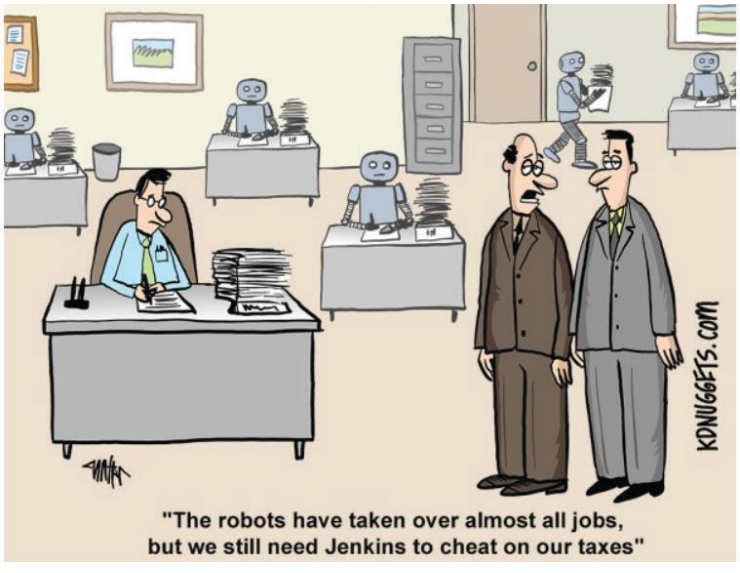
recently revealed that between May and June, phone calls from companies inquiring about AMP's robots increased by a factor of five. At IAM Robotics, which makes autonomous mobile robots, incoming calls asking about their products doubled between January and July.

◆ Because of the pandemic, more than half of corporate-warehouse operators responding to a Honeywell Intelligrated survey said they were willing to spend more money on automation; 66 percent of e-commerce companies said they were looking at opportunities in automation, and 59 percent of food-and-beverage companies and 55 percent of logistics providers said they are more willing now to invest in automation.

◆ With schools and libraries closed because of the virus, middle school librarians in Montgomery County (VA) have turned to Wing, the drone delivery service that is a subsidiary of Alphabet, to deliver books to the homes of students who have requested the books online.

◆ Since takeout orders have become a way for restaurants to keep their kitchens operating, Kiwibot has delivered more than 110,000 meals from 100 restaurants in San Jose (CA).

◆ LivePerson supplies AI-enabled chatbots to replace call-center employees, meaning only 100 workers are required to operate an entire center, rather than the usual 1,000. In March, LivePerson experienced a fourfold increase in demand for its products, as companies were forced to close down their human-based capabilities. (*Time*, 8/17/20; *Wall Street Journal*, 8/12/20; *Washington Post*, 6/20/20; *Automotive News,* 8/17/20)



"The robots have taken over almost all jobs, but we still need Jenkins to cheat on our taxes"

Bon Appetit Management Company, a company providing food at more than 100 campuses in the country, installed robots that can make smoothies, made-to-order salads and pizzas.

In terms of automation in the workplace, the pandemic merely accelerated the already occurring deployment of machines to replace humans. For instance, just in recent months, American Eagle Outfitters installed 26 additional piece-picking robots that use AI to sort through piles of apparel. Fresh Direct installed micro fulfillment technology from Fabric, a robotic start-up, to make it possible to deliver groceries locally in Washington, D.C., within two hours. Bon Appetit Management Company, a company providing food at more than 100 campuses in the country, installed robots that can make smoothies, made-to-order salads and pizzas. Tyson Foods invested more than $500 million in automated equipment at its plants and recently acknowledged that it planned to add even more automation because of the pandemic and its risks to employees at food-processing plants. In meat-packing plants in Sweden, Denmark and France, companies have installed lasers and optical eyes to sort cuts of meat, making it possible for a single worker to do the work historically assigned to eight. (*Wall Street Journal,* 7/9/20 and 8/12/20; *New York Times*, 7/13/20)

These kinds of automation have increased their companies' productivity, which typically means that they get more done with fewer human workers.

Automation and Productivity

On December 1, 1913, Henry Ford's moving assembly line started making cars, further ushering the United States into the era of mass production. The assembly-line process reduced the amount of time it took to make a car from 12 hours to 2.5 hours, lowering the costs of production and thereby lowering the price of cars to buyers. The increase in productivity resulted from workers conforming to the demands of the assembly line, doing one function repeatedly, then each time moving the item along to the next station, where the next function would be completed, and so on.

In this way, automation technology being applied in more and more industries increased productivity and, most often, eventually decreased the need for workers

and lowered prices to consumers. In 1910, for instance, 31 percent of American jobs were on the farm; today, farm jobs represent roughly one percent of all U.S. jobs. Automation made that possible, and automation of factories in cities provided new kinds of jobs for those workers being displaced by machinery on farms. (*Time,* 8/17/20)

After the industrialization of manufacturing, computers were to be the next great innovation to increase productivity. The St. Louis Fed reported in the late 1990s that after the recessions in 1990-1991, productivity had managed a 3.3 percent increase, compared to productivity after the recessions of the 1950s and 1960s managing increases on average of 4.0 percent. Economists referred to this issue as the productivity paradox which meant more advanced technology did not result in increased productivity. Yet, manufacturing managed to avoid the paradox. Arguments about the productivity paradox have evolved, concluding either that the things computers help humans do are not easily measured or that perhaps this technology was not as great a booster of productivity as thought. (*St. Louis Fed*, 10/98; *MIT Technology Review,* 6/18/18)

The recent economic lockdown revealed the unusual kinds of relationships between hours worked by humans and productivity.

◆ U.S. productivity in the second quarter of this year jumped 10.1 percent, mostly because the number of hours worked dropped to the lowest level in 70 years and because commute times were eliminated for those working at home. To compare such an increase in productivity, note that between 2000 and 2007, productivity increased at an annual rate of 2.7 percent; between 2007 and 2019, it managed only a 1.4 percent productivity increase; it increased to 1.9 percent in 2019. In the second quarter, the country's gross domestic product (GDP) declined 31.7 percent, the sharpest decline since such records started being kept in 1947. (*Atlanta Journal-Constitution,* 9/4/20)

One industry favorably disposed to the use of computer hardware and software to increase productivity is logistics, which involves transportation/delivery of goods, storage of those goods, packaging, cargo handling, distribution processing and information processing; or, said more simply: logistics is the management of the flow of things from point of origin to point of consumption. By application of digital capabilities, these complex functions, which once consumed many human work hours, have been made much more productive. (*Investopedia,* 2/11/20)

◆ Dutch logistics firm Portbase has applied blockchain, the backbone networking system behind cryptocurrencies, to the integration of processes at the ports of Amsterdam and Rotterdam, creating what amounts to an ecosystem of carriers, ports and terminals under one management software system. Iwan van der Wolf, Portbase managing director, explained, "Portbase creates a connection between our community and the global ecosystem. It allows all players in the logistical chain to easily, quickly and securely share data with each other." (*Offshore Energy*, 9/1/20)

The drive toward productivity has created a metrics-oriented culture, which goes beyond software and hardware – or, at least, that is what Instacart has done. The company takes online orders for groceries and has "shoppers" pick needed items from store shelves, pay for them and then pass them on to delivery personnel, all completed with "speed" in mind. In short, such shoppers receive minimum wage and work 29 hours a week, one hour short of the 30-hour week government has set for mandatory health insurance. Shoppers are hounded by the company to increase their pace of work, with some of Instacart's shoppers averaging 72 seconds per item, including time in deli lines and seafood counters. One shopper explained, "You're like spinning plates, riding a unicycle. You have to go as fast as possible, and you have to be a perfect customer service agent….It's a very easy job to lose." (*Los Angeles Times*, 8/29/20)

Productivity got a tremendous boost in the first half of the twentieth century, but in the ensuing decades, it had a checkered record. Recently, however, artificial intelligence and other machine-learning capabilities have revived the focus on productivity, even to the point, as Instacart would have it, of requiring humans to work as if they were a piece in an automated process, a more extreme and diverse version of Ford's assembly line.

"It seems our new computer system is allowing us to implement idiotic ideas ten times faster than we've previously been able to!"

Productivity and Efficiency

Increased productivity can lead to increased efficiency, until a point at which it does not. When productivity reaches such a point that it begins to create mistakes or produces products that get returned because errors or faults, then it starts to hurt efficiency, even as it helps a factory break its own records of units produced. Efficiency wishes to eliminate waste, especially waste produced by output that fails to meet some level of quality. So adding automation might increase productivity, but at the same time, it might decrease efficiency.

Efficiency moved to the top of many corporations' lists of priorities with what we called Customer Do It For Us. This was the period when businesses realized that they could enable customers to, say, pump their own gas, do their own banking, check themselves into a flight, choose the right branch of decision-tree software online or on a phone, all assuring some form of customer satisfaction from not waiting in line, getting immediate responses or not having to interact with another human. In a study of customer satisfaction, consumers listed gas stations as providing their most satisfying experiences, which, essentially, said they were satisfied with their own work. These kinds of tasks assigned to unpaid "workers" (*i.e.*, paying customers) increased company efficiency and, surprisingly, customer satisfaction.

From 1990 to 2007, companies replaced 400,000 employees with machines. The pandemic is encouraging increased automation, which will likely increase job cutting, as the virus has already cut 40 million jobs and furloughed personnel because of the lockdown and the resulting economic slowdown. Perhaps as many as half of those 40 million workers will not have jobs waiting for them after the pandemic. The long-term drive to productivity as a way to increase efficiency has altered how large a company needs to be. For instance, in 1964, AT&T was the most valuable company in market valuation in the U.S. and employed 758,611 people. Today, Apple is the most valuable company in the U.S., with just 137,000 employees. (*Time*, 8/17/20)

Artificial intelligence promises to make possible new levels of efficiency. First, it can supposedly conceptualize a solution, once the purview of researchers; next, it can organize a process to create what has been conceptualized, once the purview of management; and finally, it can guide production of what has been conceptualized, once the purview of operations personnel. JP Morgan has AI reviewing all commercial-loan applications, completing in seconds what in the past required 360,000 hours of lawyers' time each year. Meanwhile, iHeartMedia has laid off dozens of DJs and turned their work over to AI software. (*Time,* 8/17/20)

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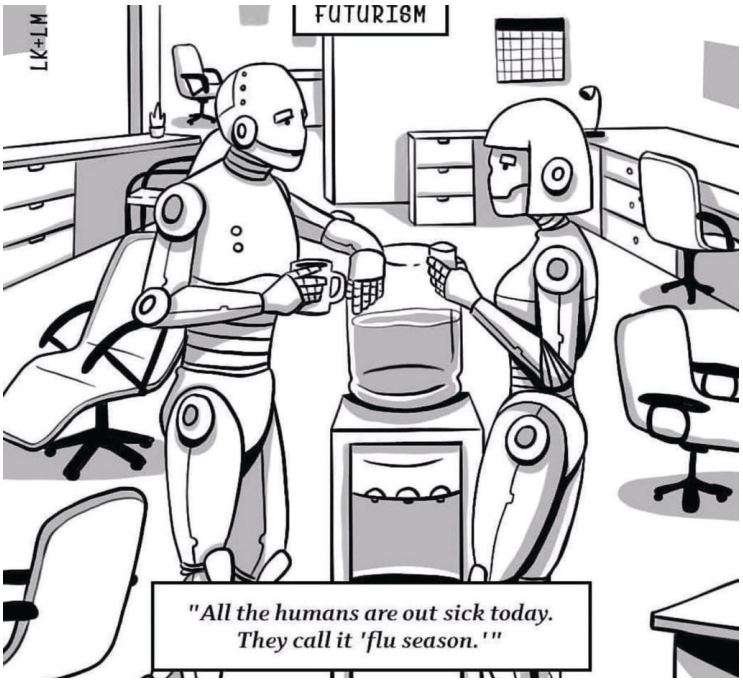
Such job displacement goes beyond productivity measurements. AI machines lead to a quicker result on loan applications, and that can please customers. Yet machines are displacing workers; self-driving cars and trucks will eliminate truck and taxi drivers, smart law algorithms will eliminate the need for human paralegals, if not lawyers in general, and AI-enabled robots will eliminate nearly all warehouse workers. AI-capable facilities might be able to displace a nearly endless range of jobs, replacing some of those with higher skilled jobs, but hardly all of them. Overall, these AI-enabled capabilities will eliminate human errors, especially after their original programmed errors are eliminated. In short, they will increase efficiency. (*Spectrum,* 12/4/20)

◆ AirDev cofounder Vladimir Leytus recently launched Bubble, which enables individuals with no coding skills to drag and drop their way to a personal app, essentially eliminating the need for coding capabilities for the creation of an application. (*BBC*, 8/12/20)



As automation and software steadily increase their reach into more advanced levels of the workforce, the resulting higher levels of efficiency can lead, counterintuitively, to financial and social problems.

Efficiency and Risk

Efficiency at AI speed is nonlinear, and nonlinear progressions, such as the infection rates of COVID-19, seem to confound those accustomed to linear change. Linear changes are easier to follow: this happens, then this happens and so on. But when exponential, nonlinear change happens, change spreads at an accelerated pace, creating diverse impacts with a multiplier effect. For those trying to grasp such levels of change, confusion can follow. Moreover, when the brain does not understand something that affects it, it will create an interpretation that makes sense of the change…even if that interpretation is completely wrong. And so society deals with COVID-19, with some people claiming it is a hoax, it is harmless, it is going away on its own and so on (see **inThought 5/26/20**)

Efficiency at the speed of AI will be confounding to the uninitiated, but even before the effects of AI on commercial and social change become clearer, society has already experienced what we have called Rampaging Efficiencies, which has already created its own problems.

Healthcare: Supply chains for some hospital equipment were organized around the just-in-time delivery method, and for the most efficient way to produce the items to fill the supply chains, production was outsourced to China. When China needed the ventilators, masks and personal protective equipment that were to go into the just in time supply chain, shipments stopped and the U.S. had to endure without necessary equipment. Also, over the past two decades, New York State pressed for the elimination of 20,000 hospital beds, seeking to increase hospital efficiency by upping bed occupancy to 85 percent. Once COVID-19 hit, however, officials had to convert conference centers and Central Park into field hospitals and order refrigerator trucks to hold mounting numbers of dead bodies. (*Atlantic,* 4/29/20)

Over the past 20 years, 75 percent of U.S. industries have become more consolidated, resulting in fewer companies serving expanding markets.

Food Production: A 2000 report from the U.S. Department of Agriculture acclaimed the modernization of meat-packing plants, saying the plants had applied scale and new technology to increase both productivity and efficiency. The resulting close proximity of workers in more efficient but closer together and smaller spaces made them susceptible to the easy spread of COVID-19, and plants from Smithfield Foods in Sioux Falls (SD) to Tyson Foods in Pasco (WA) had to close, because of infections spreading among humans working in the hyper efficient plants. As a result, early in the pandemic in Minnesota alone, 10,000 hogs were slaughtered and dumped in incinerators, a "depopulation due to market conditions," as it was called. In addition, chickens were killed *en masse.* Worried about the long-term effects of these kinds of issues, Tyson is expanding its automation in the plants. JBS, the world's largest meat-producing company, spent $42 million for a controlling stake in Scott Technology, Ltd, a robotics firm that has already automated the company's lamb processing. (*In These Times,* 9/20; *Wall Street Journal*, 7/9/20)

Consolidation: In 1978, the 100 most profitable companies earned 48 percent of the profits of all publicly traded companies combined; by 2015, the figure had reached 84 percent. Over the past 20 years, 75 percent of U.S. industries have become more consolidated, resulting in fewer companies serving expanding markets. This kind of consolidation increases efficiency…and risk. For instance, 80 percent of the world's almonds are now grown in

California, in pursuit of what biologists call a monoculture and what growers insist is the most efficient way to produce sufficient crops to feed the world. Because the almond-tree plantings in California is so expansive and concentrated, the industry must annually import bees to pollinate the trees. However, because the bees have been transported around the country to pollinate many different monoculture plantings, their natural resistance to outside diseases has been challenged. Bee colonies have been succumbing to several epidemics, and their declining numbers put the almond crop (and others) at risk. Now, Silicon Valley is trying to create artificial-intelligence pollinators, automating a natural process. Roger L. Martin, former dean of the Rotman School of Management at the University of Toronto, surveyed these kinds of consolidations and concluded, "A superefficient dominant model elevates the risk of catastrophic failure." (*Harvard Business Review*, 1/19)

Productivity and efficiency at the speed of artificial intelligence will be surprising and perhaps unsettling.

Driverless Car Mishap #13

When artificial intelligence is adding to the quest for efficiency, change will happen at a quicker pace. It will shift from linearly paced change to exponentially paced change, pushing human understanding of what is taking place further from reality. Fear of being left behind and fear of what is not understood are real consequences of exponential-pace change, leading Brad Slingerlend, cofounder of NZS Capital, to suggest that "inequality, nationalism, racism, fake news, et cetera, stem from humans' inability to process rapid, nonlinear change." (*SITALWeek*, 8/23/20)

Perhaps Slingerlend's suggestion is accurate, but experience reveals that exponential change can lead to great breakthroughs as well as worrisome social problems.

Productivity and Efficiency Continue

Productivity and efficiency at the speed of artificial intelligence will be surprising and perhaps unsettling. The Industrial Age accelerated the pace of life and work; the Information Age accelerated the pace of life and work even more; automation is moving economic returns forward at a faster and faster pace; and now, society is moving toward what might be called an AI Age, wherein the pace of change will be shifting from linear to exponential.

The pandemic has actually encouraged the use of automation and AI. For instance, applications for Nvidia's latest version of its A-100 system will enhance the pace of educating AI systems for faster applications of machine learning and lead to a significant increase in productivity and efficiency. It will also help companies meet the pandemic-enhanced demands for cloud computing, and this latest system will help AI infrastructures become even more efficient. Rick Stevens, laboratory director for Computing, Environment and Life Sciences at the Argonne National Laboratory, said the new system "will help researchers explore treatments and vaccines and study the spread of the virus, enabling scientists to do years' worth of AI-accelerated work in months or days." (*Verge,* 5/14/20)

Rewards from such efficiencies will be immense, especially in scientific and high-end commercial settings. For the more quotidian applications of the new technology, however, risks of social disruptions will increase, mostly because the pace of change will be withering and leave much of society behind. At the most recent MIT conference on AI and the Future of Work, Elisabeth Reynolds, executive director of MIT's Task Force on the Work of the Future, warned about the risks involved with doing nothing to guide AI and its possible impact on workers of today. "The future will not take care of itself. We have to do something about it." (*Spectrum*, 12/4/19)

Great rewards, great risks. That sounds like a standard investors' reality. But in this instance, the rewards and risks relate to the effects of AI on productivity

and efficiency and on how society adopts automation and edges its way into the AI Age, an age that will progress not at a linear pace but at an exponential pace and that will demand significant adjustments in human thought to be able to assimilate into and adapt to that nonlinear pace of change.

Some of our previous looks at this topic:

inThought 5/26/20 The Economic Pandemic, Part II: The Brain, The Virus And Making Bad Decisions

IF 4104 After Going Viral: Society's Rethink Is Getting A Boost From Covid-19, 3/20/20

inThought 1/13/20 How Did We Get Here? An Assessment Of A Decade Of Inferential Focus-Identified Changes And Where They Are Taking Us

IF 4022 Preparing For The Downside To Elevated Risks: Economic Stimulation And Riskier Investments Create Financial Hazards...But Everyone Knows That, Right?, 12/30/19

IF 4009 Work And Happiness: Meaning Gets Drained From Work, And People Seek It Elsewhere, 4/29/19

IF 3917 AI Lite And Robot Hype: Overarching Expectations Meet Reality, 12/14/18

IF 3905 From Work To Post-Work: Jobs, Work And The Ongoing Restructuring Of Employment, 3/29/18

IF 3816 Artificial Intelligence, Not Your Average Algorithm: What AI Is And What AI Is Not, 8/2/17

IF 3714 Living With Disruption: Certainty, Predictability And Other Anachronisms Of Our Times, 10/13/16

IF 3503 The Race To Robot Heaven…What? Deep Learning And The Progression Of Machine Capabilities, 3/13/14