December 5, 2017

Submitted Electronically Via regulations.gov and by Email to dolstratplan@dol.gov

The Honorable R. Alexander Acosta
Secretary of Labor
United States Department of Labor
200 Constitution Avenue N.W., Rm S-3502
Washington, DC 20210

> Re: Comments on the Department of Labor's Draft Fiscal Years 2018-2022 Strategic Plan: Incorporating the Impact of Artificial Intelligence, Robotics, and Other Automated Systems Technologies into DOL's Strategic Goals.

Dear Mr. Secretary:

Littler Mendelson's Workplace Policy Institute, its Robotics, Artificial Intelligence (AI), and Automation practice group, and Prime Policy Group, submit these comments in response to the Department's request for public input on its Draft Fiscal Years 2018-2022 Strategic Plan. We share the draft plan's overarching objective of bringing "jobs, more jobs, and even more jobs" to the American labor market and its stated strategic goal of supporting "the ability of all Americans to find good jobs." We also share your concern with the growing "skills gap" in the American workforce, which you correctly identify as being a "particularly acute" problem "in the fastest growing sectors of the economy, including financial services, health care, and information technology."

We noted, however, that the Department's 37-page strategic plan did not contain any references to AI, robotics, or other automated systems, which are driving some of the global economy's fastest-growing industries and will play a central role in the economy and labor market of the future. Littler and Prime Policy have extensive experience advising and assisting the companies that are developing these transformative technologies, as well as with companies in industries that must manage the disruption that automation brings. We thus know firsthand the benefits that technological changes can bring to the workplace and labor market, as well as the costs of failing to adequately prepare for such changes.

For the reasons discussed below, we believe that the Department of Labor, in cooperation with other government agencies and private industry, should take proactive steps to provide American workers with the skills necessary to participate in the labor market for these emerging technologies, which promise to revolutionize the global economy and labor market during the coming years, and to implement measures designed to ensure that workers whose jobs are

vulnerable to automation are not left behind. We earnestly hope that the Department will incorporate these suggestions in its final Plan.

I.   Why AI and robotics will play a central role in the Department's future

A.   Recent advances in AI and robotics have led to a sharp increase in the capabilities and cost-effectiveness of automated systems.

The past decade has been marked by rapid technological development in the capabilities of automated systems, most notably robotics and artificial intelligence (AI). In 2010, the decisive victory of an AI system over the most successful human *Jeopardy!* contestants brought recent advances in AI to the world's attention, including the ability of such systems to understand human language. Since that time, even more sophisticated AI systems have been developed by harnessing the power of machine learning. In machine learning, digital systems employ statistical methods to recognize patterns in data. Using these techniques, modern AI systems can progressively improve their own performance in tasks ranging from identifying human faces, to recognizing cancerous cell growth patterns, to predicting future movements in the stock market. With the advent of "deep learning," which uses layers of neural networks inspired by the structure of the human brain, AI systems can quickly learn to perform complex tasks that used to be the exclusive province of highly trained human professionals.

Notably, when we refer to the advantages of recent improvements in AI, we are specifically referring to what industry and academic experts refer to as "beneficial AI." This is a term of art that describes the development of autonomous systems that are controlled by humans and that are developed and deployed for the benefit of humans. This principle of AI development applies to all of the classes of automated systems and concisely captures the fundamental principle that technological change should not be pursued for its own sake; rather, technological changes constitute "progress" only when the changes benefit the economies and societies in which the technologies are used.

Recent advances in computer vision, through which automated systems can acquire and analyze visual data, are likewise opening a host of new applications for both AI and robotics. State-of-the-art computer vision systems can rival or exceed human perception in many areas. A new camera system designed at the Massachusetts Institute of Technology (MIT), for instance, can detect objects that are hidden or obscured by analyzing shadows and patterns of light reflection.[1]

These revolutionary advances in computer vision have already found numerous applications across industries. Many new cars available today are equipped with AI systems that can detect obstacles and proactively avoid collisions by analyzing data collected from onboard cameras and sensors. Improvements in computer vision have also led to remarkably accurate facial recognition software, allowing for biometric security features to be built into smartphones,

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[1] Luke Dormehl, "MIT camera can 'see' around corners by analyzing nearly invisible shadows," Digital Trends, Oct. 10, 2017, https://www.digitaltrends.com/cool-tech/mit-camera-see-round-corners/.

workplace security systems, and any other system or application where identity verification is necessary. There will be immense demand in the coming decades for workers able to maintain the cameras and sensors that collect visual data, to say nothing of workers able to design and program the systems that analyze such data.

Advances in machine learning and computer vision have spurred the development of more sophisticated robotic systems. The capabilities of these robots, combined with dramatic reductions in cost for physical components such as processors and memory, have greatly increased the number of applications for robotics, both in the workplace and at home. Since the dawn of the 21st century, automated aerial drones, autonomous vehicles, robotic vacuums, and wearable robotic devices such as exoskeletons and robotic limbs have gone from science fiction to a present reality. Robots are also becoming an increasingly common sight in the workplace due to the rise of collaborative robots, or "cobots," which are smaller and cheaper than previous industrial robots and have features that allow them to safely interact with human workers in the same physical workspace. Falling costs have, for the first time, made integrating robotics in the workplace an economically viable option for employers of all sizes.

The rise of these various new forms of robotic technology has many implications for the American labor market. First, the increasing ubiquity of robots in people's daily lives both at work and at home will greatly increase demand for workers performing robotics-related services, given the need to maintain and repair the complex electronic and digital systems that power them. There also will be increased demand for workers trained to build and test robotic systems. An economy with a shortage of such workers will be at an immense disadvantage as robotic technology continues to advance.

In addition, many (if not most) workers whose jobs do not, on the surface, have anything to do with robotics may nevertheless be required to work with them daily in the coming years. Already, warehouse workers move materials or finished products using drones and floor robots, and office workers share documents with colleagues through telepresence robots. By the time today's school children enter the workforce, robots may well be as commonplace in the workplace as computers are today. Having workers with the ability to operate these machines will thus be essential to ensuring the continued vitality of the American workforce and economy.

When assessing recent advances in automated systems, it is important to recognize that in addition to the new economic and social advantages that these more sophisticated automated systems will bring, the development of such systems means that more jobs and industries are potentially vulnerable to automation than ever before. As a result, the widespread adoption of these emerging technologies is likely to cause significant economic and social disruption. Failing to prepare for the disruptive effects of these technologies could have dire consequences for individual workers, companies, and the labor market as a whole.

B. **Automated systems are already revolutionizing the global economy.**

The list of potential uses and applications of robotics and AI technology is so extensive that it defies summary. We will list a few illustrative examples of the ways in which automated systems are creating sea changes across the global economy and labor market.

In healthcare, AI and robotic systems are allowing physicians to provide safer and more effective patient care. AI has led to rapid advances in "data-driven medicine," with physicians using the analytic power of AI to improve the effectiveness of medical care at every stage from diagnosis to the development and execution of individualized treatment plans.[2] Robotic surgery will be used in more than one million medical procedures in 2017, more than double the number performed in 2012. One physiotherapy robot, which is manufactured in a robotics laboratory that employs more than 200 skilled workers in the manufacturing process, can rehabilitate stroke victims 60% faster than human physical therapists. In medical research, AI systems have been used to identify cell growth patterns that might serve as early warning signs for cancer and to provide more accurate prognoses for patients who already have cancer.

In addition to assisting in patient treatment, automated systems are being used to improve hospitals' operational efficiency and patients' quality of life. Hospitals are investing in robotic systems to move everything from drugs to lab results to bedsheets across hospital floors. Facilities ranging from children's hospitals to assisted living facilities are investing in intelligent robots designed to provide comfort and companionship to patients. The rapid development of natural language processing allows these systems to interact directly with diverse groups of patients. One prototype elder care robot is already "equipped with cameras to read facial expressions, sensors to capture vital signs, and speech recognition capabilities to know when to call for help."[3] In the future, such robotic systems might be able to fill the largely unmet demand for caregivers.

Automated systems are also bringing dramatic changes to the transportation sector, which plays an essential role in the proper functioning of the labor market. Autonomous vehicles and intelligent transportation systems promise to revolutionize transportation on a scale not seen since the rise of the automobile more than a century ago. Already, American roads are filled with vehicles equipped with semi-autonomous technologies that use cameras, sensors, and artificial intelligence to detect and, in many cases, actively avoid potential collisions. Every major auto manufacturer in the country now offers such technologies on at least some models. Even greater advances are on the horizon, with both traditional automakers as well as tech companies pouring resources into the development of fully autonomous vehicles.

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[2] *See* Jennifer Kite-Powell, "Artificial Intelligence And Data Driven Medicine," *Forbes*, July 27, 2016, https://www.forbes.com/sites/jenniferhicks/2016/07/27/artificial-intelligence-and-data-driven-medicine/#3a57e3ef3069.

[3] Chris Weller, "IBM is working on a robot that takes care of elderly people who live alone," Business Insider, Dec. 28, 2016, http://www.businessinsider.com/ibm-pepper-robot-elder-care-2016-12.

The market for autonomous vehicles is already large and is expanding rapidly. One major transportation services company recently agreed to purchase more than 24,000 driverless vehicles by 2021. Sales of autonomous vehicles are projected to reach 600,000 units per year by 2025 and 21 million per year by 2035. Long before then, it is likely that autonomous features such as active collision prevention and lane centering will become standard features on most, if not all, new vehicles sold.

Autonomous and semi-autonomous vehicles will have numerous components not present in earlier generations of automotive technology. The hardware for one advanced semi-autonomous driving system, for instance, consists of eight cameras, a radar unit, and ultrasonic sensors all powered by an onboard supercomputer. As autonomous vehicle technology becomes increasingly standard, there will be strong and sustained demand for workers trained to maintain, repair, and replace the cameras, sensors, and computer systems that drive the autonomous technology, as well as data analysts capable of parsing and analyzing the immense amount of data the vehicles' systems will collect. Securing autonomous vehicles' systems from hackers will be crucial to maintaining highway safety, thus increasing demand for workers with the skills needed to implement effective cybersecurity measures.

Individual autonomous vehicles will form part of larger Intelligent Transportation Systems (ITS) that will transform the way people and goods are moved in the 21st century. An ITS utilizes data collected from satellites, road-based cameras, and sensors on individual vehicles. This data can be used to reduce congestion, improve road safety, and increase the cost and energy efficiency of transportation systems. Here too, there will be a demand for workers trained to analyze data collected by each ITS, as well as workers who can maintain the extensive electronic systems that are needed for an ITS to function properly.

The impact of these technological changes upon the current transportation workforce will be significant. As such, the Department should carefully study how these changes will impact workers in the transportation sector, and be proactive in ensuring that adequate opportunities for retraining are available for workers who perform jobs or tasks that are vulnerable to automation.

The list of applications for automated systems hardly stops there. The Department of Defense spent more than $1.5 billion on AI projects in 2016, and that number is sure to rise in the future. In civilian life, 80 million smart home devices were sold in 2016, and that number is projected to double this year. In short, virtually every sector of our economy is already feeling the effects of these emerging technologies.

Against this backdrop, it is hardly surprising that investment in AI development has skyrocketed in the past decade. The number of acquisitions or funding rounds for AI startups increased more than twelvefold from the first quarter of 2011 (11) to the equivalent quarter in 2016 (134).[4] Total private investment in AI has tripled since 2013, with companies investing at

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[4] CB Insights, "Funding to Artificial Intelligence Startups Reaches New Quarterly High," July 17, 2016, https://www.cbinsights.com/research/artificial-intelligence-funding-trends-q216/.

least $26 billion in 2016 alone.[5] In the robotics industry, tech companies spent $19 billion dollars to acquire robotics start-ups in 2016.[6] The pace of investment in these industries shows no signs of slowing—and the governments of the other global economic powers are wasting no time boosting their domestic AI and robotics industries.

> **C.   The governments of the other major economic powers are investing heavily in automated systems and in training workers who can build, operate, and maintain them.**

The governments of other countries are already moving aggressively to ensure that their workforces are well-positioned to fulfill the increasing demand for workers trained to design, assemble, program, and maintain automated systems. China has been particularly forceful in reorienting its economy and workforce to reap the benefits of the anticipated growth of the AI and robotics industries. Earlier this year, the Chinese Ministry of Science and Technology released a "Next Generation Artificial Intelligence Development Plan," promising to "vigorously use governmental and social capital" in an effort to achieve Chinese dominance of the AI industry. The plan's goal is to establish China as the world's leader in AI by 2030. In addition, the Chinese government is orchestrating the early retirement of more than 1.8 million coal and steel workers, with each worker receiving a $600/month pension, as part of a mass pivot from traditional industries toward twenty-first century technologies.

Local governments and individual companies in China are similarly pushing automation. In Guangdong, a key manufacturing center, the provincial government has promised to spend $150 million incorporating advanced automation into factories and fostering related innovation and skills. Chinese tech companies are investing billions of dollars each year in an effort to challenge Silicon Valley's AI industry.

China is hardly alone in seeking to carve out a dominant position in these industries of the future. In Germany—long one of the world's leaders in the development and use of robotics—companies have partnered with the German government to aggressively incorporate AI into the German manufacturing sector as part of Germany's "Industry 4.0" initiative. Similarly, the Japanese government is implementing a 91-page "New Robot Strategy" calling for increased education and vocational training in robotics.

The message from these developments is clear: companies and governments across the world already recognize that the countries that lead the markets for automated systems will have a decisive advantage in the future global economy. America simply cannot afford to let itself fall behind as other economic powers propel themselves forward.

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[5] McKinsey Global Institute, *Artificial Intelligence: The Next Digital Frontier?*, at 5 (2016), *available at* https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/how-artificial-intelligence-can-deliver-real-value-to-companies.

[6] Frank Tobe, "Over $19 billion paid to acquire 50 robotics companies in 2016," *The Robot Report*, Jan. 5, 2017, https://www.therobotreport.com/over-19-billion-paid-to-acquire-50-robotics-companies-in-2016/.

D.   Automated systems drive job growth

Fears that automation of specific tasks will lead to increased unemployment have long accompanied technological advances that permit certain tasks to be automated. These concerns are once again being raised in response to recent advances in automated systems. The very legitimate human concerns of both employers and their employees regarding the potential impact of new technologies should not be ignored. To minimize potential human dislocation, traditional businesses and their workforces must have a significant voice in how automated systems are implemented.

Fortunately, American companies are already demonstrating that aggressive utilization of AI and robotics can elevate rather than eliminate employees. A recent survey revealed that most of the companies that have been most aggressive in adopting automation technologies have either maintained or increased the number of human workers.[7] In this way, companies are using robotics and AI to increase productivity and position themselves for the economy of the future without adding to unemployment.

Germany's experience demonstrates that these strategies can work on a broader scale as well. At the level of individual firms and workers, research has shown that in Germany, "robot-exposed workers in fact have a substantially higher probability of keeping a job at their original workplace."[8] Far from destroying workers' jobs, "robot exposure increased job stability for these workers, although some of them end up performing different tasks in their firm than before the robot exposure." As a result, the number of workers in Germany's manufacturing sector has remained exceptionally high even as the number of industrial robots in Germany has more than tripled over the past two decades.[9]

This comports with historical experience, which has shown that in the long run, technological advances do not reduce the total amount of work available in an economy, but instead change the nature of the work that is available. Two and a half centuries ago, the first Industrial Revolution transformed economies dominated by agriculture—with most people

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[7] Deloitte, *The 2017 Deloitte State of Cognitive Survey*, at 2 (2017). *See also* Nick Wingfield, "As Amazon Pushes Forward with Robots, Workers Find New Roles," *NY Times*, Sept. 10, 2017; Nicky Cappella, "Accenture automates 17,000 jobs without layoffs," The Stack, Jan. 19, 2017, https://thestack.com/big-data/2017/01/19/accenture-automates-17000-jobs-without-layoffs/.

[8] Wolfgang Dauth et al., *The rise of robots in the German labour market, Vox—CEPR*, Sept. 19, 2016, http://voxeu.org/article/rise-robots-german-labour-market.

[9] *See id.* A far greater threat to the robustness of America's labor market is the increasing number of cities and states that have adopted or are considering legislation dramatically raising the minimum wage. *Michael Saltsman*, "San Francisco's Problem Isn't Robots; It's the $15 Wage Floor," WALL STREET JOURNAL, Nov. 24, 2017. Such measures drive workers at risk of automation out of the labor market before the companies that employ them have the opportunity to retrain and transfer them into higher-value positions. And, of course, workers pushed out of the labor market may never return to it, particularly if they have not been provided with retraining relevant to the jobs of the future.

surviving through subsistence farming—into economies based on manufacturing and services. The first and second industrial revolutions helped make the two countries at the forefront of technological change (Great Britain and the United States, respectively) into the world's preeminent economic powers, spurring the creation of the middle class and dramatically raising the standard of living and economic security of workers.

But technological change also has a disruptive impact, rendering some individual jobs obsolete and radically changing the nature of many other jobs. The Industrial Revolution was defined as much by the significant social and economic disruption it caused as by the long-term economic growth and improved standards of living it helped to spur. Indeed, the reason that the Department of Labor was established in 1913 was that existing institutions were simply unable to cope with the widespread disruptions that industrialization was bringing to the American labor market.

The lesson to be drawn from the history of technological change and the fear that such change generates is not that we should discourage the development or use of automated systems. Instead, the lesson is that both industry and government must do a much better job of planning for displacement of jobs that are vulnerable to automation and ensuring that the benefits of these technological advances are widely recognized and shared. For DOL, this means paving career tracks for workers at risk of displacement so that they gain the skills necessary to perform the new jobs created by technological advances.

The willingness of employers and consumers to accept these workplace changes is directly correlated with their understanding of the risk/reward proposition associated with adopting new technologies. Companies involved in developing and deploying automated systems will bear a heavy burden to explain the benefits of their technologies—and to alleviate the concerns of companies and consumers fearing job losses due to automation—if their technologies are to be fully embraced. We must not turn a blind eye to the negative impact that automation has on many workers. At the same time, DOL should avoid pursuing a regulatory and enforcement agenda that would have the effect of stifling the innovation and opportunity that robotics and AI will afford the American economy, its businesses, and its workers. Only by confronting these issues head-on, and by considering and accounting for the legitimate and sometimes-conflicting interests and concerns of all the relevant stakeholders in the labor market, will we minimize the negative consequences of technological change.

II.   How automated systems are already helping achieve DOL's strategic goals

A.   Automated systems improve workplace safety and ease pressure on workers' compensation systems.

Automated systems can help make the workplace safer and ease the financial burdens on employers caused by workplace injuries and the absences that result from them. Companies are already using data analytics to identify employees with the necessary training or certification to perform tasks, thus permitting supervisors and managers to ensure that potentially dangerous

tasks are only performed by workers qualified to do so. Automated systems linked to cameras and sensors can also alert employees to potential hazards such as chemical spills and improperly stored equipment.

In many industries, automated systems can take workers out of harm's way altogether. In settings as diverse as deep-sea exploration and law enforcement, robots and other forms of automation technology can be called upon to perform tasks that would pose great health and safety risks if performed by a human worker. The market for robotics in industrial welding—historically one of the most hazardous manufacturing-sector tasks—surpassed $2 billion in 2016 and is projected to grow an additional 30% over the next four years.[10]

For first responders, automated systems already have demonstrated their immense potential to enhance workers' health and safety. Police departments and the armed forces already have years of experience using bomb disposal robots. Robots can also be deployed to put out fires in settings that would pose a particularly high risk of harm to firefighters, such as in areas contaminated by hazardous or combustible materials. Recent advances in drones and AI may make it possible for automated systems to respond quickly to medical emergencies, using sensors to detect vital signs and provide timely information to emergency medical technicians. As these technologies continue to develop, automated systems promise to greatly enhance the safety of the brave Americans who work as first responders.

B.   Automated systems increase opportunity for disabled Americans

Automated systems promise to have a dramatic impact on workers with physical disabilities or impairments, permitting them to participate in the labor market and take positions from which they otherwise would be excluded. One of the main obstacles to workforce participation for Americans with physical impairments is transportation. Experts estimate that lack of access to reliable transportation is likely the primary barrier to employment for approximately one quarter of working-age adults with disabilities who are not working.[11] According to one recent analysis, self-driving cars would bring new employment opportunities to more than 2 million Americans with disabilities.[12] The introduction of fully autonomous vehicles thus offers truly transformative potential to raise workforce participation as well as to create new job opportunities for disabled Americans already in the workforce.

In addition, rapid advances in exoskeletons and other wearable robotic technologies are already allowing workers with physical limitations to perform tasks they otherwise would be

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[10]   BCC Research, "Robot Automation Leads Solid Growth in Welding Products Global Market," https://www.bccresearch.com/pressroom/avm/robot-automation-leads-solid-growth-in-welding-products-global-market.

[11] Henry Claypoole et al., *The Ruderman White Paper--Self-Driving Cars: The Impact on People With Disabilities*, at 16 (2017).

[12] *See id.*

unable to accomplish. Exoskeletons that assist workers in lifting and carrying heavy objects allow injured workers and workers with medical limitations to rejoin the workforce and resume their prior work activities more quickly.

For workers with more serious physical impairments, advanced wearable robotics can help them stand, walk, and perform other essential workplace activities. Exoskeletons equipped with sensors and powered by AI can detect nerve signals, predict the wearer's intended motion, and then apply assistive force. "Smart" wheelchairs can navigate around obstacles and detect the depth and incline of stairway steps, thus giving wheelchair users the ability to ascend and descend stairs without assistance. One Massachusetts-based company offers an exoskeleton system that enables workers suffering from paralysis to walk with the assistance of crutches, thus offering unprecedented levels of mobility to individuals with spinal cord injuries. For individuals with Parkinson's disease, lightweight exoskeletons powered by AI can calm tremors and recognize and assist in the performance of everyday motions such as picking up objects and pointing.[13] Anticipated refinements would give users the ability to engage in even more dexterous tasks such as writing and typing.

AI and robotics thus offer an extraordinary opportunity to enhance employment opportunities for disabled workers. In addition to bringing more Americans into the workforce, these technologies will enhance the earning power of workers who, due to disability, injury, or other forms of physical impairment, have been unable to reach their full potential. As your draft plan states, these individuals represent a "vast, untapped resource [that] presents a ripe opportunity to grow America's workforce, increase innovation in our workplaces, and bolster our overall economy." Cultivating a workforce able to design, build, and maintain automated systems offers unprecedented potential to tap that resource and improve the lives of millions of working-age Americans.

III.   Recommendations

A.   Modernize DOL and its approach to automated systems.

The draft plan rightly includes several references to the need for DOL to seek and implement "evidence-based" policy, programs, and decision-making within the Department itself. In the modern world, adopting such an approach must include a commitment by DOL to using the powerful analytic tools that AI and other data science technologies can bring to bear. Fields as disparate as finance, medicine, and sports management have already been revolutionized by the introduction of modern predictive analytics and insights produced by complex algorithms. The same powerful tools should be put to work by DOL.

Voluminous data on American workers—as well as the labor market as a whole—are already available through the Bureau of Labor Statistics, the Census Bureau, other government

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[13] Eliza Strickland, "Exoskeleton Could Quell the Tremors of Parkinson's Disease Patients at Crucial Moments, *IEEE Spectrum*, June 29, 2016, https://spectrum.ieee.org/the-human-os/biomedical/devices/exoskeleton-could-quell-the-tremors-of-parkinsons-disease-patients-at-crucial-moments.

agencies, NGOs, and private companies. By and large, these statistics remain a vast untapped resource in terms of the insights they could provide. DOL could and should mine and analyze them to identify the areas in which the Department's resources can have maximum impact. In addition, the BLS should supplement existing sources of data with "real-time data on the adoption of automation technologies, job openings, labor market dynamism, skills in demand, and how individuals are coping with job transitions."[14] Already, numerous companies are using data-driven service providers to create smarter and more productive workforces. What companies are already doing on a microscale, DOL can do on a macroscale by using the same tools to optimize the American workforce as a whole.

The Department should also update its regulations and standards to reflect the recent advances in automated systems without undermining your vision for "maximizing our flexibility towards innovation and the dynamics of our workforce." OSHA has not amended its Guidelines for Robotics Safety since 1989. Advances in robotics over the past three decades have made those guidelines not merely obsolete, but counterproductive, given that they were issued at a time when robotic systems had only limited and controlled interactions with human workers. We applaud the recent Alliance established by OSHA, the CDC's National Institute for Occupational Safety and Health (NIOSH), and the Robotics Industries Association (RIA) to improve awareness, training, education, and communication relating to robotic safety issues. The Department should implement the best practices identified by the Alliance and work towards establishing similar industry alliances in the areas of AI and other automated systems technologies.

Given the central role that automated systems will play in our economic future, it is imperative that the Department take steps to ensure that America's workforce is equipped to reap the benefits that these transformative technologies will bring. To ensure that DOL's policies, programs, and standards keep up with the rapid changes that modern technology is bringing, we recommend that the Department establish a Future Workforce Bureau. This bureau should not serve as a source of new and potentially innovation-stifling regulations. Rather, it would be tasked with identifying regulations and standards relevant to automated systems that need to be updated, integrating data analytics into the Department's operations, and identifying and developing new policies and programs to ensure that the American workforce does not fall behind those of other countries in fields related to automated systems. The ultimate goal of the new bureau would be to close the "skills gap" that threatens to hamper America's ability to maintain its preeminence in the economy of the future.

      B.   **Close the skills gap through training, education, and apprenticeships relevant to AI and robotics.**

To close the skills gap and establish America as the world's leader in the technologies that will define our future, DOL should also partner with education institutions, other

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[14] McKinsey Global Institute, *Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation*, at 125 (2017).

government agencies, and the private sector both to provide current workers with the skills necessary to work in robotics and AI-related fields and to cultivate a future workforce capable of establishing the United States as a global leader in these emerging technologies.

1. Focusing Employment and Training Administration (ETA) resources on programs relating to automated systems

First, DOL should consult with AI and robotics companies to educate itself about the skills and training that American workers will need to learn in order to work in their industries. Gaining a proper understanding of the nature of these technologies and the types of skill sets associated with them will allow DOL to design measures specifically catered to cultivating an American workforce that is equipped to participate in the rapidly growing fields involving automated systems. Given the rapid pace at which these technologies are developing, this process of self-education must be sustained and continuous—yet another reason that the Department should establish a dedicated bureau or division specifically tasked with promoting a modernized American workforce.

The overarching arching goal of this process of agency self-education will be to identify the critical skills necessary for American workers to participate in these growing industries and, once those skills are identified, to partner with companies, educational institutions, and other government agencies to ensure that all American workers have access to appropriate education and training. It will be particularly important to increase the availability of midcareer training opportunities for workers, with a focus on providing workers with the specific skills necessary to participate in the industries surrounding these emerging technologies. The experience of other countries demonstrates "the importance of focusing labor agencies on reemployment and the acquisition of new skills, rather than simply handing out unemployment benefits or controlling for fraud," by adopting an approach "that nudges workers to take a more active role in their own retraining and provides tools for them to be successful."[15] To that end, a substantial portion of the ETA's resources should be devoted to programs geared toward expanding the number of workers with the necessary skills to participate in the labor market that will grow around automated systems.

Fortunately, it is easier than ever for workers to gain the training necessary to perform work relating to automated systems. With the advent of massively open online courses (MOOCs), there are an unprecedented number of online programs in data science, computer programming, and other related fields. Many of these programs do not require enrollees to have more than a high-school level education and offer certificates and credit towards degrees. Many are also self-paced, thus permitting learners to progress through programs on their own schedule. Their costs tend to be comparable to or less than similar programs offered at community colleges and traditional adult education centers. In addition, with the advent of low-cost hardware platforms like Raspberry Pi—which sells for $35 and can be used to control numerous robotic and computer systems—there is an enormous opportunity for DOL to partner with educational

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[15] *Id.* at 124.

institutions to train American workers of all ages in robotics and related fields at costs far lower than traditional technical training.

Implementing these measures immediately is critical to ensuring that America does not fall behind as the global economy evolves, and to ensure that the Department's laudable aim of overhauling the Department's apprenticeship efforts—which you recently recognized as "not scaling" to meet the needs of American companies—and other workforce development efforts have a sustained positive impact. Other economic powers like China, Japan, and Germany are already investing substantial financial resources in reorienting their workforce toward AI, robotics, and other 21st century technologies. If the ETA fails to ensure that its programs are geared toward filling the jobs of the future, workers who utilize them will soon find themselves back where they started, while China and other rising economic powers establish dominance in the technologies that will define our future economy.

2.   Stemming the Rising TIDE

As with previous periods of rapid technological change, the rise of automated systems will create many new jobs that do not even exist today and, in the long run, should lead to improved standards of living and economic security for America's workers. But the changes will also render certain jobs obsolete and reduce demand for workers in many other occupations. Consequently, preparing the workforce for the future must also mean confronting the technology-induced displacement of employees (TIDE) that will accompany the coming wave of automation from AI, robotics, and autonomous systems. This TIDE will disrupt the labor market and present challenges to industries, workers, and governments alike on a scale not seen in a century.

To meet the TIDE, we urge DOL to convene an interagency working group that, in conjunction with the new Future Workforce Bureau, would be charged with developing federal initiatives to respond to and mitigate job losses, regional economic disparities, and related societal concerns associated with these changes. Absent such efforts, many American workers will be unable to share in the benefits that automated systems will bring. DOL should be in the forefront of efforts to ensure that all Americans—regardless of geography or demography— share in the opportunity that these new technologies can bring to our society.

3.   Creating a sustainable pipeline of workers trained in automated systems

In addition to ensuring that current workers are not left behind and have access to appropriate training through the ETA when needed, the Department should partner with government agencies and educational institutions to create a sustainable pipeline of workers with skills necessary to participate in the labor market of the future. This effort should include institutions serving all age levels, including K-12 schools, research universities, community colleges, MOOCs, and lifelong learning institutions.

At the K-12 level, DOL should work with the Department of Education as well as state-level education agencies to increase the number of science, technology, engineering, and mathematics (STEM) teachers nationwide by easing certification requirements for STEM teachers. Depending upon the state, it can take one to two years for an otherwise qualified teacher candidate to gain initial certification as a teacher. This both discourages potentially qualified candidates from pursuing a teaching career and also raises unnecessary barriers for people with careers in STEM to make a midcareer switch to teaching. Given the widespread shortages of teachers nationwide—the Learning Policy Institute estimates that there will be a shortfall of 112,000 teachers in 2018—easing certification requirements would not only help build the workforce of the future, but would also directly create jobs by funneling Americans into these vital teaching positions.

Of course, relaxing STEM teacher certification requirements would only be effective if there are more Americans with the necessary education and training to teach STEM-related subjects. For that reason, DOL should partner with education agencies and institutions to promote STEM courses and programs at universities, community colleges, and other institutions of higher education. This effort will bear fruit in multiple ways. As with establishing ETA programs related to automated systems, increasing the supply of available STEM-trained workers will directly increase the number of Americans qualified to work in the robotics and AI industries. In addition, such an effort would increase the number of Americans able to teach both school-age children and adult workers in fields related to automated systems, thus ensuring that America stays competitive in those industries in the long-term.[16]

Here too, other countries are already investing heavily in providing their own children with a proper STEM education and their workforces with skills relevant to the technologies that will define the world's economic future. The United States has already fallen outside the top 20 countries in mathematics test scores, and outside the top 30 in science.[17] Tech industry leaders have long warned that the United States is at risk of losing its dominant position in the tech industry if it cannot improve its pipeline of workers proficient in STEM subjects. Given the immense resources that China,[18] South Korea,[19] and other countries are pouring into STEM

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[16] To ensure that American workers can receive the full benefits of their education and training—and in accordance with the objectives of President Trump's "Buy American, Hire American" executive order, which directs visa programs to "protect the interests of American workers"—DOL should also work to strengthen employers' incentives to hire American workers in lieu of hiring foreign nationals through the H1-B visa program. To that end, DOL should consider partnering with the Department of Homeland Security and other government agencies and, where necessary, urge Congress to take measures that would encourage companies to hire American workers.

[17] Organization for Economic Cooperation and Development, *Program for International Student Assessment (PISA) 2015 Results: Excellence and Equity in Education, Vol. I* at 49-108, 175-200.

[18] Ricky Ye, "While US STEM education market declines, China invests heavily," *The Next Web*, https://thenextweb.com/contributors/2017/06/19/us-stem-education-market-declines-china-invests-heavily/.

[19] Hanna Park, "PRIME: Korea Pours $1.8 Billion Into Graduating More Engineers," *World Education News and Reviews* (Sept. 6, 2016), https://wenr.wes.org/2016/09/prime-a-massive-government-subsidy-seeks-to-reshape-higher-education-in-korea.

education, the need to commit to creating a sustainable pipeline of STEM-trained workers could hardly be clearer.

We appreciate your consideration of these matters. These issues are a matter of great interest and concern for our organizations and our clients, with whom we confront the constant changes that occur in the modern workplace. We want to manage, not obstruct, the changes that AI, robotics, and other automated systems will bring to our economy and labor market. In the coming months, we will be issuing a more extensive report on how automated systems will transform the workforce and workplace of the future. We would be happy to share the report with you once it is complete. In the meantime, please contact us if we can provide any additional information or resources.

Respectfully submitted,

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