

Work of the Future – 2030

Overview of Jobs of the Future

History shows major changes in the occupational landscape and pace of life with each of the four industrial revolutions (Vale, 2016). The first industrial revolution, characterized by the steam engine, led to greater dispersal of jobs as those requiring machine power were not restricted to locations with wind or flowing water to power mills. Electricity and mass production brought about the second industrial revolution, leading to a surge in manufacturing jobs and supporting industries such as transportation, sales, and business. The advent of the digital age, the third industrial revolution, gave us the ability to collect and process massive amounts of data quickly and opened up new jobs related to computers and technology innovation. Now, we are entering the fourth industrial revolution, highlighted by the internet of things and artificial intelligence (Choi, 2017; Vale, 2016).

Throughout history, the introduction of new technologies has led to changes in jobs, from replacing workers with machines to changing how people perform their job to creating new occupations. According to futurists, this trend will continue. Policy analysts predict up to 47 percent of jobs in the United States could be automated between 2017–2037 (Bakhshi, Downing, Osborne, & Schneider, 2017; Houser, 2017). Opportunities will become limited in many industries, mostly in low- or medium-skill jobs, as automation reduces the number of humans needed to perform routine tasks. Further, business leaders and strategists predict that 50 percent of the occupations of 2014 will no longer exist in 2025 (Andrew, Ip, & Worthington, 2014). Technology, automation, artificial intelligence, and other innovations that have yet to be developed will lead to new occupations and jobs.

Atkinson and Wu (2017) take a different perspective of technological disruption, suggesting that others have based their doomsday predictions of rampant job loss on “faulty logic and erroneous empirical analysis.” Instead, they calculate, from 2010 to 2015, approximately six technology-related jobs were created for every 10 lost, the lowest share of jobs lost to technology of any period since 1950 to 1960.

While there will likely be changes in jobs and occupations of the future, what those changes will be, the extent and pace of changes, and the impact on employees entering or currently in the workforce are equivocal. In this report, we review the research related to potential changes in the workplace and highlight forecasts of jobs of the future.

Projections of Shifts in Jobs

Prediction of widespread unemployment due to technological advances is nothing new. For example, in the 1930's, John Maynard Keynes predicted large-scale job loss associated with new technologies (as cited in Frey & Osborne, 2013). Recently in the United States, automation has been replacing jobs faster than it can create them (Atkinson & Wu, 2017; Brynjolfsson & McAfee, 2011), although perhaps not as quickly as some suggest. Autor, Levy, and Murnane (2003) found that as industries use automated technology to reduce the cost of performing routine cognitive and manual tasks, they hire more people to perform nonroutine cognitive tasks.

The occupations in which people are or will be employed are expected to shift, but this does not necessarily mean current jobs will be totally eliminated. As Manyika (2017a) reports, at least 30 percent of activities for most occupations could be automated using current technology.

Assuming in many current occupations certain activities or tasks will be automated, current jobs will change and more people will need to work with technology. Although some employees may lose their jobs because automation will drastically eliminate the need for human skills, integration of technology will help other workers perform their job better or enable them to be more efficient or productive. For still other workers, the demand for their skills may increase or the nature of what they do and how they accomplish tasks at work will change.

O*NET Projections

O*NET OnLine (National Center for O*NET Development, 2018) is a rich source of “detailed descriptions of the world of work.” There is a wealth of data available to those looking for work or interested in changing careers, as well as support for workforce development and human resources professionals, researchers, and policy analysts.

Using 2016–2026 employment projections from the Bureau of Labor Statistics, O*NET includes a set of Bright Outlook occupations. Twelve of the Bright Outlook occupation categories (including 20 distinct occupations) are expected to grow rapidly with an employment increase of 10% or more and are forecasted to have 100,000 or more job openings between 2016 and 2026 (see Table 1). O*NET identifies occupations linked to the green economy, focused on reducing environmental risks and initiating sustainable development without degrading the environment. Green jobs identified in O*NET are those where changes are expected in job demand, including work requirements such as tasks performed or worker qualifications such as knowledge, skills, and credentials needed for employment in these positions.

Table 1. O*NET Bright Outlook Occupations with Rapid Growth and Numerous Job Openings

Major Occupation Group	Occupation Category	Green Economy Sector
Business and Financial Operations	Accountants and Auditors	
Education, Training, and Library	Teachers and Instructors, All Other (includes Tutors)	
Healthcare Practitioners	Registered Nurses (includes Acute Care Nurses, Advanced Practice Psychiatric Nurses, Critical Care Nurses, and Clinical Nurse Specialists)	
Healthcare Support	Home Health Aides	
	Nursing Assistants	
Personal Care and Service	Personal Care Aides	
Food Preparation and Serving	Cooks, Restaurant	
	Combined Food Preparation and Servicing Workers, Including Fast Food	
Building and Grounds Cleaning and Maintenance	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	
	Landscaping and Groundskeeping Workers	
Sales	Sales Representatives, Services, All Other (includes Energy Brokers)	X
Construction and Extraction	Construction Laborers	X

Source: O*NET OnLine

Several researchers have mined the O*NET data to make predictions about the future of jobs, identifying ones expected to increase and ones to decrease in the future. Bakhshi et al. (2017) used O*NET's importance ratings in foresight exercises to generate input for a machine learning model, with the goal of mapping O*NET knowledge, skills, and abilities variables to future occupational demands. In the United States, the model predicts increased demand for teachers from pre-school through high school and post-secondary. Animal care workers, legal professionals, and engineers round out the top five occupations with expected increased demand.

Jobs Expected to be Lost or to Decrease

Job loss and decrease due to technology is evident all around us. Grocery stores offer multiple lanes where customers scan their own purchases, monitored by a single cashier. Only a few years ago there were multiple cashiers serving the customers. Financial institutions offer more and more automated functions such that their customers need to interface with a person less often than ever before. For example, customers can now use a mobile application to deposit a physical check without leaving home. Andrew, Ip, and Worthington (2014) predict customer work will disappear and many middle management positions will no longer exist in 2025. Frey and Osborne (2013) describe greater use of data and algorithms to computerize cognitive tasks such as fraud detection, health care diagnostics, legal document review, and financial advice. With automation expanding into more cognitively-advanced occupations, demand for individuals with certain professional skills, such as financial analysts and law clerks, are predicted to decline.

Frey and Osborne (2013) used O*NET data to study how susceptible jobs are to computerization. Using data for 702 occupations, they modeled the potential for jobs to be automated within 10–20 years. Their model predicted workers are most likely to be replaced with technology in occupations that involve transportation and logistics, office and administrative support, manufacturing, and service.

Bakhshi et al. (2017) did not use their model to predict decreased demand, but rather to predict low probability of increased demand. Those in skilled and semi-skilled trades, such as woodworkers, printing workers, metal and plastic workers, and other production occupations, were at the top of the future low demand list. Financial clerks received low ratings comparable to those in the trades.

Jobs Expected to Increase

Bakhshi et al. (2017) expect growth in professional occupations that require creative, digital, design, and engineering expertise. In addition to creativity, Osborne and Frey (n.d.) suggest growth in jobs that require social intelligence and manipulation, such as iOS and Android developers, social media interns, big data architects, data scientists, user interface/user experience (UI/UX) designers, Zumba instructors, and beachbody coaches. Further, strong interest in environmental sustainability is expected to benefit individuals employed in architectural and green occupations (Bakhshi et al.). Also, they foresee increased roles for people specializing in work reorganization, such as management analysts and training specialists.

New Jobs to be Created

Jobs requiring creative intelligence and social and emotional intelligence are predicted to be added to the economy, as are positions requiring the ability to leverage artificial intelligence (AI; Andrew, Ip, & Worthington, 2014). New jobs using creative or social and emotional intelligence or AI are expected to be more fulfilling than current jobs.

Generally, specific details about future jobs are scarce. Wagner (2011) discusses 70 jobs likely to exist in 2030. These jobs will be created through (a) retrofitting or adding new skills to existing jobs, (b) blending or combining functions from different jobs or industries, and (c) problem solving or creating new jobs to solve a problem. Types of jobs that might be added through retrofitting could support commercial space travel, such as space construction, space suit repair, space junk recyclers, astro-teachers, and exozoologists. By blending careers, the future might include environmental health nursing to treat patients exposed to toxins. To provide authoritative news in an era when anyone can publish online may lead to authority-journalists who specialize in an occupation and are cross-trained to report about their field. To solve future problems, we may hire digital footprint managers or digital archaeologists or future-guides. Wagner mentions occupations in the sustainability and green energy industries may be added, such as green career coach, autonomous vehicle operator, energy harvester, drone dispatcher, smart car interior designer, smart road designer/engineer, and smart road sensor control monitor/analyst. Gordon (2011) predicts there will be new careers inspired by nanotechnology, such as bio-botic physicians and bio-botist assistants to integrate biological functionalities and implanted nano-robotics to extend life.

Drivers of Change

The literature discusses three major drivers of projected shifts in jobs of the future—technology (Frey & Osborne, 2013), artificial intelligence (Manyika, 2017b), and social changes (Bakhshi et al., 2017; Manyika, 2017a). With changes in jobs come adjustments in the workplace. Experts predict that workplace culture and processes will shift as well as career paths and how people learn the necessary job skills needed to perform jobs of the future.

Impact of Technology

Literature is replete with observations of the accelerating impacts of technology in recent decades, including predictions this acceleration will continue. Baby boomers remember a world when communication required a phone call that was timed when both parties were available to speak or a letter that took days to be delivered; researching a topic involved going to the library or referencing a home copy of encyclopedia volumes; and getting a flat tire meant a hike to find a pay phone. Today's young people are digital natives. They cannot imagine a world before e-mail allowed asynchronous communication; the internet offered a wealth of instantaneous information at one's fingertips; and cell phones connected individuals to worlds beyond measure. The explosion of technology is expanding in multiple directions—and quickly.

Bakhshi et al. (2017) employed an innovative approach to predicting job trends by first paneling experts in “foresight workshops” and then inputting their expert judgments into a machine learning system. Their analysis of the experts' judgments identified three key trends in technological change. First, fears about the impact of automation on employment are enduring. Second, estimates of the impact of future automation range from 9–47 percent of U.S. employment. Third, technology can amplify human performance and bring about new occupations and sectors.

For its 21st annual survey of CEOs worldwide, PwC interviewed 1,293 CEOs in 85 countries, including 104 from the United States, in October and November 2017 (Ryan, Sapin, Rao, & Ampil, 2018).

Based on these interviews, U.S. CEOs were hiring for broadly relevant digital skills and collaborative, creative, and efficient work styles. About two-thirds (63%) of those who were hiring found it more difficult to identify qualified workers than before. Responses to this same survey indicated that artificial intelligence (AI) will be the innovation of the next two decades. CEOs predict that many workers will need AI literacy.

One of the challenges of a rapidly changing work environment is the ability of workers to keep pace. While new entrants into the workforce will grow up and attend school immersed in state-of-the-art technology, continued innovation ensures even these digital natives—those who have an advantage over older, digital immigrants who completed school before digital technology became omnipresent—will require ongoing training to stay current on technological knowledge, awareness, and skills. Employees who joined the job market prior to many of the current technological advances are already challenged with staying up to date. Two approaches to keeping tenured employees abreast of the latest technological developments are upskilling and reskilling.

Upskilling

When an employee upskills, that individual learns new skills to improve performance on the job or to adapt to new requirements of the job. Upskilling has the advantage of retaining experienced employees, a positive outcome as these employees are a known commodity to the employer, absent the risks of employing a new hire who may not be a good fit. Knowledge of corporate procedures, norms, and expectations eliminate the need for orientation and start-up time, and reduce the probability of missteps. Retaining seasoned employees also supports the maintenance of institutional memory, which can be crucial as an organization evolves and grows.

Training to upskill employees may be sought by the employee, imposed by the employer, or both. The PwC's Workplace of the Future study found three-quarters of respondents expressed willingness to update their own skills. At the same time, most responding CEOs acknowledged an ongoing responsibility to upskill their employees (Ryan et al., 2018).

PwC's Annual Global CEO Survey specifically investigated the employer's perspective on upskilling. Nearly two-fifths (39%) of respondents reported initiating or using continuous learning initiatives to provide development paths for employees to gain skills.

Reskilling

When an occupation becomes obsolete or the changing nature of the position no longer suits an employee, reskilling may be in order. More disruptive than upskilling, reskilling is training an employee to perform an entirely different job.

Results from PwC's annual survey of CEOs indicate companies that "reinvent their own talent" by reskilling their employees will have an edge by creating pathways for employees to better contribute to data-driven initiatives, which may lower costs and improve the customer experience among other impacts (Ryan et al., 2018). However, the U.S. lags other large economies (e.g., Germany, China, Japan) in assuming responsibility for retraining after automation (i.e., robots and AI) has been introduced into a job. The authors conclude that, while automation will result in job losses, over time those will be generally offset by new jobs. They

note that “retraining workers to work with the support of AI will be important to future economic success” (Ryan et al., 2018, p. 15)

Working with Data

Alec Ross, author of *Industries of the Future*, provides an historical perspective of the workplace. He describes land as the raw materials of the agricultural age, followed by iron in the industrial age, and data in the information age. He posits that whoever owns, controls, and/or can harvest meaning from data will define the future workplace. Ross (2016) emphasizes the sheer quantity of data being produced in recent history and the opportunity for data analytics to mine those data. For example, he notes that “90 percent of the world’s digital data has been generated over the last two years” (page 154). He opines that the sum of “all data from paintings on cave walls through 2003, we now produce every two days” (Ross, 2017).

PwC issued a report on the workforce of the future, using findings from a survey of 10,000 people in China, India, Germany, the United Kingdom, and the United States on how they think the workplace will evolve. From the survey findings, the authors developed four “Worlds of Work” for 2030 to describe hypothetical future scenarios defined along two continuums: collectivism and fragmentation. Authors concluded the increasing use of digital platforms and AI mean data are key. With augmented intelligence, humans and machines collaborate to make decisions. Uniquely human traits of emotional intelligence, creativity, persuasion, and innovation become more valuable. Adaptability will become increasingly important as work changes (PwC, 2017).

Human-Technology Interactions

Not only are data produced and stored at astounding rates, but individual access to such data through technology is expanding. Ross (2017) asserted that 20 billion networked devices were in circulation in 2017. He projected this number will reach 45 billion in 2020. This growth will likely not produce a steady expansion across all markets, but rather result in bursts of growth in traditional areas that have not been as impacted by the digital economy, such as transportation or mining.

PwC’s Annual Global CEO Survey predicts that businesses will initiate upskilling initiatives to teach employees the skills they need to augment their own work with the support of technology. The authors contend that companies will infuse AI into all aspects of their business, not just technology-related areas (Ryan et al., 2018).

New Technology Jobs

Technology jobs such as software engineers are on the rise, but two other trends may result in new technology jobs. First, the blending of AI technology with a human component, or augmented intelligence, may open opportunities for technology-enhanced versions of jobs that are available today (PwC, 2017).

Second, Ross (2016) points out an increasingly popular conviction that the opportunities of the future will no longer rigidly distinguish technical fields from liberal arts or humanities. He suggests hybrid studies will become more prevalent, such as a combination historian/electrical engineer or political scientist/computer scientist. He describes the thinking of Toomas Ives, President of Estonia: “...domains previously occupied only by people with backgrounds in the liberal arts, like government, will become increasingly occupied by people with more background knowledge in science and technology” (page 246).

Impact of Artificial Intelligence

Types of Artificial Intelligence

Although people may mean different things when they refer to artificial intelligence (AI), they generally mean the use of computers to perform tasks that require cognition and learning without programming the steps of the task. Often, AI is used to refer to machine learning, “where computers are taught or self learn how to recognize things” (Shaw, 2017). Bughin et al. (2017) describe other types of AI, including computer vision, autonomous vehicles, natural language, smart robotics, and virtual agents.

Machine learning is intensive, for the humans who must provide the “training data” and for the computer to process the information. Shaw notes that machine learning has many applications, such as predicting nefarious behavior or mechanical breakdown and identifying possible disease in 3D radiology images. Research is underway to explore the use of AI to make machine learning more efficient and accurate.

Shaw expects computer vision, using cameras to infer what they are seeing, to become the most prevalent type of sensor. Computer vision will be integral for self-driving cars and other autonomous vehicles such as self-driving trucks, buses, trains, and ships. Autonomous flying drones, which may be used for package delivery or to aid in aerial search and rescue, also will benefit from computer vision.

Natural language processors are familiar to many as they ask Siri for directions or to settle a debate. Smart home devices such as Google Home or Alexa are natural language processors. Once these devices understand what a person has said or written, Shaw states that a virtual agent is the next step. The virtual agent can help the human, provide financial advice, perform basic health diagnosis, or guide an individual through steps of an activity or job. Smart robotics are in use today, especially in manufacturing. Shaw expects robotics to become more prevalent in medicine, cleaning, stocking, agriculture, and food service in the future.

Machine learning is but one way of many to categorize AI. Hintze (2016) defines AI using a hierarchy from type I-reactive machines (e.g., Deep Blue, IBM’s chess supercomputer) to type II-limited memory (e.g., self-driving cars monitor information over time) to type III-theory of mind (e.g., understanding that thoughts and emotions affect behavior) to type IV-self-awareness (e.g., being aware of oneself).

New Artificial Intelligence Jobs

Research continues to advance AI (Bughin et al., 2017; Hintze, 2016; Shaw, 2017), with the implication that jobs developing and studying AI will continue to grow as the technology is incorporated into more daily life routines. Research firm Gartner, as cited in Singh (2017), predicts by 2020 more jobs will be created by the expansion of AI than will be lost. They estimate, that although AI will be responsible for the loss of 1.8 million jobs between 2018 and 2020, AI will create 2.3 million jobs. Healthcare, the public sector, and education will lead the way in incorporating AI into their sectors.

Increasing use of digital platforms and AI mean data will be key to creating new AI jobs (PwC, 2017). With augmented intelligence, humans and machines must collaborate to make decisions. Singh (2017) expects one in five workers will rely on AI to assist them in their jobs by 2022. It will be important for people to learn to work with and alongside AI machines.

Impact of Social Changes

Globalization

Globalization refers to the increasing interconnectedness of the world, both economically and politically. Along with automation, globalization is viewed as one of the main factors shaping the future workforce (Bernstein, 2016; Simon, 2016).

Companies operating on an international scale may have financial incentive to move jobs from the U.S. to other countries. This has been demonstrated historically through the loss of low-skilled manufacturing jobs due to offshoring (Hatzichronoglou, 2005). Today, higher skilled jobs also run the risk of offshoring, including computer-oriented science, technology, engineering, and mathematics (STEM) jobs (Lim, 2016).

Technological advances are closely linked with globalization's impacts on the workforce. "Labor-linking" technology allows geographically dispersed people to vie for the same job, creating a competitive environment that could potentially drive wages down (Basu, 2016). However, there remain numerous higher-skilled jobs that are less subject to this threat, particularly those in healthcare and service industries that require face-to-face interactions (Blinder, 2007).

The potential for interaction with clients, customers, and coworkers from across the globe has implications for the skills that are valuable as well as valued. For example, employees may find it easier to negotiate the workplace when they have the skills needed to communicate effectively with geographically dispersed people from a range of sociocultural backgrounds. Employers are increasingly recognizing the value of cultural competence and communication skills among new hires (Vozza, 2016), especially when those skills are needed to perform future jobs that involve interaction on a global scale.

Environmental Sustainability

Environmental policies have long been linked to the reduction of jobs in specific industries (e.g., coal), though a causal link is up for debate (Morgenstern, Pizer, and Shih, 2001). The availability of jobs in such industries in the U.S. may in fact be limited by a decreased demand for fossil fuels that has resulted from advances in energy efficiency technology (Magill, 2017). Regardless of the mechanism at work, there is reason to believe the jobs of the future will continue to be shaped by both policy and consumer behavior related to environmental sustainability.

Beyond contributing to the obsolescence of some jobs, the focus on environmental sustainability continues to create new jobs and to change jobs that currently exist. Job opportunities for innovation related to environmental sustainability may increase as individuals and corporations alike seek to reduce energy consumption and waste (Bakhshi, Downing, Osborne, & Schneider, 2017). Companies that are changing practices to reduce their environmental footprint may create jobs for "sustainability professionals" who will take on the role of managing company resources (Hamilton, 2012). The National Center for O*NET Development has identified green economic sectors, green increased demand occupations, green enhanced skills occupations, and green new and emerging (N&E) occupations, many of which will likely boast increased job opportunities in coming years. Green enhanced skill jobs are those in the existing occupation that require significant changes due to the impact of the increased focus on environmental sustainability (O*NET, 2018).

Demographic and Population Patterns

As of 2016, foreign-born workers constituted nearly 17% of the U.S. labor force (Bureau of Labor Statistics, 2017). By 2060, approximately 20% of the total national population is expected to be foreign-born (Colby & Ortman, 2015). Some raise concerns about the potential loss of jobs by American-born workers to immigrants (Hoban, 2017). Others argue the rising immigrant population will increase opportunities for U.S.-born workers, as immigrants frequently perform low-skilled jobs that are complementary to, and increase the productivity of, work performed by other Americans (Greenstone & Looney, 2012). However, many immigrants also hold advanced degrees, particularly in STEM fields (Solis, 2011), and could therefore play a crucial role in meeting the demand for highly skilled workers.

As working Baby Boomers draw closer to retirement age, there is concern over the loss of the knowledge and skills of the overall labor pool (Burke & Ng, 2006). Globally, the ratio of non-working age people to working age people appears to be on the rise (Bakhshi, Downing, Osborne, & Schneider, 2017). This trend may be counterbalanced by policy changes that raise retirement ages or provide incentives for older workers to remain on the job (Lerman & Schmidt, 1999).

The overall aging of the population has implications for available jobs. Jobs in healthcare and the production of goods and services targeting the needs of older citizens are on the rise (Singh, 2015). However, the influx of highly-educated Millennials into the workforce has its own implications. These workers are anticipated to bring a new set of expectations of their employers, including demands for improved working conditions and human resources policies (National Academies of Sciences, Engineering, and Medicine, 2017). At the same time, there is rising concern regarding this full subpopulation's preparedness with the skills required in the ever-changing world of work (KRC Research, 2014).

Education and Training

It has been estimated that most children entering primary schools today will work in job types and roles that don't yet exist and that will be characterized by the need for not only technological, but also social and analytical skills (World Economic Forum, 2016). It is anticipated workers of the future will hold an increasing number of jobs over their lifetime (Pompa, 2015). These factors, coupled with increasingly rapid technological change, will necessitate a continuous process of education and training throughout these future workers' careers (Károly & Panis, 2004). This suggests the need for consideration of both the education and training offered to students prior to their entry into the paid labor force, as well as how systems for continued education and training will be implemented and sustained.

Numerous innovative approaches to preparing students with the in-demand middle level skills needed to perform jobs of the future are expanding in their implementation. Career and technical education (CTE) programs, apprenticeships, early college high schools, and career academies are among the approaches that seek to bolster the skill levels of Americans entering the workforce for the first time (Joint Economic Committee Democrats, 2018). On-the-job training (OJT) models are another innovative approach that provides incentives to employers to hire lower-skilled workers and offer them targeted training while they engage in paid labor, as well as offer continued training to allow for career advancement (Kobes, 2013).

Equity Issues

Many anticipate the trends of globalization and automation will lead to increasing inequality, as wages for highly skilled workers rise while low- and unskilled workers will compete with both automation and workers located in other countries (The [Foundation for Young Australians](#),

2017). Other areas of concern regarding equity in the workplace relate to gender and age. Women who seek to both parent and work continue to face potential wage reductions and loss of skill development when they take time off for family leave (O'Marah, 2018). Some anticipate women will be disproportionately impacted by job losses due to automation (Hayasaki, 2017). Aging workers may face threats to their continued employment over issues related to healthcare costs and age-related disabilities (National Bureau of Economic Research, 2018).

New Social-Oriented Jobs

Futurists envision new positions will be created to do work that has never been done before. Most of these jobs will develop in response to shifts in the marketplace or they will be created because of advancing technologies. Envisioned jobs include those that harness the power of social media to create tailored experiences for customers or clients (Wagner, 2010). With more companies using social media to connect with customers and to expand their presence in the market, employees' experience with and understanding of social media will be increasingly valued by employers (Kumar, Bezawada, Rishika, Janakiraman, & Kannan, 2016). Companies and organizations will need to monitor, maintain, and improve their online presence, and new positions will likely be created for that purpose (University of Kent, 2018).

Workplace of the Future

When examining the workplace of the future, Frey and Osborne (2013) convened human experts in machine learning to classify a subset of jobs according to the likelihood of their "automatability." Through analysis of O*NET variables as proxies for three irreplaceable attributes (i.e., perception and manipulation, creative intelligence, and social intelligence) they developed a model to predict the automatability of the full set of O*NET occupations. Results indicated that 47 percent of U.S. employment can be classified as high risk for automation within the next decade or so.

The Guardian's Workplace Benefits Study (2017) defines four top trends impacting the workforce in 2018 and beyond. Each of these trends is related to technology:

- Technology is enabling an on-demand workforce;
- Automation is requiring an enhancement of workforce skillsets;
- Employers are reinventing talent recruitment; and
- Varying workplace demographics require different strategies for adoption.

Workplace Culture

Agile Workforce

As organizations are required to respond quickly to changes in an increasingly globalized and technologically advanced world, they seek an agile workforce that is similarly capable of responding to unanticipated change with speed and flexibility (Breu, Hemingway, Strathern & Bridger, 2001). Workers of the future may be expected to rotate among a variety of roles and tasks, as employers seek to find the skills needed for a specific task at a particular time (Wadors, 2018). As companies leverage a variety of work models (e.g., ad hoc teams, crowdsourcing, independent contractors) to meet their needs, workers may find themselves entering into many different types of nontraditional work arrangements (Green, 2014). Andrew,

Ip, and Worthington (2014) expect an increase in distributed work places. Continual reskilling will be a key element in sustaining high levels of agility (Lyons, Blitz, & Whittall, 2017).

Less Structure and Predictability

Careers have been traditionally viewed as a progression of jobs, often upward through a predictable, hierarchical structure (Lyons, Schweitzer, & Ng, 2014). Careers of the future will likely unfold in less hierarchically structured environments, where there will be increased interconnectedness among departments and where individuals may assume different job roles depending on the context of the work at hand (Heerwagen, 2016). Job tasks themselves are expected to be less structured and predictable as new technologies replace once rote and predictable duties with ones that require abstract thinking and flexibility (National Academies of Sciences, Engineering, and Medicine, 2017).

Sharing Economy

More and more, modern day consumers and workers engage in short-term economic transactions around services that involve sharing some material good (e.g., car, living space) or skill for monetary compensation (Sundararajan, 2016). Also referred to as the gig economy, platform economy, access economy, or collaborative consumption, this sharing economy is anticipated to increase exponentially over the coming decades (Yaraghi & Ravi, 2016). Such work arrangements have both potential positive and negative consequences for workers of the future. It can be argued that individuals will be empowered by the sharing economy to go into business for themselves and gain returns on their assets. On the other hand, the sharing economy removes protections that workers have enjoyed under more traditional work arrangements (Lamberton & Rose, 2012).

Continuous Learning

McKinsey & Company (2017) recommend that workers of the future be prepared to be lifelong learners. McKinsey Global Institute (MGI) partner Susan Lund explained, “For young people today, what’s clear is that they’re going to need to continue to learn throughout their lifetime. The idea that you get an education when you’re young and then you stop and you go and work for 40 or 50 years with that educational training and that’s it—that’s over. All of us are going to have to continue to adapt, get new skills, and possibly go back for different types of training and credentials. What’s very clear is that what our kids need to do is learn how to learn and become very flexible and adaptable.”

Guardian (2017) recommends that employers address the need for continuous learning through experiential, retraining, and cross-training programs, as well as mentoring, e-learning opportunities, and tuition assistance.

Ross (2016) opines the U.S. adoption of free education until the age of 18 was appropriate as long as a high school graduate could get a job in a “port, factory, mine or mill—a middle class job.” However, in the information age, he suggests we know the pace of change demands that we be lifelong learners.

Flexible and Non-Traditional Career Paths

Predictions regarding future career paths are wide ranging. Popular “wisdom” has long asserted that younger generations no longer expect to join an employer after high school or college and stay with that same employer until retirement. Lyons, Schweitzer & Ng (2015) analyzed the career mobility patterns of four generations and found that job mobility increased with each

successive generation. Specifically, “The magnitude of the differences was large, as Millennials [born 1980 or later] had almost twice as many job and organizational moves per year as the generation Xers [1965-1979], almost three times as many as the Boomers [1946-1964], and 4.5 times as many as the Matures [born prior to 1946]” (page 16). However, this change in job mobility does not reflect an increase in employee turnover from one employer to another, but rather increased movement through various positions within a company. They postulate that technology, among other factors, may make some positions obsolete. The authors conclude the traditional career model is still strong and the “oft-cited truisms about the ‘new’ or ‘modern’ careers may be exaggerated” (page 18).

Intuit & Emergent Research (2017) predict that by 2021, 9.2 million American workers will derive at least some of their income as independent contractors operating within a “gig economy”—situations in which organizations establish short-term contracts on an as-needed basis. This is a substantial growth projection relative to the 3.9 million in 2016. McKinsey Global Institute (2016) estimates that 20–30 percent of individuals of working age in the U.S. and the European Union conduct independent work.

This trend is facilitated by technology that allows a job incumbent to be geographically distant from the employer; the advantages to an organization of selecting the best candidates for a given project, without a long-term commitment; and the ability to increase and decrease staff levels as demand warrants. This is further enabled by current and planned features in job-employee matching software such as Monster.com, Aftercollege.com, and Taskrabbit and networking sites such as LinkedIn (Brynjolfsson & McAfee, 2016).

Interdisciplinary Teams

Based on research by Burkus (2016), some organizations encourage employees to engage in more face-to-face communication in an effort to increase problem solving and decision making efficiency (as cited in Colbert, Yee, & George, 2016). As a result, workplaces evolve to provide more flexible space for collaborating and working in teams (Giang, 2015). Experts from Unum Limited’s Futures100 network (2014) foresee more conversation and debate, either face-to-face or on conversation-based platforms. Employees will need to blend skills and disciplines when working with others. They will collaborate with each other rather than compete. Workers will need listening skills and to display empathy, and build relationships to enable collaborative and interdisciplinary ventures.

Summary of Themes of Work and Workplace of the Future

When it comes to work of the future, change is the only certainty. However, this review of relevant literature points to some overarching themes that provide a solid base for making predictions about the world of work that today’s kindergartners will need in 2030 when they graduate from high school. This world will likely look very different from the world of work their parents were prepared for, both in terms of the available jobs and the work environment in which those jobs are carried out.

Jobs of the future will undoubtedly involve technology. From searching job openings, to performing job tasks, to receiving professional development, interacting with new and emerging technologies will be a distinctive feature of future jobs. Fields that had previously been quite separate may be blended in new ways, and existing jobs may be blended with new technologies to create positions we’ve never seen (think: space junk recyclers!).

The high school graduates of 2030 will set out on a career pathway characterized by change. Whether they work independently through the gig economy, or move among multiple employers or across multiple departments or projects, workers of the future will likely find themselves part of an increasingly diverse and dispersed workforce. Jobs will be continually evolving to meet changing demands and to incorporate the latest innovations. Ongoing training will be a necessary component of future jobs. Employees will need to adapt and embrace life-long learning to be successful in the workplace.

With some sense of what the future holds for work and the workplace, it becomes clear expected changes in jobs and job environments will correspond to changes in associated skills. A key next step to ensuring that students graduate high school in 2030 prepared for the next step on their postsecondary pathway is to identify the skills and abilities needed to successfully perform the jobs of the future.

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