

CHALLENGES FOR MANAGING BUSINESS WITH 21ST CENTURY TECHNOLOGY

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ABSTRACT

Businesses in the 21st Century are facing a new world that includes having to decide what technology they need to adopt from Artificial Intelligence (AI), Big Data, to robots, drones and 3D printers, as well as create a workforce that includes part-time and contract employees, plus full-time employees who want a purpose in their work. As companies replace humans with robots to increase efficiencies as well as use AI algorithms to crunch Big Data, the workflow and processes must be restructured to accommodate technology, and employees must be trained to use it. Employee engagement must be supported to ensure employees are making decisions to support company goals and values in a technologically-assisted environment. According to research, cognitive abilities, complex problem solving, and social skills will be necessary in work environments where machine thinking and human thinking will become interdependent. Scenario thinking will provide the insight into how new technologies or demands of workforce might affect an organization's structure based on its future goals; thus, allowing it to adopt technology that will serve its purpose. It will help the organization focus on using technology to solve problems and accomplish its goals while considering possible ethical issues.

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KEYWORDS: Technology Changes, Management Changes, Workforce Changes, Internet of Things, Artificial Intelligence, Ethics, Big Data, Corporate Social Responsibility

INTRODUCTION

Businesses in the 21st Century are facing two interconnected challenges: technology that is changing the structure and performance of the organization and a workforce that is changing how and why it wants to work. They must consider how and if to adopt new technologies like Internet of Things, artificial intelligence (AI), and Big Data, including renting space on IBM's Watson. They must consider how 3D printers, autonomous cars, nanotechnology, and drones, could change the supply chain and the nature of their competition. They must restructure operations and performance management as they outsource functions that have previously been internal. They must adjust not only to having robots do work previously done by humans, but create an effective and efficient work environment that includes full-time employees, part-time and contract employees, many of whom are demanding a sense of purpose in their work. In the midst of this changing environment, businesses must still meet the needs of consumers and other stakeholders, many of whom require a commitment to social responsibility.

Organizations must adapt to the needs of the modern workforce. New and emerging technologies are transforming the way work is done. Manyika et al. (2015) estimate that the Internet of Things “could have an annual economic impact of \$3.9 trillion to \$11.1 trillion by 2025 across many different settings, including factories, cities, retail environments, and the human body. At the top end, that level of value—including the consumer surplus—would be equivalent to about 11 percent of the world economy” (p. 23). The Triple Pundit: People, Planet, Profit (2015) noted “In about 4-5 years, there will be 50 billion ‘things’ connected

to the Internet of Things. GE estimates that convergence of machines, data, and analytics will become a \$200 billion global industry over the next three years” (para. 1). While flexibility is not a reality for all workers, many want it to be. Overall, organizations have a pressing need to become more agile and collaborative. Underlying all of this is an evolving employee attitude about what a job should be. Employees know what is important to them and are not going to settle for less. They want their work to have meaning and purpose. They want to use their talents and strengths to do what they do best every day. They want to learn and develop. They want their job to fit their lives. And they're willing to look for a company whose mission and culture reflect and reinforce their values (Gallup, 2017, para. 1).

According to a 2015 McKinsey Quarterly report, research showed that “currently demonstrated technologies could automate 45% of the activities people are paid to perform and 60% of all occupations could see 30 percent or more of their constituent activities automated” (Manyika et al, 2015). In order to take advantage of new technologies and remain competitive, businesses must analyze their organizational structure in the light of their purpose and vision to identify if, where, and when technologies can improve production. Organizations must make decisions that include evaluating future economic, political, and environmental issues, so that the global environment that produces supplies and products is considered. For example, adding robots to factories much slower in the United States than in other countries because businesses would have been accused of destroying American jobs. It was not until 2009 that U.S. businesses started adopting technologies that replaced many of the employees they let go during the recession of 2008. The May 2017 Job Openings and Labor Turnover Survey reported that job openings are the highest they have been since 2000 (DeSilver, 2017, para. 1). This may be because workers are not interesting in working full-time or in the jobs that are open, but this may also mean that robots will be used to fill the need. Scenario thinking is one process that provides new insight into how new technologies or new demands of workforce might affect the work and profit generation of business.

Once it has been decided that new technologies can improve productivity, the work process must be analyzed and restructured. For example, if Big Data analytics are adopted, employees must be retrained to insure the quality and accuracy of the data that is analyzed as well as analyze the results. This may transfer some decision making to a lower level in the organizational structure. Programs must be developed to educate employees to the benefits of adopting new technology; they must see the technology as allowing them to do more of what engages them in their jobs, not as stealing their jobs. This can lead to fulfilling employees’ demands for purpose and value in their work since it will require a focus on supporting the goals and values of the business.

We know that big shifts are coming. Yet it’s impossible to fully imagine the impact they will have on competing, business, and society. But this we do now: by working in concert, humans and cognitive systems have the potential to dramatically improve and accelerate outcomes that matter to us and make life on earth more sustainable. This alliance of human and machines offers the promise of progress on a massive scale. (Kelly & Hamm, 2013, p. 139)

Schwab (2016) noted twenty-one tipping points that would occur by 2025 identified in a survey of company executives and experts by the World Economic Forum identified in a survey that included the first 3D printed liver transplant and first printed car in production, “30% of all corporate audits performed by artificial intelligence,” “10% of cars on U.S. roads being driverless,” “the first AI machine on a corporate board,” “block chain being used by a government to collect taxes,” and the “first city of 50,000 with no traffic lights” (p. 26).

This paper will provide examples of the literature that is available in the areas of technology and worker requirements. It will then explore the various technologies that are changing the way organizations do their work and produce results. Changes in the needs and demands of the future workforce will be analyzed in relationship to new technologies. The paper will describe how organizations must restructure themselves

to use new technology and a new workforce, and provide a vignette of a business owner who must make decisions about both.

LITERATURE REVIEW

Most academic research on either new technology or managing an organization using new technology is from the last century or the early part of this century, and thus is outdated, given the rapidly changing world.

Technology

The research for the impact of changing technology is in two areas. First, authors who are in the technology field or in the journalism field write about the current and future applications of technologies, and the ethical issues that are confronting new uses for technology (Aquino, 2012; Brynjolfsson & McAfee, 2014; Ford, 2015; Kelly, 2016; Kelly & Hamm, 2013; Kilham, 2014; Lohr, 2015; Mayer-Schönberger & Cukier, 2013; O’Neil, 2016). Applying Artificial Intelligence produces programs for 3D printers that can now use many materials, from plastics to metals to make objects. Companies can make their own parts when needed rather than ordering from a supplier and storing in a warehouse. Individuals can produce specialized products that can be ordered on the Web. Applying Big Data analytic programs to provide specific information from huge databases allows computers to write accurate stories about sports and weather without human intervention (Aquino, 2012).

Second, the current applications and companies using technologies are found in reports by McKinsey&Company, which issues new reports regularly on the uses of technology as well as issues and problems (Mayhew, Saleh, & Williams, 2016; Manyika et al, 2015; Patel, Shangkuan, & Thomas, 2017;). The Internet of Things (IoT) is creating Big Data available to support systems that work with little human management (Chui, Löffler, & Roberts, 2010; Manyika, 2017). The World Economic Forum (2009, 2015, 2016) provides research on the changes in the global environment and workforce, including by country. The International Federation of Robotics (2016) provides information on the movement of robots from laboratory to factory floor. Other sources of up-to-date information are news publications like the Wall Street Journal, The Economist, and Fortune.

Technology is making it more economically feasible to automate many processes. Marr (2016) describes how forty-five companies use Big Data. In late 2015, Wal-Mart cut 7,000 back-office jobs in its stores, and it recently announced that it would cut nearly 1,000 corporate jobs, by January 31, 2017 (Nassauer, 2017). Marshall Brain, author of *Robotic Nation*, wrote, “by 2013 there will be 1.2 million industrial robots working worldwide—that’s one robot for every 5,000 people” (as cited in Aquino, 2012, para. 1). The International Federation of Robotics (IFR) says there will be 2.6 million industrial robots globally by 2019.

Effects of a Changing Workforce

Research shows that what employees want from work is undergoing major shifts that will greatly affect how work is managed (Clifton, 2011; Gallup, 2013, 2015, 2017). Businesses are increasingly outsourcing major functions to other firms, and many are hiring contract workers so that they have control over how many employees they need on staff at any one time (World Economic Forum, 2016) This dovetails with research that says employees are choosing to work part-time (CONE Communications, 2015; Green, 2015). Brynjolfsson & McAfee (2014) describe a growing peer economy in which people can do meaningful work as individuals. Green (2015) describes The Freelancers Union, which provides services for freelancers and part-time employees who do contract work for companies as well as work in the peer economy. Technology is changing the landscape in which workers can do meaningful work.

New requirements for workers (The Elephant in the Truck, 2017) as well as the changes that technology are bringing are converging to create new forms of production and organization. The core skills needed in all industries will increasingly focus on cognitive abilities, complex problem solving, and social skills (Schwab, 2016; World Economic Forum, 2016). Kelly and Hamm (2013) maintain that machine thinking will not replace human thinking, but together they will produce new products. One skill required for complex problem solving is scenario thinking. Asking “What if?” is an easy method of considering new situations on the horizon before they come too close for a reasoned response (Lohr, 2015; Wilburn & Wilburn, 2011). Using existing global scenarios for 2025 and 2030 (National Intelligence Council, 2008; World Economic Forum, 2009, 2016; Shell International Limited, 2005, 2011) can help businesses identify the changes that could happen that would have the most serious impact on their viability, and write scenarios for them. The 21st century will be one of transformation, but since that transformation is based on technology, it will develop at unanticipated speeds into uncharted waters.

FIRST CHALLENGE: TECHNOLOGY

Artificial Intelligence, Big Data, and the Internet of Things

Artificial intelligence (AI), or machine learning, uses huge amounts of data, called Big Data, collected by the Internet of Things (IoT) to create the robots that pack goods, cut noodles, cook hamburgers, tutor children, and counsel people with emotional problems run by systems like IBM’s Watson, as well as self-driving cars and drones.

... the physical world itself is becoming a type of information system. In what’s called the Internet of Things, sensors and actuators embedded in physical objects—from roadways to pacemakers—are linked through wired and wireless networks, often using the same Internet Protocol (IP) that connects the Internet. These networks churn out huge volumes of data that flow to computers for analysis. When objects can both sense the environment and communicate, they become tools for understanding complexity and responding to it swiftly. What’s revolutionary in all this is that these physical information systems are now beginning to be deployed, and some of them even work largely without human intervention. (Chui, Löffler, & Roberts, 2010, para. 2)

Network Narrative Science uses AI to create self-contained sequences of actions called algorithms to process the data and create meaning. These algorithms then write stories for baseball and softball coverage because it is cheaper than hiring humans (Aquino, 2012).

Mayer-Schönberger and Cukier (2013) defined Big Data as “things one can do at a large scale that cannot be done at a smaller one, to extract new insights or create new forms of value, in ways that change markets, organizations, the relationship between citizens and governments, and more” (p. 6). One of their examples is the telescope in New Mexico used for the Sloan Digital Sky Survey that collected more data in a few weeks than had been discovered up to that point in astronomy. Google and Yahoo created processing technologies that can collect and make sense of huge quantities of data. David Ferrucci, who led the team to develop Watson’s ability to beat the reigning human winner of Jeopardy! states that the future of artificial intelligence

requires a closer working partnership between data and the animating ideas of cause and effect—theories, hypotheses, mental models of the world, the “why” of things. Technical advances are making the symbiotic relationship increasingly practical. “The data informs the model,” he says, “and then you have that back-and-forth cycle of improvement.” (as cited in Lohr, 2015, p. 115)

Early in its career, Watson answered Wonder Woman when asked to name the first female astronaut. Once its algorithm had been changed to separate fact from fiction, it named Valentina Tereshkova of the Soviet

Union in 1983. “The cognitive chips [second generation design called TrueNorth] and Watson are complementary technologies. For the sake of simplicity, you can think of them as the right brain and the left brain of the era of cognitive systems. Watson, the left brain, focuses on language and analytical thinking. The cognitive chips address senses and pattern recognition. Over the coming years, IBM scientists hope to meld the Watson and TrueNorth capabilities together to create a holistic computing intelligence” (Kelly & Hamm, 2013, p. 84).

Artificial intelligence (AI) allows 3D printers to take a sketch in two dimensions and print it as a three-dimensional object, which can be anything from a toy or knick-knack to an airplane wing or a building block for a home. General Electric’s Leap jet engine is

going to incorporate a fuel nozzle produced entirely through additive manufacturing. The process, properly known as 3-D printing, involves building up layers of material (in this case alloyed metals) according to precise digital plans. . . . The benefit of additive manufactured parts has already been proven on other models. (Zaleski, as cited in Schwab, 2016, p. 163)

Robots

The International Federation of Robotics (2016) stated that

The number of industrial robots deployed worldwide will increase to around 2.6 million units by 2019. That’s about one million units more than in the record-breaking year of 2015. Broken down according to sectors, around 70 percent of industrial robots are currently at work in the automotive, electrical/electronics, and metal and machinery industry segments. (para. 2)

Kilman (2014) predicts that in the near future, every worker will have an AI computer or a robot as his or her partner. Aquino (2012) wrote that there were nine jobs that humans might lose to robots: pharmacists, lawyers and paralegals, drivers, astronauts, store clerks, soldiers, babysitters, rescuers, sportswriters, and other reporters. Schwab (2016) cited a study by Frey and Osborn in 2013 as identifying jobs that were most prone to automation: telemarketers; tax preparers; insurance appraisers for auto damage, umpires, referees and other sports officials, legal secretaries; hosts and hostesses in restaurants, lounges and coffee shops; real estate brokers; farm labor contractors; secretaries and administrative assistances except, legal, medical and executive; couriers and messengers. The study identified as least prone to automation: mental health and substance abuse social workers; choreographers; physicians and surgeons; psychologists; human resources managers; computer systems analyst; anthropologists and archeologists; marine engineers; and naval architects, sales managers and chief executives (p. 39).

The first indications of these changes are already apparent. A Japanese retailer has a robot that babysits children while their parents shop. A Japanese restaurateur, who caters and sells noodles for the lunch crowd, has a robot that cuts the noodles. Since he only needs it for three hours a day, the \$2,000 price tag was much cheaper than hiring a person, even part-time (Tobe, 2016). Aquino (2012) described an automated, robotics-controlled pharmacy at two UCSF hospitals launched in 2015 and nurses at UCSF Medical Center using “barcode readers to scan the medication at patients’ bedsides, verifying it is the correct dosage for the patient” (para. 9). Ford (2015) proposed that new category of medical professionals could solve the problem of a decreasing number of family practice physicians; they would examine patients and enter the information into a diagnostic and treatment system that has access to all of the latest Big Data to determine a course of treatment.

SECOND CHALLENGE: A CHANGING EMPLOYEE BASE

Changing Structure of Economy

“Advances in artificial intelligence, machine learning, and natural user interfaces (e.g., voice recognition) are making it possible to automate knowledge-worker tasks that have long been regarded as impossible or impractical for machines to perform” (World Economic Forum, 2016, p. 7). The World Economic Forum’s *The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution* in January 2016 found that 44% of respondents thought that the changing nature of work was a top trend. As mentioned earlier Aquino (2012) and Schwab (2016) list many jobs that will move to robots or AI. However, the economy is changing in additional ways that will create a new workforce structure for businesses. Contractors and part-time employees who work only as needed now do many jobs (Weber, 2017). “Organizations are likely to have an ever-smaller pool of core full-time employees for fixed functions, backed up by colleagues in other countries and external consultants and contractors for specific projects” (World Economic Forum, 2016, p. 6).

In September of 2015, the Bureau of Labor Statistics reported that more than 20 million Americans were working less than 35 hours a week and that there had been an increase in Americans who said they worked part-time for ‘other non-economic reasons.’ This category “Refers to persons who usually work part time for non-economic reasons such as childcare problems, family or personal obligations, school or training, retirement or Social Security limits on earnings, and other reasons” (United States Department of Labor, 2015, para. 1). The numbers in this category have increased 12% since 2007. However, survey data has also said more people are choosing not to work full time because they want to have time to pursue their passions (Green, 2015).

Green (2015) quotes Deloitte’s chief talent officer, Mike Preston, as predicting, “as much as 40 percent of the U.S. workforce may be part-timers by 2020” (para. 24). Some corporations like Deloitte are developing paths for part-timers, such as Deloitte Open Talent to identify workers who want to work part-time and provide networking opportunities for them. Eleven percent of Deloitte’s 70,000 workers now work part-time by choice (Green, 2015).

Brynjolfsson and McAfee (2014) identified a growing peer economy in which people can do meaningful work by serving one another, such as with Uber, Lyft, TaskRabbit, and Airbnb. “With peer-to-peer platforms, companies and individuals can do things that previously required large-scale organizations. In some cases, the talent and resources that companies can connect to, through activities such as crowdsourcing, may become more important than the in-house resources they own” (World Economic Forum, 2016, p. 7). A sharing economy is being built. “In crowdfunding the audience funds the work. . . . Kiva turned microfinancing into peer-to-peer lending” (Kelly, 2016, p. 158). These growing opportunities may convince more to become part-time by choice, especially once regulations have been codified. The Web has made it possible for people to create and sell things on the Internet, or to run blogs that viewers subscribe to that focus on food or pets or travel. Additionally, there are organizations to help part-timers. The Freelancers Union coordinates health insurance, dental, retirement plans, and other services for its 263,000 members who are freelancers and part-time employees not employed by a traditional company.

A PATH FORWARD

Employee Engagement: Managers

The structure of business has been a pyramid structure with layers of managers between workers and senior leaders. Employees in most businesses were full-time and located in the same place. Managers organized the work tasks around a 40-hour workweek. It was easy to schedule meetings, and oversee performance.

It was also easy to have events that that connected employees' individual performance to the organizational goals and mission and provided employees connect with each other and their leaders. Even when people worked remotely from home, they could be required to work one day a week in the office so all employees could collaborate with others and be briefed on organizational news. Now both organization and communication is difficult with employees who work remotely and/or part-time.

This creates a new environment for managers who are still responsible for meeting their production and performance goals but have less control over many of the workers who perform the tasks. Additionally, even full-time workers do not work in the same location as the manager, as technologies like co-working spaces and teleconferencing allow remote working from not only employees located globally, but also whose employer is located in their own zip code. Although IBM has decided that collaboration and innovation is not enhanced by employees who are working remotely and is following Yahoo in pulling self-directed teams back to the office (Simons, 2017), many companies allow working remotely. However, Gallup (2013) found that workers who spend only 20% of their time working remotely are the most engaged. "These employees likely enjoy an ideal balance of both worlds—the opportunities for collaboration and camaraderie with coworkers at the office and the relative sense of freedom that comes from working remotely" (p. 28).

Managers must be able not only to work with this diverse group of employees but must be ready to provide them the training they need to deal with the changing workplace. *The World Economic Forum 2016 Future of Jobs Survey* predicts that there will be changes in core skills needed in all industries; for example, cognitive abilities, complex problem solving, and social skills will become more significant to the future work environment. Employees will not only have to understand how technology is providing them data with which to solve problems to make decisions, they will need to be able to use communication and negotiation skills for their interactions with contractors and others outside the core business. These skills will certainly help ensure that the necessary work is being accomplished by a myriad of types of workers, but it also requires that there be continuous opportunities to develop current skills and learn new ones.

Add to this the fact that the manager is responsible for helping employees navigate their work processes working side-by-side with robots or using AI for the data they work with. "This isn't about replacing human thinking with machine thinking. Rather, in the area of cognitive systems, humans and machines will collaborate to produce better results, each bringing their own superior skills to the partnership" (Kelly & Hamm, 2013, p. 7). This may mean that an employee who has been pulling inventory from shelves and packing boxes learns to teach a robot to pick inventory, while he or she takes on more duties of shipping. A marketing employee may need to learn to use Big Data to find out details about his or her customers' needs instead of using surveys and one-on-one communication, but this may mean that employee will need to communicate more with operations about how customers' needs are changing so that the business is ready to meet them.

Managers must also help employees understand that robots and AI are not replacing them but taking the drudgery tasks out of the employee's job and creating increased efficiency and effectiveness. They must help them see how Big Data can provide better information about the customers than was possible in the past, thus making the business more effective in meeting customer needs. If employees perceive robots as helpers, a manager must be prepared to see employees anthropomorphize them, which may mean the employees complain the robots are being overworked or mistreated. Minsoo Kang, a University of Missouri-St. Louis humanities professor, says "people are typically ambivalent about coexisting with machines, but naming robots could be a sign of kinship or comfort" (as cited in Ramsey, 2015, A1).

Experience with robots in some industries has shown that naming the robots or having robots that have faces and facial responses builds trust. Robots at Tesla are named after X-Men because they do superhuman feats. Nissan's employees name the robots after characters in movies. At a Ford plant, Baby Zilla moves

the body of a truck out of the body shop while working next to Godzilla that lifts the entire vehicle and moves it from one moving assembly platform to the next. Employees can understand why robots add value and efficiencies to the process (Ramsey, 2015). Spiegel (2013) describes USC's Ellie, a counseling robot (with face and soothing voice, of course) and the finding that that some people feel safer telling their problems to a robot than to a human who might judge them. On the other hand, businesses must know in advance which human jobs will be replaced in the near future, in order to either move the human to another job or prepare the human for a lay-off.

Robots can work 24/7, but people cannot. If the robots are running 24/7, then humans will need to monitor them. Those humans will be small in number and may not have a supervisor who can make decisions; thus, they will need to understand how to make decisions and communicate them to operations as well as work as a team with those who monitor the robots on the other shifts. New types of productivity measures will need to be developed for these human workers.

Employee Engagement: Organizations

The Gallup Q¹² survey, based on thousands of interviews to identify the elements that demonstrated employee engagement, has been administered to more than 25 million employees in 195 countries and 70 languages since the late 1990s (Gallup, 2013). Gallup's research has shown that employee engagement is highly correlated to business outcomes such as profitability, productivity, and customer satisfaction. Engaged employees:

Cooperate to build an organization, institution, or agency, and they are behind everything good that happens there. These employees are involved in, enthusiastic about, and committed to their work. They know the scope of their jobs and look for new and better ways to achieve outcomes. They are 100% psychologically committed to their work. And, they are the only people in an organization who create new customers. (Gallup, 2013, p. 21)

According to the research discussed earlier, people in the 21st century want their work to have purpose. In order to be interested in working for an organization, these people want it to have more than a business purpose, they want it to have a community purpose and be responsible for the environment. The 2015 Cone Communications Millennial Corporate Social Responsibility (CSR) Study reported that at least three-fourths of Millennials were likely to "consider a company's CSR commitment when deciding where to work," and "more than one-half were willing to take a pay cut to work for a socially responsible company" (p. 2). However, a recent survey by the United Kingdom's Charities Aid Foundation's (CAF) Public Perceptions of Corporate Giving report "revealed that 61% of British adults believe that CSR is merely a PR exercise and 73% believe that businesses should be more open about their corporate donation efforts" (Givey, 2016, para. 1). Rather than simply donating to causes, "over a third (36%) said their organization should be doing more. Amongst millennials—those aged 18-34—the level of disappointment rose to a staggering 44% who felt this way" (Givey, 2016, para. 10). Nearly all companies have Corporate Social Responsibility initiatives today, but it is important to employees who can actively support these initiatives by using their talents and skills. Home Depot and Lowes allow employees paid time off to work on local Habitat for Humanity projects, to help clean up after a storm, or to help the city to rehab an apartment building as a homeless shelter. An accounting firm's employees may increase psychological commitment when the CSR project is helping people from lower socio-economic groups complete their income tax returns or helping a nonprofit set up its accounting system. A tech firm's employees may use their skills for a good purpose when they set up computer systems for nonprofits using hardware and software donated by the firm or help governments mine Big Data to identify how building inspectors need to prioritize their inspections for overcrowding or fire hazards. Employees also support adopting sustainability goals like decreasing water use or recycling 100% of waste of programs in which they can actively participate.

As the competition for skilled and talented workers intensifies, organizations have an opportunity to hone their attraction and retention strategies so they can more effectively recruit and keep sought-after candidates (Gallup, 2017, para. 1). Engaged employees are needed if humans are to work with robots rather than see them as enemies. It will require increased communication to coordinate the handoff of tasks and projects from one employee to another and to encourage collaboration. Teamwork and problem-solving skills are increasingly important but more difficult to develop and measure, especially in a scattered workforce. However, this means that talents in decision making are defined as “solve the many complex issues and problems inherent in the role by thinking ahead, planning for contingencies, balancing competing interests, and taking an analytical approach” (Gallup, 2015, p. 15), and developing relationships, which requires building “a positive, engaging work environment where their teams create strong relationships with one another and with clients” (Gallup, 2015, p. 15) are more important than ever.

Ethical Decision Making Using AI and Big Data

“Technology is a tool for modeling what-if decisions, using the digital says that not only can a company dig down into digital replica of the physical world to peer into the future to make more accurate predictions and better decisions” (Lohr, 2015, p. 63). Organizations must decide how they will use Big Data for decision-making and then develop guidelines and processes for using it. They must define the parameters for those developing algorithms, and set policies for how employees can use the data from algorithms, particularly for marketing. Lohr (2015) quoted Rothschild when he was with Facebook: “It’s not about the size of the data. It’s about being able to collect and then steer the organization based on the metrics you really most value in the long run” (p. 91).

Mayhew, Saleh, and Williams (2015) presented steps for making sure that technology works for your purpose, and provides what you need for making decisions, rather than simply being gathered because the technology delivered it. One requirement is to know what question the data is to answer; this might be how to increase revenue or efficiencies or decrease errors. Another is to continually have a feedback loop that demonstrates the data is accurate and still providing answers. Accuracy of the data supplied by Big Data is also important to monitor, as the data Google used to predict the number of flu cases demonstrated. Google was more accurate than the Center for Disease Control in flue prediction for three years, but then in 2012, it predicted much higher numbers of cases than actually happened. Its algorithm was based on queries about flu symptoms, which had worked for previous years because people queried the Web when they had symptoms. However, in 2012, the news media predicted a bad flu season and people queried the Web for information to be prepared, even though they had no symptoms (Mayer-Schönberger & Cukier, 2013). Humans still have to evaluate the results of algorithms and the data collected and analyzed. Some algorithms produce incorrect information because they are not complete, or they become outdated in terms of the data being used. Policies for how and how often accuracy is measured must be established.

O’Neil (2016) cautions about the dangers inherent in algorithms that can create models that are opaque and produce discriminatory results. Acxiom is a supplier to businesses of consumer information; it culls its data on people “credit agencies as well as public records such as electoral rolls, marriage and birth registers, consumer surveys, and from thousands of other businesses and organizations that collect data on their customers and service users” (Marr, 2016, p. 106). Unless customers “opt out” at the right moment, it passes that information to anyone who buys it.

If we want to bring out the big guns, we might consider moving toward the European model, which stipulates that any data collected must be approved by the user, as an opt-in. It also prohibits the reuse of data for other purposes. The opt-in condition is all too often bypassed by having the user click on an inscrutable legal box. But the “non-reusable” clause is very strong: it makes it illegal to sell user data.” (O’Neil, 2016, p. 214)

Lohr (2015) describes the incorrect information about himself in Acxiom's database that he attributes to algorithms that made the wrong correlations: one 'listed interest' for him was Christian families, apparently because his two children attend a Catholic school, since he has no other information on his religion anywhere on the Web. Acxiom did not respond readily when asked to make changes that were damagingly incorrect. It has no ethics policy itself; its company Web page on ethics puts the onus of ethical use on the buyer of the data: "To protect your customers and your brand, it's crucial to implement ethical data practices to ensure data collection and use is legal, just, and fair" (Acxiom, 2017, para 1).

There are other issues of privacy that are still of concern since the law is not keeping up with how Big Data is used. Predictive analytics uses algorithms to foresee possible events or changes. For example, Target, using data on women who purchased cribs and diapers as a strong probability that they gave birth, then searched the women's purchases for the prior nine months. It then searched for women who were buying those products, assumed they were pregnant, and sent coupons to them as targeted advertising. It created a public problem when news went public about a father who complained his high school daughter had received a coupon for a product aimed at a pregnant woman, which he thought was not only an invasion of privacy but also an error (Mayer-Schönberger & Cukier, 2013). Target apologized, but it then turned out that the company's data was correct, and it was not an error. The European Union is currently deciding new rules for targeted advertising as an invasion of privacy.

Discrimination, as a legal concept, focuses on the treatment of people in groups, by ethnicity, gender or age. Big-data methods make it possible to assemble people by interests and characteristics that are far more detailed than traditional demographics. The technology also affords the opportunity to discriminate in another way—among people down to the individual level. (Lohr, 2015, p. 192)

There are other, more serious, possibilities for discrimination, since algorithms can search for people whose data searches indicate possible health conditions, which would allow a company to target them with an ad for medication. A health insurer might take those people out of the population that received its advertising. Lohr (2015) cites Alex Pentland of MIT Media Lab: "You have a right to possess your data, to control how it is used, and to destroy or distribute it as you see fit" (p. 204). Pentland describes personal data as "like modern money—digital packets that move around the planet, traveling rapidly but needed to be controlled" (Lohr, 2015, p. 204). In 2014, the Obama administration recommended that consumers should have control over their own data, and "the focus of regulation should be mainly on the use of data rather than on its collection. Europe favors stronger limits on data collection" (Lohr, 2015, p. 204).

There must be collaboration between those who write the algorithms and gather the data and those who use it for predictive analysis or marketing. One such collaboration is IBM's WatsonPath, used for medical diagnoses, which shows "the doctor a graphic picture of the program's step-by-step progression to the suggested diagnosis. This approach is what some call "algorithmic accountability" (Lohr, 2015, p. 204).

Big Data processes codify the past. They do not invent the future. Doing that requires moral imagination, and that's something only humans can provide. We have to explicitly embed better values into our algorithms, creating Big Data models that follow our ethical lead. Sometimes that will mean putting fairness ahead of profit. (O'Neil, 2016, p. 204)

Scenario thinking is a process through which an organization can consider the possible ethics issues in the future of a decision today. Porter (1985) and Schwartz (1991) focus on scenarios being stories of possible future outcomes that help people learn what to consider when making decisions for the future, but they are not predictions. Schwartz (1991) quotes an old Arab proverb that says, "He who predicts the future lies even if he tells the truth" and goes on to say, "Rather, scenarios are vehicles for helping people learn. Unlike traditional business forecasting or market research, they present alternative images; they do not merely

extrapolate trends of the present” (p. 6). Scenarios are narratives that describe the possible futures that would positively or negatively affect the strategic decisions made today. “The time horizon for scenarios must be short enough to create scenarios that are probable, but long enough for us to imagine that important changes with an impact on the future business can take place” (Lingren & Bandhold, 2003, p. 53).

There are existing global scenarios for 2025 and 2030 published by the U.S. National Intelligence Council (NIC) (2008), the World Economic Forum (2009, 2016), and Shell International Limited (2005, 2011). They can be used by anyone, but they are particularly important to those doing business globally. They focus on the global economy driven by technology, political power, the power of tribes and religion, and the rising power of developing nations. They are updated as events change their possible trends. They can help businesses identify how the environment might change that would make a decision currently being considered unwise. Additionally, organizations can tap research such as that of McKinsey & Company that conducts surveys that ask executives about forces in the global economy. For example, in 2010, its research team identified five forces that would be the strongest and provide the best opportunities for companies: The Great Rebalancing; The Productivity Imperative; The Global Grid; Pricing the Planet; and The Market State (Bisson, Stephenson, & Viguerie, 2010).

In the introduction to *Global Trends 2025: A Transformed World* by the U.S. National Intelligence Council (NIC), C. Thomas Fingar, Chairman, National Intelligence Council, said:

By examining a small number of variables that we judge probably will have a disproportionate influence on future events and possibilities, the study seeks to help readers to recognize signposts indicating where events are headed and to identify opportunities for policy intervention to change or lock in the trajectories of specific developments. Among the messages we hope to convey are: “If you like where events seem to be headed, you may want to take timely action to preserve their positive trajectory. If you do not like where they appear to be going, you will have to develop and implement policies to change their trajectory.” (National Intelligence Council, 2008, para. 2)

Creating a mini-scenario that addresses adopting a new technology would show the necessary changes in required job skills, which would allow managers to evaluate the cost of hiring those skills compared to buying the technology. This might lead to an evaluation of the ability of the current workers to learn the new skills, and the availability of training, for example. It would also identify how to track the technology to know when a version would be outdated

Asking “What if?” is an easy method of considering new situations on the horizon before they come too close for a reasoned response (Wilburn & Wilburn, 2011). Asking, “What if this happened? How would my business be impacted?” of a new technology could help identify a path for adopting it when the time was right. Asking “What if?” certain changes might happen in the economy or in technology can also identify issues that need to be addressed now. For example, asking “What if the data becomes inaccurate?” might have allowed Google to pay more attention to the individual data points it was collecting for its algorithm and what new data points might come into play on flu predictions. This would also allow ethical questions to be addressed: What if actions based on data ignore privacy rights? What if inaccurate data causes discrimination? Then stories can be written to consider different possibilities for any of the trends to help make decisions, and the stories can be shared with employees, so they can help watch for changes in their areas of work and expertise.

Whereas the short-term impact of AI depends on who controls it, the long-term impact depends on whether it can be controlled at all. . . . All of users should ask ourselves what we can do now to improve the chances of reaping the benefits and avoiding the risks. (Russell, Tegmark, & Wilczek as cited in Schwab, 2016, p. 98)

SCENARIOS FOR MATT

A peek at what a business owner named Matt is dealing with in change may demonstrate the enormity of how the role of organizing and managing a business must change and how asking What if? can help him make decisions. Matt owns a local delivery company; he has been in business for twenty years and delivers in a fifty-mile radius. He managed his drivers and their schedules with a computer program that told him what shipments were ready for delivery and where they were to go by when. Shipments were loaded on trucks according to delivery area. Drivers were grouped by delivery areas. By delivering in the same areas, drivers learned the roads and areas of congestion. They avoided school locations during morning and afternoon rush; they knew where roadway or building construction was happening. This practice had led to greater efficiencies, since he heard from his drivers only if they had problems.

Then came Global Positioning System (GPS) and Google Map, which could identify not only efficient, but also safe routes, and then apps like Waze and INRIX® came along to show the most efficient, even though different, routes at various times of day, based on traffic congestion or accidents. The routes avoided streets with traffic lights at every intersection and avoided left turns across traffic. The apps also provided instant information to the drivers so they could change the route if there was a traffic tie-up. Matt decided he needed to automate his trucks with the new technology because he was sure it would speed deliveries. He could offer same day delivery, increase his customer satisfaction, and perhaps add customers. He installed the technology and brought a person in to train his drivers on using it. Some drivers grumbled that they were giving up their autonomy and decision-making to technology, but they started using the technology. In the next two months, three drivers had accidents because they were consulting the technology. He then mandated that they pull over to the shoulder to use the technology. However, the next month, most deliveries, especially during peak times, took more time than they did before, as drivers stopped to consult the technology and then drove streets with which they were not familiar, which meant they had to consult the technology even more often. Upon reflection, Matt realized he did not use the technology to solve a problem, since his customers were not complaining, but he had created problems by adopting it, and did not meet his goal of speedier delivery.

The next time Matt considered implementing a new technology, he used a What If? Model. He had decided many years ago to buy only one brand of delivery truck so that he would achieve more efficiency in maintenance and repairs, but they were all at least ten years old now. Recently, an automotive company had offered him software that would use data analytics to identify when routine maintenance should be done on certain parts depending on type of travel, such as stop and go or high speed. The trucks would also be fitted with monitors tied to the software that would alert to possible failure of a part. In such a case, the truck could be returned to the facility before it was stranded on the road and towed at significant expense.

Matt decided to check his records to see if he had a problem that technology would solve. He found ten incidents of trucks breaking down that required sending another truck to unload the contents to make deliveries, and paying a tow truck to take the truck to the repair shop. He then checked his customer logs and found customer complaints had spiked during those breakdowns because deliveries were late, sometimes by 24 hours. Further analysis indicated two customers had switched to another delivery service because they had deliveries delayed two of the ten times trucks broke down.

However, thinking back on his earlier experience with the apps, he was concerned that his drivers might not pay attention to the monitors, or they might not analyze what the information meant. If they simply pulled over whenever the monitor indicated a problem, even if it was one that the book said could allow 100 miles of driving under 50 mph before replacing. He would still have broken trucks on the side of the road. If a truck really did need to be stopped, he would need a process for transferring the packages and notifying customers just as he always had. Perhaps customers could be provided real-time information about the new delivery time. Perhaps he should keep one truck available at all times for such transfer until

he had data on how often the technology required a truck to stop. However, the issue of training and decision making still loomed large given his past experience. Drivers would have to be trained on what the notifications meant; he had been told that some problems might require immediate engine shutdown, but others would simply require maintenance within 200 miles or driving at slower speed. The drivers would need the autonomy to act on the data they were receiving, rather than checking in to see how to respond. He also needed to check out his legal responsibility of the technology identified a problem, but the driver did not take the proper measures and an accident cause injury or death. Matt decided he would ask the company for names of firms that had implemented the technology for at least a year so he could talk to them about their experiences.

One of Matt's competitors had installed robots for moving packages from entry points in the warehouse to delivery trucks, or in some cases, to temporary storage in the warehouse. Matt asked What if? about adding robots and realized his current for employees to do the tasks would not make robots economically feasible at the current price. However, he had eight of his current employees talking about retirement, and he had realized that he needed to be sure his older employees were still capable of the heavy lifting required. He was already having trouble hiring full-time employees to work in the warehouse. He had interviewed someone recently, but the person only wanted to work part-time because he was working with his wife to start an online business making custom jewelry. What if this was a trend? It would mean managing part-time employees and scheduling would be more difficult, especially for peak times. He had always had a low turnover rate, which was one of the reasons for his profitability, but he would have to keep an eye on the potential pool of future employees and their needs. Matt decided to watch the price of the robots he would need so he could determine how many experienced people he would need to lose to justify bringing in the robots. He would still have to hire technicians to operate the robots.

Another technology Matt read about that he thought could improve his business was 3D printing. He read that there were programs that could print basic truck parts. His trucks were past any warranty periods and repairs were costly, especially since the parts were not readily available. There were programs for those parts that were inexpensive, and one machine would turn a photo of a part into a program for printing. With a 3D printer, a new part could be made and the old one replaced quickly, sometimes within an hour. This would mean he would no longer need a huge room to store spare parts, but he would need space for working on the trucks since currently they were sent to a repair shop. On the negative side, this change would mean one employee who managed the spare parts inventory would need other tasks. Matt did not think he would be able to learn to operate the 3D printer, so unless he could find other work for him, the person would have no job, and he would have to hire someone to use the 3D printer. Another issue was whether the 3D printer would be able to print what he needed and in order to shift most maintenance in house. Matt decided to look at his records for his maintenance costs, including the costs of parts before making a decision.

In his research on 3D printers, Matt discovered that UPS had started using its 3D printers to actually print products for customers for "prototypes or one-of-a-kind items" using a customers' CAD files or parts needed during manufacturing assembly and testing (The UPS Store, 2015). What if that became more prevalent? Would new 3D printing companies pop up that would help customers either print from their own CAD file or create their own file from a two-dimensional drawing. What would that do to his business? Would his customers find it more efficient and less expensive to simply make products that they were buying from stores and he was delivering? What if he could make some of the products with his 3D printer? He definitely would be able to make some equipment parts that one customer ordered in bulk. Since he would not be using his 3D printer 24/7 to make parts, offering as a service could defray the cost. Since 3D printers' price depended on the materials they used and the size of what they could print, tipping his toe in this technological water could help create new business. With the possibility of autonomous trucks and drones making the last-mile deliveries, and Uber and Lyft considering delivery services, Matt needed to pay attention to the future viability of his delivery service by making decisions based on What if? scenarios.

CONCLUSION

According to many industry observers, we are today on the cusp of a Fourth Industrial Revolution. Developments in previously disjointed fields such as artificial intelligence and machine learning, robotics, nanotechnology, 3D printing and genetics and biotechnology are all building on and amplifying one another. . . . Overall, there is a modestly positive outlook for employment across most industries, with jobs growth expected in several sectors. However, it is also clear that this need for more talent in certain job categories is accompanied by high skills instability across all job categories. Combined together, net job growth and skills instability result in most businesses currently facing major recruitment challenges and talent shortages, a pattern already evident in the results and set to get worse over the next five years. . . . The question, then, is how business, government and individuals will react to these developments. To prevent a worst-case scenario—technological change accompanied by talent shortages, mass unemployment and growing inequality—reskilling and upskilling of today’s workers will be critical. (World Economic Forum, 2016, p. v)

Jim Clifton (2011), Chairman of Gallup, believes that what people all over the world want are good jobs. The organization of business must support development of engaged workers that will create these good jobs. “The computers will be crunching data, while humans do the higher-level thinking—supplying the conceptual ideas, rules, and judgement that guide the automated data analysis and prediction” (Lohr, 2015, p. 117). Businesses will have to have structures that promote communication across all functions as well as processes to manage a workplace of robots, part-time employees, and employees working remotely, with strong communication and problem-solving skills. Because they will be training employees to do the analytical thinking, they need to hire people who have the motivation to learn and who will stay with the firm, given the significant costs of continually replacing full-time employees. Gallup’s (2015) research shows that “People who use their strengths every day are six times more likely to be engaged on the job” and “7.8% more productive” and those who receive strengths feedback on have turnover rates that are 14.9% lower than those for employees who do not” (p. 43).

The uncertainties around the pace and extent of technological change are enormous. Some fear a future of mass unemployment. Others are sanguine that people will have time to adapt. Companies have to want to adopt new technologies, after all, and regulators may impede their take-up. What is not in doubt is the need for new and more efficient ways to develop and add workplace skills. (The Elephant in the Truck, 2017, p. 16)

Processes will need to be in place to help employees learn what they do best and to convince employees that technology will free up more time to do what they do best. At the same time, managers will need to help employees understand that they must learn new skills when technology replaces their jobs completely. Artificial Intelligence and Big Data will provide better information on which to make better decisions, but it will also produce so much information, that the organization must be able to define the information necessary for production and managing the company, and the questions that the information needs to answer, much of which will take collaboration between management and employees.

The technological and workforce changes affecting organizations today are disruptive. Organizations must reconsider how they manage and optimize performance using technology, just as the how, when, and where people work is shifting. Decisions on what to prepare for the future workplace and workforce withstand the winds of change in the 21st century when scenario thinking is used and the question “What if?” is asked every time there is information about a new technology or a new use for existing technologies. Failure to do so will mean organizations will struggle to attract and keep great employees and managers.

In a memo to IBM managers on April 25, 1960, CEO Thomas Watson Jr. addressed head-on the issue of “thinking machines.” He wrote ‘Computers will never rob man of his initiative or replace

the need for his creating thinking. By freeing man from the more menial or repetitive forms of thinking, computers will actually increase the opportunities for the full use of human reason. Only human beings can think imaginatively and creatively in the fullest sense of these words.” (Kelly & Hamm, 2013, p. 138)

Kelly (2016) reminds us that we will become interdependent with the machines we create in order to solve our problems. Organizations must recognize what that interdependence might look like so that they make decisions about adopting technology that will help them navigate their success in the future.

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