THE FUTURE

THE WORLD OF TOMORROW, DESCRIBED TODAY

Our future is being shaped by powerful forces that will have a profound impact on government, business, and society. Defense leaders stand at the brink of a world in which wars, geopolitical landscapes, and ethical and policy environments will be dramatically different. Civil leaders face a wave of change in our global workforce. Business leaders face the most turbulent economic changes of the last century.

We must work together to build this future. We must guide the outcomes of our most profound debates, creating a future that strengthens our economy, enhances global security, and provides for our exploding global population. This book highlights the forces that will shape our future and provides a starting point for this discussion.

ARE WE READY FOR THE FUTURE?

Our world is facing a rapid expansion of new ideas, technologies, and economic models that are creating profound change in our lives, our businesses, and our future. Technological innovation and the accelerated evolution of our society will give rise to historic debates. What do we value? What is the nature of privacy? How do we define humanity? Leaders must make choices to guide the outcome of these debates into a future that strengthens our economy, enhances global security, and provides for 10 billion people.

Each of us is poised to help build the future. A future where change can broaden opportunity but threatens to widen inequality. A future where we harness science and technology to contribute to the human story but confront the perils of economic decline. To build this future, we must harness our spirit of discovery, our diversity of talent, and our determination to create tomorrow's businesses, today.

The trends outlined in this book will have a profound impact on government, business, and society. It is within this environment that we will build businesses that empower tomorrow's leaders. Three megatrends will have a particularly outsized impact on the future world:

- Population growth and longer lives, leading to 10 billion people on our planet by 2050, largely living in sprawling megacities in what is now the developing world
- Robotics and autonomous technology, which will augment or replace dirty, dangerous, and dull physical work and drive the ability of computers to learn and make decisions previously done by humans
- Natural resource constraints, which will necessitate rapid innovation to increase capacity and efficient use of energy, water, and food sources.

We created this book to shape the discussion of tomorrow's new businesses and highlight trends—both old and new—that are powerful forces of change and opportunity.

The future is ours to write. Begin your journey at **boozallen.com/futures** or contact us at **future@bah.com**

OUR FUTURE

IN BRIEF

FOR DEFENSE LEADERS

Defense leaders stand at the brink of a world in which the way we fight wars, geopolitical landscapes, and ethical and policy environments are all dramatically changing.

Combat robots and autonomous vehicles will supplant soldiers in future wars. By 2040, the only Americans serving in combat roles will be in special operations, peacekeeping, and peacebuilding missions. Innovative manufacturing technologies will bring the factory to the front line. No longer will complex logistic systems be needed to transport soldiers and materials through war zones. Operational costs and human casualties will decrease dramatically. The long-term cost of war will drop as the number of veterans decreases.

The U.S. will not be the only nation racing to replace humans with robots, giving rise to an entirely new arms race. The global population will shift toward what is now the developing world. Nearly two-thirds of the population will experience extreme poverty, causing a dramatic increase in the likelihood of radicalization and civil unrest. The struggle to provide food and energy for a global population of nearly 10 billion will strongly influence geopolitics. Conflict will break out over our most critical natural resource: clean water.

Defense leaders will face this future amid increasingly complex ethical and policy issues. They will face intense scrutiny for using technologies that diminish our connection to the human costs of war. They must consider the implication of robotic troops that can be hacked and will need strategies for controlling robot armies. They will need to ensure that cheaper wars do not create an environment in which leaders are more likely to enter into combat.

FOR CIVIL LEADERS

Civil leaders face a wave of change in our global workforce as the population explodes, workers live dramatically longer, and jobs disappear.

The global population will reach a staggering 9.7 billion people by 2050. The locus of the global economy will shift to emerging markets. People will migrate to megacities to capture economic opportunity. People will live longer, healthier lives than ever before and will work longer to support themselves. Employees will be able to contribute meaningfully over far longer careers.

Machines will begin to perform many physical tasks, eliminating the need for physical labor in tedious, repetitive, and dangerous jobs. At first machines will be used only by a narrow range of roles—coffee baristas, drivers, and warehouse workers. But soon, increasingly capable machines will tackle more complicated roles, such as managing households, caring for children, and serving as police officers. Software will perform routine cognitive tasks, freeing humans to focus on social and emotional work. Machine intelligence will replace humans in repetitive roles and augment humans in highly skilled fields. Both physical laborers and knowledge workers face massive job loss to machines.

Civil leaders will need to balance policy that incentivizes business innovation with safeguarding economic security. They will need to create programs to support a larger, older global population. They will face difficult questions about ensuring the ethical behavior of robots placed in positions of power over humans. They will need to create jobs, social welfare programs, and economic stimuli that protect workers whose jobs are overtaken by software.

FOR BUSINESS LEADERS

Business leaders face the most turbulent economic changes of the last century. More and more value will be delivered through new products, in new channels, to new consumers.

Executives will need to think carefully about how to build sustainable, flexible companies that can offer differentiated value. They will have many more tools at their disposal: a large talent pool of flexible workers dispersed globally; more business solutions available as services rather than capital expenditures; more predictable tax and regulatory frameworks; and cheaper options for getting to market.

These tools will be dearly needed. There is no guidebook for the emerging tectonic shifts in our global economy. Population expansion will create 3 billion new consumers, largely in emerging markets. At the same time, the developed world will need new products and services to suit the needs of an aging population. Our interconnected planet will need ways to protect identity and privacy, make secure transactions, and use data to design bespoke products and services. Constraints on natural resources, and the purchasing behaviors of the global middle class, will compel businesses to build good products with little waste.

Companies will watch their competitive advantages of today—optimized supply chains, preferred channels, differentiated manufacturing processes, and market-leading products and services—erode thanks to new business models, new technologies, and shifting consumer preferences. Leaders will need to explore entirely new ways of conducting business to remain viable in the face of these economic changes.

OUR FUTURE

DEBATES

PRIVACY

CANNOT EXIST IN A FULLY CONNECTED

WORLD

Proliferation of human data will force us to reevaluate the meaning of privacy. Today, humans create more data every 10 minutes than we did in the first 10,000 generations of our species. We produce much of this data unknowingly. Connected cars send 25 gigabytes of data to the cloud every hour, the equivalent of the full "Lord of the Rings" movie trilogy. The volume of data we produce will increase exponentially in the coming decade. Today, 10 billion devices are connected to the Internet. By 2020, that figure will soar past 50 billion.

Most of us recognize that our Internet-connected devices contain sensitive personal data. Many of us don't realize that the seemingly innocuous data these devices produce can be aggregated and analyzed to infer intimate details of our private lives. An innocent release of London bicycle hire data made it possible for the public to view individual customers' trips. The public could identify when people were late to work or slept somewhere other than their homes. In another example, a media lab in the Netherlands assembled a database of Dutch citizens' birth dates, professions, addresses, sexual orientations, and even medical histories using only publicly available data.

As it becomes easier to knit together large data sets, we will fiercely debate the definition of personal privacy. Academic institutions will argue that data transparency benefits society by allowing us to understand and overcome crime, disease, and poverty. Companies will argue that access to data enables them to create the products and services we demand. Private citizens and their political representatives will fight back, petitioning for legislation that forces organizations to dramatically improve privacy protections.

Future leaders will need strategic support to navigate the complexities of the privacy debate. Civil leaders will seek help creating legislation that balances privacy rights and business interests, while business leaders will seek data science experts with deep regulatory knowledge to help them capitalize on customer data without running afoul of the law. Defense leaders will use data to understand enemy intentions and improve threat assessments. The ability to balance the use of data with legal and ethical issues will determine which organizations succeed in the future economy.

THE DEBATE FOR...

- It's already too late. Most people are unaware that by signing terms-of-service agreements they have given consent for companies to store, analyze, and resell their data.
- Even anonymous data can be aggregated and analyzed to infer our identities, as well as intimate details of our private lives.
- Personal data will help us solve critical problems such as crime, disease, and poverty. Access to data is in our broader social best interest.
- Even if laws are put into place to ensure privacy, we don't know the extent of the data we produce every day, so we have no means to oversee its use.

AND AGAINST...

- Comprehensive privacy laws will be created as people begin to understand the negative consequences of collecting, storing, and analyzing personal data.
- Stronger data protection laws will hold companies responsible for abuse and neglect, shifting control back to individuals.
- The cost of data breaches will continue to rise, creating enough financial risk that companies will stop collecting and storing personal data.
- Technological advances will create mechanisms for individuals to control their personal data. The desire for individuals to monetize their data will force companies to embrace these technologies.

ALGORITHMS

CANNOT PREVENT

DISCRIMINATION

The convergence of machine intelligence, Internet-connected devices, and vague personal privacy definitions will force us to decide how much decision making we're willing to cede to software. The growing availability of human data will make it possible for organizations to forecast human outcomes with a high degree of accuracy. Machine intelligence capability will be lauded as an advancement in human decision making, but it will also force future leaders to navigate a broad range of ethical dilemmas. A May 2014 White House report found that the use of data has "the potential to eclipse longstanding civil rights protections in how personal information is used in housing, credit, employment, health, education, and the marketplace."[1]

Schools could automatically assign students to remedial classes based on their similarities to previous poor-performing students. Credit card providers could assemble a web of social, demographic, and personal information to determine creditworthiness. Police could make preemptive arrests based on algorithmic inferences about who will commit crimes. These are just a few examples of the ethical dilemmas we will face.

A famous 2010 Chicago police department experiment collected real-time crime and gang movement data, along with other variables, to forecast criminal activity and ensure police presence. The program worked. In the first year, Chicago's notoriously high murder rate had declined by 5 percent, and by the following summer the annual death toll from violent crimes had fallen to 1965 levels. The program, however, appeared to carry a strong racial imbalance. Statistics showed that most crime occurred in about 10 percent of the Chicago land area, largely linked to predominantly black and Hispanic gangs. While the forecast may seem an objective rendering of crime, biases in how data is collected, the ease of measuring murders, and the timeliness of the information may reinforce existing beliefs and effectively result in profiling.

The potential for algorithmic discrimination will put pressure on civil leaders to better understand and interpret machine-learning mechanisms. They will need to create policy that reduces the potential for unequal treatment. Business leaders will face scrutiny for their use of data to categorize and confer judgment on customers. They will seek regulatory and legal support to defend against claims of discrimination. Defense leaders will need certainty that the machine-learning algorithms they use to make strategic decisions are devoid of bias.

THE DEBATE FOR...

- Algorithms are created by humans. Humans have intentional and unintentional biases that inevitably become embedded within the algorithms we create.
- Our world contains discrimination. Algorithms are designed to model the real world, so they will model this discriminatory behavior.
- There are biases in how data is collected.
- When algorithms are fit against this data, the biases transfer.

AND AGAINST...

- Broader reliance on algorithms will force us to understand the risk of discrimination. We will begin designing algorithms to prevent the unintentional embedding of discriminatory behavior.
- Algorithms will actually allow us to find discrimination faster and with more purpose, helping us take action to eliminate discrimination in many aspects of our lives.
- Supervisory algorithms will be put in place to identify patterns of discriminatory behavior early so corrective action can be taken.

ECONOMIC INEQUALITY

We will need to decide how much we protect our most vulnerable citizens amid growing global economic inequality. Technological advancements that reduce the need for lower skilled workers will exacerbate inequality. Machines will displace humans in more than 5 million jobs by 2020 and in 40 percent of all jobs in the two decades that follow. Dirty, dangerous, and dull physical jobs will be lost to robots first, followed by administrative and white-collar roles. The rise of machines will displace knowledge workers. Organizations will compete for only the highest educated humans.

While income inequality has been increasing since the 1970s, today it is at levels unseen since 1928, when 1 percent of earners accounted for almost 24 percent of income. Economic inequality negatively impacts all aspects of human society. Unequal nations are more violent than equal ones. They have higher rates of incarceration, mental illness, obesity, stress, drug use, and infant mortality. They are more segregated and have worse educational outcomes. People in unequal societies die earlier. This is already evident in the U.S., where growing inequality has driven increases in death rates for less educated men, primarily from suicide, alcohol and drug poisonings, and alcohol-related liver disease.

As technological advances continue to accelerate the hollowing-out of the middle class, we will debate how to reward entrepreneurship and innovation while caring for our most vulnerable citizens. Politicians and citizens will argue the merits of instituting a universal basic income to keep billions of people out of poverty. We will consider alternatives to labor taxes as the method of funding our government. Business and government leaders will disagree about how to promote flourishing markets while reducing negative externalities.

Civil leaders will drive efforts to reduce inequity and protect the poor. They will seek help transforming our educational systems to prepare students for an economy with radically different talent needs. They will require support in developing policy that galvanizes new industries and creates new jobs. Defense leaders will confront heightened global unrest. They will explore new means for de-escalating conflicts to avoid a surge of civil wars around the world. Business leaders will face growing public scrutiny over executive compensation and worker treatment. The market for corporate social responsibility brand development will grow rapidly.

THE DEBATE FOR...

- Our social welfare system is not prepared for a world where machines are capable of performing human work quickly and cheaply.
- Failing to take action will lead to civil unrest following the inadvertent establishment of a class system with an uneducated, extremely poor working class.
- There is a risk of global economic collapse. Massive losses of physical labor and knowledge workers will create widespread unemployment and loss of tax and consumer income.

AND AGAINST...

- The last century of relative economic mobility was an anomaly triggered by two world wars and massive demographic changes. We cannot reasonably expect that level of mobility
  to continue.
- Like every technological revolution of the past, the creation of robots and machine intelligence will spur new industries that will require human minds and muscles.
- Our economic system for allocating resources rewards entrepreneurship and innovation. Changing these rewards may dissuade further generations of inventors.

OUR FUTURE

TECHNOLOGY

SOFTWARE AUGMENTS OR REPLACES

KNOWLEDGE WORK

"The 15 leading global economies will lose 5.1 million jobs to robots and AI in the next five years."[2]

Software will perform routine cognitive tasks, freeing humans to focus on social and emotional work. Many white-collar jobs will fundamentally change, entirely new jobs may be created, and other jobs will disappear completely. Our grandchildren will be challenged to identify a course of university study given the uncertainty around future careers.

Machine intelligence (MI) will first replace humans in administrative roles. At law firms, software will scan, analyze, and annotate thousands of pages of legal documents in seconds. When our children buy homes, they will never sit down with a loan officer to discuss the terms of their mortgage—software will determine what amount and how they should borrow.
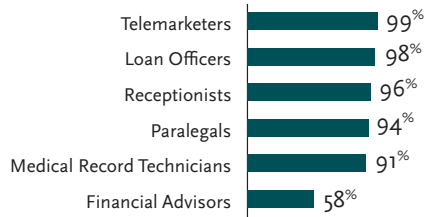
In highly skilled fields, MI will augment workers. Our doctors will more quickly and accurately diagnose illnesses. Business, government, legal, and defense executives will test decisions against wide-ranging scenarios using MI. Computer programmers will create high-level systems architecture while MI agents create code, reducing errors that lead to system vulnerabilities.

As advances in software transform our economy, civil leaders will seek help creating jobs, social welfare programs, and economic stimuli that can protect knowledge workers whose jobs are overtaken by software. Proliferation of MI will transform consumer expectations, pushing businesses into an arms race to develop the smartest software. Defense leaders' reliance on algorithms to interpret intelligence will grow, and the need for low-level intelligence analysts will diminish.

PROBABILITY OF JOB AUTOMATION[3]
Select Positions, Within 20 Years

Position	Probability
Telemarketers	99%
Loan Officers	98%
Receptionists	96%
Paralegals	94%
Medical Record Technicians	91%
Financial Advisors	58%

SIGNPOSTS OF CHANGE

In May 2015, a journalism software company challenged a seasoned NPR reporter to an article-writing competition. Its software program took less than 2 minutes to write a financial earnings report nearly identical to one produced by the journalist in 7 minutes. The AP now uses this software to publish 3,000 stories every quarter. The number is poised to grow as news-writing algorithms grow smarter.[4]

ROBOTS

WILL FIGHT
OUR
WARS

"Today, the United States has the greatest number of military bots of any country. These machines are well armed and lethal and have killed thousands."[5]

Combat robots and autonomous vehicles will supplant soldiers in our future wars. The cost of our participation in combat is financially and emotionally staggering. The wars in Iraq and Afghanistan have killed 6,887 soldiers, wounded 52,434, and left more than 400,000 with post-traumatic stress. The lifetime medical care for these soldiers is expected to cost more than $1.3 trillion. The spiritual cost to soldiers and their families is unquantifiable. Robots will enable us to reduce the high price of combat. The total number of soldiers in the military will decline significantly. By 2040, the only Americans serving in combat roles will be in special operations, peacekeeping, and peacebuilding missions. Unmanned drones, field combat robots, and sophisticated cyber software will make up the lost firepower. Robots will increase operational precision and reduce civilian casualties of war.

The U.S. won't be the only nation racing to replace humans with robots in combat roles. Competition to stay ahead of robotics technology will give rise to a new arms race. Russia, China, Iran, and dozens of other state and non-state actors will rush to keep ahead of their respective adversaries.

Our defense leaders will need help accelerating combat robot capabilities in a tense operational environment. They will seek help analyzing the massive volumes of data combat robots produce to better understand and stem conflict. They will face pressure to improve defensive and offensive cybersecurity capabilities in an environment in which it is possible to hack soldiers. They will explore the ethical and policy considerations of wars that aren't fought by humans.

SIGNPOSTS OF CHANGE

In July 2015, the head of the U.S. Army Training and Doctrine Command announced that the U.S. Army will reduce brigade combat teams from 4,000 soldiers to about 1,050, using robots to make up the difference. The U.S. isn't alone in investing in combat robot capability. In January 2016, U.S. defense officials ordered an investigation into suspected Chinese penetration of U.S. systems to steal combat robot software. Russia created a combat robot program in 2014 and reportedly used it in Syria in 2016.[6]

MECHANICAL
MUSCLE

WILL REPLACE
PHYSICAL
LABOR

Machines will perform many physical tasks, eliminating the need for physical human labor in tedious, repetitive, and dangerous jobs. Robotics will at first be used only for a narrow range of physical tasks, replacing coffee baristas, drivers, and warehouse workers.
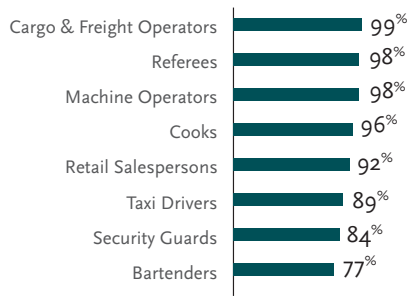
Robot operators will guide long-haul trucking fleets on interstate highways, retaining human drivers to manage only the more complex city maneuvers. The U.S. Postal Service will be entirely automated, either through government action or via outsourcing to a major robotics player, such as Amazon.

Increasingly capable machines will later tackle more complicated physical roles, such as managing households and stores and cleaning streets. Many of our police, firefighters, and security guards will one day be supplanted by robots. We will judge the first parents who hire robot nannies to mind their children on date night. Later, we'll wonder how we ever entrusted our kids' care to our unpredictable fellow humans.

Civil leaders will need help evaluating which jobs can and should be performed by robots. They will face difficult questions about ensuring the ethical behavior of robots placed in positions of power over humans. We will demand new policy to ensure our safety. Business leaders will require strategic support for implementing robotics to cut costs and increase operational agility. Defense leaders will send robots to execute the most dangerous wartime activities in our stead.

PROBABILITY OF JOB AUTOMATION[7]
Select Positions, Within 20 Years

Position	Probability
Cargo & Freight Operators	99%
Referees	98%
Machine Operators	98%
Cooks	96%
Retail Salespersons	92%
Taxi Drivers	89%
Security Guards	84%
Bartenders	77%

SIGNPOSTS OF CHANGE

At Carnegie Mellon University's Robotics Institute, a social robot now greets visitors and escorts them to appointments across the university. Professors plan to apply the new technology more broadly for tasks such as minding children and assisting the elderly. Autonomous vehicles are also taking on more physical work previously left to humans. In April 2016, a platoon of driverless trucks programmed by Daimler and Volvo traveled more than 2,000 km across Europe unassisted.[8]

INNOVATIVE MANUFACTURING

WILL MAKE ANYWHERE A FACTORY

Additive manufacturing, or 3-D printing, will transform how we build products. Products will no longer be ordered, built in far-off locales, and shipped great distances. We will instead download product designs, send them to 3-D printers in our homes and offices, and access our new goods instantly.

3-D printing technology will benefit the environment. Fewer shipping trucks on the road and ships in the sea will reduce pollution and lessen energy demands. Less raw material will be required to build new products, reducing waste and protecting scarce natural resources.

At the same time, this new technology will threaten millions of jobs. Developing economies are at a particularly high risk of disruption. Countries around the world have started their journeys toward economic development by exporting goods to wealthier nations. This route to economic development will disappear. Jobs in adjacent industries—such as trucking, shipping, mining, and logging—will also be at risk.

Entire economies will need to adapt. Business leaders will require support in adapting strategies to succeed in an economy that rewards rapid innovation instead of low costs. Cybersecurity expertise will be in high demand as organizations work to protect intellectual capital in a distributed production environment. Civil leaders will need help developing better methods of calculating value derived from proprietary ideas. As developing countries are destabilized by the loss of economic development, defense leaders must anticipate and prepare for greater unrest and threats to national security.

SIGNPOSTS OF CHANGE

In 2012, an American prop maker traveled to South Africa to work on a prototype for a child-sized prosthetic. The device was intended for a little South African boy named Liam, who was born without his right hand. The prop maker had to return to the U.S. before perfecting the design, but 3-D printing technology enabled him to continue iterating it. He programmed updates to his design into a 3-D printer so Liam could print out an updated version halfway around the world. The design was eventually optimized to fit Liam perfectly. Today, the same method has been used to provide customized prosthetics to hundreds of children around the world.[9]

OUR BRAINS

WILL CONNECT DIRECTLY WITH

MACHINES

"Wearables will give way to 'embeddables,' nano-scale machinery inside our bodies, which can monitor us and modify us. The enhanced human will have improved attributes such as sensing, thinking (aided by computation) and in more physical ways, such as endurance, resistance and longevity."[10]

Until now, we've controlled computers by looking at screens and typing with our fingers. In the future, we will use direct brain-computer interface (BCI) to operate software and machines with our thoughts. BCI will drastically improve our physical and cognitive capabilities.

BCI facilitates collaboration between the brain and external devices by interpreting the brain's electrical signals and transmitting them to a device. The technology is already used to help the disabled operate advanced prosthetics. As it becomes more sophisticated, we will use BCI to control a wide range of robots, unmanned vehicles, and other machines with our thoughts.

The impact will be tremendous. We will be able to browse the Internet, create artwork, and manage our homes without getting off the sofa. We will analyze the data our brains produce, unearthing the secrets of our minds. Minimally invasive implanted BCI devices will monitor and regulate our nerve signals, enabling us to adaptively control our organ function.

The development of BCI will have a profound effect on human society. Civil leaders will need help navigating the regulatory implications. For example, consider our having to compete with augmented humans in the job market. Defense leaders will need help analyzing and harnessing brain data to create new offensive and defensive technology.

SIGNPOSTS OF CHANGE

In May 2015, a paralyzed man was able to drink a beer on his own for the first time in 13 years using a robotic arm controlled by BCI. Researchers at Caltech implanted the neural chips that control the arm into the part of his brain responsible for the intent to move. To control the arm, he simply thinks about what he intends to do. DARPA announced in January 2016 it would devote more than $60 million to develop similar BCI technology.[11]

SOCIETY AND PHYSICAL WORLD

WE WILL

LIVE MUCH
LONGER

By 2050, we will substantially increase the length of our lives by improving replication of our cells. Medical technology that enables us to edit human DNA will enable doctors to eliminate many devastating human diseases. Doctors will cure Alzheimer's, multiple sclerosis, muscular dystrophy, and countless other terminal illnesses by removing them from our gene pool. It will not be uncommon to find eight generations of a family assembled at reunions. Great-great-great-grandmothers will read books to their toddler descendants.

As we enjoy better health and longevity, we will confront new societal and psychological debates unique to radical life extension. To live healthy, active lives of more than 150 years, we will need to change how we think about relationships, careers, and learning. People will work longer to support themselves. Since most physically taxing jobs will already be performed by robots, employees will be able to contribute meaningfully over far longer careers. Entire industries will emerge to cater to chronologically older but highly active people.

Civil leaders will require support adapting economic, social security, and other policies to accommodate longer lifespans. They will need help developing programs that promote mental health and well-being into later stages of human life. Business leaders will need help building product and workforce strategies to engage much older customer bases and talent pools. Planetary overcrowding and competition for resources will force defense leaders into a new era of conflict.

GLOBAL LIFE EXPECTANCY[12]
1900–2050

48 yrs. — 1950
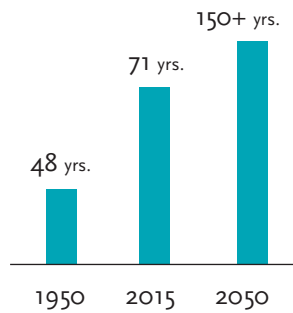71 yrs. — 2015
150+ yrs. — 2050

SIGNPOSTS OF CHANGE

In May 2016, researchers at the NeuroAIDS Center at Temple University announced they had successfully used CRISPR-Cas9, a gene-editing tool, to cut HIV genes out of live animals. In 2015, scientists used the same technology to alter the genes that affect aging in fish.[13]

THE
P O P U L A T I O N
WILL EXPLODE, MOSTLY IN CITIES

"We will spend more on and build more infrastructure in the next 40 years than we have in the last 4,000 years. By 2030, more than 2/3 of the world's population will live in cities."[14]

Global population will grow by 37 percent between 2016 and 2050 to reach a staggering 9.7 billion people. The developing world will replace the developed as the most populous. The locus of the global economy will shift from established markets to emerging ones. People will migrate to megacities to capture economic opportunity.

Rising global population will put significant pressure on our infrastructure by the late 2020s. We will need to update electrical grids, water purification tools, and transportation and telecommunications networks. Urban development policy must evolve to contend with development needs. The emergence of smart cities will drive infrastructure sustainability. These cities will be run by highly networked systems that enable real-time responsiveness to problems and rapid solutions.

Civil leaders will need support developing smart, sustainable infrastructure policy that protects our environment. They will seek expertise to interpret the massive volumes of data produced by smart cities. Defense leaders will seek help understanding and manipulating innovations in infrastructure to undermine adversaries. Military strategy will adapt to account for a future in which wars will be fought almost exclusively in cities.

SIGNPOSTS OF CHANGE

Pakistan's population grew from 33 million in 1947 to more than 180 million in 2012. It is now the sixth most populous country in the world. China also hit a historic population milestone in 2012: For the first time ever, city dwellers outnumbered the rural population. According to the Chinese statistics bureau, 691 million people now live in cities, amounting to more than 51 percent of the population.[15]

WE WILL NEED

FOOD &
ELECTRICITY

FOR 10 BILLION PEOPLE

Our per capita natural commodity consumption will double and our global energy use will rise by 35 percent in the coming decades. Access to food and energy will decline. We will rely on technological innovation to sustain our growing ecological footprint. We will need to maximize all parts of soft commodities production. We will need to curb land and water consumption, as well as greenhouse gas emissions.

Food production will be transformed. First-world countries will produce food at home instead of importing it. The developing world will rely on biotechnology to produce massive volumes of food for growing populations. Genetically modified crops will increase yields. Climate change will shift centers of production.

Food and energy scarcity will have a huge impact on geopolitical security. Civil leaders will increase investment in technologies that improve production of these critical resources. Defense leaders will seek support navigating a growing number of conflicts over food and energy around the world.

GLOBAL ANNUAL CROP PRODUCTION[16]
In Trillions of Calories

16,000

9,500

Food Available
in 2006

Food Needed
in 2050

SIGNPOSTS OF CHANGE
Mali's average rainfall has dropped by 30 percent since 1998 owing to climate change, with droughts becoming longer and more frequent. Hunger has become a chronic problem, with more than 1.8 million people in need of food aid. Facing famine and the loss of their livelihoods, many young men from the region have left to participate in armed conflicts nearby, including the 2011 conflict in Libya.[17]

ACCESS TO

CLEAN WATER

WILL ENTER THE

GEOPOLITICAL DEBATE

"The risk of conflict will grow as water demand is set to outstrip sustainable current supplies by 40% by 2030.[18]*"*

"45% of total GDP, or \$63 trillion, will be at risk due to water stress by 2050."[19]

As of 1990, 20 countries lacked sufficient access to water to meet daily needs. Five more countries are expected to join this category by 2025, leaving 47 percent of the world's population without adequate access to water. This vital natural resource is quickly surpassing oil as one of our scarcest. Conditions will worsen as populations grow unless we adopt sustainable usage patterns.

A 2012 U.S. national security assessment warned that conflict over water could spur future terrorist attacks. Access to water will become a global policy debate and a key consideration for regional security. The United Nations has declared access to water to be a basic human right, but in the future, water may be a traded commodity. Populations may shift and resettle to areas where water can be found. We will develop conservation strategies to prevent violent clashes and unfair trade.

Defense leaders will require support responding to tensions in water-scarce areas. Corporate executives will account for impending shortages in product development plans and risk management assessments. Governments and utility companies will seek help creating partnerships to improve efficiency and reduce water waste. New technologies, such as those that desalinate or recycle water for consumption, will be a necessity.

SIGNPOSTS OF CHANGE

In January 2015, the Yemeni government announced that clashes over water are killing up to 4,000 people a year. These conflicts, which predate the country's civil war, include raids on wells and other fights over water access involving armed groups.[20]

WORK

WILL BECOME MORE

FLEXIBLE

"People will continue shifting away from the one life, one career mentality—an already observable trend among millennials."[21]

Many jobs will be performed by temporary, remote, part-time, and contract workers. Employers will connect with talent through online platforms that enable fast and direct hiring for in-demand skills. Employees will be able to seek the highest pay for convenient and profitable short-term work. Careers will be defined in weeks and months instead of years.

For some, this change will be liberating. For others, it will create a constant search for the next job. A fraction of the workforce will need to perform a portfolio of activities to generate an adequate income. A single earner might be an Airbnb host, a data scientist, and a therapist.

Our civil and business leaders will be responsible for ensuring talent remains productive and engaged in the new work environment. Civil leaders will seek help creating financial products that provide for employees' care and expenses during periods of unemployment. They will need help partnering with business leaders to create the standards for a common resume—an objective job performance scorecard that allows workers to move seamlessly between jobs. Business leaders will need help managing a flexible workforce and navigating the risk and uncertainty associated with it.

SIGNPOSTS OF CHANGE

Today, an estimated 53 million Americans are employed in the on-demand economy. A 2015 Stanford survey found that 75 percent choose on-demand jobs to increase the flexibility of their work schedules and 47 percent chose them because they offer better pay. Fifty-six percent of those surveyed said they could imagine themselves staying in on-demand work for the rest of their lives.[22]

CARS

WILL
DRIVE US

"One study suggests a single self-driving car could replace up to 12 regular vehicles. If you shifted the entire city to autonomous cars, it would need a staggering 90% less parking than it needs today."[23]

By 2020, automotive manufacturers and technology companies will release the first fully autonomous vehicles to consumers. By 2040, most cars will be autonomous.

The economic and environmental benefits of driverless cars will be transformative. Companies will build fleets of self-driving cars to conveniently provide on-demand transport. Personal vehicle ownership, and the associated environmental costs, will decline. Parking lots will be transformed into green spaces. Those of us who had lacked access to transportation—the disabled, elderly, and young—will be able to move independently for the first time. With fewer cars on the road and little opportunity for human driving error, traffic fatalities will drop precipitously. Our grandchildren won't know what a parking space is. They will never drive a car.

To capture these benefits, civil and business leaders will need partners to create a regulatory and business environment that supports autonomous vehicles. Civil leaders will need help creating policy that encourages adoption of driverless vehicles while avoiding safety risks as the technology evolves. Business leaders will need data scientists' expertise to analyze billions of miles of driving data to ensure their vehicles' safety. This will be particularly important during the period of time in which driverless and driven cars share the road.

SIGNPOSTS OF CHANGE

In April 2016, Google, Ford, Uber, Lyft, and Volvo announced the formation of a lobbying group to encourage U.S. regulators to create and adapt legislation to allow for widespread adoption of driverless vehicles.[24]

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