

How Long Will Your Job Last?



Contents

The Robots Are Coming	1
Going, going, gone	2
All about AI	2
Have we been here before?	3
What jobs are at risk?	4
How work is changing	4
Some of the jobs that robots won't take	5
The major obstacles to AI	6
AI changes jobs – and also creates new ones	6
Working with robots	7
Robots, too, have their limits	8
What Should Governments Do?	9
Government policy	10
Universal basic income	10
How education and training can prepare us	11
Education needs transformation to prepare for the future	12
Why we need immigrant labour	12
In brief	13
What Should Employers Do?	14
The bottom line	15
Shift from labour to skill-based jobs	15
Diversity needs to be the norm	15
Reinvent the HR/people function	15
How companies can help with training	15
Governments and companies working together	16
Managing staff as well as money	17
In brief	17
What Should Employees Do?	18
Diversifying skills and staying adaptable	19
Developing new skills and retraining	19
The shift to skill-based jobs	19
Jobs that are robot-proof	21
In brief	21
Conclusion	22

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The Robots Are Coming

How is automation going to affect us all? And what steps should you be taking to get ready for its inevitable invasion?

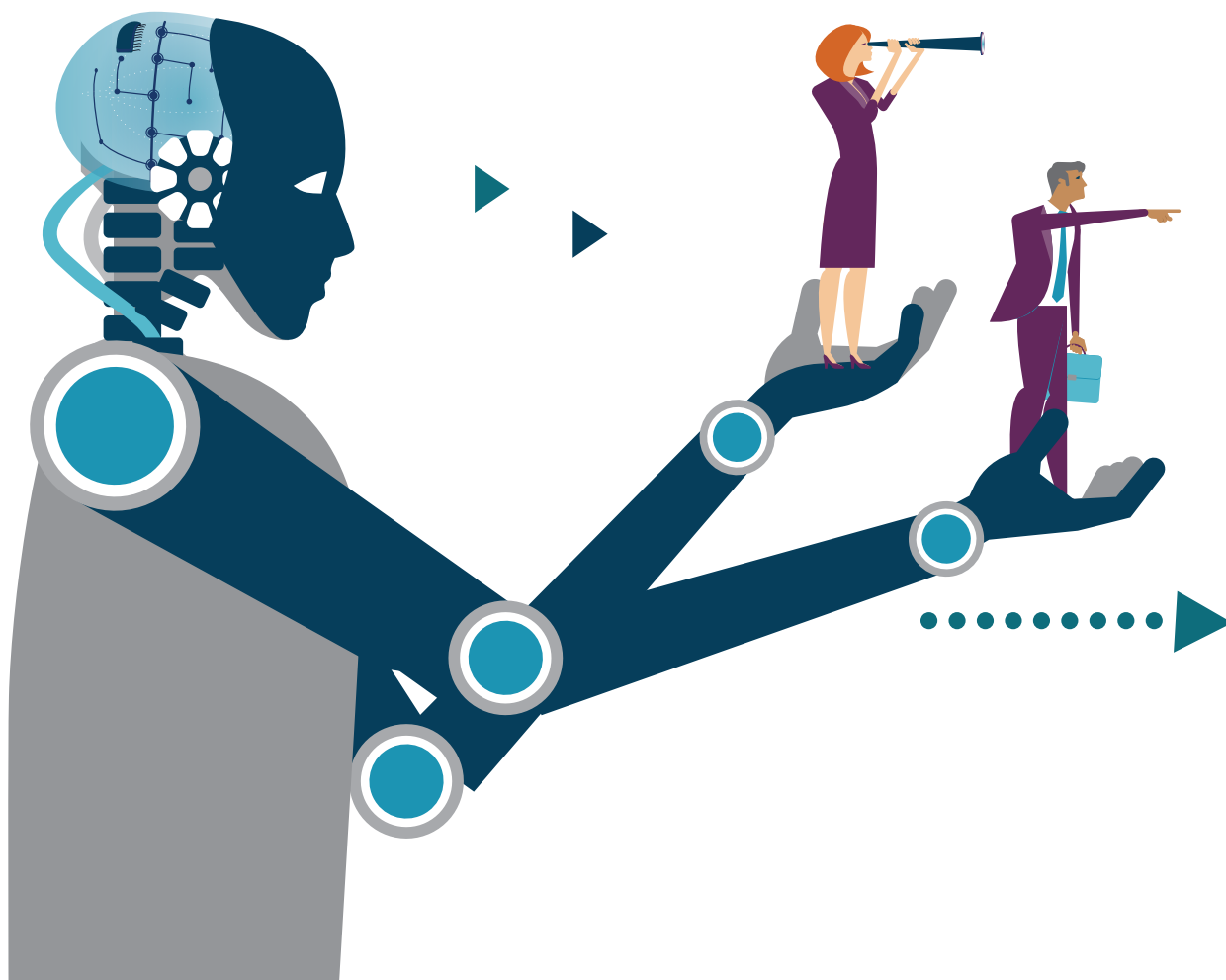
In his book *Humans Need Not Apply*, Jerry Kaplan of Stanford University says that automation is “blind to the color of your collar”. Whether you’re a CEO, a factory worker, a legal assistant or a financial advisor, automation is likely to transform the kind of work you do.

The robots are coming! A recent McKinsey & Company study found that about 30% of tasks in 60% of occupations could be computerised, while Oxford University researchers estimated that almost half of US jobs would be automated within the next two decades.

The key question is: Will automation cause a huge number of jobs to be lost, or will it lead to a change in the nature of jobs?

Today’s technological revolution is very different from what happened in the industrial revolution. The pace of change is exponentially faster, and its scope is much wider.

Despite the proliferation of studies, there is still much debate about the future of jobs. However, we can be sure that the nature of jobs will change, and that various technologies will take over many of the jobs handled by humans today. But first, let’s look at what’s happening now.



Going, going, gone

Robots are writing symphonies, creating paintings that resemble the works of Rembrandt and even fooling daters on Tinder. Their capabilities are expanding at rates we cannot fathom. But reports vary on how many jobs automation will take over.

The landmark Oxford study by Frey and Osborne (2013) estimated that 47% of jobs in the US were “at risk” of being automated within twenty years, especially jobs in transportation, logistics, and office and administrative support, but also occupations in the service industry. However, they looked at whole occupations, not individual job-tasks. This, the OECD (Organisation for Economic Co-operation and Development) argued, led to an overestimation. It found that, across the 21 OECD countries, only 9% of jobs were automatable.

Jobs in finance and accounting, transport and distribution, and in media, marketing and advertising are most likely to be automated in the next decade, the research says. The potential impact would affect 15% of the current workforce in the private sector – amounting to 4 million jobs in the next ten years.

On the other hand, a report from McKinsey Global Institute (2017) estimated that 51% of economic activity could be automated by existing technology. This does not mean that half of all jobs can be automated with current technology, but rather *job tasks*. Machines are great at handling rote, predictable tasks, such as repetitive physical labour, data collection and processing. Any tasks that involve these will be replaced.

According to McKinsey, 25% of a CEO’s daily tasks could be automated by technology currently available – freeing up their time for managing people and thinking creatively. This is true for many jobs. Rather than your entire job being automated, it’s likely that AI (Artificial Intelligence) will just take over parts of your job – thus liberating you to do other, more useful things.

As AI develops and its array of skills grows, more and more people whose jobs revolve around those skills will be replaced

The impact of automation is already being felt globally, from manufacturing jobs in China and insurance-claim workers in Japan to top hedgefund managers in America. This is just the beginning: as AI develops and its array of skills grows, more and more people whose jobs revolve around those skills will be replaced. McKinsey also predicted (in 2013) that AI and robotic banking would displace 110 million full-time workers around the world by 2025. By 2020, AIs could be powering around 85% percent of customer service transactions, rendering them human-free.

The predicted job loss depends largely on the country in question. For example, the US is far more at risk than the UK or Japan. According to PwC, 38% of US jobs are at risk of automation, compared to 30% in the UK and 21% in Japan. According to Ball State University, 87% of all manufacturing jobs lost in the US between 2000 and 2010 were due to robots, not globalisation. The proportion of unemployed US men aged 25-54 has more than doubled in the last 35 years.

It’s also worth noting that the most common job in nearly all US states is truck driver (including delivery workers). What was once a certain career path for many and a way of life for generations is being wiped out at a dramatic rate. A whole cross-section of American society will not only be left jobless, but left helpless in an economy where their skills are no longer needed. It is a harsh reality that’s fast approaching due to machine learning. And it is a reality that faces many careers in the coming years.

All about AI

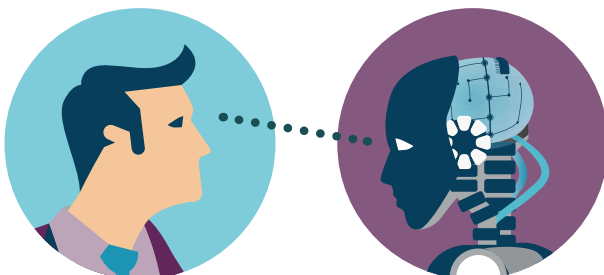
Improvements in computing power have brought about a revolution in AI in the past five years. But what exactly is AI? It’s a field of computer science focused on creating intelligent machines that work and react like humans. Activities that computers with AI are designed for include speech recognition, learning, planning and problem-solving. It encompasses a wide range of technologies that can be applied to a broad spectrum of tasks.

Two terms we often hear related to AI are machine learning and deep learning. *Machine learning* generally involves teaching a machine how to do a particular task, such as recognising a number, by feeding it data and directing it to make predictions from new data. People often have to hand-engineer certain features for the machine to look for, and this can be a complex, time-consuming task.

Deep learning is a type of machine learning that requires less hand-engineering. It often involves artificial neural networks. Briefly, it is a new way of processing large amounts of data, but more importantly the computer's processing capacity improves as it works. The computer learns by itself, without supervision. This has been around for a while but it's only recently that it's become clear how powerful it is. It's what is driving facial and speech recognition, and it's playing an increasing role in our everyday life – from asking Siri (Apple's virtual assistant on iPhones) to set a reminder to when Google search predicts what you are looking for before you finish typing your search words. Soon we may all be sitting in driverless cars. However, we're still only at the start: companies such as Google, Microsoft and Facebook are spending millions on research into deep machine learning and advanced neural networks. Computers will get even smarter.

Positive effects of robots

- Japanese industrial automation company AIST has created PARO, a robotic baby seal, covered with fur, which acts like a real pet. It is being used to help tackle loneliness in nursing homes where pets are not allowed.
- Christian, a 12-year-old boy was diagnosed with Leukaemia, and could no longer attend his Texas elementary school. VGo, a robot, sits in the front row of class for him with a network-enabled video camera that allows Christian to sit at home and see and hear on his laptop what is going on. If he raises his hand, the hand of VGo is also raised. When Christian answers questions, the answers are relayed through VGo's speakers.
- Facial recognition works by analysing the characteristics of a person's face, including the distances between eyes, nose, mouth, etc. These measurements are kept in a database and used to compare with other images so as to find a match.



AI learns to walk

In 2014, Google acquired DeepMind, a company that soon made news when its AI software defeated the world's best player of the Chinese strategy game, Go. DeepMind is currently exploring more elemental things – such as teaching itself to walk, run, jump and climb. It also developed a system to scan one million images from eye-scans and is training itself to spot early signs of degenerative eye conditions – soon it will be able to spot the early warning signs far quicker than any human could.

How long before it learns to do what it needs in order to take your job?

AI has many use cases. Most notably, the first arrest through the use of facial recognition was made in south Wales in 2017. Visual recognition software could prove useful in giving the visually impaired a more effective means of reading and understanding images.¹ Facial recognition can also be used to measure diner satisfaction in restaurants and provide greater insight into the overall dining experience.

Have we been here before?

The new technological revolution has been called the Fourth Industrial Revolution, but there's one key difference with previous periods in history, such as the transition from carriages to cars – and that's the rate of change. According to Thomas Friedman's book *Thank You for Being Late*, in our age of dizzying acceleration and an exponential increase in computing power, technology is changing far quicker than we're able to adapt to it.

Some argue that AI has been destructive – pointing out that Amazon closed down 1,200 Borders stores, for example, or that the 'selfie moment' destroyed Kodak which, at its peak, employed 145,000 people.

¹ http://www.nytimes.com/2013/06/04/science/israeli-start-up-gives-visually-impaired-a-way-to-read.html?pagewanted=all&_r=0

Pessimists are also concerned about the rate of change. The International Data Corporation has predicted that, by 2018, one-third of new robotic deployments will be “smart collaborative robots that operate three times faster than today’s robots and are safe for work around humans”.² It also forecast that, by 2019, 30% or more of the world’s pioneering companies will have hired a Chief Robotics Officer, and, by 2020, salaries in the robotic sector will have increased by at least 60%. At the same time, there will be a massive skills shortage in robotics due to the lack of people skilled enough to fill the jobs available. So, as robots take over more jobs, more jobs in the area of robotics are opened up for humans.

People will have to keep pace with this change if they want to stay employed.

As in previous generations, people will have to keep pace with this change if they want to stay employed. Weavers had to learn how to use looms (and were compensated with higher wages). It’s no different today, with warehouse workers having to learn to manage robotic coworkers.

While there will be much disruption, according to Dr Jing Bing Zhang, an expert on robotics technology, there are also unprecedented opportunities. For example, AI has paved the way for incredible innovations in health, energy and education.

The main difference between today and 200 years ago is that machines then replaced physical labour, whereas *today’s machines are replacing mental labour as well as physical labour, while at the same time creating new types of labour.*

What jobs are at risk?

The World Economic Forum predicted that robotic automation would result in a net loss of more than five million jobs across 15 developed countries by 2020 – and that is a conservative estimate. Around 56% of the total workforce of the developing nations of Cambodia, Indonesia, the Philippines, Thailand and Vietnam are said to be at risk – as they are largely working in the garment manufacturing industry.

According to McKinsey, more than 60 million full-time employee equivalents and more than \$1.9 trillion in wages are associated with automatable activities in Europe’s five largest economies (France, Germany, Italy, Spain and the UK). A recent report by France’s Employment Council determined that in France about 10% of jobs will disappear, 50% will be transformed, and the remaining 40% won’t change.

A report by UK thinktank the Institute for Public Policy Research (IPPR) said that those most at risk from automation were concentrated in low-skill sectors of the economy and were least able to adapt to change.

How work is changing

All work can be divided into four types: routine, non-routine, cognitive and manual. Routine work is the same stuff day in day out, while non-routine work varies. Within these two varieties, there is manual work (mainly involving the body) and cognitive work (mainly involving the brain). The two kinds of jobs with rosy outlooks are those that require so little thought we pay people less to do them, and jobs that require so much thought we pay people well to do them.

It’s routine tasks that will be replaced. Routine does not necessarily mean mundane or low-level, but more exactly codifiable. Tasks that demand flexibility and don’t follow well-understood procedures will be much slower to be replaced. For example, it’s tricky to develop an automatable method of writing a persuasive essay, coming up with a great new hypothesis, or developing an exciting new service that no-one has seen before. We don’t have an instruction manual for doing that.

Some of the most difficult jobs that require flexibility, such as a manicurist, janitor, flight attendant or UPS driver, jobs that require a high level of skill such as engineer and scientist, and, at a lower level, plumber. Those in the middle – lawyer, financial advisor – will be more at risk. “The middle jobs will disappear,” according to MIT professor Tomaso Poggio.

More than a hundred years ago, Oscar Wilde recommended as much automation as possible, saying: “To sweep a slushy crossing for eight hours is a disgusting occupation. To sweep it with mental, moral, or physical dignity seems to me to be impossible. To sweep it with joy would be appalling. Man is made for something better than disturbing dirt. All work of that kind should be done by a machine.”
1891 essay, ‘The Soul of Man Under Socialism’

2 <https://www.idc.com/getdoc.jsp?containerId=prAP42000116>

Some of the jobs that robots won't take

Not all jobs will be taken by the robots as many human skills are incredibly hard to replace. Jobs where social skills such as persuasion, emotional intelligence and cultural awareness are needed will still be in high demand.

Any job that requires empathy will be difficult to automate, as will any job where you're managing or developing people (9% at risk of automation), where decision-making, planning or creativity is required (18% at risk), or where you're interacting with people (20%). Here are some more examples of jobs that will be slow to be replaced:

Childcare: Babies and toddlers need human interaction to develop. Also, parents won't want robots to be closely involved in this vital stage of development.

Chef: Even though robot chefs have already been developed, they can't taste or smell, or get creative with flavour combinations in the same way as humans.

Tour guide: The need for 'real experience' will be more in demand as technological advances take over so many facets of our lives. Research has shown that experiences are far more conducive to personal happiness than possessions.

Journalist: AI can generate sports stories, financial results, etc, but can't get to the heart of a story in the way that good journalism can – capturing emotion and creating a connection through words. Well-written content is more important than ever – which is good news for those in industries like marketing or advertising.

Artist: Good art is the result of an individual's creative force. AI can replicate but not create art. It can respond to commands or follow rules, but cannot give form to the emotional truth that is essential to art.

Dental hygienist: Only 13% of the work can be automated at present, but more importantly, humans will be very slow to let a robot near their teeth!

Some say the last job ever to be taken over by a machine will be a **comedian**. The human brain is incredibly complicated and we don't understand yet what makes people laugh. It will be a long time – if ever – before a machine can understand how to make people laugh in the way that a human can.

Many experts argue that people with **programming skills** will be in the most advantageous position, as robots can't overthrow you if you're the one programming them! In general, those who are highly skilled and highly educated will be far more competitive.

So, you think creative roles are safe?

Even creative roles such as web designer aren't guaranteed a safe future. The Grid is a new service that offers "websites that design themselves". Its artificial intelligence can rapidly build custom solutions for clients. It all feels natural, as if you're interacting with a designer.

Chatbots are even becoming social media managers. Kit is a chatbot that helps retailers run social media campaigns. It posts updates, and runs ads and email campaigns. Persado is a marketing tool that can help brands use the right words to inspire action. It ensures that ads, messages, etc are emotionally engaging.

Emily Howell has released its first album 'Darkness into Light' – the first album created entirely by a computer. Maybe creativity is not impossible for robots.

Why Amelia could replace 250m people

Amelia is being beta-tested in companies right now. Developed by IPsoft over the past 16 years, she's learned how to perform the work of call-centre employees. She can learn in seconds what takes us months, and she can do it in 20 languages. Because she's able to learn, she's able to do more over time. In one company she successfully handled 1 of every 10 calls in the first week and by the end of the second month could resolve 6 of every 10 calls. It's been estimated that she could put 250 million people out of a job, worldwide.

Viv is an AI coming soon from the creators of Siri who'll be our own personal assistant. She'll perform tasks online for us, and even function as a Facebook News Feed by suggesting we consume the media she'll know we'll like best. In having all this done for us, we'll see far fewer ads. That means that the advertising industry that the Internet is built upon stands to be hugely disrupted.



The skills robots can't replicate

Let's look more closely, however, at the skills people will need in the world of AI. So far, we have been focusing too much on the technical skills alone. That's where the high-paying jobs are, but Geoff Colvin, author of *Talent is Overrated: What Really Separates World Class Performers from Everybody Else*, argues that, if we develop such skills to the detriment of human skills, we're in trouble. Personal, thinking and digital skills will be vital. We're going to have to be agile and learn to change within jobs and to adapt between different jobs.

Personal skills: Personal skills are critical to productive and efficient organisations. They include self-motivation, motivating others, adaptability to new kinds of work, communication and collaboration. These are the skills that earn you more, since jobs that require them are less routine, and so least susceptible to automation. There is a skills gap here; those fresh out of college are lacking such experiential skills, which can only be garnered by having worked on the job. Technological dependency and virtual communication are also impeding the development of these skills.

Thinking skills: People will need more and more to solve unstructured problems, work with new information, and apply reason and theoretical knowledge to work scenarios. But such skills are also in short supply. In a LinkedIn survey, 58% of hiring managers said a lack of these skills among employees was limiting company productivity, while 89% of executives in a *Wall Street Journal* survey were having a 'very' or 'somewhat' difficult time finding candidates with these skills. We have highly educated graduates, but how many know how to apply their theoretical knowledge to everyday work scenarios?

Digital skills: These are the skills required to work with new technology, to learn new skills using software, to determine the trustworthiness of online information, to quickly adapt to new tech, etc. A 2014 Deloitte survey found that specific tech skills have an ever-shrinking shelf-life, becoming obsolete in as little as 2.5 years without additional training.

The major obstacles to AI

One major obstacle to the advance of artificial intelligence relates to what humans will be comfortable with. Take for example, the airline pilot. Computers could easily automate this position. Computers don't tire, don't get bored, don't get complacent or don't panic during, say, a seven-hour flight, but (whatever Michael O'Leary thinks) would we ever fully accept a robot pilot? AI can do a lot of jobs, but just because a job can be automated doesn't mean it will be. This will be the main impediment to total robotic domination. People want a salesperson they can relate to and a financial advisor they can trust.

Cost is also a factor that may impede AI. For example, while you may be able to replace a human cook with AI, could they deliver the same culinary experience that a Michelin Star chef does? Would you feel like you got value for money? On the other hand, an AI cook might well make sense in a 'conveyer-belt', fast-food scenario.

It's important to keep in mind that people have value, and always will.

AI changes jobs – and also creates new ones

A report by Forrester Research indicates that close to 15 million new jobs will be created in the US over the next decade as a direct result of automation and AI, equivalent to 10% of the workforce.

Retail alone employs 15% of the British workforce, putting 2.3 million jobs at risk in that area. Amazon uses little orange robots (Kiva) to manage its warehouses. This robot sifts through stock, picks a product, packs and ships it in 15 minutes. It takes a human 60-75 minutes to do the same work. Since 2013, Amazon has increased the number of these warehouse robots from 1,400 to 45,000. However, despite this, its rate of hire hasn't changed at all. This is because the low labour cost keeps products cheap, thus increasing demand and thereby raising the need for more workers in warehouse management.

Over the course of the 20th century and into today, the United States has moved from having 40% of the workforce in agriculture to less than 2%. But this has not led to huge unemployment. New work was found for people to do. In the past, strong muscles and good endurance were important, but now we have substituted mechanical horsepower for human physical exertion. While cars made horse and jockey workers, blacksmiths and carriage drivers redundant, they indirectly created many other jobs, not just in car manufacturing but also in construction of roads, the motel and hotel industry, and restaurants on highways.

Similarly, ATMs didn't displace bank tellers. They've actually increased in number by 2% every year since 2000. Their function has been transformed; they require new skills, such as social skills, problem-solving, and the ability to offer bespoke advice and expert insight. ATMs increased productivity, lowered overhead costs and allowed banks to open new branches and hire more people.

Think about how the Excel spreadsheet did not displace accountants, but instead created more jobs for them. It used to take days for an accountant to tinker with a spreadsheet and come back to a client with predictions on business strategy. When the Excel spreadsheet came into play, this took minutes, so accountants were less expensive and businesses could afford to use them more. This led to more not less jobs.

In the past technological change has brought with it increased productivity - which has given rise to more wealth and more diverse goods and services that people want to buy, what has always happened is that productivity has given rise to more wealth and more consumption, to more diverse goods and services that people want to buy.

Fancy a microchip implanted in your body?

Swedish startup company Epicenter is offering to implant its employees with microchips the size of grains of rice that function as swipe cards: to open doors, operate printers, or buy coffee with a wave of the hand. The implants use the same technology as contactless credit cards or mobile payments. All these small changes may lead us to a place we cannot return from. Wearables may be useful, but they may be hacked. How would you feel about having something in your body that might be controlled by a cyberhacker?

Working with robots

It seems, then, that robots aren't going to steal our jobs, but instead are going to take over individual tasks. That means we're going to have to get used to working with them more closely. We will have to interact with them to get the overall project done.

There are robots being designed that shadow people in highly instinctual jobs (i.e. based on a combination of knowledge and years of experience) such as head nurse, and detect patterns in how they make decisions. These robots could be used to train rookies.

Cobots, the name given to collaborative machines, are designed to work alongside human workers. They are still new, making up less than 5% of global robot sales, but are getting cheaper (averaging around \$24,000 each) thanks to cheaper sensors and increased computer power. They're also easier to train and deploy than big industrial robots. They may well revolutionise production, particularly for smaller companies (which account for 70% of global manufacturing).

The more likely future will be humans working side by side with robots, as opposed to complete displacement of all jobs by robots. BMW have already discovered the benefits of robot-human teams, which proved 85% more productive than either alone.

The future organisation will resemble more of a hub or ecosystem consisting of various working arrangements and service providers - from freelancers, to full-time staff, to AI systems. It's up to the employer to optimise the working relationships of these service providers, be they robots or remote teams.

Robot revolution on the factory floor

LocusBots can 'talk' to each other in warehouses. Their navigational system makes it easier for them to work effectively with one another and with humans in a crowded warehouse. They move through warehouses, stand near a shelf so that a person can load an item, and then take it to the packers who put the items into boxes.

Office manager Betty monitors staff and keeps tabs on environmental conditions. If the fire door is open, Betty will notice and send an alert. If anyone is working late, she'll alert security staff that they're still in the office. She is powered by AI and thus learns as she goes. For robots like Betty to be able to work alongside humans, they need to be able to operate autonomously without expert help, to teach themselves, to adapt to changing environments and to improve their performance.

We're only at the beginning, however. Robots will also lead and direct robots in the future. According to Jason Kingdon, chairman of robotic automation company Blue Prism, robots will organise work for robots, find repetitive rule-based tasks, and remove unnecessary steps to improve efficiency and make the tasks less boring for humans. If it is found that a task requires a decision, the task will be passed to a human. 'Thought' will be left to the humans and 'doing' to the robots.

Collaborative robots, already working on factory floors, take care of the heavy, repetitive hazardous work. Surgical robots are performing low-risk operations. Robot home health aids help cook meals, assist people out of bed and perform other routine tasks.



Dynamic collaboration

The Dynamic Group in Ramsey, Minnesota, makes moulds for mass production (e.g. Sellotape dispensers and bullets). Four people used to work at one mechanical press, but now it's just one person and a robot. Each robot costs \$35,000, with only one technician needed to maintain them. What was once a laborious, time-sensitive task takes just 35 seconds, with little waste, and carried out at a rapid, steady pace. But it's not the speed that's revolutionary so much as the collaboration.

Robots, too, have their limits

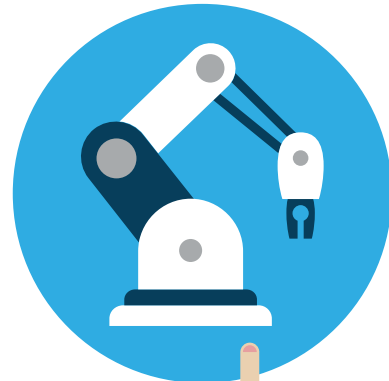
With so much focus on what robots can and will do, we mustn't forget our own, human virtues. As noted above, the main challenge to total robot domination is our appetite for human interaction. People still have irreplaceable value, says David Hyman, historian at Cornell University. Small and medium-sized businesses may struggle the most when it comes to incorporating collaborative robots, or cobots, because that is where owners, workers and robot relationships are the most intimate. And robots, after all, cannot yet compete for tasks that demand genuine creativity, maintaining highly complex or empathetic relationships with other people, or manage extreme unpredictability.

Despite that, we all need to get ready for the changes being brought about by automation – whether we're in government, employ others, or are employees.

Why we can get the future so wrong

When it comes to history, we think in straight lines. When we imagine the progress of the next 50 years, we look back to the progress of the previous 50 as an indicator of what will likely happen. To think about the future correctly, however, we need to think exponentially rather than in a linear way.

Our own experience makes us biased about the future. We base most of our ideas about the world on our personal experience, and that experience has ingrained what we believe to be undeniable truths. If you hear that people may live to be 150 and eventually not die at all, you may instinctually respond, 'No – if there's one thing I know from history, it's that everybody dies'. And yes, no-one in the past has not died. But nor did anyone fly in an airplane before airplanes were invented.



What Should Governments Do?



Jobs are gradually but rapidly being computerised, but governments are not addressing the issue. MIT professor Erik Brynjolfsson, co-author of *The Second Machine Age*, argues that many business leaders and politicians have become complacent. Indeed, Trump's Treasury Secretary said earlier this year that the threat of robots taking human jobs was "not even on our radar screen".

The challenge we face today is not a world without work but a world with rapidly changing work. We need to prepare displaced workers for new jobs. Labour will increasingly be needed in education, healthcare, infrastructure, environmental cleanup, entrepreneurship, scientific discovery and many other areas. As David Bowie said, "tomorrow belongs to those who can hear it coming".

What, then, are the key steps that governments should take to protect employees, employers and society as a whole?

Government policy

It is important that governments evaluate both the benefits and drawbacks of technological advancement for the future of jobs, and that proper policies be put in place.

Support entrepreneurship in a more flexible economy

People will need greater freedom to innovate. We need to encourage entrepreneurship and job growth in young companies, and facilitate worker movement from one job or city to another. In the US, for example, there are far too many restrictions on some kinds of work, which impedes progress. Economist Morris Kleiner has said that 5% of American workers needed a licence in the 50s whereas now the figure is 30%. In Tennessee, a hair shampooer needs 70 days of training and to pass two exams, while an emergency medical technician needs just 33 days of training. Licensing can contribute to reduced labour-force participation, higher long-term unemployment and higher part-time employment.

The base of economic growth in any area lies in innovation. Governments should support innovation by implementing low-tax regulations and increasing access to capital. With this type of support, SMEs can thrive more easily and create more jobs.

Eliminate unhelpful regulation

Employment regulation is important, especially to protect workers from exploitation. However, changes in the job market are happening much more rapidly than any regulation can keep up with. This means we should at least look at how we can either speed up regulation or make sure that the regulation is beneficial. Uber has had to fight taxi regulators in city after city despite customers valuing the convenience. Tesla sells its electric cars at fixed prices but laws in six states, which account for 18% of the US new car market, prevent automakers from acting as retailers. Such regulations protect special interests, not consumers, and undermine innovation.

Redefine employment

Workers are defined as employees or contractors, which can affect whether they receive overtime pay and are eligible for compensation for workplace injuries. With technological disruption, the number of contractors and freelancers has increased dramatically. This underlines the need to rethink the way workers are classified. Economist Alan Krueger and former US Deputy Secretary of Labour Seth Harris proposed the term 'independent workers', who enjoy the same rights as employees, whether online or offline, and a more flexible approach. The growth of the freelance market and the fact that future workers could be jobless but not workless means we need to look at how we define what having a job means.

Tax the machines?

Bill Gates has suggested that we tax robot productivity similarly to how we tax our income. If a human performs €50,000 worth of work, they get taxed on that through their income. Robots are not taxed, even though they might produce much more in net profit. The idea would be to help to fund retraining in areas in which humans are better suited, such as care and education, where there is an acute shortage. Freeing up labour for work in those areas could help our healthcare system, lead to smaller class sizes, and ensure better care for people with special needs. The EU considered a proposal to tax robot owners so as to pay for training workers who lose their jobs, but this was rejected earlier this year on the grounds that it would stifle innovation and competitiveness.

Universal basic income

When it comes to automation, it's not just job losses that we should be concerned about, but also depressed wages and greater income inequality. Universal Basic Income (UBI) is the policy of giving people unconditional cash payments regardless of their work status, income or anything else.

Certain critics have argued that a UBI system might cripple the economy as the reward for work would be overlooked. A guaranteed minimum income mustn't disincentivise people from working. It's widely held that people don't function well without the structure of work; that, when people lose their job, it's not just that they're losing income, they're also losing their identity.

However, a project in Finland indicates that UBI is not in fact a disincentive to work or educate yourself. The country has started paying its unemployed citizens an unconditional monthly sum, in a social experiment that is being watched around the world. Under the two-year, nationwide pilot scheme, which began on 1 January 2017, 2,000 unemployed Finns aged 25 to 58 receive a guaranteed sum of €560 a month. The income replaces their social benefits and is paid even if they find work. Early findings indicate that the guarantee of a consistent monthly income means more people return to education or set up their own business.

How education and training can prepare us

To what extent does our educational system need to prepare us for the changes in our working world? Textbook-oriented education does not prepare future employees for the practical and skill-based jobs of the future. The solution may be to increase the amount of practical learning in schools.

Invest in STEM

Education needs to be linked to the economy and what employers are looking for. Developed nations need to invest more in science, technology, engineering and mathematics (STEM) education. Back in 2011, former President Barack Obama called for the US to add 100,000 STEM teachers to the workforce. In the past five years, partly thanks to the Clinton Global Initiative, more than 40,000 new STEM teachers have been trained and it looks as if the target can be reached. In Ireland, for example, the number of teachers with a biology degree outnumber those with a physics degree by 3:1. There is too much of an imbalance with regard to science subjects. We need to ensure that our pupils have a wider educational grounding across the sciences.

STEM education is about more than, say, creating a nation of coders. It's about inspiring an interest in STEM subjects in general so that, no matter what skills will be needed in 10-20 years' time, that generation will want and be able to adapt.

Highlight the need for humanities skills

It may come as a surprise, but the rise of AI and increasingly automated technologies is likely to increase demand for humanities graduates. STEM education is crucial, but so are the humanities subjects, because they teach critical, creative, philosophical, ethics-based skills that no computer can learn by itself.

Interestingly, technology has always been driven by people with strong backgrounds in the humanities. AI requires human input to direct all this development and training, and specifically it needs the thinking and skills that the humanities educate us in.

Governments and educational institutions therefore need to highlight the value of humanities education, and indeed of interdisciplinary education that blends the critical thinking of the humanities with the technical skills of STEM. This also needs to be understood by parents who often cannot see what job will be available to their child after a humanities degree.

Prepare young people for life beyond the classroom

Education systems today need to prepare young people to deal with more rapid change than ever before, seek jobs that have not yet been created, use technologies that have not yet been invented, and solve problems that cannot be foreseen. It is essential to prepare them for life beyond the classroom.

We can promote stronger entrepreneurial skills among young people by embedding key aspects such as critical thinking, intelligent risk-taking and collaboration across the curriculum, from primary to higher education.

In Ireland, the lifelong learning rate is just over 7%, which is less than half the benchmark set by the EU under its Education and Training Framework. It aims to have 15% of adults aged 25-64 engaging in lifelong learning by 2020. While under-performance in Ireland cannot be totally attributed to lack of resources, it raises serious concerns. Governments may need to look at how they incentivise lifelong learning. Ireland has fallen behind in the EU league table for education spending, yet Ireland has the EU's fastest-growing population.

Promote pre-emptive education

Some jobs will likely be more disrupted than others. It may be wise for people in high-risk jobs to leave before getting laid off so that they can educate themselves for a new job that is not at risk. Universal basic income (see above), or something similar, could tide them through the transition.

Value highly skilled, low-paid jobs

It's strange that the jobs we do very well are jobs we do not seem to care much for, such as social-care jobs that economists define as low-skilled. Yet it will be easier to automate an accountant's job than a social-care job – so who is more skilled? Care jobs may not need a formal qualification, but they need innate qualities that many do not have. While an accountant or a lawyer needs a degree to do their skilled jobs, you could argue that the skills in care jobs – empathy, influencing and patience are much harder skills to master.

Quality

According to the US Department of Labor, of the 30 fastest-growing jobs over the next ten years, more than half are some variety of nurse, therapist, healthcare worker or carer. *Financial Times* employment correspondent Sarah O'Connor stresses that, by 2030, there will be 34 'super-aged' countries, where one person in five is over 65, and that, although robots can help workers to look after older people, they cannot replace them, nor should we want them to.

How do we ensure that such jobs, which will not be replaced, are paid better? We can at least start by valuing them more.

Education needs transformation to prepare for the future

Our education systems are failing our children by not preparing them for the workplace of the future. That is the key finding of a report by the World Economic Forum (WEF), *Realizing Human Potential in the Fourth Industrial Revolution*. It proposes a series of practical measures to align education and training with future job requirements.

1. Teaching through children's love of learning:

Reinventing education starts in early childhood, where the focus should be on literacy and reading. Often children's natural curiosity is suppressed by rote learning in school.

Teaching programmes have been developed that are designed to work with children, not against them. For example, Quest to Learn is a public school for kids aged 6-12 in New York City with a hands-on, inquiry driven, game-based approach to teaching and learning. Students learn to collaborate, communicate, and solve real-world problems in an enjoyable and accepting learning environment. The preliminary results of a study indicate that Quest to Learn 8th-10th graders show twice the rate of learning growth as college students in critical thinking, problem-solving, analytical skills, and written communication. The children learn with the enjoyment and determination of gamers.

2. Keeping the curriculum dynamic: Curricula need to be dynamic and responsive to evolving business needs. In Finland, one of the world's top-performing nations in education, the curriculum is updated regularly to provide an overall framework, with room for local adaptation by the schools themselves.

3. Open-sourcing education: The report proposes training innovations that open up alternative learning routes and experimentation with new techniques. For example, the New York City Department of Education has created 'Lab' schools and tasked them with reinventing teaching and learning. In Ghana, the US and France, schools are pioneering short courses in coding based on peer-to-peer teaching, project-based learning and gamification.

4. Taking teachers out of the ivory tower: Initiatives such as teacher 'externships' in businesses, workplace mentoring and involving the private sector in teacher training are proposed to bring teachers and the 'outside world' of business and industry closer together.

5. Giving students a sense of the real world of work – for example, through internships and ongoing career coaching.

6. Addressing the vocational stigma: Vocational and technical education is critical to the world economy. For example, the WEF report says, "Germany's vocational training system sees apprentices divide their days between classroom instruction and on-the-job training at a company. Apprentices are paid and their training typically extends to between two and three years. Not only does this approach create an excellent talent pool, it also smooths the – often difficult – transition from education to the world of work".

7. Digital fluency: Digital skills will be critical in addressing the growing digital skills crisis. One successful example comes from India, where the National Association of Software and Services Companies (NASSCOM) has partnered with NGOs and the Indian government to build National Digital Literacy Centres across the country to enable digital literacy.

8. Lifelong learning: In Singapore, people receive an annual training allowance that they can spend on a range of training courses that develop future-oriented skills.

Why we need migrant labour

In a world that is growing increasingly hostile to immigration, it's important for governments not to lose sight of the benefits of migrant labour. The greying population and ever-increasing demand for talent will result in a skills and labour gap – particularly within healthcare – where demand for nurses, doctors and carers will be acute. Governments need to tackle this by looking to import workers. Retraining existing workers will only get us so far. Employers also need to work harder to attract candidates from abroad.

The UK will suffer in the next few years as many EU citizens employed there move out and fewer migrate to the country. A survey has shown that 56% of EU employees are already considering leaving the UK. In the NHS, the proportion jumps to 84%. The UK is likely to face a serious skills shortage in the coming years.

With political pressure around immigration in many parts of the world, it is important for people to understand that it is not immigrants that will be taking the jobs, it will be robots and machines.

In brief

The challenge we face is not a 'world without work' but one in which work is rapidly changing. We need to prepare displaced workers for new jobs. It is essential that governments urgently evaluate both the benefits and drawbacks of technological advancement for the future of jobs, and put proper policies in place.

We need to prepare displaced workers for new jobs.

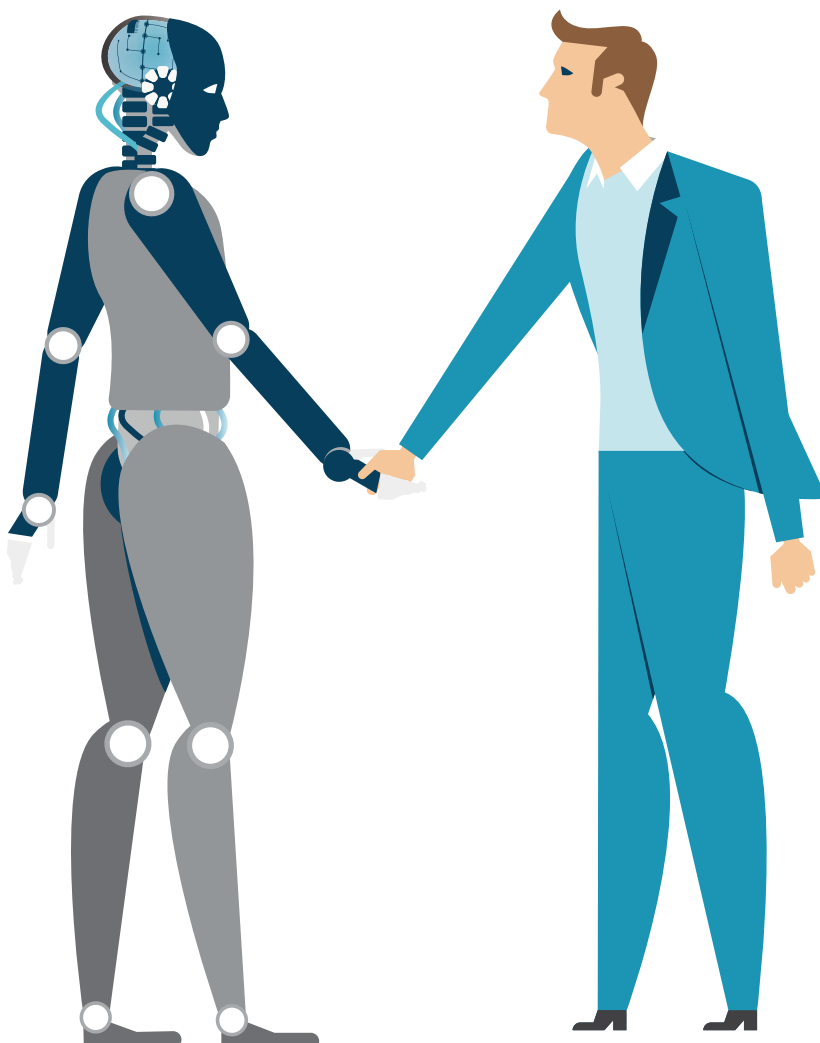
Governments need to support entrepreneurship and job growth in a more flexible economy, facilitate worker movement from one job or city to another, support innovation by implementing low tax, pare back regulations and increase access to capital, and eliminate unhelpful regulation. With the growth of the freelance market and given that future workers could be jobless but not workless, we also need to look at how we define what having a job means.

Since even workers who retain their jobs may end up with lower wages, governments might consider creating a system in which workers will partly own the machines that will be used in the workplace.

Automation means not just job losses, but also depressed wages and greater income inequality. One proposal to tackle this is the concept of universal basic income, which is being piloted – so far quite successfully – in Finland.

When it comes to education, developed nations need to invest more in science, technology, engineering, and mathematics (STEM). But governments and educational institutions also need to highlight the value of humanities education, and indeed of interdisciplinary education that blends the critical thinking of the humanities with the technical skills of STEM.

Finally, education systems need to prepare young people to deal with rapid change, seek not yet created jobs, use not yet invented technologies, and solve not yet foreseen problems. We need to develop stronger entrepreneurial skills among young people. Governments must also look at how it can incentivise lifelong learning.



What Should Employers Do?



It may be in a company's interest to remove as many employees as it can in favour of machines. Cost is always a key factor. Therefore, the future automation of jobs will probably affect employees more, but many employers will be affected by the extinction of businesses that the advances in technology will lead to. If they want to succeed, they need to prepare for the inevitable changes.

The bottom line

Employers' main focus has to be the bottom line. The number one cost in business is usually staff costs. The CEO of Momentum Machines, which has created a robot that can make burgers, has said, rather brutally: "Our goal is not to make employees more efficient, it is to completely obviate them". China has an increasing number of 'blackout factories' where there is no need for lighting as no people work there. With more robots, machines and AI, employers would be foolish not to be looking at ways to cut their workforce where appropriate.

Shift from labour to skill-based jobs

In general, however, AI doesn't mean the total removal of jobs but more a change in their nature, so that they become more skill-based. Getting more skilled workers ensures the survival of businesses in the future. All in all, employers will have to start adapting to a working world in which productivity is driven less by employees and more by robotisation. In many cases, robots are not replacing jobs but working alongside employees. The employer thus needs to focus more on understanding their role in the company, making decisions and asking better questions while the robot or machine is doing the 'heavy lifting'. This means that fewer doers and more thinkers will be needed.

Diversity needs to be the norm

Numerous studies have highlighted the benefits of a diverse workforce; but in a globalised world hungry for great talent, this has never been more critical. With more and more difficulty finding skills for specialist roles, we need to develop diverse workplaces and, to do so, ensure that we eliminate both conscious and unconscious bias in selected employees.

For example, the status of women in Japan has contributed to its stagnation. Japanese women are highly educated and girls score best in standardised tests, but Japan is hemorrhaging its female workforce. After women have their first child, over 70% of them stop working for at least a decade and many never return to work. At executive level management, only 1% are female.

Reinvent the HR/people function

The term Human Resources has fallen out of fashion among millennials and in Silicon Valley. Many HR people are now using terms such as People Operations, but it's not just a change of name that is needed. The HR function needs to be more strategic and have a seat at the C-suite table. Companies will survive by employing the best people with the best ideas. Often companies talk the talk on this topic without walking the walk. To truly ensure that employers both hire the best and keep their skills up to date, senior management need to be judged according to their success in doing so. Laslo Boch, the former HR head at Google, stresses that hiring is essentially the most critical function of an organisation. If you do this better than anyone else, many other problems disappear. In a world where one idea can transform your business, it is critical to identify those employees who can make the difference to your organisation.

How companies can help with training

In their 2013 study, 'The Future of Employment: How Susceptible Are Jobs to Computerisation?', Michael Osborne and Carl Frey suggested that 702 professions risk extinction due to automation. They also predicted that occupations in transport and logistics, sales and services, and office support would be most vulnerable. This should prompt employers to start organising worker training to prepare for the change. Such training might not necessarily be about changing their line of work altogether, but rather preparing employees for positions of control and help them to become more tech-savvy.

However, according to a 2016 report by Degreed, companies are failing to help their employees to develop their careers. That's why many workers self train. Degreed, a startup that tracks across-the-board learning, found that two-thirds of HR professionals in the US admitted that their workers were not turning to them for learning. Instead, they were learning through networking, blogs, books, apps, online courses, podcasts, etc, as opposed to mentoring, company e-learning programmes or company-sponsored conferences.

If companies want to keep their talent, and keep them engaged, they will have to offer training. Coursera for Business offers companies the opportunity to tap into the demand for online courses, paying for employee use. BNY Mellon and L'Oréal have signed up, and BNY asks employees to take classes as part of their onboarding.

Quick learning for the smartphone generation

A recent approach is to offer short digital lessons to get over the challenge of attention deficit. In the smartphone age, people are more distracted than ever. Researchers surveyed more than 2,000 people and found that the average human attention span has fallen from 12 seconds in 2000, or around the time the mobile revolution began, to eight seconds (compared to nine seconds for goldfish!).

This has led to the rise of microlearning apps and websites such as Duolingo, Grovo, Udemy and LinkedIn all offer microlearning formats. These can be used to learn both hard and soft skills (e.g. managing conflict) or about a new type of software. Microlearning works well because it ensures spaced repetition, which is far more effective than cramming.

Uber makes Duolingo available to its drivers in Colombia, Brazil and Mexico so they can brush up on their English language skills and attract more fares. When they improve their proficiency, their cars are listed whenever English-speaking travellers seek a driver who speaks English.

Pernod Ricard, the wines and spirits company, offers 300 courses to its employees each year; 20% of them are delivered through microlearning formats. But, since microlearning has its limits, the company still offers instructor-led courses and online courses.

Governments and companies working together

How can we promote continuous education? First, we need to acknowledge that companies and governments must work together to make it happen. If government unemployment centres can become education centres, with an online platform like Coursera, then private companies could contribute the content, for free or for a fee. This combines the best of both worlds: the distribution capabilities of a government, and the real-world experience of private companies that will need to hire the people down the line.

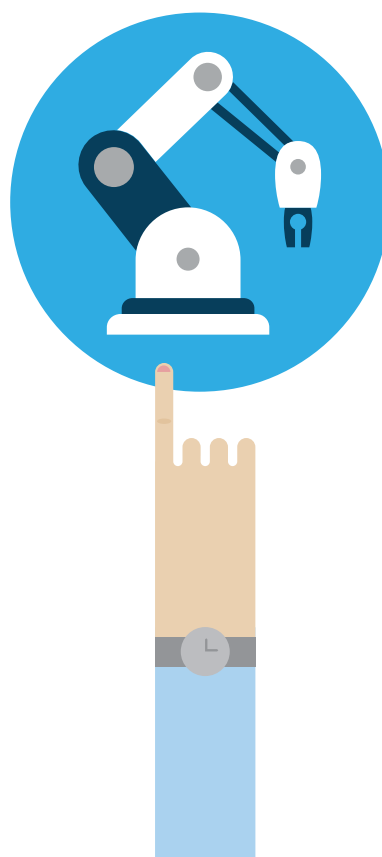
There may be an interesting side-effect: as education becomes shorter and more accessible, people will be able to switch careers faster and easier, leading to more liquidity in job markets, as those needing a job will have more options, and those looking to hire won't have to wait for someone with the right education. The supply of and demand for jobs will be more balanced, meaning lower welfare costs and more productivity, consumption and competitiveness.

Some companies are getting ready for the skills shortage coming down the tracks. For example, General Electric has committed \$50m to Boston public schools to help improve STEM education, while Converse and HubSpot are training future employees before they graduate from college.

HubSpot partnered with the Center for Marketing Technology to help develop a curriculum for students based on an actual training programme that HubSpot offers professional marketers. Such training is invaluable. HubSpot execs come into the classrooms and help the students create actual campaigns for the company's clients. Students get an understanding of what working on a project might look like, how to change tactics based on customer preferences, and how to manage client expectations.

HubSpot execs come into the classrooms and help the students create actual campaigns for the company's clients.

Companies can also offer internships or what have been called entry-level jobs. Employees can then hit the ground running when they start their new job. According to the Bureau of Labor Statistics, the US unemployment rate for 20 to 24-year-olds is nearly twice that of 25 to 34-year-olds. Young people lack the skills that employers seek in their entry-level employees. However, many companies, such as Apple and Converse, have got involved with school career services and sought out high performers. They want to help students gain experience, but it's also in their best interest to shape and train students who may turn out to be future employees.



Managing staff as well as money

Financial capital is abundant and carefully managed; human capital is scarce and rarely carefully managed. Why? In part, it's because we value good management of financial capital and, more importantly, we measure and reward it. As the adage goes, you can't manage what you don't measure. To measure human capital is much harder as there are so many more variables.

Most companies have not kept pace with the accelerating change, and productivity has suffered. Only 12% of the Fortune 500 companies from 1955 are still in business. Last year alone, 26% fell off the list. Companies have no choice but to take action if they are to stay competitive. More than ever they need the best talent, to spend time on their business and not just in the business, to work on career strategies, talent mobility, organisation ecosystems, leadership, diversity technology, employee experiences, and so on.

It's not all about productivity. We also need to ensure as far as possible that people enjoy their work. As Brad Pitt says in *Fight Club*, we're "working jobs we hate so we can buy shit we don't need". Many people are working in jobs they neither enjoy nor feel engaged in.

People management will be critical. Recognising and rewarding good management of time, talent and energy will be more crucial than ever. When Reid Hoffman founded LinkedIn, he promised that the company would help advance the careers of talented employees who signed on for two to four years and made an important contribution, either offering them another tour of duty at LinkedIn or supporting their efforts if they moved on. This tour of duty approach helped attract and retain entrepreneurial talent.

Consultancy companies like Bain have developed metrics such as the *productive power index*. For human capital, we need to start thinking about the opportunity cost of a lost hour. For example, Woodside, an Australian oil and gas company, took a hard look at meetings, and discovered that they were taking up between 25% and 50% of staff time.

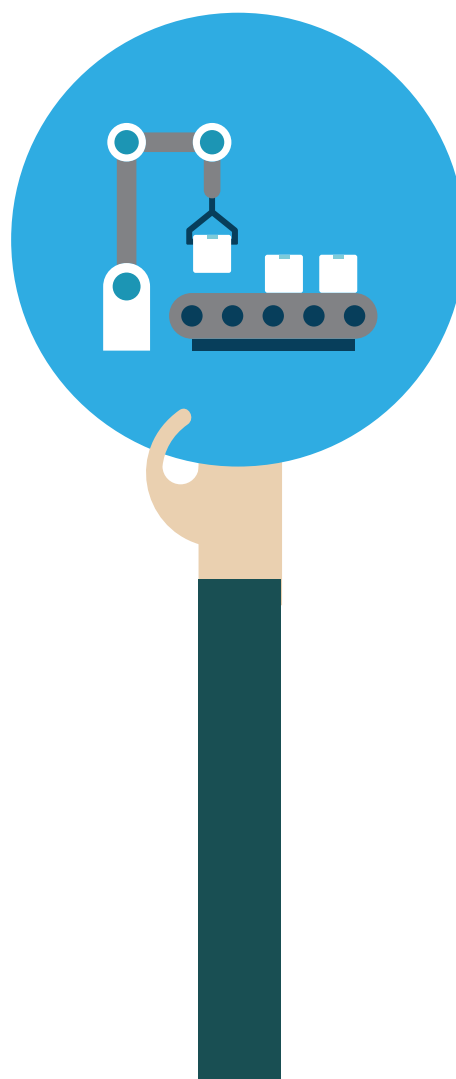
While the growth in technology may cause many people to lose their jobs, some types of jobs will not easily be automated. Employers should focus on such jobs and figure out a way to maximise their value in the workplace.

In brief

Employers will, of course, seek to cut their workforce to cut costs. But, in many cases, robots will not replace jobs but work alongside employees. The employer thus needs to focus more on understanding their role in the company. The question is not so much 'which jobs are going to be replaced?' but 'how does work need to be redefined?' An organisation will be an ecosystem of a wide range of work providers, including both AI and human.

Employers also need to think about organising employee training so as to prepare for the changes; for example, to prepare them for positions of control and help them to become more tech-savvy.

Employees now spend more time working than any other activity, including sleeping and spending time with loved ones and friends. This is somewhat scary; what employers need to take from this is the importance of hiring, engaging and retaining the best people in a world that has never moved so fast.



What Should Employees Do?

The future of jobs is still uncertain. Nevertheless, we can be sure that the nature of jobs will not remain the same and that some of the jobs handled by humans today will be automated. According to RoboticsOnline, more than 250,000 robots are working in the US today. How can we learn from past developments? What steps should employees take to prepare for the inevitable future?



Diversifying skills and staying adaptable

Julia Lindsay of the iOpener Institute in the UK has said, “the workforce is likely to shift towards part-time, freelance work”. According to Paul Mason, director of Innovate UK, employees will need to be more adaptable; as automation and technology change the working situation, jobs will be more fluid and multifaceted, so employees will also have to become more flexible and look to play different roles at the same time. The world of work will be one of those projects. Our roles will be more fluid and ever-changing as opposed to a job for life.

According to Forbes, 50% of the workforce in America will be freelancers by 2020. In the past, economic growth would allow employees to focus on a particular field of work for a long time and then retire. However, nowadays employees need to diversify, mainly because having a wider range of skills attracts more opportunities. Such diversification of skills will protect workers from the effects of technological advancement. As Dr Carl Frey predicted, while robotisation will lead to the erosion of jobs as we know them, the process will also lead to the creation of other kinds of jobs, demanding new skills.

Developing new skills and retraining

“Workers of the future will need to be highly adaptable and juggle three or more different roles at a time,” says Anand Chopra-McGowan, head of enterprise new markets for General Assembly. Continuing education will play a key role in ensuring that people develop new skills.

While employees will need to acquire new skills, employers will have to understand the shift from a role-based to a more diverse system, in which people are no longer expected to be suited to a single role. In the past, occupations defined individuals; more and more, individuals define occupations.

The more roles that individuals can fill, the more opportunities are open to them. In a society in which the Internet of Everything – the intelligent connection of people, process, data and things – has reduced the need for inspectors, engineers and facility managers, people need to be flexible and to re-educate themselves when necessary.

Education development is unlikely to go in the same direction and at the same speed as the market, so employees will probably have to bear most of the responsibility for educating themselves.

The shift to skill-based jobs

As noted before, changes will not bring about the total removal of jobs but will instead change their nature. Jobs will be increasingly skill- rather than labour-based. For example, the managers of distribution centres report that they can’t hire enough workers with the necessary skills to deal with the new technology.

While new technologies have eliminated some jobs (e.g. clerks and warehouse labourers), they have also created new jobs by creating new capabilities. “However, these new jobs require specialised skills among both the managers and technicians, who typically have college degrees, as well as among the less-educated operational occupations. Workers who have these skills, often learned on the job, are actually in short supply. Moreover, industry experts see the need for skilled workers increasing in the short run and persisting for at least another decade.”



Employees need to step back and start to look at what is hard to automate. A two-minute unscripted conversation is much harder to automate than learning PhD-level calculus. As employees, we still are in control of the most powerful computer, the human brain.

Tim Hanson, a researcher at Berkeley, calls the human brain “one of the most information-dense, structured, and self-structuring matters known” – operating on only 20 watts of power. An equivalently powerful computer runs on 24,000,000 watts.

Skills rather than jobs

Employees should think less about jobs and more about skills. Jobs are going to appear and disappear much quicker than ever before, so we need to help the next generation focus on skills development. We tend to put too much emphasis on hard skills (coding, life sciences, maths) but if you ask CEOs what skills they want, they will always say: persuading, leading, communicating, inspiring. These are the skills to build and they will always be useful.

The right degree of education

The Institute for Spatial Economic Analysis (ISEA) has highlighted that people without a high-school degree face an almost six times higher risk than those with a doctorate of losing their livelihoods. This is because they are more likely to be working jobs that are less complex and easier to automate. So education matters and, regardless of what you study, the benefit is not just what you learn but the network you gain and the resilience you need to pass exams.

But what degree?

While a literature or philosophy degree may seem impractical, it's worth considering skills such as debating philosophical quandaries, addressing challenging concepts and developing writing skills. On the flipside, jobs in the US that focus solely on mathematic ability are on the decline, but jobs combining maths and social interaction are on the rise. Young people should focus on a degree that will strengthen their natural abilities and develop their soft skills. University should be more about being challenged with questions than getting answers. The world is full of immensely complex things: an enzyme structure, the language of Shakespeare, the workings of a modern economy. These don't have black and white answers. Not having all the answers is okay.

Lifelong learning

Lifelong learning is set to become the norm, involving the building and refining of skills throughout life and not just in university. The fastest-growing university in the UK is the University of the Third Age where the average age of students is 64. University may be important but it's more important to embrace the idea of continuous learning and development as the norm throughout your life.

The power of your network

In the future when people are being interviewed, there may be more focus on a candidate's personal network and connections. As things develop, the ability to access other people's skills, ideas and knowledge will become more and more important. People need to hone social skills with people outside their own circle, and understand the power of building real relationships rather than just Facebook friends and Instagram followers.

Travel still broadens the mind

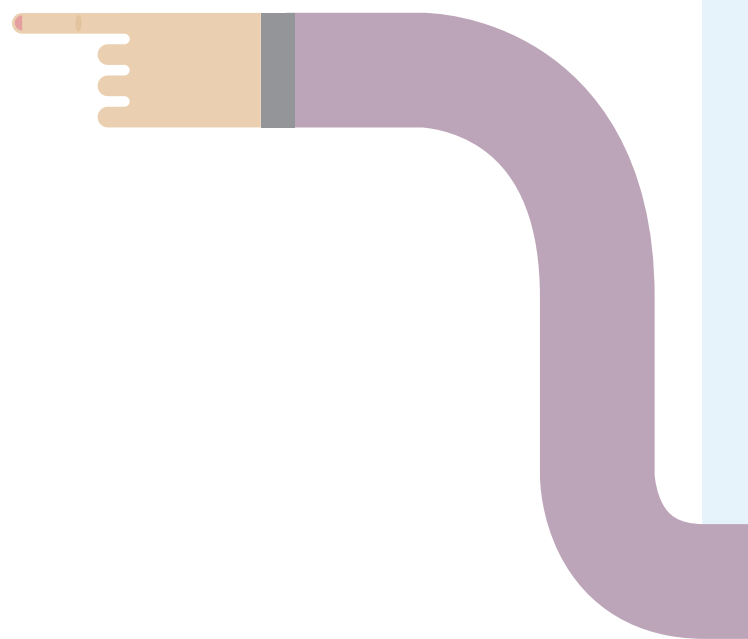
Even though we can now see the world (in a fashion) on our phones or desktops, we still need to travel to experience it properly. Ireland is not just a mix of Temple Bar, the Cliffs of Moher, sheep, green fields and pubs, but that is the impression you might get from watching a one-minute montage video. As the world becomes smaller, your customers and potential employees can be anywhere, so it will become even more important to understand different cultures and practices in various nations – so be delighted when your children travel!



How technology can enhance the value of jobs

Sodexo's CEO of corporate services, Sylvia Metayer, says their building maintenance crew started using drones to survey roofs for maintenance. Before this, people had to climb up to the roof to check. Now they stay safe on the ground. Their job hasn't been replaced, merely enhanced. Those on the ground have more time to talk to clients. Their job has more value.

Alastair Bathgate, CEO of Blue Prism (a software company that helps automate tasks in customer service, accounting and other jobs), reports zero job losses. In banking, for example, automation of more time-consuming tasks frees up the customer service representatives to take other calls. The on-hold time went down, he said, not the head count.



Jobs that are robot-proof

It will be a long time before many of the human/social jobs are replaced, such as childcare workers, chefs, nurses (where empathy is needed), and journalists (involving emotion and human interest). Other careers that will continue to prosper will be teaching, direct sales and counselling.

Then there are the jobs that entail complex human interaction. Managing a team is a tricky job, requiring a wide range of human skills, including the understanding of nuances, dealing with people of diverse backgrounds, and so on.

There are now robots that can draw and compose music, but advancement in technology will hardly affect jobs that need a high level of creativity. Computers are generally only good for solution-oriented as opposed to creativity-oriented tasks.

In brief

There will be an increasing shift towards skill-based jobs, and part-time, freelance work. Jobs will be more fluid and multifaceted, so employees will also have to become more adaptable and flexible, perhaps juggling three or more different roles at a time.

Continuing education and training will play a key role in ensuring that people develop new skills.

Conclusion

The predictions of studies such as the 2013 Oxford University study, which estimated that almost half of US jobs will be automated within the next two decades, are scary. However, as we have seen, it is tasks rather than jobs that will be automated. While technology takes over some tasks, it also increases demand for goods and services, and thus intensifies the demand for workers who can carry out the remaining tasks.

Instead of merely eliminating jobs, new jobs will be created, often in different occupations. Computers have been deployed in offices over the last three decades, yet this led to a 1.2% growth in jobs per year in the US. Yes, some occupations, such as switchboard operators, lost jobs, but healthcare jobs, which also use computers, grew at a rate of 2.5% per year.

While the jobs may not disappear, new skills are needed. Secretaries may do less typing thanks to word-processing, but they have also had to develop new skills to carry out other tasks. In many jobs, the skills needed are difficult to learn, because technology changes rapidly. Over a third of US businesses report difficulty in hiring workers with the skills required.

The rapid development of artificial intelligence is likely to quicken the pace of change, and thus intensify the stress of switching to new jobs and learning new skills. That is why governments need to introduce policies that mitigate the problems of displacement and educate people for the future of jobs. While employers will want to take full advantage of automation, they also need to work out the best combination of human staff and AI, encourage flexibility and adaptability in their staff, and assist them in retraining.

Employees, meanwhile, must be prepared to upskill, to learn how to work alongside the robots, to be flexible and adaptable, developing the new skills that will be required as technological developments continue to disrupt the workplace.

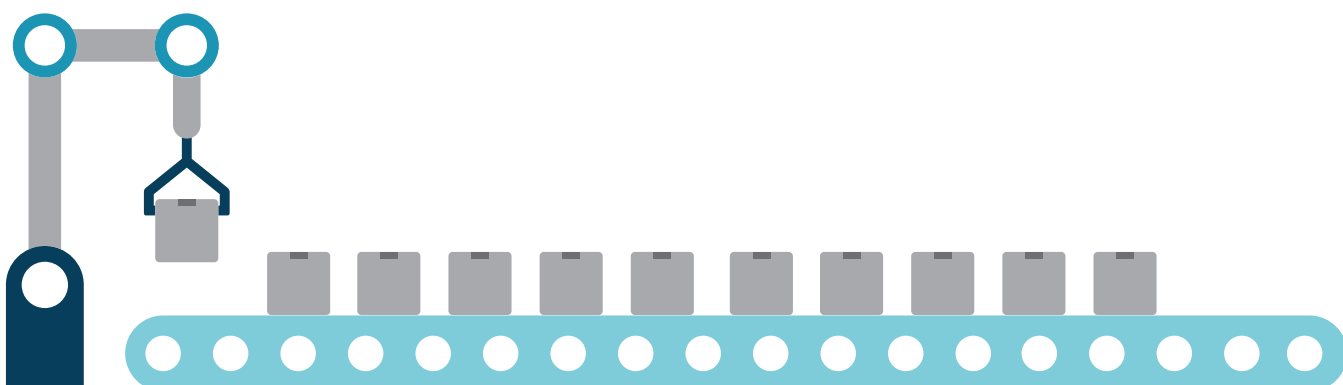
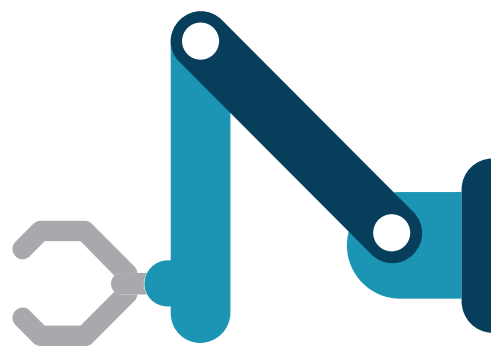
To sum up, *it's likely that the coming decade will be characterised not by widespread unemployment, but by redeployment*. It could be said that solving the AI job crisis isn't about coping with mass unemployment but about ensuring mass continuous education.

After that, we just don't know. Machines are already doing things that we once thought only humans could do. But we should keep in mind that the point of education is not to prepare us for a boring, unrewarding job, but for a life well lived. As far as possible, we should aim for a world in which robots do what we least like doing, while we do rewarding, enjoyable work that fulfils us. As Steve Jobs said, "the only way to do great work is to love what you do".





"Tomorrow
belongs to those
who can hear it
coming"



Notes

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

