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THE WORLD IN 2040

The future of healthcare, mobility, travel and the home

MEGATRENDS OF THE 21ST CENTURY

Allianz Partners

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About the Author

Ray Hammond has been researching, writing and speaking about future trends and developments for almost 40 years.

He is the author of 14 books on the future and he has written, consulted and lectured for the world's great corporations, for governments and for many universities in Europe, the USA and in Asia. He is a regular broadcaster on both national and international radio and TV channels.

In 2010, Michal Gorbachev presented him with a medal for his services to futurology which was issued by the Italian Chamber of Deputies on behalf of the United Nations. In the citation, President Gorbachev wrote:

> "We are delighted to honour Ray Hammond for his constant commitment to research and for his stunning speculations about the future, enlightened by scientific knowledge and an evident concern for humankind."

Author's Note

This report represents my own opinions about likely future developments. It does not represent the views of Allianz Partners. When I was asked to research and write this report, I was provided with guidance about the topic areas to research, but I was given a free hand to develop all editorial matter independently. Any errors and omissions are my own responsibility.

Megatrends of the 21st Century

There are seven major trends that will shape the future. These environmental, social, political and technological trends are already well-established, and over the last few decades, it has become possible to see how they will affect global development during the rest of the 21st Century.

These megatrends are:

1. **Asymmetric global population explosion**
2. **Climate change**
3. **The renewable energy revolution**
4. **Globalisation**
5. **Multiple revolutions in healthcare**
6. **Accelerating, exponential information technology development**
7. **The bottom two billion – the world's poorest people**

Of course, there are many sub-trends and influences that will also play a huge role in shaping the future, e.g. increasing economic inequality and the availability of free higher-education courses online.

But to qualify as a megatrend, each candidate trend must already have had a significant impact on world development and must be highly likely to continue to do so in future.

Trend 1: Asymmetric Global Population Explosion

Today, there are about 7.6 billion people on the planet. The United Nations forecasts that by 2030, that number will have risen to 8.5 billion and by 2040, it will have reached over 9 billion.

And the number of people living in the world will keep going up. By 2100, there will be 11.2 billion people on the planet.

But the resources of the Earth already seem hugely overstretched. How will we find the food, water and energy necessary for 50 per cent more people? To quote Gandhi: "The world has enough for everyone's need, but not enough for everyone's greed."

By 2040, there will be over 9 billion people on the planet

It should be possible to find the food necessary for 11 billion people. Today, 90 per cent of the world's agriculture is operating at subsistence level farming, with very low productivity and up to 50 per cent of food produced is wasted in the distribution chains of the developing world before it reaches the consumer. Improving farming productivity and reducing the waste in the food chain – e.g. through the use of refrigeration and anti-waste packaging – can provide the food that is required.

Finding fresh, clean water for all of the new arrivals on the planet will prove more challenging than finding the necessary food. There is plenty of fresh water on the planet, but most of it is in the wrong place – at the poles.

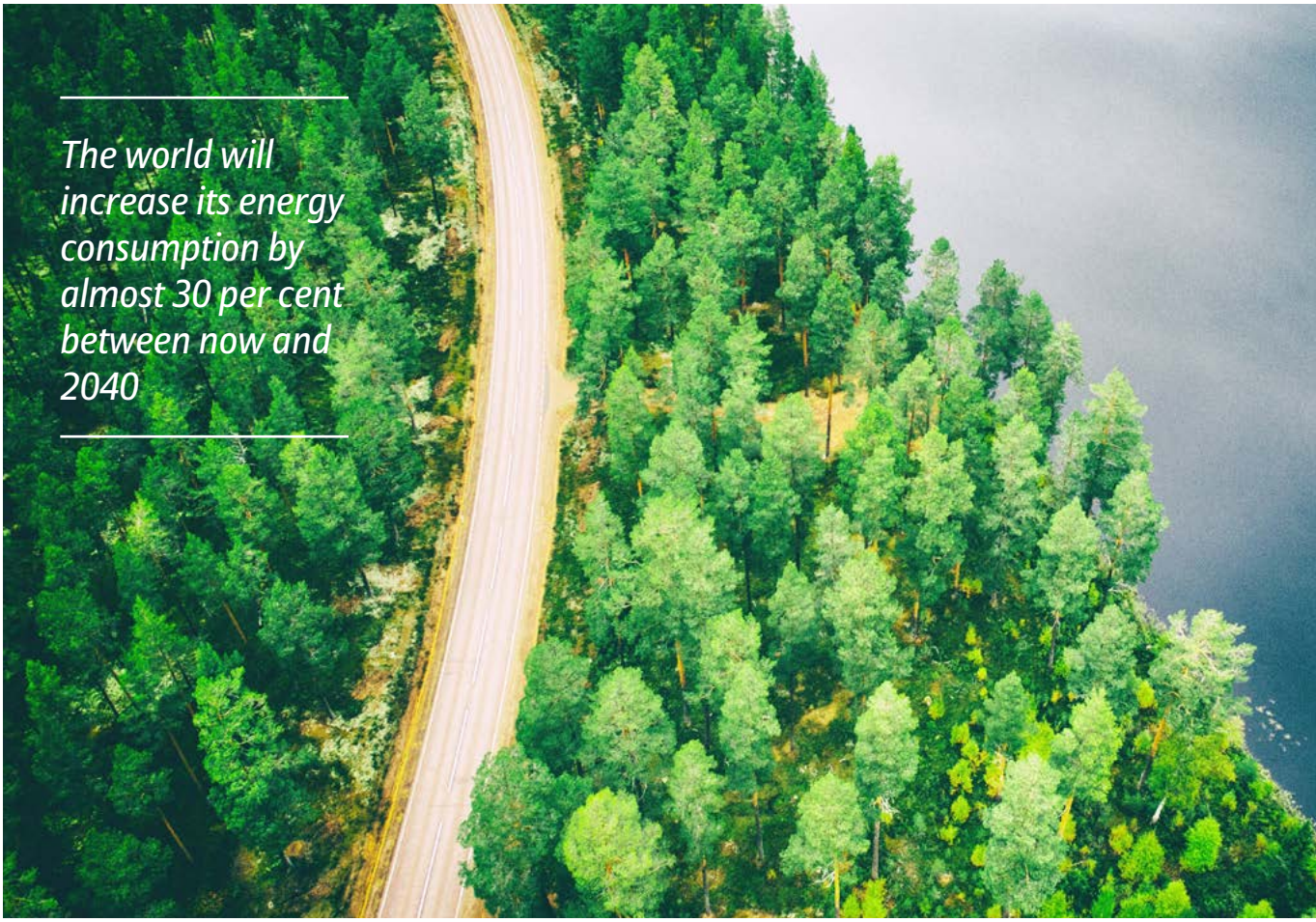
It has been suggested that fleets of fresh water tankers will be crossing the oceans in 2040, but I am certain that for many developing nations, the answer will be low-cost, low energy, small-scale desalination plants.

Today, most desalination plants in use around the world use enormous amounts of energy to convert salt water, brackish water and impure water into fresh drinking water.

Mini-desalination units now under development in different locations will produce fresh water from air moisture, or from dirty or salt-water sources. These small units will use renewable energy and, by 2040, are likely to provide the main form of fresh water supply in many developing nations.

The world will increase its energy consumption by almost 30 per cent between now and 2040. But, because of climate change, the additional energy requirements of an extra four billion people must be met solely by renewable energy generation.

The good news is that through the startling improvements in the efficiency of renewable energy systems, I have little doubt that by 2040, there will be plentiful supplies of clean energy from wholly renewable sources.



Trend 2: Climate Change

The global community has known about the damaging effects of emitting greenhouse gases into the atmosphere for over 50 years.

But, despite clear, long-range warnings, and despite national and international efforts to reach agreement on ways to tackle what has now become known as climate change, the news about our planet's atmosphere keeps getting worse.

A recent landmark report from the United Nations' International Panel on Climate Change (IPCC) paints a far more dire picture of the immediate consequences of climate change than previously thought.

The report also states that avoiding the resulting damage to our environment requires transforming the world economy at a speed and scale that has "no documented historic precedent".

The report states that if greenhouse gas emissions continue at the current rate, the atmosphere will warm up by as much as 2.7 degrees Fahrenheit (1.5 degrees Celsius) above pre-industrial levels by 2040, inundating coastlines and intensifying droughts and poverty.

Since the global financial crash of 2008, public interest in the topic of global warming has waned, but even if the general public has been largely disinterested in the long-term implications of climate change, this may start to change as global warming brings more extreme weather events to all parts the world.

The number of annual extreme weather events doubled between 1980 and 2004, and it will have doubled again by 2040. Climate change is now becoming a real-time event.

Forest fires in California, super-typhoons in the Philippines, flooded rivers in China, heatwaves in India, mega-destructive hurricanes in the Caribbean and droughts in Cape Town and Australia are all examples of recent extreme weather events that have become more likely to occur, and to occur more often, because of climate change. Geographical zones that have previously been without hurricanes, typhoons and cyclones are now having to prepare for weathering such super-storms.

The main symptom of an over-heated atmosphere is not warmer weather, but more frequent and more extreme weather events.

Whether or not the voting public will now start to demand that political leaders enact policies to limit the emissions of the greenhouse gases which cause global warming is unclear.

In some parts of the world, environmental protection is already a high priority for voters. In the European Union, many governments include politicians specifically voted into power because of their policies on fighting climate change and protecting the environment. And China, which was until recently one of

the worst greenhouse gas emitters, has recently started on an aggressive programme to reduce greenhouse gas emission and to reduce air pollution.

A bloc of nations collectively responsible for emitting 80 per cent of the world's greenhouse gas emissions signed the Paris Climate Accord in 2015. These included China and the USA – the world's two biggest emitters of climate change. Since then, the USA has said it will withdraw from the Accord.

It takes 30 years for the carbon being emitted today to sink into the oceans and be absorbed before re-emerging as warm air

But climate change is an international problem that still needs a co-ordinated global response. As this report was being written, world leaders met in Poland for a UN summit on climate change and agreed an action plan to put into effect the aims agreed in the Paris Climate Accord. Before the meeting, China was central in arranging crucial pre-summit meetings to build a consensus for an action plan. This role reversal is all the more surprising because Beijing has, for many years, shunned a leadership role in climate talks.

What does all this mean for daily life in 2040? Even if co-ordinated and drastic international action was taken now to reduce the levels of greenhouse gas emissions by 80 per cent, the climate in 2040 will still be producing a string of wild and extreme weather events, the like of which have not been seen on this planet since the ice age. The reason this future is unavoidable lies in the length of the carbon absorption cycle.

It takes 30 years for the carbon being emitted today to sink into the oceans and be absorbed before re-emerging as warm air. This warm air contains the energy that is eventually absorbed into the climate and the greater the amount of energy, the stronger are the hurricanes, storms, floods and droughts that follow. And, as the polar ice keeps on melting, the oceans continue to rise, inundating coastal areas and causing widespread flooding.

Extreme weather events will have become the norm by 2040. Coral reefs will be dying, coastal areas will be under water, and storms, fires and droughts will bring massive disruption and high death tolls. We cannot say we were not warned.

Trend 3: The Renewable Energy Revolution

For all of the reasons outlined already, our need to make the transition from burning fossil fuels to generating energy from clean, renewable sources such as the sun, the wind, biomass, hydro, geothermal sources, etc., has become very urgent.

Today, only 8.4 per cent of the world's electricity comes from renewable sources. However, it is forecast that by 2050, half of the world's energy requirements will be met from renewable sources.

After such gloomy predictions on the state of the Earth's climate in 2040, it is good to be able to report that phenomenal and unexpected progress is being made in developing renewable sources of energy generation. This progress is so great that I consider it to be the start of a renewable energy revolution.

By 2050, half of the world's energy requirements will be met from renewable resources

Over the last eight years, the price of solar voltaic panels which capture sunlight and convert it into electricity has fallen by 86 per cent. Over the same period, the cost of energy from off-shore wind farms has fallen by 23 per cent. At the same time, the efficiency of solar panels has doubled and the amount of power generated by a large wind turbine has increased by 40 per cent.

As a result of these developments, the cost of renewable energy is now falling so fast that it should be a consistently cheaper source of electricity generation than traditional fossil fuels by 2020, according to a recent report from the International Renewable Energy Agency (IRENA).

But perhaps even more important than the falling cost of the technology required to harvest electricity from renewable sources is the development of new battery technology which allows the captured energy to be stored for use when the sun is not shining and the wind is not blowing.

Cost-effective energy storage has long been the missing piece of the renewable energy puzzle, but now this is quickly being provided, thanks to a number of technology and cost breakthroughs, as well as increasing investment in battery innovation. The cost of battery storage systems has fallen by roughly two thirds in the last five years and investments in battery development are forecast to reach $620 billion by 2040.

In the UK, electricity grid operators and distributors have recently begun installing huge batteries which can store power generated by renewable sources and keep it available for re-introduction to the grid when needed.

Cost-effective energy storage has long been the missing piece of the renewable energy puzzle

And in Southern Australia, grid batteries were installed after extreme weather conditions damaged key energy infrastructure resulting in prolonged state-wide blackouts. Other grid operators around the world are following suit.

The US market for batteries able to store grid power nearly tripled in 2018 and batteries are rapidly being installed by power companies, businesses and home owners. The US market alone is expected to exceed $1 billion in 2019 and, in the UK, the National Grid predicts that by 2020, small-scale distributed generation will represent a third of total capacity.

One of the first commercial storage batteries for use with renewable energy generation systems was offered by Tesla in 2015.

For domestic use, Tesla offers The Powerwall and for industrial and grid applications, the company offers The Powerpack.

As a result of this renewable energy revolution, there is now considerable doubt about the significant investments being made in new nuclear power generation projects. About 50 nuclear power reactors are currently being constructed in 15 countries including the USA, UK, France, China, India, UAE and Russia.

But, in addition to swallowing huge sums of cash, nuclear power stations take a very long time to build. I now think it likely that the rapid progress being made in the development of renewable energy generation and storage systems will mean that many of these giant construction projects will turn out to be uneconomic.

Trend 4: Globalisation

In the last 25 years, modern globalisation has done more to reduce world poverty than all of the foreign aid provided by the rich world to the developing world since the end of the Second World War.

Over one billion people have been lifted out of extreme poverty and the global poverty rate is now lower than it has ever been in recorded history. In fact, by 2010, the United Nations had already achieved its Millennium Development Goal of halving poverty by 2015, and recent projections suggest that, by 2050, poverty will be eradicated everywhere, except in Africa.

This massive reduction in extreme poverty is one of the greatest human achievements of our time

This massive reduction in extreme poverty is one of the greatest human achievements of our time, and it is thanks to the effects of the rich world investing in, and trading with, the developing world – the process we call 'globalisation'.

It might be thought that with recent trade disputes between the USA and China, the era of globalisation is coming to an end. But nothing could be further from the truth.

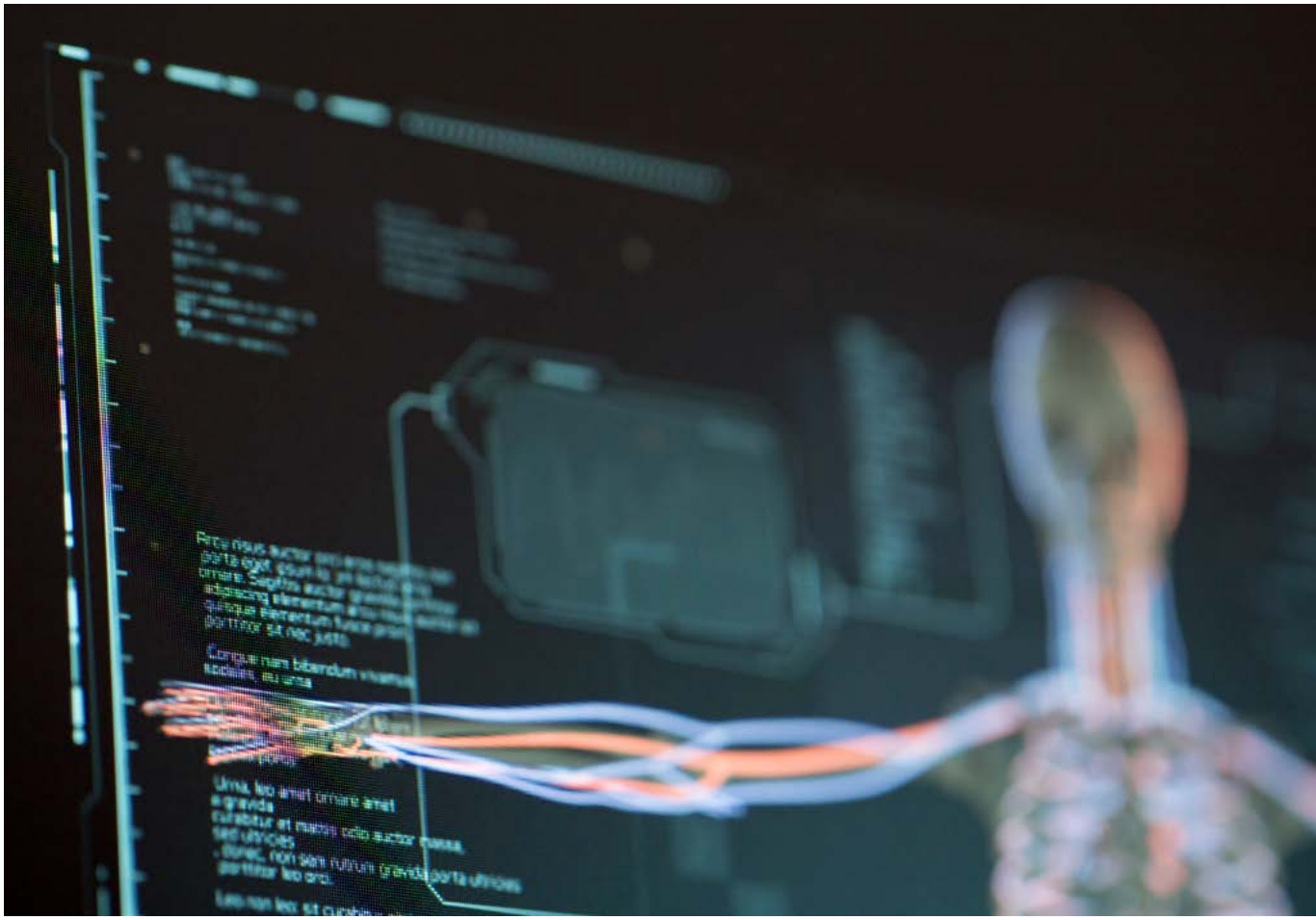
Even as some new trade barriers are being created by the USA, the rest of the world is busy negotiating new trade deals and removing the barriers and tariffs that are hindrances to globalisation.

After nearly five years of negotiations, the EU and Japan have signed a free-trade agreement that came into force in February 2019. This massive deal covers one third of the world's GDP.

And the world's biggest trade deal, the Regional Comprehensive Economic Partnership (RCEP), is expected to be agreed in 2019. This agreement includes the 10 members of the Association of Southeast Asian Nations (ASEAN), Australia, India, Japan, South Korea, New Zealand and the world's second largest economy, China.

In doing these huge deals, the leaders of the EU, Japan, China, Australia, and Russia have recently reconfirmed their commitment to free trade and globalisation. The emerging world has both a deep interest in keeping globalisation going and greater power to defend it than ever before. It will fiercely contest any attempt at a return to trade protectionism.

It is also much harder than it once was for the USA – let alone smaller economies – to de-globalise. International commerce today is driven by knowledge flows, which are not stopped by tariffs and walls, and by the large-scale production enabled by cross-border supply chains.



Trend 5: The Multiple Revolutions in Medicine and Healthcare

Over the next two decades, five major revolutions will transform how medicine is practised and how healthcare is delivered. These revolutions are:

- Personalised medicine – based on personal DNA analysis and electronic health data collected from individual patients
- Stem-cell medicine – the use of stem cells to repair/regrow tissue and organs
- Nano-scale medicine – drug delivery and development at sub-microscopic levels
- Gene-editing – altering human DNA to improve health
- Digital health – using AI and digital technology to diagnose and to monitor patient health

Each of these five revolutions would individually transform the prospects for human health and longevity. But, taken together, they will produce an entirely new paradigm for healthcare – one in which consumers will collect their own health data, geneticists will remove hereditary diseases from the population, artificial intelligence (AI) systems will routinely aid diagnosis and treatments will be tailored and personalised for individual patients.

Trend 6: Accelerating, Exponential Information Technology Development

For the last 50 years, computers have been doubling in speed and power every couple of years – without the cost of the microprocessors themselves increasing. This exponential development has been dubbed 'Moore's Law', after Gordon Moore first identified the phenomenon in 1965. And, in recent decades, the speed of this exponential development has itself been accelerating.

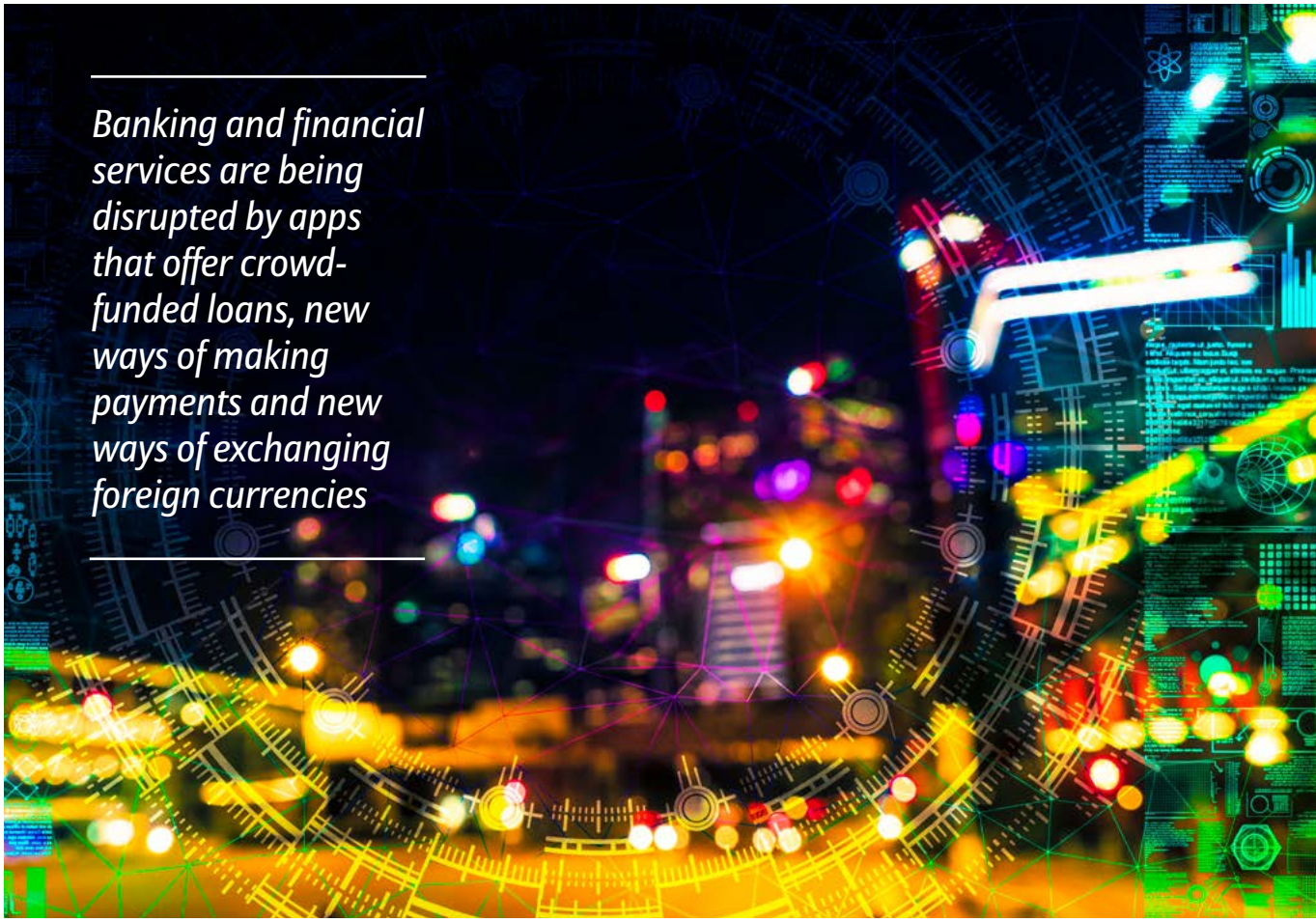
Today, the processing speed of microprocessors is no longer doubling every two years because chip designers are reaching the physical limits of packing more transistors into very small spaces. But improvements in algorithms, AI, computer architecture and network bandwidth mean that the overall performance of computer systems is still improving at an exponential rate. Within the IT design community, it is as if Moore's Law has become 'Moore's Lore', a self-fulfilling prediction.

Even without understanding why information technology is developing so quickly, consumers can sense this phenomenon in the increasing capabilities of their smartphones, the faster speed of their connections and the rapid development of new services such as social media, taxi-hailing apps and phone-based payment systems.

But the most noticeable effect of such rapid technological development is severe economic and social disruption. In the short term, this is threatening many traditional businesses' growth prospects and it is also upending and dislocating entire business sectors.

The hotel industry has been disrupted by smartphone apps which allow travellers to book rooms in private homes – these include Airbnb, OneFineStay and Booking.com. This disruption has forced conventional hotels to change their business models and reduce prices, giving travellers far greater options in travel planning.

The restaurant business has been profoundly disrupted by apps such as TripAdvisior, TopTable, OpenTable and MyTable.com that offer diners reviews of restaurants and the ability to book tables online.



And food home delivery services such as Deliveroo, Uber Eats and GrubHub are adding further disruption (while creating new opportunities) in the restaurant market.

Banking and financial services are being disrupted by apps that offer crowd-funded loans, new ways of making payments and new ways of exchanging foreign currencies. Cyber currencies are further disrupting financial markets.

And conventional taxi services have been severely disrupted by car-sharing apps and by taxi and ride-sharing apps such as Uber, Zipcar, Lyft, Grab and Didi. The old conventions of hailing a taxi or phoning for a private-hire car are dying off, and completely new forms of public mobility are emerging with electric bicycle and scooter rental also starting to become popular in cities.

It is fair to say that ride hailing and vehicle-sharing apps are in the process of disrupting the entire transport sector.

But, at the same time, digital disruption is also creating outstanding opportunities for start-ups that are able to exploit the rapid growth opportunities offered by the so-called "network effect" that is inherent to internet-based businesses. Never has wealth been created so quickly.

Taxi-hailing app Uber was founded only a decade ago, but it has already become worth more than the Ford Motor Company or General Motors. And it doesn't make a single car. This high-scalability and extreme form of rapid growth is a prime example of the 'network effect' operating in internet-based businesses.

Room-booking app Airbnb was founded in 2008 and is now worth more than Marriott Hotels, the largest hotel chain by revenue in the world. And Airbnb doesn't own a single room.

Founded in 2004, Facebook is worth more than the value of Coca-Cola, PepsiCo and McDonald's combined. And Facebook doesn't make a single product.

Amazon, founded in 1994, is now worth more – almost $1 trillion more – than the combined value of more than 21 other major retailers, combined – from Walmart to Costco. And Amazon owns no physical retail outlets.

And Alphabet (the parent company of Google, which was founded in 1998) has become the world's third most valuable company (the most valuable at the time of writing is TenCent, the Chinese online retailer).

It is worth noting that all of the world's six most valuable companies are in the technology sector. Investors know that a revolution has occurred.

New digital technologies are also changing society itself. Dating apps have changed how we meet potential partners and social media has changed how we communicate with friends, how we donate and raise money for good causes and how we get our news.

It is worth noting that all of the world's six most valuable companies are in the technology sector

By 2040, digital disruption in the form of AI and automation is likely to make large numbers of humans no longer needed in the workplace.

Most workers made redundant by digital disruption in the next ten years or so will be able to find re-employment either through re-training, or by becoming part of the self-employed gig economy.

And, at present, consumers are demanding more and more new services from other humans - e.g. life coaches, tattooists, dog walkers/groomers, personal fitness trainers, finger-nail artists, travelling zoo operators and pet mentors. For the time being, the slack resulting from technological unemployment will largely be taken up by increases in the range of human-provided services.

But, sometime after the mid-2030s, the wave of digital disruption and automation will have become overwhelming, at which point a large sector of the population will be unable to find paid work as we understand the concept today. Machines will be generating the wealth and it will be taxes on the robots and the wealth they generate that will fund our societies.

Robot taxes may be used to provide a 'Universal Income' for those unable to find paid employment. And, I think it likely that our concept of 'work' will have to change.

Today, some of the most important jobs in the world are not thought of as 'work' and are unpaid. These jobs include being a mother, being a family carer, being a housekeeper and being a family-member child minder.

It will be very important for the society of 2040 to reassign occupational value to the unpaid roles described above. For many people, 'work' is an important part of self-identity, and a reclassification of today's unpaid and voluntary roles would go a long way towards meeting the psychological needs of those made redundant by automation.

From the individual's point of view, information technology in 2040 will have become beguiling, virtually invisible and an inseparable part of our lives. Today's smartphone will have shrunk to become a device that will be the hub of the 'body network' that almost everybody will wear. The body networks of 2040 will include smart contact lenses (or spectacles), in-ear buds, smart jewellery (e.g. broaches, smart rings and watches), as well as a whole slew of health and fitness monitors dotted around the body and sewn into clothing.

Body network operations will be managed by a virtual software

assistant and it is very likely that most of us will chose to anthropomorphise these assistants by giving them a sex and a name.

These artificial personalities will become our closest and most intimate friends. Although it may seem a strange concept today, we will be forming strong relationships with machine personalities in 2040, even if such entities don't have any physical form.

How such virtual relationships will affect human-to-human relationships is impossible to guess, but I am confident that in 2040, body networks and virtual assistants will be so widely available and so affordable that nobody will have to experience loneliness unless they wish to. By 2040, artificially-intelligent companions will have arrived.

But, although AI will have become extremely capable by 2040, it will not yet be approaching human levels of intelligence.

AI systems will be outperforming humans at many specialised tasks, but they will not be rivalling their creators in what AI researchers call 'general intelligence'. That achievement will still lie in the future, but society in 2040 will need to be fully engaged, working out what to do when it becomes possible to create AI that is equal to, or which exceeds, human intelligence. The answer to that question will decide the future of our species.

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Trend 7: The Bottom Two Billion People

Even as globalisation is continuing to lift millions of people out of abject poverty, there are approximately 2 billion people trapped in about 58 nation states which are experiencing only minute growth, no growth at all, or actual economic shrinkage. Together, their existence will become so important to world society that I have long identified the existence of this group as being the seventh key trend.

The people in these 'bottom states' don't have access to global markets (and even if they did get such access, they would have little to sell except natural resources).

Abject poverty may become one of the defining issues of the century

These societies are so poor that the people are constantly fighting amongst themselves for what little wealth they possess and half of them do not have access to any form of electricity. These societies suffer from plagues and famine, are largely illiterate, have only the most rudimentary healthcare and, because of chronic instability, they attract no foreign investment capital. Indeed, what little domestic capital exists or is generated is almost immediately exported to overseas bank accounts in the rich countries for fear of the same political instability. (Although China has recently started to make heavy infrastructure investments in Africa, it has yet to invest in the nations inhabited by the bottom two billion.)

The situation is so serious that Robert Gates, Defense Secretary of the USA under both the George W. Bush and Obama administrations, says "Fractured or failing states are the main security challenge of our time".

Massive amounts of western aid, both financial and in kind, have been given to the countries which are home to the bottom two billion ($5 trillion as of 2012), but it seems to have made very little difference to the lives of ordinary people in the bottom two billion.

The reason our aid has helped so little is that the problem is so great: many of the societies to which we gave our cash were so poor that it was immediately grabbed and embezzled by all who had any degree of power.

In this short survey of what the world may be like in the year 2040, why should it matter so much to us in the developed world that two billion people (and, potentially, many more by 2040) will be stuck in abject poverty? Besides the moral imperative, there are two main reasons; the first is the enormous financial cost to the developed world that failing and fighting nations inflict on the global economy, e.g. the conflicts in Afghanistan, Iraq, Libya, Somalia, South Sudan, and Syria.

The second reason is that abject poverty provokes large-scale illegal economic migration from the poor world to the rich nations – immigration which causes huge political and economic instability. In the decades to come, this has the potential to become a new megatrend and may become one of the defining issues of the century.

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