مؤسسة دبي للمستقبل
DUBAI FUTURE FOUNDATION

FUTURE OPPORTUNITIES REPORT

THE GLOBAL 50

2022

FOREWORD

UNDERSTANDING THE FUTURE IS A KEY TO SUCCESS

Countless intellectuals, developers, research centers, and analytical and predictive software solutions regularly strive to come up with scientific predictions for the years and decades ahead of us to forecast the future. However, history teaches us that humanity's unbridled imagination has no limits and that our creativity and innovation can achieve unexpected leaps in humankind's journey.

Over the past 50 years, humanity has witnessed exponential developments that have resulted in the sort of change that previously took 500 years to achieve. Our progress is advancing at an accelerated rate. The cumulative effect of creativity, technology and social progress means that the next 50 years are likely to see transformations that surpass humankind's achievements on every front. These radical changes will transcend continents, people, and societies. They will touch every aspect of our lives. From our work to our decisions and our relationships, no one, anywhere, will remain unaffected.

Different nations will experience the impact of these transformations at varying rates. Some countries may progress quickly along the path towards economic and social development. Others may have a harder time catching up. It is necessary as a global community to create an inclusive vision for the future where "human wellbeing" forms the basis of any future plans and strategies.

At Dubai Future Foundation, we refer to this next phase as 'the era of quantum shifts', the term borrows from the field of quantum computing. It denotes the rapid, sudden, and radical changes that will create a range of possible scenarios for the future, and these will occur in parallel in different parts of the world.

The report we present outlines how these upcoming transformations offer inspiration and opportunity for each of us. While we may witness some of them over the short term, others are still being explored – but most are likely to realise within the next 50 years. Every aspect of society including governments, institutions, companies, scientists and innovators will have an inclusive and integrated role in turning these opportunities into reality.

We may not be able to accurately define the landscape of the next 50 years. But we can certainly play a part in shaping it. A proactive and intentional approach will enable us to craft the future we want. And experience has taught us that realizing our goals requires strategic planning and preparation, as well as clear roadmap for adapting advanced technologies. Most importantly, creating the future requires us to unleash our imagination, to avoid restraining ideas and dreams, and to shun limits of any kind on our expectations.

The future is not ours to await; it's ours to create. Those who understand and plan for future transformations are best placed to design and control the path ahead of us all.

MOHAMMAD ABDULLAH AL GERGAWI

Vice Chairman of the Board of Trustees and Managing Director of Dubai Future Foundation

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INTRODUCTION

Growth, prosperity and well-being are likely to change in the future. Equally, definitions of growth, prosperity and well-being will also change as we become better able to measure the things we value in more comprehensive and comparable ways. In the next half-century, our concept of thriving could change completely to one unfamiliar to us today. But what we can be confident about is that human needs and motivations for self-realisation will endure.

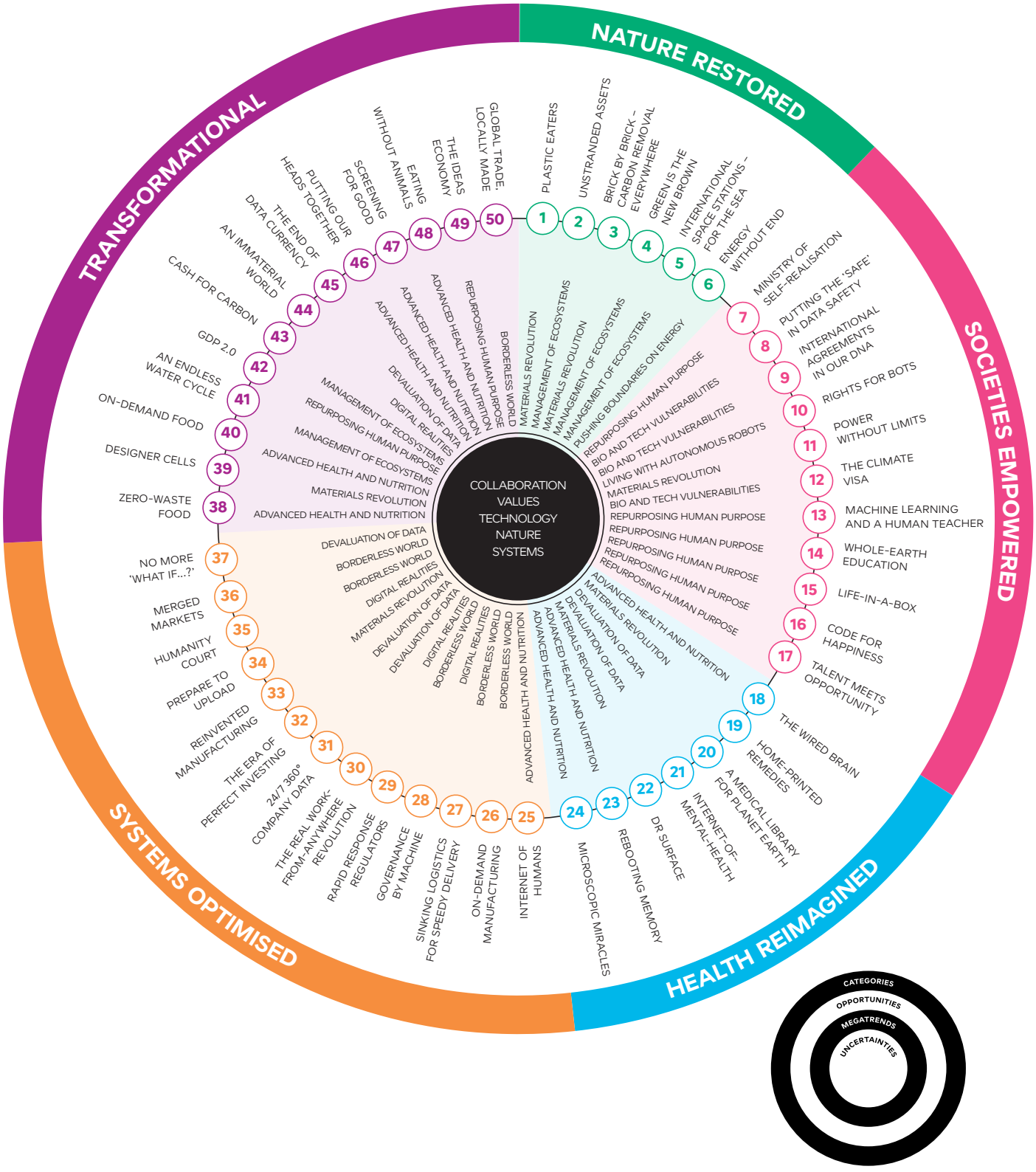
The opportunities covered in this report cover the breadth of human experience and our relationship with our environment, spanning energy, communications, health, medicine, governance, ecology, education, culture and business. They range from universal access to energy to evolved digital and immersive realities, from machine-run companies to advances in medical screening that promise to reduce the burden of disease dramatically.

It is important to remain focused on the future at a time when our world is still adjusting to the impact of a global pandemic that has cost millions of lives and inflicted economic damage on countries, companies, communities and individuals.

The response to the crisis has demonstrated the power of innovation – with solutions that would not have been available had innovators not been focused on creating a better future over the past few decades. Researchers created vaccines from recently developed classes of medicines. People used new video-conferencing technologies to continue to work and engage with their families and friends. Companies and governments worked to restructure supply chains to maintain the flow of essential products.

The experience has shown that, while external, unplanned-for events can disrupt our civilisation, human ingenuity and innovation can respond.

OPPORTUNITIES MAP FOR THE GLOBAL 50



DEFINITIONS OF GROWTH, PROSPERITY AND WELL-BEING

TODAY

GROWTH –
the increase in the total real output of goods and services in an economy over time.

PROSPERITY –
a life of dignity and stability, free from the threats of poverty or harm, with access to decent employment opportunities and services such as education and healthcare.

WELL-BEING –
a good state of mental and physical health and feelings of life satisfaction.

TOMORROW

GROWTH could go beyond economic factors, for example by accounting for negative impacts, to create a measure of net-positive growth.

PROSPERITY may encompass the same factors but set the bar higher: societies seen as prosperous will offer easy access to highly personalised education and healthcare services and widely varied means to earn a living, whether through employment, entrepreneurship or creativity. People will have more life choices and a more supportive environment in which to make them.

WELL-BEING could be more about feelings of self-realisation as advances in medicine and technology lead to a greater ability to address mental and physical health issues. Positive social interactions and a sense of belonging conducive to self-esteem may take on greater weight in well-being, placing new demands and expectations on support from the state and society.

OUR VIEW OF THE FUTURE

The Dubai Future Foundation prepared this report through a series of foundational activities that explore the future of growth, prosperity and well-being. This was followed by the use of a methodological approach to generate ideas and identify opportunities for the future, emanating from uncertainties, one megatrend or the interplay of two or more megatrends, a sub-set of which has been shared in this report. Some of the technologies or policy ideas behind these opportunities are the subject of long-standing, in-depth research. Some are at an early stage; others have hardly been explored.

As part of this process, over 100 studies, reports, books and articles published by business and scientific sources, governmental and international organisations and mainstream media were reviewed and analysed. This was followed by interviews and virtual round tables (see acknowledgements) to explore questions about the future of growth, prosperity and well-being.

THE QUANTUM ERA

We are entering an era of ‘quantum shifts’. Indeed, we may already be in it. The term ‘quantum’ originates in quantum theory, where it denotes an abrupt transition from one energy state to another by atomic and sub-atomic particles. More broadly we use it to describe the rapid, disruptive and dramatic changes that we are starting to see in technology, business, government, medicine, culture and other areas.

Quantum thinking also embraces the concept of ‘entanglement’ (Wikipedia, n.d.), the idea that the behaviour of objects can be correlated even when they are remote from each other. This can be related to the intertwined complex relationships and interconnections that determine how the future may play out. Some forces can drive societies in opposite directions, while some innovations can enable them to move forward together in progress.

When such changes occur swiftly, we describe them as ‘quantum shifts’ or ‘quantum leaps’. The message of this report is that many such shifts can be managed to have a positive impact if we only recognise the opportunities that lie ahead.

NAVIGATING A DIVERSE AND CHANGING LANDSCAPE FOR GROWTH, PROSPERITY AND WELL-BEING

People and places are experiencing changes at different speeds and to different degrees – and they are responding in different ways. Long-term trends are creating both new ways to thrive and new challenges to survive. As these trends accelerate, radically different ways of life, much more radical than today, could co-exist in parallel in different parts of the world, within cities, within communities, within families and even within our individual selves.

As widely diverging futures are possible, preparing for the future is not merely an intellectual exercise: it is about understanding how people's expectations are changing, anticipating the new risks and opportunities they could face in their daily lives, and navigating uncertainties to create the conditions for individuals to thrive. **The focus on growth, prosperity and well-being is ultimately a focus on people.**

UNCERTAINTIES: THE CONTEXT FOR GROWTH, PROSPERITY AND WELL-BEING

Our approach to understanding how growth, prosperity and well-being could evolve is based on five uncertainties that are likely to be critical over the next 50 years – to governments, businesses and people's experience of daily life. Each uncertainty represents a continuum of possible outcomes between two extremes. Where any given country or community lies on each continuum could differ from place to place and from time to time, and there are many possible combinations of points on each continuum. This could lead to people around the world living in a wide range of radically different socio-economic, political and environmental contexts. While these uncertainties are not new, what is new is the challenge of meeting people's rising expectations of better growth, prosperity and well-being in the diverse, co-existing and constantly changing realities that the world will experience in the future.

The first uncertainty continuum is about **collaboration**: the extent to which governance and international collaboration advance at a global level, reorganise around multiple new poles, retreat or take on new forms according to the challenges or issues being addressed. Multilateral collaboration could break down in some ways, while other new forms of collaboration could contribute to greater shared prosperity and well-being.

The role of **values** in shaping people's lives is the next critical uncertainty. Towards one end of the continuum, countries and communities could converge towards shared values – or at least become better equipped to manage diverging values. Towards the other end, we could see value differences increasingly dividing communities or nations.

Technology is the third uncertainty continuum. At one extreme, it could become our master, with people experiencing a sense of being controlled by technologies in their daily lives. At the other extreme, technologies could be more of a multiplier, with people benefiting from their use to spread solutions for the individual and common good. Of course, different kinds of technologies could follow different paths.

The fourth critical uncertainty concerns **nature**. Over the next 50 years, climate change and environmental degradation could accelerate and worsen. At the same time, humans could find new ways to minimise environmental risks and harness nature's capacity to restore itself. How well we develop and apply those new solutions will most likely shape where people land on this continuum.

The final uncertainty covers the **systems** that societies and economies rely on. These could become more fragile in the face of crises or be continually redesigned for greater resilience. The continuum here is about how well those systems will evolve to manage people's changing needs.

10 MEGATRENDS: THE BASIS FOR IDENTIFYING OPPORTUNITIES FOR GROWTH, PROSPERITY AND WELL-BEING

The research conducted for this report revealed 10 megatrends that are relevant to the future. The 50 opportunities detailed in the report represent some of the different ways in which the megatrends might manifest themselves. These megatrends are not exhaustive. Others will become apparent as the future unfolds. Each involves many uncertainties, with potential impacts – negative and positive – on multiple systems. Events such as economic downturns or technological disruptions could drive them in different directions over multiple decades. They are relevant at global, regional and country levels while also being beyond the control of any one country or region. The 10 megatrends are:

1. **Materials revolution:** Researchers are studying nature to find inspiration for synthetic biological materials with novel physical properties that can be made in a laboratory. Over the next few decades, technological advances in materials science could result in wide-ranging applications to enhance sustainability, durability and efficiency. Supply chains may be re-engineered as individuals become producers in a regenerative or self-sufficient economy.

2. **Devaluation of data:** Ubiquitous real-time data is increasingly challenging the viability of business models based on asymmetric information. As more data becomes open, competition shifts from the question of who has the best data to that of who can best analyse the data that is available to everyone. New kinds of data – such as open-source DNA of many living organisms, brain mapping and microbiome analysis – can provide platforms for innovation in areas such as disease prevention and treatment.

3. **Increasing technological and biological vulnerabilities:** The more data becomes open, and the more interconnected and intelligent systems become, the more vulnerable a range of critical infrastructure and services will be – from finance to supply chains to potentially hackable DNA-based personalised medicine. Complexity could grow faster than the capacity to mitigate risks of system failure and cyberattacks. Quantum-proofing the internet will require new solutions and may be very complex.

4. **Pushing the boundaries on energy:** New solutions for electricity generation and storage, some not involving batteries or heat, are set to enable new models of energy distribution when combined with smart grids and superconductors. Examples include facilitating peer-to-peer electricity sharing across buildings and bringing cheap and consistent power to remote communities without the need for generators, allowing them to develop rapidly. Fusion could make energy limitless and bring immense benefits worldwide.

5. **Management of ecosystems:** Environmental impacts are seen less in terms of specific processes and more in terms of ecosystems. Ecosystem services are valued more highly with a greater understanding of their role in innovation and climate change mitigation and the connections between the biological world, humans and the digital world. More accurately assessing the value to humanity of the natural habitats of different countries could drive the emergence of new models to invest in ecosystem services. Community- and building-level ecosystems can become regenerative micro-economies that need to be served differently by governments and utilities.

6. **Borderless world:** Health, education and other services increasingly cross borders, pointing to a digital future with minimal transfer of physical goods. There is a growing need to clarify jurisdictions for cross-border transactions and set up international dispute resolution mechanisms that can resolve issues for everyone, wherever they are in the world.

7. **Digital Realities - living in immersive virtual and digital spaces:** Digital platforms evolve into digital realities beyond digital twins. Brain–computer interfaces could lead to a new symbiosis between the human and virtual worlds, allowing people to touch, smell, feel, see and hear surroundings in which they are not physically present. This would enable many aspects of life to be replicated in virtual spaces, including work and legal systems. It would also raise policy questions, such as how physical-world legalities and ethics apply in virtual spaces.

8. **Living with autonomous robots:** Humans may come to trust robots more than other humans because they act predictably, ensure confidentiality and make better decisions. But robots also pose ethical questions. How far should they be granted rights? When should they be made available, and for whom? A sharing economy could involve robots that create opportunities to aid greater growth, prosperity and even well-being.

9. **Repurposing human purpose:** Advanced artificial intelligence can open new ways to realise human potential and reconfigure our purpose in the future. Intelligent, connected systems are enabling more personalised access to goods and services within people's homes. Mental health conditions may be remedied by brain–computer interfaces and real-time testing and monitoring. People will seek income in different ways in future, with the economy set to revolve more around creative problem-solving – for example, there is potential for people to initiate inventions and solutions and own part of the intellectual property. Throughout history, technological shifts have led to new kinds of occupations emerging, suggesting that fears about job displacement can be alleviated if we know how to mentor people to operate in a more efficient world.

10. **Advanced health and nutrition:** Biofoundries that harness biological processes to produce sustainable products, including novel agritech and foods, have the potential to improve individual and collective outcomes while reducing environmental stresses. Personalised metabolic and genetic nutritional profiles can enable huge advances in addressing a range of physical and mental conditions, boosting longevity, productivity and well-being. Food and nutrition may become more regenerative, health diagnoses instantaneous and treatment more available either in people's homes or through nutrition and robots for therapy. More accessible gene editing and gene therapy can, with appropriate regulations, bring many benefits.

Understanding these 10 megatrends, together with the uncertainties, their implications and the decisions and choices surrounding them will help us identify even more opportunities and mitigate the associated risks. Our research indicates that they are set to play a major role in changing the world's economy, business and society, transforming how we live. They are worthy of consideration by everyone – governments, businesses and civic society – seeking to realise their goals and visions for growth, prosperity and well-being into the future.

NAVIGATING OPPORTUNITIES

The opportunities shared in this report are not exhaustive; they present some of the different pathways and approaches to growth, prosperity and well-being. They offer possibilities for major advances in our quality of life while raising profound questions for society to resolve. Some opportunities will be more pertinent than others. Some contexts may have the conditions in place to share in the benefits, others may not. Equally, the risks relating to some opportunities might not be limited to those countries or businesses exploiting the opportunities directly: risks often travel faster than benefits.

Each of the opportunities presented includes a question for the future with a tagline that answers it driving further thinking. Each of the opportunities also includes trends and challenges observed today that make these opportunities relevant in the future along with a high-level assessment of the associated benefits, risks, most significant megatrend driving the opportunity and sectors that can impact or be shaped by the opportunity.

HOW DECISION-MAKERS CAN USE THIS REPORT

As readers, decision-makers in government, business or civic society can explore these opportunities in various ways. They can	Tap into the opportunities as a source of thought and inspiration to identify prospects for investment and new ways to create value for their customers	Use them for foresight, to reflect on opportunities that would be worth exploring in the context of evolving perceptions of what matters most to civilisation
Map opportunities to their own value propositions and strategies in order to identify gaps or risks to their future visions	Dive deeper into one or more opportunities to explore specific ideas and initiatives that can bring positive long-term financial, environmental and societal outcomes	Think about associated complexities in needs, motivations, systems, stakeholders and trends within each of the opportunities and identify the risks this may pose to their global competitiveness
Identify the impact of each of the opportunities on their organisation or community	Find or build tools that can track people's experience, perceptions and subjective sense of prosperity and well-being, beyond economic growth	Identify necessary partnerships and inputs needed to address associated uncertainties and opportunities in the future should they materialise

The next 50 years are set to bring both unprecedented challenges and vast new technological possibilities. However, some countries and societal groups will be better able than others to manage the uncertainties, meet the challenges and take advantage of the opportunities. The purpose of this report is to shift thinking from 'What will happen in the future?' to 'How can we best prepare to improve or protect growth, prosperity and well-being?', whatever that future might be.

NATURE RESTORED

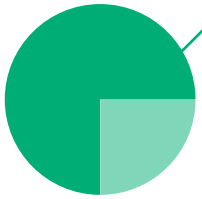
Minimise environmental risks, harness nature's capacity to restore itself or have a positive impact on crucial environmental ecosystems and habitats, creating a more stable, healthier planet for all.

OPPORTUNITY #1

WHAT IF ALL WASTE WAS SAFELY DEGRADABLE?

PLASTIC EATERS

Bioengineered microbes and enzymes can break down all forms of waste, recyclable or not, reducing plastic pollution and improving quality of life and health



The US Environmental Protection Agency estimates that **about three-quarters of waste is recyclable**

WHY IT MATTERS TODAY

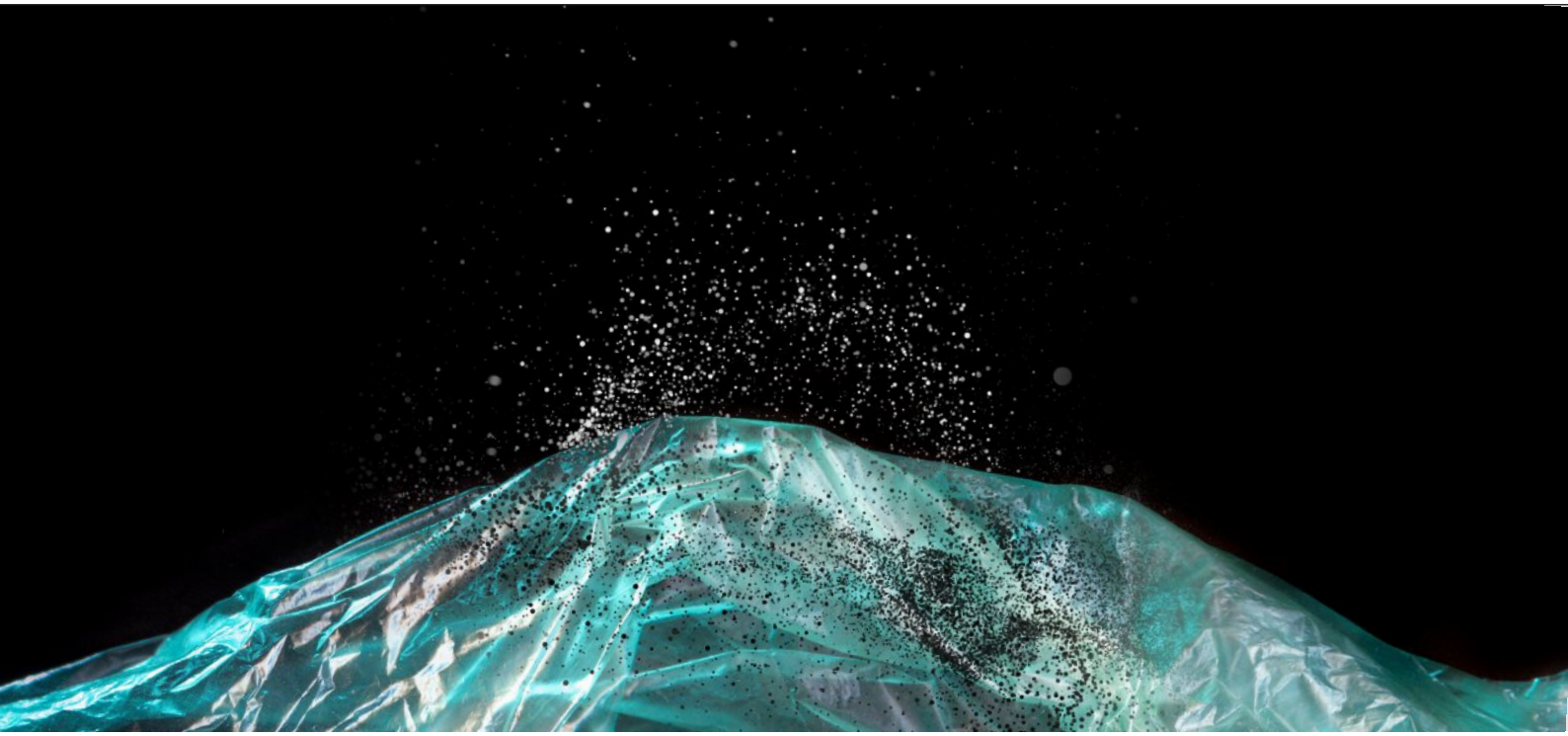
The world produces over two billion tonnes of waste each year.[1] The US Environmental Protection Agency estimates that about three-quarters of waste is recyclable but just under a third is actually recycled.[2] The greatest challenge is plastic waste which pollutes the ocean, harms marine wildlife and is detrimental to public health.

The economic cost of plastic pollution is $13 billion a year, including clean-up costs and financial losses to fisheries and other industries.[3] Microplastics are another problem, the bulk of these fragments being from car tyres that constantly produce microplastics as they wear down.[4] Initial surveys of microplastics in the air, water, salt and seafood have suggested that children and adults might ingest anywhere from dozens to more than 100,000 microplastic specks each day and people might be ingesting around the mass of a credit card's worth of microplastic a year.[5]

In the Arabian Gulf, plastic waste makes up as much as 16% of the public's trash – and that figure is growing. Meanwhile, the Middle East is responsible for about 8% of global plastic production.[6] The region loses out on $29 million[7] in annual revenues as a result of marine plastic pollution.

SECTORS

AGRICULTURE & FOOD · ADVANCED MATERIALS & BIOTECHNOLOGY · CHEMICALS & PETROCHEMICALS · CONSUMER GOODS · ENERGY, OIL & GAS · INFRASTRUCTURE & CONSTRUCTION · MANUFACTURING · METALS & MINING



In the Arabian Gulf, plastic waste makes up as much as

16%

of the public's trash

The Middle East is responsible for about

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THE OPPORTUNITY TOMORROW

A low-waste society can be achieved through advances in biomaterials, which have exciting implications for industries from fashion to medicine and electronics to car manufacturing. New biodegradable or easy-to-recycle biomaterials can be used in a range of applications instead of metals and plastics. And, since the discovery of plastic-eating bacteria at a Japanese waste site in 2016,[8] the path to a low-waste society can be enhanced through bioengineered microbes and enzymes that digest plastic and other waste products.[9]

Advances in bioengineering and synthetic biology can also enable homes and buildings to be equipped with complete waste disposal systems that recoup energy and reduce materials to biodegradable or reusable components like 3D-printed fibres. They can eliminate harmful waste – such as microplastics – and the need for landfill sites and incinerators. Municipal waste systems can be redesigned to focus on collecting only valuable waste and managing unintended synthetic bio-organisms that may be released into the biosphere.

BENEFITS

People's quality of life and health improve as fewer pollutants enter ecosystems and energy is recovered for use in heat and power.

RISKS

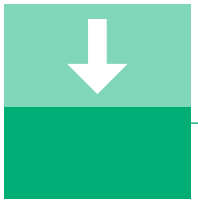
Risks arise from the unintended toxicity of some waste elements or the build-up of toxic gases in disposal systems.

OPPORTUNITY #2

WHAT IF WE REPURPOSED OIL RIGS?

UNSTRANDED ASSETS

Abandoned oil and gas facilities, both offshore and onshore, can be repurposed for carbon sequestration to reduce both carbon dioxide and methane in the atmosphere



Limiting global warming to 1.5°C requires **reducing global carbon dioxide (CO_2) emissions by 45% by 2030**

WHY IT MATTERS TODAY

Limiting global warming to 1.5°C requires reducing global carbon dioxide (CO_2) emissions by 45% by 2030 compared with levels in 2010 and to net zero around mid-century.[10] One route to aid these efforts is to capture and store CO_2 beneath the Earth's surface, where it has been estimated that there is room to sequester trillions of tonnes of carbon dioxide (CO_2).[11]

An estimated 300 billion tonnes of that capacity[12] lies in depleted oil and gas fields, both onshore and offshore, from which the energy resources have been produced and consumed. However, currently only around 40 million tonnes of CO_2[13] are captured and stored each year, mainly from energy production facilities. The challenges lie in finding economical and practical ways of capturing CO_2 and transporting it to underground geological storage.

SECTORS

ADVANCED MATERIALS & BIOTECHNOLOGY · ENERGY, OIL & GAS · INFRASTRUCTURE & CONSTRUCTION

THE OPPORTUNITY TOMORROW

While the 20th century saw a boom in platforms and plants that extract oil and gas from the ground, the 21st century could see such structures being converted to store carbon dioxide underground. In some ways, it is the reverse of oil and gas extraction.

As the world transitions to clean energy, these rigs are set to become obsolete, stranded assets. Rather than removing these platforms, which may be more environmentally harmful than leaving them in place once decommissioned,[14] they could be converted to enable them to inject the CO_2 recovered from factory and power plant emissions (using carbon capture and storage (CCS) technologies) into the depleted reservoirs. New technological solutions – known as direct air capture with carbon storage (DACC) – can extract CO_2 already in the atmosphere. This can also be transported to and stored in depleted oil or gas fields.

BENEFITS

By reducing atmospheric carbon levels, these solutions can help lessen the environmental, economic and social impacts of climate change.

RISKS

Risks include carbon dioxide leaks, seismic activity as carbon dioxide is being injected, acidification from deep ocean storage and physical or cyber-attacks on critical systems and storage facilities.

OPPORTUNITY #3

WHAT IF EVERY SURFACE COULD REMOVE CARBON?

BRICK BY BRICK – CARBON REMOVAL EVERYWHERE

Novel materials, coatings and genetically modified plants can remove carbon from the air and help cities become net zero or even carbon negative spaces

WHY IT MATTERS TODAY

The world needs to remove carbon dioxide (CO_2) from the atmosphere in order to offset remaining emissions and reach net zero by 2050,[15] limiting global warming to 2°C in order to avert the worst effects of climate change,[16] according to the Intergovernmental Panel on Climate Change (IPCC). To reach that goal, it is estimated that 2,500 large carbon capture and storage (CCS) plants are needed to take 3.75 billion tonnes of CO_2 out of the air by 2040,[17] dwarfing the current annual global capacity of about 40 million tonnes.[18]

Being carbon neutral (aka net zero) means removing an equal amount of CO_2 that has been emitted into the air. Being carbon negative means absorbing more than what has been emitted.[19] Carbon removal solutions can make a region or company carbon neutral if they offset an equal amount of emissions elsewhere or carbon negative if the CO_2 removed exceeds the continuing emissions.

SECTORS

ADVANCED MATERIALS & BIOTECHNOLOGY · AUTOMOTIVE, AEROSPACE & AVIATION · ENERGY, OIL & GAS · INFRASTRUCTURE & CONSTRUCTION

THE OPPORTUNITY TOMORROW

From bioplastic and wood to concrete and sand, researchers and companies around the world are developing materials[20] and genetically modified trees and plants[21] that can together help absorb carbon. Many of these advances in materials, smart surfaces and biomaterials are ready to be scaled across cities and communities in paving, paints and coatings. This could transform our surroundings into global-scale carbon capture and storage systems.

Scalable solutions for carbon capture in our environment can be combined with innovative regulations and building standards which drive the switch to alternative materials that take carbon out of the atmosphere so it can be used for other things. For example, by feeding captured carbon dioxide to algae it can be converted into biomass, which can then be harvested and turned into biofuel.

BENEFITS

Embedded, distributed carbon removal requires less capital and energy than large-scale carbon capture and storage initiatives. Walls, streets and buildings that capture carbon and/or are produced without a carbon footprint mean cities can become giant carbon sinks, significantly contributing to the goal of net-zero or even carbon negative emissions.

RISKS

Storing high volumes of CO_2 runs the risk of leaks or accidents which would contribute to pollution or local ocean acidification if deep ocean storage is used.

OPPORTUNITY #4

CAN WE MAKE DESERTS FERTILE?

GREEN IS THE NEW BROWN

Growing plants and algae in deserts tackle issues from food security to land degradation and increase the liveable area of Earth

Drylands make up more than

40%

of Earth's land surface

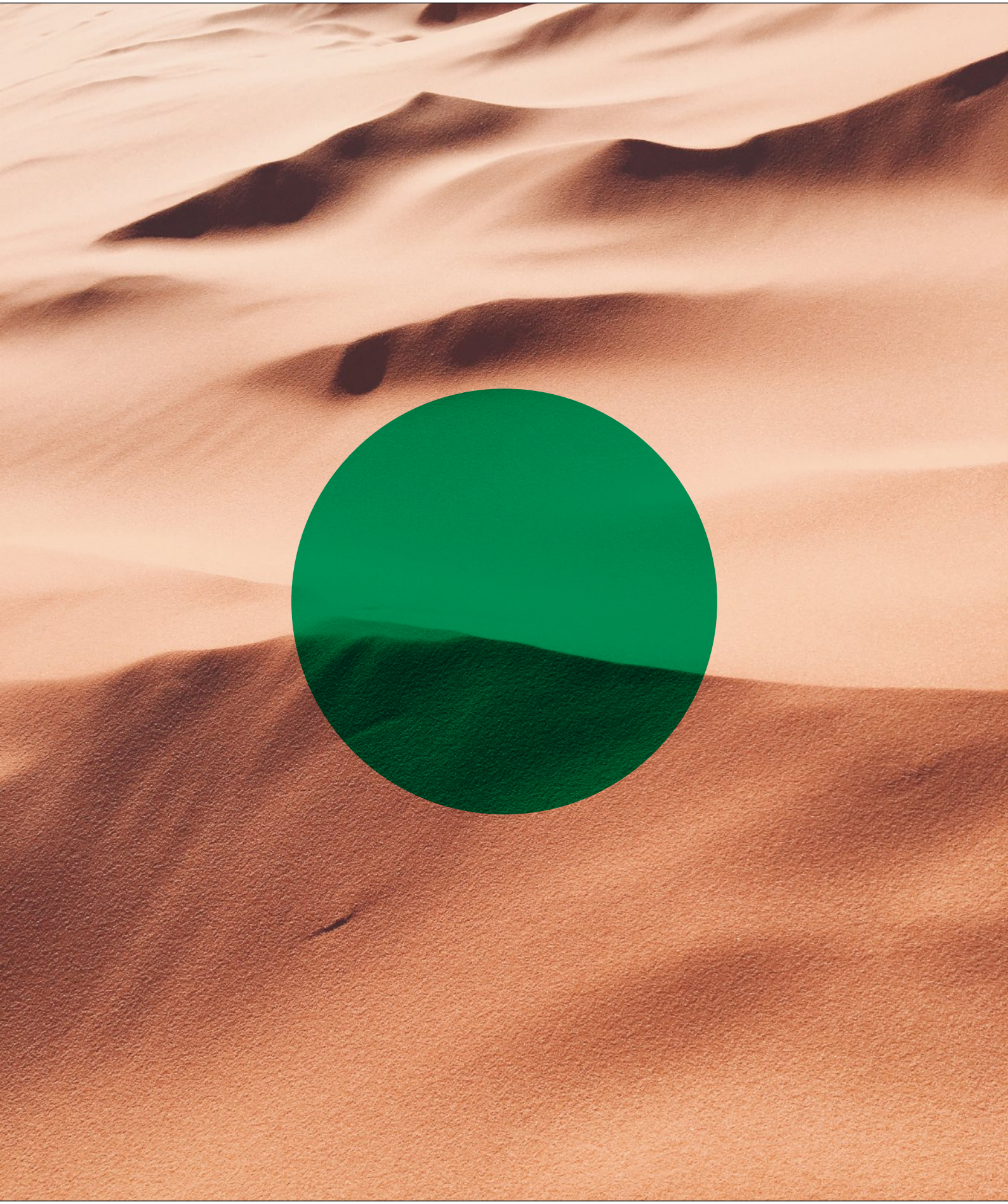
WHY IT MATTERS TODAY

Drylands make up more than 40% of Earth's land surface.[22] Around 2.1 billion people live in such areas,[23] with a population growth rate of 18.5% between 2010 and 2020.[24] With global temperatures on the rise, as much as a third of the world's population could be living in desert-like conditions by 2070.[25] Two of the largest deserts are the Arabian Desert, covering an area of 900,000 square miles (2,330,989 square km),[26] and the Sahara, covering an area of around 3,320,000 square miles (8,598,760 square km).[27]

While some deserts are vibrant ecosystems, they are largely unliveable for humans and animals alike. In 2019, desertification and other land degradation was calculated to have cost the world economy more than $85 trillion,[28] according to the World Bank. The rate of land degradation has accelerated to 30 to 35 times the historical rate, according to the UN.[29]

SECTORS

AGRICULTURE & FOOD · ADVANCED MATERIALS & BIOTECHNOLOGY · INFRASTRUCTURE & CONSTRUCTION · REAL ESTATE · UTILITIES



THE OPPORTUNITY TOMORROW

Green infrastructure offers greater economic, environmental and social value than deserts. It attracts economic growth and investment. Greening land increases land and property values, employment, productivity and tourism. The effort can also alleviate the effects of climate change and pollution, improve public health and well-being, and promote biodiversity.[30]

Advances in geoengineering and biotechnology are making it possible to transform deserts into fertile land with green infrastructure. There are many different approaches to this push to green the desert which include: changing the properties of desert sand[31] to increase nutrients; using natural water condensation processes powered by renewable energy to harvest water from the air;[32] or using treated wastewater[33] and cloud-seeding[34] to increase rainfall. Such advances need to be supported by investment and international agreements on the safe use of these technologies.

This greatly expands the scope for vegetation to grow and for the production of specialised crops such as algae for foodstuffs or novel biomaterials that may be used in sustainable textiles, among other applications.

Projects that aim to reverse the degradation or restore the degraded land are already in operation. Dubbed ‘Great Green Walls’, they are situated in the Gobi Desert in China (4,500km)[35] and the Sahara Desert in Africa (8,000km).[36]

As much as **a third of the world's population** could be living in desert-like conditions by 2070

BENEFITS

Making deserts fertile provides new livelihoods and improves the quality of life for hundreds of millions of people. Plants and other biomass grown in former desert areas create natural carbon sinks and contribute to reversing the impact that climate change has had on increasing desertification. It would safeguard communities and reduce the need for migration.

RISKS

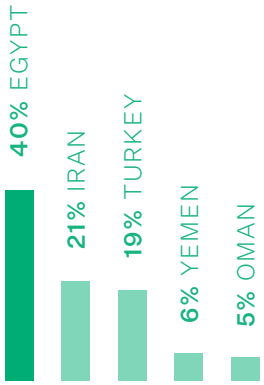
Risks include damage to indigenous flora and fauna, increased land prices and other unintended consequences of imposing human-centric, large-scale manipulation of a climate.

OPPORTUNITY #5

CAN WE SAVE OCEAN ECOSYSTEMS AND HABITATS?

INTERNATIONAL SPACE STATIONS – FOR THE SEA

An independent supranational body enforcing the protection and restoration of ocean ecosystems in international waters, preserving aquatic ecosystems with associated economic benefits and aiding in innovation



In the Middle East, **Egypt is the biggest producer** of capture fisheries and aquaculture.

WHY IT MATTERS TODAY

Nearly three-quarters of the earth's surface is covered by water and 94% of the earth's living species exist in the oceans.[37] Much remains to be learned about Earth's vast oceans, over 80% of which are yet to be explored,[38] and more research is needed, especially in climate change adaptation strategies and the sustainable development of coastal communities.

A total of 167 countries and the European Union are parties to the United Nations Convention on the Law of the Sea (UNCLOS), which came into force in 1994, setting sea limits and laying the foundation for the multilateral governance of the oceans.[39] Meanwhile, issues such as algal blooms, microplastics and the overfishing of favourite species such as cod, tuna and salmon pose threats to our aquatic ecosystems.

People of the Arabian Gulf are related economically, culturally and socially to the sea. These ecosystems provide important goods and services and are rich in varieties of fish, which represent a major source of food for people in the region.[40] Other ecosystem benefits range from primary energy production and nutrient cycling to erosion and sedimentation control.[41]

SECTORS

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At risk, the total production of fresh seafood in the Middle East region amounts to around 2% of the total worldwide[42] and, since 1961, fish production has been growing at an annual rate of 16%.[43] Egypt is the biggest producer in both capture fisheries and aquaculture, supplying 40% of total production in the Middle East. This is followed by Iran (21%), Turkey (19%), Yemen (6%) and Oman (5%). Kuwait, Qatar, Syria, Lebanon and Jordan are the lowest producers.[44]

THE OPPORTUNITY TOMORROW

A future issue-based supranational partnership could see an international agreement between nations. Such an agreement may, for example, establish a sea station focused on marine life in a specific area as a platform for scientists who specialise in marine biology, hydrology, geology and chemistry, as well as experts on climate change adaptation and sustainable development in coastal communities. A partnership of this kind could provide opportunities for technological spin-offs with significant positive socio-economic impacts.

BENEFITS

Restoring oceans mitigates the effects of climate change, such as warming and acidity. Furthering international collaboration enables novel commercial use of the seas – such as rare mineral mining, aquatic farming and deep-sea transport – to be approached sustainably and in ways that benefit all.

RISKS

Rate of climate change and marine pollution exceed efforts to preserve and restore oceans.

OPPORTUNITY #6

WHAT IF ENERGY WAS LIMITLESS?

ENERGY WITHOUT END

Daily life transformed by a limitless supply of energy through nuclear fusion

WHY IT MATTERS TODAY

Global energy consumption has risen by around 60% since 1990 with associated carbon dioxide emissions doubling since then.[45]

Around 37% of power generation was from coal followed by 23% from gas and around 3% from oil. The total share of power generation from combustible fuels in 2019 was 63%.[46]

The share of low carbon sources (wind, solar, nuclear, hydro) in power generation has been steadily increasing to stand at 32.2% of global supply in 2019.[47]

Even though the price of renewable technologies remains high for some countries, costs have been falling[48] by an estimated 13% for onshore wind projects, 9% for offshore wind projects and 7% for solar photovoltaics (PV).[49] The cost of large-scale solar projects has decreased by 85% in the last decade.[50]

Closing all coal power plants would cut emissions by around 3 billion tonnes of CO_2 a year.[51] This represents around one-fifth of the reduction in emissions needed to halve emissions by 2030 compared with 2010 as required to limit the temperature rise to 1.5°C.[52] It would also reduce costs of energy by an estimated $32.3 billion per year.[53] It is projected that emerging and developing economies will need to increase investments in clean energy by more than 7 times to $1 trillion by 2030 to reach the global goal of net-zero emissions by 2050.[54]

The lower cost of renewables provide a strong business case to move past coal while pursuing net zero emissions.[55]

SECTORS

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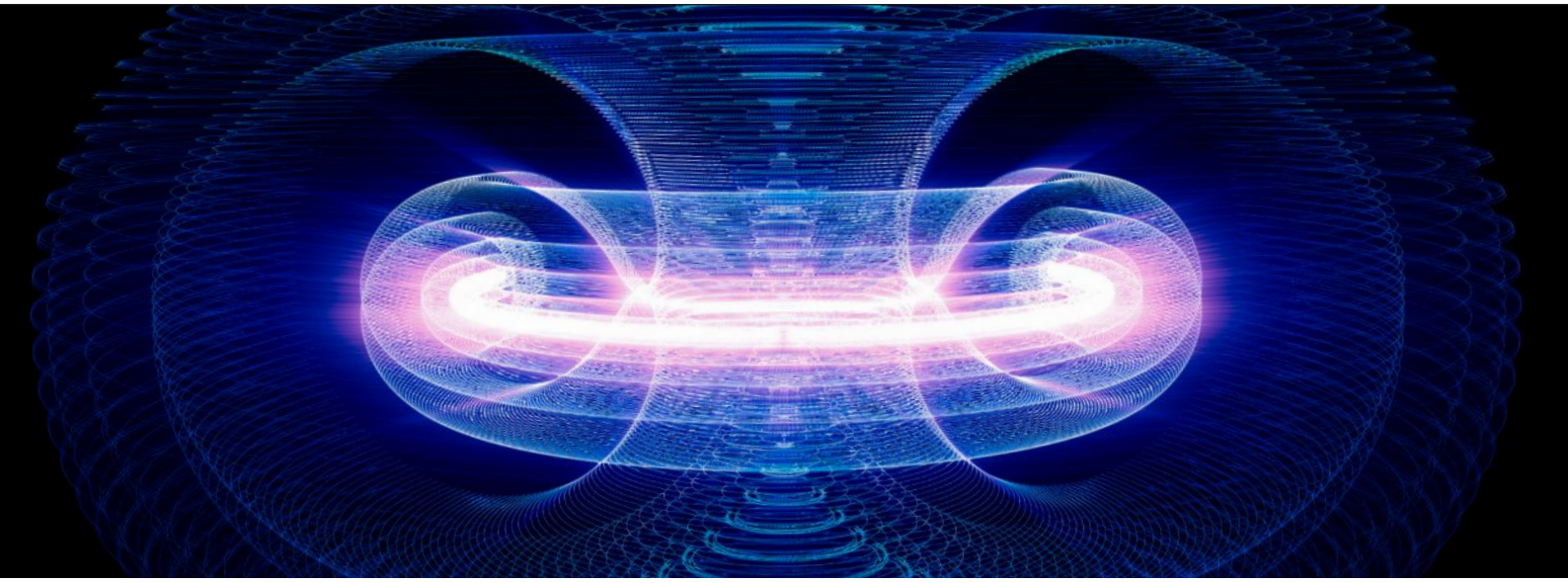

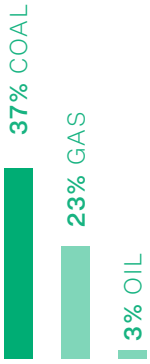

The total share of power generation from combustible fuels

Closing all coal power plants would cut emissions by around

3 billion tonnes

of CO_2 a year

one-fifth of the reduction in emissions needed to halve emissions by 2030

THE OPPORTUNITY TOMORROW

Nuclear fusion has the potential to accelerate the energy transition beyond the changes made possible by renewables by providing a source of energy that is emissions-free, cheap, safe and almost limitless. Fusion reactors require no hazardous materials such as uranium or plutonium and produce no greenhouse gases. Their fuel, seawater, is readily available. Fusion can potentially provide energy independence for numerous countries and decarbonise energy use.

Research and demonstration projects are developing rapidly, such as the ITER device, supported by 35 countries.[56] As many as 74 experimental fusion reactors are currently operating, with 15 more proposed or planned.[57]

Potential advances include floating[58] low-temperature reactors that can extract hydrogen isotopes from seawater while burying low-level radioactive waste deep in the seabed. In combination with ultra-low latency energy transmission through high temperature superconductors, this near infinite form of clean energy could become available very widely.

BENEFITS

Limitless power enables the growth of new industries. Travel and logistics can become both cheaper and less environmentally damaging, as can electricity, heating and cooling. People can live more comfortably, efficiently and productively, increasing their quality of life.

RISKS

Risks include accidental or deliberate incidents with the handling of radioactive waste from fusion, even though it has a short half-life.

SOCIETIES EMPOWERED

Empower societies by offering solutions to humanity's most complex and universal needs, optimising systems they rely on, safeguarding risks that could make societies more fragile in the face of crises and extending individual and collective potential for growth and development.

OPPORTUNITY #7

HOW TO SUPPORT PEOPLE IN LIVING A MORE FULFILLING LIFE?

THE MINISTRY OF SELF-REALISATION

As universal needs are met, governments make a priority of self-realisation in legislation, influencing their own agenda across all areas of policy as well as that of their citizens

WHY IT MATTERS TODAY

Well-being: from happiness and self-realisation[59] to positivity and having a meaningful life.[60]

Where happiness is focused on attaining emotional feelings of enthusiasm or others associated with happiness, self-realisation is the process by which individuals try to reach the highest potential from self-acceptance, understanding purpose in life, uncovering and applying personal talents, making positive social connections, managing everyday life and operating with autonomy.[61] One of people's highest needs, from one's own realisation of talents and potential to personal integration and unity of purpose.[62]

Including the Middle East, the global personal development market was valued at around $38 billion in 2019 and is expected to grow at a compound annual growth rate (CAGR) of more than 5% from 2020 to 2027 to reach $57 billion by 2027.[63] The market includes but is not limited to books, platforms and coaching in mental health, motivation, self-awareness, skill enhancement and related areas and is expected to continue its advance enabled by technology, neuroscience and greater psychological understanding.

SECTORS

EDUCATION · HEALTH & HEALTHCARE

The global personal development market was valued at around

$38 billion

in 2019

expected to reach

$57 billion

by 2027

THE OPPORTUNITY TOMORROW

As people live longer and healthier lives, and as automation and technological advances change the nature of work,[64] citizens' expectations of government could shift to include support for self-realisation and more fulfilling lives. In keeping with the dynamics of an era of quantum shifts, governments may evolve to adopt such a focus in policy and legislation, taking into consideration the impact each policy will have on citizens' potential for self-realisation as well as their interactions with each other and government.

While a single ministry can undertake such a role, novel forms of cross-department governance may allow for greater impact. By taking a cross-disciplinary approach, governments could look for policy solutions to support individuals' efforts for self-realisation. This can include promoting initiatives on: self-improvement; lifelong education; career and skills development; community engagement; and cultural and sporting activities.[65] These can be supported by new metrics to measure growth.

BENEFITS

As well as enhancing individual well-being, these initiatives encourage positive interactions with others and thus improve social cohesion.

RISKS

A risk of governments unintentionally impinging on individuals' liberty and agency when determining what constitutes self-realisation.

OPPORTUNITY #8

IS THERE A WAY TO PROTECT OUR MOST PERSONAL DATA?

PUTTING THE 'SAFE' IN DATA SAFETY

Individuals' personal data is stored in a digital safe, protecting their privacy in an environment where real-time data capture and analysis is ubiquitous

WHY IT MATTERS TODAY

Data breaches, deletion or manipulation of critical data, disruption of services, fraudulent transactions and theft[66] led to more than 37 billion[67] records being compromised in 2020.

Overall, the direct costs of data breaches in 2020–2021 rose from $3.86 million to $4.24 million, approximately 10% year on year.[68] Valuable to cybercriminals, between 2020 and 2021, healthcare data breach costs increased from an average total cost of $7.13 million in 2020 to $9.23 million in 2021, a 29.5% increase.[69] Also in 2021, data breach costs in the public sector witnessed a 78.7% increase in average total cost from $1.08 million to $1.93 million.[70] Ransomware events cost an average of $4.62 million per attack in 2021.[71]

These include the costs of recovering a lost or stolen record and containing the associated impact but do not include the hidden costs from increased insurance premiums, operational disruptions, devaluation of trade names and loss of intellectual property.[72] The most common type of record lost is customer personal identifiable information (PII) at $180 per lost or stolen record in 2020 compared to an average of $161 per record in 2021.[73] With increasing demand for protection from such events, the global cybersecurity market is predicted to grow from around $167 billion in 2019[74] to $345 billion by 2026[75] and individuals are increasingly concerned about their personal data.

SECTORS

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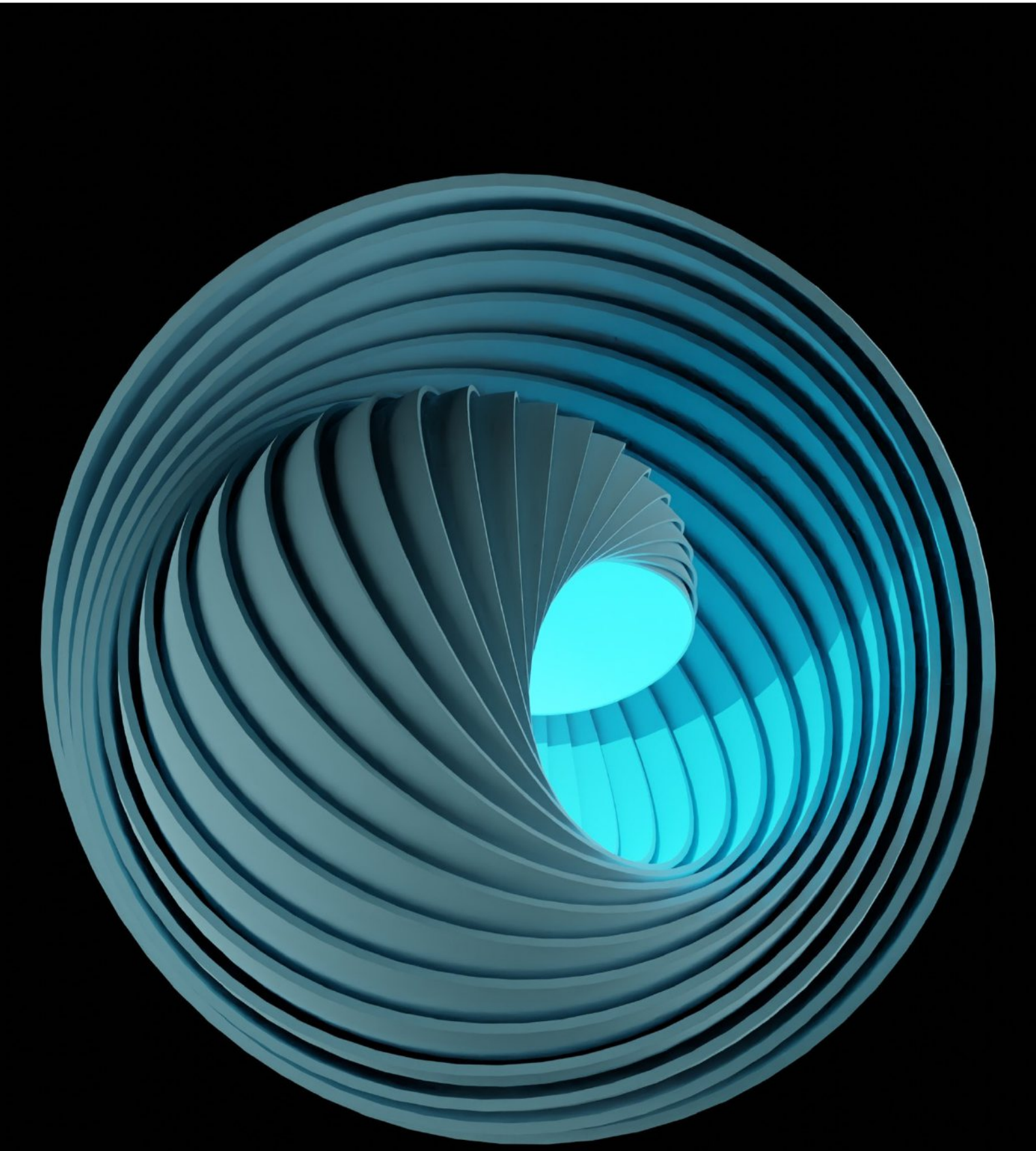

Cost per lost or stolen record

$161 average (2021)

The most common type of record lost is customer personal identifiable information (PII)

THE OPPORTUNITY TOMORROW

With advancing machine intelligence and the growth of quantum computing, data could proliferate at a rate that challenges cybersecurity systems to keep track of it and to distinguish between personal and public information. However, advances in storage technology, distributed ledger technology, encryption and user authentication methods can lead to new kinds of cybersecurity systems that store sensitive data in safe spaces.

'Digital safes', or digital trusts, that use novel encryption systems can enable people to perform online transactions and interact using emerging technologies such as augmented reality, feeling secure in their protection against cyberattacks. Moreover, by adopting new technologies including encryption and distributed ledger technology, a data trust can provide transparency in data sharing and auditing that shows who is using the data at any time and for what purpose, thus removing the legal and technological friction that currently exists in data sharing.[76]

BENEFITS

As people gain confidence in the safety of their personal data, levels of trust can increase among individuals, government and business, improving societal cohesion and entrepreneurialism. Data trusts can also encourage data interoperability as well as the ethical governance of data, for example by ensuring that individuals have consented to the various uses of their data (as required by regulation in several jurisdictions around the world), removing data bias and de-identifying personal data.

RISKS

Risks include states betraying their citizens' trust and increased vulnerability of societal well-being to unintentional or malicious data breaches.

OPPORTUNITY #9

WHAT IF THE WORLD AGREED TO A GENETIC CHARTER?

INTERNATIONAL AGREEMENTS IN OUR DNA

A global agreement on gene editing ensures access to advances while safeguarding against discrimination and abuse

WHY IT MATTERS TODAY

The public's perception of gene-based editing and therapy has fluctuated over recent decades. Deaths and damage have occurred among patients in in gene therapy trials,[77] weakening public support, and the technology remains far from perfect. In one research study in London, researchers found that approximately 16% of the human embryo cells analysed had 'accidental mutations'[78] after gene editing had been done.

However, following the use of CRISPR (clustered regular interspaced palindromic repeats) editing to provide accurate diagnosis of Covid-19 and associated variants,[79] there has been an uplift in public sentiment. Although perceptions of gene editing improve more generally in the medical sphere, together with an increase in public acceptability of such treatments,[80] ethical concerns grow about its potential to be a source of discrimination when used for physical, aesthetic, cognitive, physical or moral enhancement.[81]

Meanwhile, the technology has expanded. The US Food & Drug Administration (FDAP) approved the first cell and gene therapy in 2017.[82] As of November 2021, there are 22 FDA-approved cell- and gene-based therapy products available to minimise genetic diseases.[83] However, despite expansion, underlying genetic data used in genomics research do not always include underrepresented groups.[84] This is particularly relevant for the Arab population as most of the research comes from the US where the Arab population is only a minority. Some projects are being developed in Kuwait, Qatar and Saudi Arabia but more regional efforts are needed.[85]

SECTORS

HEALTH & HEALTHCARE

In an effort to improve the ethical standing of genomics programmes, the Global Alliance for Genomics and Health (GA4GH) has developed a number of frameworks that countries follow when implementing genomics in their healthcare systems. One such framework is the Ethics Review Recognition Policy that takes into account the difficulties with current cross-border genomics programmes.[86] The Oviedo Convention – opened for signature in 1997 and ratified by 29 countries in Europe[87] – is the only international legally binding instrument covering biomedical research, genetics and organ and tissue transplantation.[88] It addresses concerns about genetic enhancement by limiting the purposes of any intervention on the human genome to prevention, diagnosis or therapy.[89]

THE OPPORTUNITY TOMORROW

A combination of expert scientific and ethical debate and political willingness to align regulations across nations can lead to the adoption of a global charter setting out principles relating to genetic manipulation. Such a charter would promote the role of gene editing as a tool to treat diseases while setting out processes for managing risks and, if necessary, responding to situations where indirect mutations arise and harm those who have had their genes edited.

BENEFITS

A gene charter for editing, including provisions on enhancement, would provide clear regulatory guidelines for tackling genetic diseases, providing countries with a framework to use for gene editing services. It would enforce equal access for all people looking to receive this service and protect the rights of those whose genes have or have not been edited. It would support gene editing as a means of preventing suffering and help prevent gene editing from becoming a source of abuse.

RISKS

Risks of unintended harm arise through discrimination against groups rejecting genetic editing for value-based reasons and lack of participation and adoption by nations.

OPPORTUNITY #10

WHAT IF ROBOTS NEEDED RIGHTS?

RIGHTS FOR BOTS

A framework that outlines the rights for robots as a proxy for human rights

WHY IT MATTERS TODAY

The number of new industrial, professional and consumer service robots reached approximately 22 million in 2020.[90]

The global robotics market was valued at around $25 billion in 2020 and is expected to reach up to $260 billion by 2030.[91] In the manufacturing industry, there are 113 robots for every 10,000 employees worldwide.[92] The market for professional service robots (transportation, cleaning, medical, hospitality, agriculture) with sales of $6.7 billion worldwide was up 12% in 2020 from 2019. At the same time, sales of new consumer service robots (domestic cleaning, lawn mowing, vacuums) grew 16% in 2020 to $4.4 billion worldwide.[93] Some 47% of the service robot suppliers are from Europe, 27% from North America and 25% from Asia.[94, 95]

THE OPPORTUNITY TOMORROW

Highly autonomous machines with near-human levels of general intelligence – as well as super-human capabilities in specific areas – have the potential to become ubiquitous, not only in factories but in homes as well.

As people rely more on robots for their comfort and productivity, they may start to perceive them differently, feeling uncomfortable about disposing of them as they become obsolete, leading to widespread calls for 'robot rights'. But an increase in violence towards robots may be another predictor of future violent behaviour[96] and such violence could become an implicit form of dehumanisation,[97] particularly in domestic robots, leading to reduced empathy and increased distrust and anger towards others.

By bringing together a combination of programmers, robot producers and suppliers existing procedures can be reviewed[98] and a new framework for robot rights implemented and certified at the production level.

SECTORS

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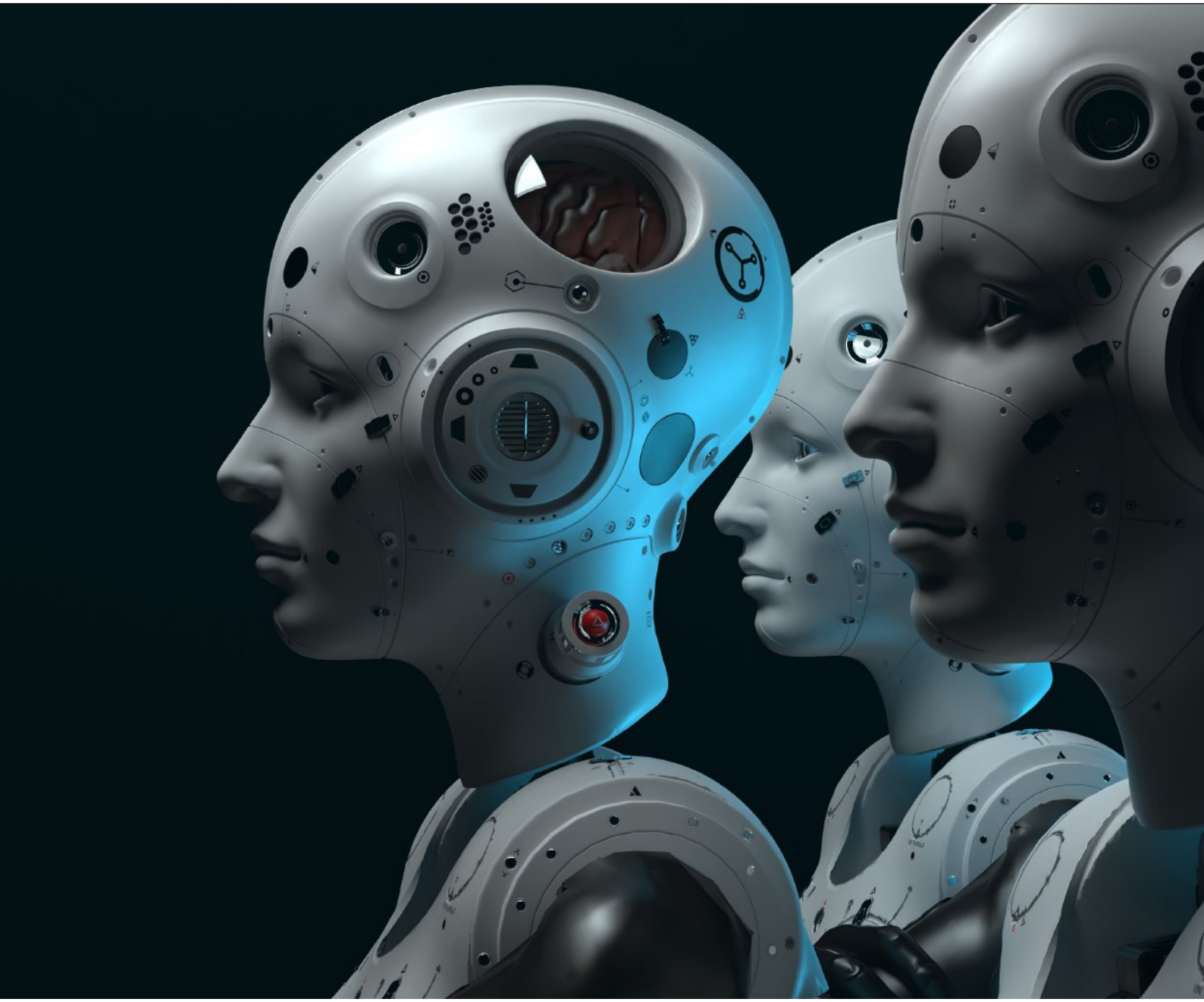
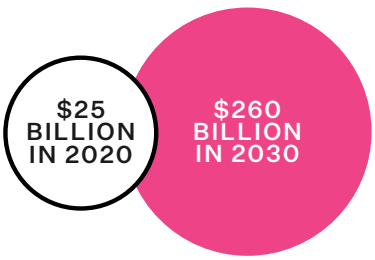


The global robotics market is expected to grow **100 times**



BENEFITS

By recognising their contribution to society, the rights-for-robots movement sparks thinking about what our treatment of machines says about our wider values. Robot rights may become a signal for more tolerant societies and a proxy for human rights.

RISKS

Risk of robots' rights making people feel inferior or that their rights have been diminished[99] as robots take over more tasks and grow in influence.

OPPORTUNITY #11

WHAT IF AFFORDABLE ELECTRICITY IS UNIVERSAL?

POWER WITHOUT LIMITS

Transporting energy without loss, linking populations and industries everywhere

WHY IT MATTERS TODAY

Global electricity consumption has more than doubled in the past 30 years to over 22,000 TWh.[100] This trend will continue, especially as close to 250 million electric passenger vehicles may be on the roads by 2030[101] and up to half of industrial processes become electrified.[102]

Even though 90% of the world has access to electricity,[103] it is still unevenly distributed.[104] Similarly, while average losses in the transmission and distribution of electrical power range from 5% to 18%[105] globally, other areas in the world can lose up to 60%[106] of energy transmitted in their cities or communities. Widespread access to dependable, environmentally friendly, low-cost electricity is a critical enabler of growth and prosperity.

In the Middle East, energy consumption has increased five times in the past 30 years to over 1,020 TWh.[107] Compared to output and also unevenly distributed, the World Bank reported an average loss of 13.5% in electric power transmission and distribution in the Middle East and North Africa in 2014.[108] In the absence of more recent numbers, and taking a global average of 11.5% for transmission and distribution loss, the Middle East may lose up to 140 TWh of electricity generated per year, close to the 131 TWh annual electrical consumption in the United Arab Emirates.[109] The Dubai Water & Electricity Authority (DEWA) reported an average loss of 3.3% in the first half of 2021.[110]

THE OPPORTUNITY TOMORROW

The phenomenon of superconductivity was discovered over a hundred years ago, in 1911, by Heike Kamerlingh Onnes in Leiden, Germany.[111] It denotes a lack of electrical resistance in certain materials at certain temperatures and has been used in technologies such as magnetic resonance imaging (MRI).[112]

SECTORS

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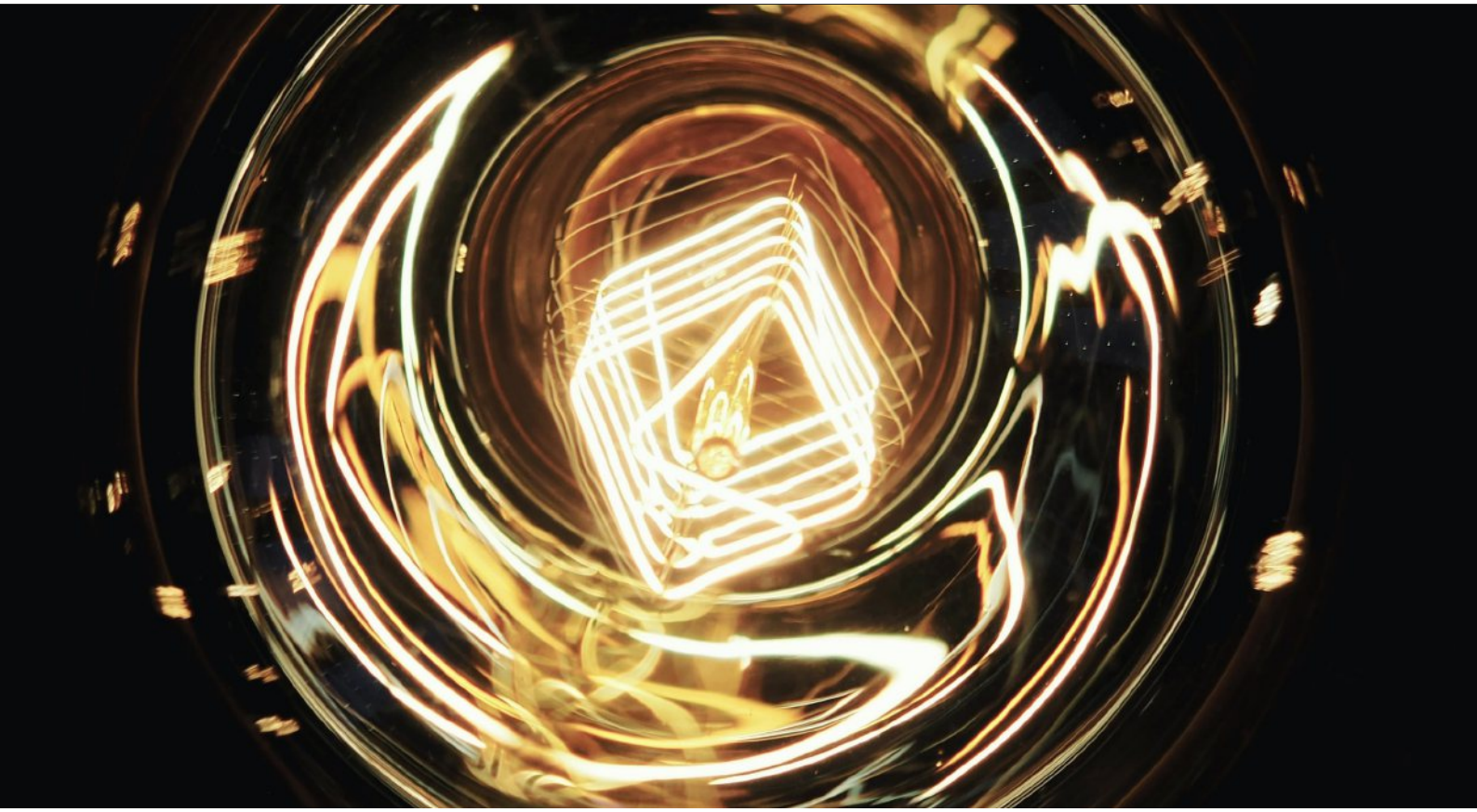

Global electricity consumption has **more than doubled** in the past 30 years to over

22,000TWh

In the **Middle East,** energy consumption has **increased five times** in the past 30 years to over

1,020TWh

New superconducting bismuth-based[113] and other materials that can transport energy with no loss promise to make energy production and distribution far more efficient. Superconducting wires are already central to advances in nuclear fusion technologies that are likely to accelerate commercial applications.[114] Use of efficient superconducting cables in the future will allow more people around the world to be connected to electricity grids and enable businesses to locate their premises close to energy generation sources.

BENEFITS

Lower global energy costs and more efficient use of resources would increase the quality of life, reduce pollution and boost economic growth in regions that currently lack energy capacity. Advances in superconducting technology will mean that lower voltage current can be transmitted and less real estate space would be required for unsightly pylons or electrical current-converting sub-stations.

RISKS

There is potential for a winner-takes-all dynamic in superconducting technology to limit the benefits of breakthroughs. The concentration of power transmission could also increase the potential impact of attacks or outages.

OPPORTUNITY #12

HOW TO ESCAPE A CLIMATE DISASTER?

THE CLIMATE VISA

A globally recognised permit for people in climate-stressed regions to legally migrate

WHY IT MATTERS TODAY

Climate change is redrawing the global map.

As many as 48 countries – mostly islands – could disappear by 2100 because of rising sea levels.[115] On land, the Sahara Desert expanded by 8%, or 100 kilometres, southwards between 1950 and 2015, and continues to expand at that rate.[116] This, and other impacts of climate change from shoreline erosion, coastal flooding and agricultural disruption, might necessitate people migrating and resettling in other areas.[117]

There could be 216 million climate refugees by 2050[118] searching for safer and more economically stable places to live, 143 million of them in sub-Saharan Africa, South Asia and Latin America.[119]

Equally as dramatic, 1–3 billion people could be forced to move to places with climate conditions that are outside – and largely hotter than – those that humanity has tended to live within over the past 6,000 years. Billions will also be living in countries that do not have the infrastructure to adapt well to climate change impacts and conditions that make life more challenging.[120] The Middle East is one such region, experiencing record high summer temperatures above 50°C and being scarcely equipped to deal with the challenges to come.[121]

SECTORS

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As many as

48

countries - mostly islands - **could disappear by 2100** because of rising sea levels

There could be

216 million

climate refugees by 2050

THE OPPORTUNITY TOMORROW

Not all countries and regions will experience the worst impacts of climate change[122] and those less affected could collaborate to help those suffering the most.

Multiple countries could work together to create a 'climate visa' scheme that provides people in climate-stressed regions with the opportunity to migrate in a managed way to host countries looking to grow their populations or with the capacity to absorb them. The opportunity lies in establishing such a scheme ahead of the moment of need, ensuring economic, political and humanitarian feasibility.

BENEFITS

Informed by modelling of likely migration movements, the scheme will win the support of climate-stressed countries as reducing their populations makes it easier to manage the impact of climate change. It improves the life chances of millions who can migrate legally to regional partner countries or countries with declining populations.

RISKS

Risks include host countries taking in too few climate refugees or failing to respect agreements, loss of young and educated workers affecting the economic dynamism of climate-stressed regions and challenges of integrating new migrants.

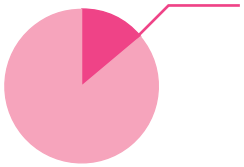
A consequence may also be loss of indigenous cultures and collective trauma of being dislocated from former homelands.

OPPORTUNITY #13

WHAT IF SCHOOLS WENT BEYOND SCHOOLING?

MACHINE LEARNING AND A HUMAN TEACHER

Using neural interfaces to acquire knowledge with teachers serving to empower children with future life skills and mental well-being



14%

of 10–19 year olds have a mental health issue

WHY IT MATTERS TODAY

Over 1 billion children go to school on any given day.[123] Globally, there are approximately 93 million children with disabilities – a group that faces the largest barriers to receiving education.[124] From a mental health perspective, 14% of 10–19 year olds have a mental health issue.[125]

Other complex challenges facing schools include early dropouts,[126] intolerance of ethnic and religious diversity[127] and exclusion due to poverty or conflict.[128] These issues have led to a greater need to promote student well-being in schools.[129] In response, more countries are adopting a whole-school approach, where students go to school not only to study conventional subjects but to engage with the school culture and become active in their communities.[130]

Nearly half of the Middle Eastern and North African population of around 465 million[131] are children and young people under the age of 24.[132] The region faces similar challenges to the rest of the world with calls for more inclusive education and demands for more support for mental health.

SECTORS

EDUCATION · HEALTH & HEALTHCARE · INFORMATION & COMMUNICATION TECHNOLOGY

THE OPPORTUNITY TOMORROW

Traditional learning is giving way to broader development of aptitudes needed for everyday life and good mental health. As brain–computer interfaces for knowledge acquisition keep improving and accommodating individual differences, children will need less time to acquire knowledge and more educational capacity can be devoted to development of life skills and good mental health.

Technologies can be used to monitor brain signals and associated neurocognitive processes and interact with students through feedback mechanisms such as questions and prompts. This can both enable better learning for those with special educational needs and enable all students to learn and think more effectively.[133] With such accelerated learning, more time and attention will be devoted to understanding the best ways to learn life skills and improve mental health, including new approaches to hiring, training and monitoring teachers.

These shifts can combine to create the political and public will to transform the roles of schools in society. Curricula will be adjusted and schools repurposed as spaces for self-realisation and well-being, focusing on creativity, social skills and play. A teacher's role would be to empower and mentor children in life skills. The machine's role would be to ensure knowledge acquisition and empower teachers with better insights on learning and mental health.

BENEFITS

Schools become hubs for new thinking and ideas. The shift away from exam-driven learning reduces childhood stress, with benefits for long-term well-being and psychosocial and physical well-being. Communities and families take on a wider role in improving childhood health behaviours and development.

RISKS

Risks include widening inequality in employment and self-actualisation if not all schools are transformed. Harm can also arise if long-term evidence reveals that less structured learning does not equip students as well as intended.

OPPORTUNITY #14

WHAT IF THERE WAS A GLOBAL CURRICULUM?

WHOLE-EARTH EDUCATION

A common curriculum implemented around the world with millions learning the same skills, creating a shared global understanding and improving employment prospects

1 in 5

children are not in school

WHY IT MATTERS TODAY

There are 773 million people around the world who are still illiterate, most of whom are women.[134]

An estimated 617 million children around the world are unable to reach minimum proficiency levels in reading and mathematics due to lack of trained teachers and insufficient learning materials, along with other city or country-specific reasons from poverty and gender to ethnic divisions and conflict.[135]

One in five adults in OECD countries have not attained upper secondary education, and in 2019 at least 10% of school-aged young people in around a quarter of OECD countries were not in school.[136]

In the Middle East and North Africa (MENA), around 200 million people, nearly half of the total population, are under 24 and one in every five children are not in school.[137] In the 2021 Arab Youth Survey, 87% of young Arab people (18–24) were concerned about the quality of education in a region where youth unemployment, at 25%, far exceeds the global average of 13.5% and, according to the World Bank, educational standards are widely perceived as being at the root of the problem.[138]

A third of young people in the Middle East and North Africa (MENA), would consider emigrating for economic reasons and educational opportunities.[139]

SECTORS

EDUCATION · HEALTH & HEALTHCARE

THE OPPORTUNITY TOMORROW

Countries can collaborate to create a globally recognised, core curriculum of high and consistent quality from kindergarten up to age 18.

This effort can be enabled by new technologies that support both remote and in-person learning, a market projected to be worth $350 billion by 2025.[140] These new technologies also offer the option for remotely administered computer-based assessments to level up the efficiency of examinations and certification processes across all schools.

This global curriculum provides an agreed base for children's personal growth and prosperity, with countries augmenting it according to their national or cultural preferences or means. The central organisation which administers this common core curriculum would provide a standard, globally recognised certification of skills attained at each grade level. A student could be confident that they have received an equivalent education as students studying in any other school across the world as long as they followed the same path through the internationally recognised curriculum.

BENEFITS

Scalable teaching solutions and materials can bring down the costs of education at the same time as levelling up educational attainments around the world. The global curriculum promotes intercultural understanding and bonds between people by creating a shared experience from childhood. This leads to greater transferability of skills and mobility for people, which boosts individuals' life chances and well-being while creating social and economic value for local and national communities.

RISKS

Risks include poor execution of the curriculum because of local limitations in technological infrastructure and resistance from conventional education providers. Young people's skillsets may not align with local or regional skill demands, or they may feel disconnected from local values or norms if the core curriculum is not complemented with culturally or nationally significant subjects.

OPPORTUNITY #15

WHAT IF WE NEVER HAD TO LEAVE OUR HOMES?

LIFE-IN-A-BOX

Self-sufficient homes, inspired by space research, that provide life's essentials and unburden the planet

759 million

people worldwide do not have access to electricity

WHY IT MATTERS TODAY

Civilisation today is not delivering basic necessities for billions.

Despite progress on the United Nations' Sustainable Development Goals (SDGs) related to food, water and energy, over 2 billion people still do not have access to adequate food,[141] one in three still do not have access to drinking water[142] and 759 million do not have access to electricity.[143] More generally, and despite decreasing fertility levels, the global population is expected to continue to increase by more than 80 million people per year to 9.8 billion by 2050.[144]

These trends in the human population place further stress on resources. Global energy consumption, assuming the global economy returns to pre-Covid pandemic levels, is projected to grow by 12% by 2030[145] and water demand, assuming no efficiency gains are realised, will rise by 40% above the level of reliable supplies.[146]

Water scarcity in the Middle East and North Africa (MENA) is expected to as much as quadruple in some countries by 2050.[147] As a result, agricultural production is projected to decrease by as much as 60% in some economies, with consequences for food security.[148]

SECTORS

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Over
2 billion
people still do not have access to adequate food

Power generation, particularly in hot climates, relies on large supplies of water for cooling and the cost of the necessary transformation toward less water-intensive electricity generation is estimated at $50 billion by 2050[149] in the Middle East and North Africa (MENA).

These challenges are compounded by the rise in climate-related weather events, from wildfires to ice storms, from flooding to drought.

The response to these pressures has been to build 'smart', eco-friendly homes that are 'off-grid' in terms of conventional networks and are self-sufficient in power, water and other resources.[150, 151, 152, 153]

The global smart home market size is projected to reach more than $620 billion by 2026, a growth rate of nearly 30% per year.[154] The global green building materials market is expected to grow from around $217 billion in 2020 to nearly $400 billion in 2025 at an annual growth rate of nearly 13%.[155]

THE OPPORTUNITY TOMORROW

1 in 3
still do not have access to drinking water

The ability for humans to live in complete autonomy, even on Earth, is still in its infancy. However, space research may provide scope for progress.

Projects such as the European Space Agency's MELiSSA (Micro-Ecological Life Support System Alternative) are researching regenerative systems for life in space with the highest degree of autonomy possible to produce food, water and oxygen from waste. Similarly, the Amsterdam-based 'Space for Food' study looked at how the closed-loop technology used to recycle water in space could be applied on Earth with potential irrigation-quality water recovery of up to 80% and nutrient recovery sufficient to produce roughly 2 kilograms of vegetables per person per day from the municipal waste stream.[156]

Future autonomous homes can include personalised on-demand water, electricity and food services, as well as Internet connectivity for immersive experiences for work or recreation.

There are many efforts in place focused on innovative solutions for an all-encompassing solution for homes that can be installed permanently or as needed, providing food, water and energy through novel solutions and closed-loop systems. A consortium to create an open self-sufficient living ecosystems that promotes collaboration between construction, technology and utility companies can be established to build the next generation of homes and sustainable communities.

Water demand, assuming no efficiency gains are realised, will rise by

40%

above the level of reliable supplies by 2030

BENEFITS

Such completely autonomous homes can serve as survival capsules in the face of catastrophes or existential threats. Fewer demands on natural resources or physical transport networks bring greater environmental benefits and new growth opportunities.

RISKS

Social isolation and the fracturing of physical communities could harm people. Risks of malicious harm arise because of potentially higher vulnerability to physical attacks and cyberattacks on closed-loop resource systems.

OPPORTUNITY #16

WHAT IF WE MADE PERFECT LIFE DECISIONS?

CODE FOR HAPPINESS

The ability to make informed life choices using the power of predictive modelling to play out scenarios

WHY IT MATTERS TODAY

Happiness has been described in contrast to life choices such as: behaviour, for example getting more exercise; cognitive disciplines, for example showing gratitude or using cognitive behaviour therapy; and volition, for example setting and achieving realistic goals.[157] People who describe themselves as happy tend to flourish, with good relationships, high productivity and strong coping mechanisms. But there are indications that global happiness has gone down.[158]

Amongst others, the World Happiness Report ranks nations on happiness using metrics such as gross domestic product per capita, levels of social support, healthy life expectancy, generosity of others, perceptions of corruption levels and the freedom to make one's own life choices to rate countries by happiness.[159] Finland was ranked as the happiest country in the world in 2021.

The top seven happiest countries in the world for 2021 were all countries in northern Europe. The Middle East includes, on the one hand, some prosperous and quite happy nations, but, on the other, some that are at the foot of the global rankings, such as Yemen, or entirely excluded, such as Syria, for which no evaluation is provided.[160]

Even happy people occasionally experience sadness[161] and, as opposed to emotions alone, rely on evaluating their own life for a more complete assessment of one's own level of happiness.[162] What emerging research has found is that the freedom to make one's own life choices is in part related to the ability to make the best decision out of two or more possible alternatives.[163]

SECTORS

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THE OPPORTUNITY TOMORROW

People can be helped to make life choices leading to happiness through the use of quantum computing, and advanced intelligence more generally, along with vast data sets. The data sets can be used to populate bespoke predictive models either based on choice theories (the understanding of how people make choices)[164] or machine-learning models.

These models can then optimise each individual's decisions based on the environmental context and situations they find themselves in. By including people's genetic and metabolic profiles and information about their finances, personality and health, predictive models can minimise the emotional and financial fall-out of bad choices and optimise the path to the future for themselves, their families and communities.

Legal and ethical frameworks can enable the use of these models and help policy-makers better understand predictability in social policies across social contexts and improve, if not necessarily accurately predicting outcomes in social policy-making.[165]

BENEFITS

The normalisation of such tools makes societies more stable and resilient, optimising individuals' time and potential and improving their happiness. The best possible outcomes from life decisions are no longer merely hoped for but expected.

RISKS

Risks include accidental or deliberate corruption of data affecting predictions and scope for models to be used to limit people's free will. Conversely, the nature of predictive decision-making and the widespread use of these tools will continuously generate new and more complex futures, but giving less clarity on who will bear responsibility for a decision that does not lead to anticipated outcomes and does not guarantee accurate predictions in social policies.

UNINTENDED CONSEQUENCES

Unintended harm may occur by removing the potential for serendipity as people no longer realise they are missing out on 'happy surprises'.

OPPORTUNITY #17

WHAT IF WE KNEW OUR TALENTS AND HOW BEST WE CAN WORK WITH OTHERS?

TALENT MEETS OPPORTUNITY

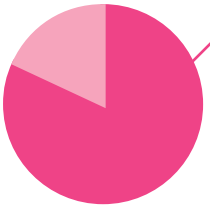
Network-based brain–computer interfaces and neuroscience innovations enable individual and collective improvement in productivity and cooperation

WHY IT MATTERS TODAY

Finding the right talent is one of the most challenging managerial tasks as 82% of companies do not believe they recruit highly talented people.[166] Emerging from the COVID-19 pandemic, talent acquisition is expected to be even more challenging.[167]

Those with greater talent are not always the most successful.[168] Luck – in practice a combination of external forces that are out of our control – may account for just over half of career success, with the rest depending on effort and talent, including intelligence, natural interests and other traits.[169]

More than half of the variability in income of the world population is based on factors over which people have little or no control, such as their country of residence and income distribution within that country.[170]



82%
of companies do not believe they recruit the right talent

SECTORS

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For example, studying 1.2 million inventors in the United States between 1996 and 2014, children born to parents in the top 1% of the income distribution are 10 times as likely to become inventors as those born to families with below-median income. White people are more than three times as likely to become inventors as are black people and 82% of 40-year-old inventors in 2019 were men.[171] Despite marginal improvement globally, on the current trajectory it will still take 136 years to close the global gender gap in terms of economic participation and opportunity, educational attainment, health and survival and political empowerment.[172] Despite achieving significant progress, the Middle East and North Africa (MENA) remains the area with the largest gender gap, at 61%.[173] Unfulfilled potential worldwide is reflected by the fact that the richest 1% have been calculated to have twice as much wealth as 6.9 billion other people.[174] In the Middle East, the top 1% of income earners owned 23% of total income in 2019, almost twice as much as the share earned by the bottom 50%.[175]

THE OPPORTUNITY TOMORROW

Identifying talented people and helping them gain equal access to environments rich in opportunities results in greater collective innovation and productivity. Research has indicated that intelligence is one of the most heritable of behavioural traits.[176] 'Grit', defined as perseverance and passion for long-term goals, has been shown to be a significant predictor of academic success. Variance in levels of 'grit' has been shown to depend on around one-third on heredity and two-thirds on environmental factors.[177]

The application of neuroscience and psychology, along with advances in artificial intelligence (AI) and network-based brain–computer interfaces, can help us predict and optimise productivity at individual and collective levels, enabling people to reach their full potential and societies to produce the best results possible.

Mapping the brain down to the neuron level can detect brain activity associated with high-level thought processes and help us understand what kinds of task are best suited for each person's brain. This allows people to be their most confident selves as they discover their innate talents. AI also allows for data analysis that can reveal how individuals work and how they work with others. Feedback in real time could boost collective activity, supporting people in accomplishing common objectives and undertaking problem-solving endeavours even faster.

BENEFITS

Individuals would benefit from improved morale and productivity, finding ways to solve problems and address societal challenges that bring both monetary and non-monetary benefits.

RISKS

Risks include inflicting psychological harm on others through network-based brain–computer interfaces along with intentional or unintentional forms of psychological control that threaten human autonomy and sense of agency.

HEALTH REIMAGINED

Redefine mental and physical health, support longer lives, drawing on science, technology and nature towards better health and new ways to personalise access for individuals and communities everywhere.

OPPORTUNITY #18

WHAT IF THERE WAS A ONE-STOP SOLUTION FOR BETTER MENTAL HEALTH?

THE WIRED BRAIN

Advanced, ultra-precise brain-mapping technology identifies the causes of mental health conditions and provides effective and immediate treatments

WHY IT MATTERS TODAY

Globally, one in four people will experience a mental health condition during their lives and two-thirds of them will not receive the treatment they need.[178]

Depression is the most common, with 264 million people suffering globally.[179] Despite the increasing need for mental health support, only around half of the 194 member states of the World Health Organisation (WHO) have mental health policies that are in line with international standards.

Depression rates amongst adults in the Middle East and North Africa (MENA) region range from 13% to 18%, with rates among women double those in men.[180]

From a support perspective, even though the global median number of mental health workers per 100,000 people has increased from 9 in 2014 to 13 in 2020, support varies. The number of mental health workers in high-income countries is more than 40 times higher than in low-income countries.[181]

Inadequate support for mental health results in financial and productivity losses. The estimated cost to the global economy is $1 trillion per year in lost productivity. However, and on the positive side, for every $1 put into treatment for common mental disorders, there is a return of $4 in improved health and productivity.[182]

SECTORS

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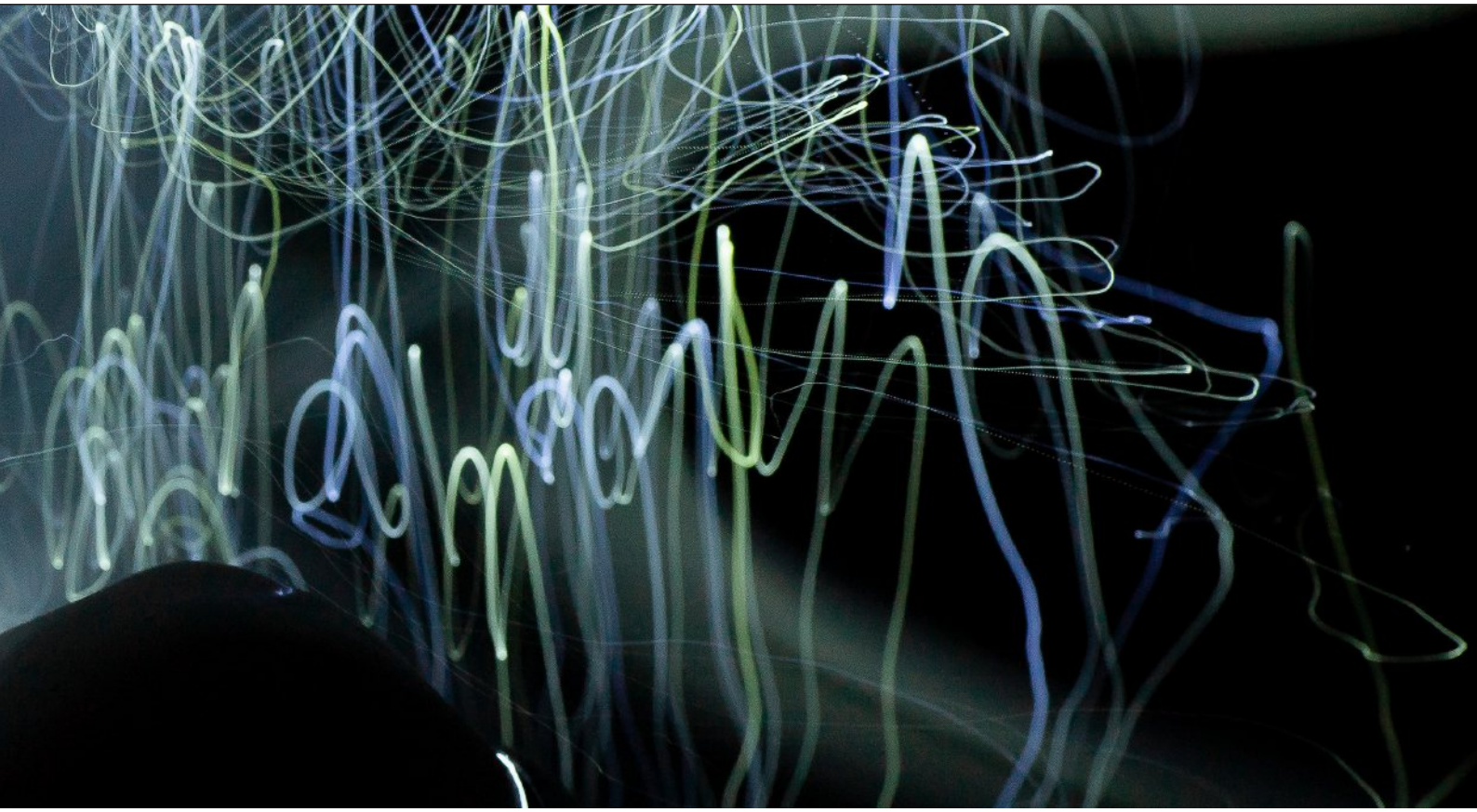
THE OPPORTUNITY TOMORROW

Brain–computer interfaces can improve mental health, treat anxiety and possibly alleviate feelings of loneliness.

Researchers have already found that stimulating certain areas of the brain can suppress neural responses associated with phobias. In the future, new neural technologies, medications and improved social understanding of mental health could potentially combine to virtually eradicate common conditions such as depression.

These technologies include precision brain mapping and modelling, non-invasive transcranial stimulation and personalised drug treatments that are monitored in real time. Advanced brain-mapping technology offers the potential for everyone to play a part in improving mental health by using wearables that enable early recognition and personalised treatment for conditions. By using such technologies, patients can read about their brain scans and learn more about their own cases. Families can understand mental health disorders that affect loved ones and medical professionals can use brain maps to better diagnose mental illnesses.

The global wearable technology market is set to reach $265 billion by 2026, with an annual growth rate of 18%[183] and the global behavioural health software market is expected to reach $4.9 billion by 2026 from $2 billion in 2021, an annual growth rate of 19.6%.[184] In the Middle East and North Africa region, the wearable medical device market is estimated to grow at 18.2% and be worth $896 million by 2026.[185]



1 in 4

will experience a mental health condition during their lives and **two-thirds of them** will not receive the treatment they need

Depression rates amongst adults in the Middle East and North Africa (MENA) region range from

13%–18%

with rates among women double those in men

BENEFITS

With better diagnosis and treatment of mental health conditions, people no longer suffer their debilitating impacts, improving the quality of life for themselves and their families. Wider communities benefit from the reduced long-term costs of treating mental health conditions.

RISKS

Risks include unintended consequences of treatments, such as personality changes and the potential for hacking into neural networks. Unequal access to new treatments could also widen inequalities in well-being.

UNINTENDED CONSEQUENCES

There is a risk of malicious harm through abuse of technologies or deliberately returning false-positive results.

OPPORTUNITY #19

WHAT IF WE HAD IMMEDIATE ACCESS TO CRITICAL MEDICINES AND SUPPLEMENTS?

HOME-PRINTED REMEDIES

Home nutrition and medicine machines enable people to optimise their health by continuously assessing key biomarkers and printing out personalised drugs and supplements as required

Nearly

2 billion

people have limited access to basic medicines

WHY IT MATTERS TODAY

Half of the world's population do not have access to essential health services[186] and nearly 2 billion people have limited access to basic medicines.[187] For those who do have access, the average person aged 65 and over takes around seven drugs a day.[188]

Research shows that almost all biopharmaceutical executives agree that the future of healthcare will be people-driven.[189] Individuals will increasingly manage their own health. The nature of healthcare will also change to become preventive, personalised, digital, integrated into daily life and enabled by new regulatory, organisational and business models.[190]

Precision medicine involves tailoring treatment to the person, taking into account their genetic and biological make-up as well as how and where they live.[191] The precision medicine market is expected to be worth $126.14 billion by 2025, growing at 1.25% per year.[192] The shift is expected to lead to cost savings in drug development of 17%, leading to a potential annual saving of $26 billion for the pharmaceutical industry worldwide.[193]

SECTORS

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THE OPPORTUNITY TOMORROW

Advances in non-invasive monitoring of people – for example, for protein markers and microbiome indicators – can combine with new solutions in on-demand drug production to make health treatment more home-based and personalised.

Home nutrition and medicine machines can enable people to optimise their health as data analysis from home-based monitoring – in combination with the person's DNA sequence – detects needs for medicines or nutritional supplements. With 3D-printed drugs, home-based machines will enable people to produce their own medicines according to the prescriptions generated.[194]

This enables progress in remote diagnosis and treatment – an emerging sector that generated $40 billion in 2020 and is projected to grow more than ten-fold by 2030 at an annual growth rate of 26% from 2021 to 2030.[195] This includes the pharmaceutical industry's growing focus on producing home equipment devices and the raw materials to supply them.

BENEFITS

Home-based systems can help prevent common conditions or enable them to be diagnosed and treated at an early stage. Improved nutrition and early intervention reduce the need for primary care visits, while constant monitoring provides early warning of infectious disease risks. Telemedicine also provides easier access to professionals and diagnosis.

RISKS

Inequalities in access to the technology can risk widening health gaps, while increased reliance on automated diagnosis and treatment solutions increases vulnerability to accidental errors. Mental health could be affected as ailments are not resolved and people do not feel better.

OPPORTUNITY #20

WHAT IF HEALTH DATA WENT MACRO?

A MEDICAL LIBRARY FOR PLANET EARTH

Medical data goes global through shared data sets combined with advanced computational power

WHY IT MATTERS TODAY

Interest in sharing data on health is not new. Global data sharing dates back to 1965 with the creation of the International Agency for Research of Cancer (IARC), part of the World Health Organisation (WHO), which now includes data from more than 180 countries.[196]

The output of data by even a single patient is vast and interest is growing in sharing. One person can generate nearly one terabyte of biomedical data, the equivalent of 300,000 photos or 130,000 books,[197] while journal publications related to 'data sharing' in PubMed increased from 46 in 1980 to 5,960 articles in 2019.[198] In total, around 30% of the world's total data is being generated by the healthcare industry.[199]

Meanwhile, the global budget for the sector is expected to grow to $15 trillion by 2030.[200] Linked to this expansion is a corresponding increase in the availability of data and data-gathering devices – including genomics, implantables, wearables, sensors, retailers, social media apps, artificial intelligence (AI), analytics, clinical data and electronic health records. This area is projected to grow at an annual rate reaching 36% by 2025: 6% faster than manufacturing, 10% faster than financial services and 11% faster than media and entertainment.[201]

Despite rapid growth, clinical trials – a linchpin of effective health care – are a major area for improvement. They take an average of six to seven years to complete and the average cost is $2.6 billion. However, there is a less than 12% chance that the drug will enter the marketplace.[202]

SECTORS

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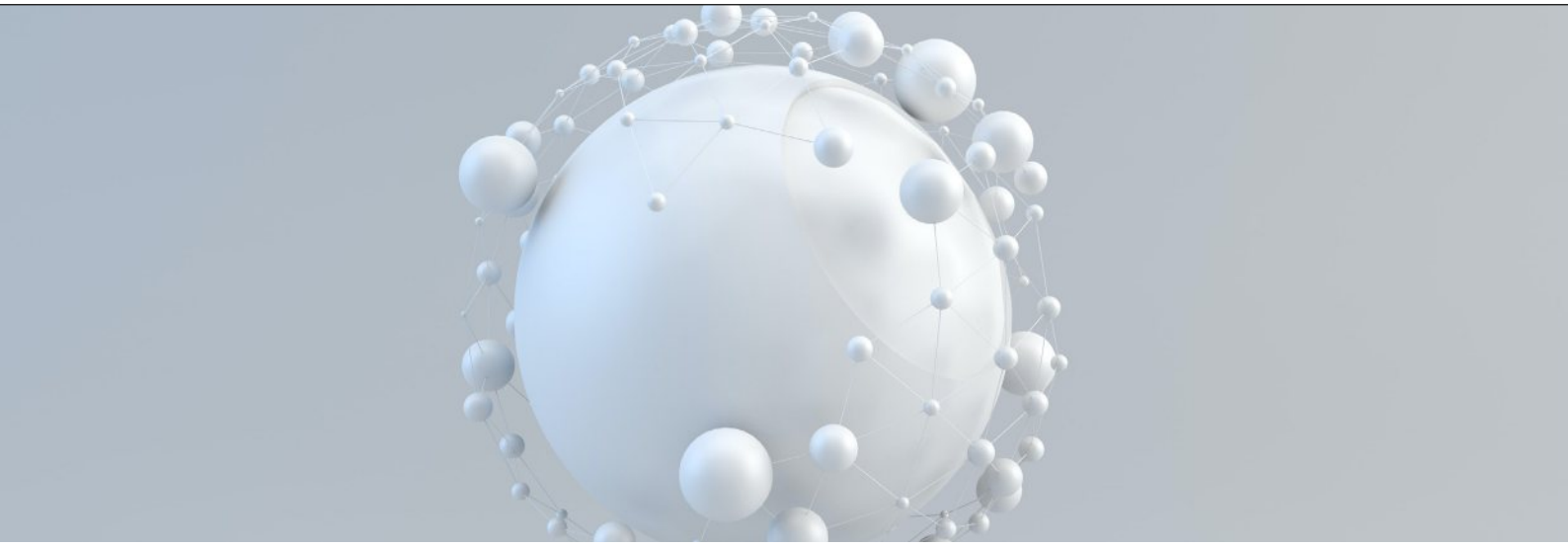

THE OPPORTUNITY TOMORROW

Sharing data across borders and advances in computing can combine to make the provision of healthcare and research on rare diseases, pandemics and other areas of health much more effective.

Global health data can be collected well beyond statistics on mortality and morbidity, with new information about epidemiology, administration and management allowing for more comparative insights with both aggregated and disaggregated data that further aid research and analysis.

Global-scale population data sets can speed up diagnoses and treatment plans for multiple conditions by either human doctors or machines. Such insights can help reveal which drugs, treatments or approaches are statistically more effective – including for rare conditions – and enable more treatment or prevention to be effectively personalised.

Developing such data sets will require countries to remove barriers to cross-border sharing of health data and enter into collaborative agreements to align on technical standards for interoperability and on ethical issues, such as privacy, access and purpose.

BENEFITS

Vast user-generated data sets support modelling for clinical trials, speeding up drug development, enabling better health outcomes and improving real-time monitoring for infectious disease outbreaks.

Larger sample sizes will allow governments to adjust health policies and improve health outcomes for everyone, particularly previously under-represented groups, as variations across sub-groups are explored.

RISKS

Risks include attacks to deliberately corrupt data sets and individuals losing control over their personal health data.

OPPORTUNITY #21

WHAT IF WE KNEW HOW WELL OUR COMMUNITY WAS DOING?

INTERNET-OF-MENTAL-HEALTH

Supporting community mental health through active monitoring

Nearly

1 billion

people globally suffer from mental health conditions

WHY IT MATTERS TODAY

Good mental health makes people more resilient and more productive as well as better able to realise their potential and contribute to their families and communities. However, nearly 1 billion people globally suffer from mental health conditions.[203]

Up to 85% of people in low- and middle-income countries who suffer from a mental health disorder, if identified, lack access to care.[204] Half of those in high income countries will suffer from a mental health condition at some point in their lives.[205] Mental health will therefore continue to be a global priority.

Mental health can be addressed by services provided at the community level through multi-sector partnerships,[206] involving individuals being treated by multi-disciplinary teams or connecting with others in groups.[207] Research on approaches and effectiveness of community-based mental health interventions is limited although, in cases explored by the WHO, community-based services had lower costs than comparable mainstream services.[208]

SECTORS

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THE OPPORTUNITY TOMORROW

Sensors and wearables can collect and collate data from individuals and locations to enable local government leaders to make assessments of the overall mental health levels prevailing in the area and act accordingly.

Research has identified over 100 neurotransmitters that can be monitored – chemical messengers connecting neurons and influencing appetite, mood, concentration, sleep and heart rate.[209] These include cortisone, serotonin, dopamine and oxytocin. Nanostructure-based sensors and biosensors for neurotransmitters can detect early signals for conditions such as Alzheimer's and Parkinson's.[210]

At community levels, advances in neuroscience, endocrinology and materials can enable real-time monitoring of neurotransmitters affecting mental health through a combination of wastewater testing and anonymised data from wearables and smart home technologies. Leaders would be able to see how well their community is doing with a real-time report card of mental health as part of the information needed to make good decisions on how to mobilise services and nurture health and prosperity through community-level support.

BENEFITS

Real-time analysis leads to interventions to provide mental health support and address external sources of depression or anxiety, such as financial stress or poor housing. Greater awareness and more proactive measures can improve societal well-being and promote a greater sense of prosperity. Targeted insights can help people take control of their own health and well-being, improving their life prospects.

RISKS

Potential risks include invasive, non-consensual monitoring and privacy issues along with interoperability and compatibility issues with data from wearables and other IoT infrastructure.

The malicious use of mental health data could pose risks to individuals' privacy and well-being, particularly in communities with limited access to wearables and low adoption of smart home technologies. Malicious falsification or misrepresentation of data could influence decisions and policies.

OPPORTUNITY #22

WHAT IF EVERYTHING WE TOUCH HELPED TO KEEP US HEALTHY?

DR SURFACE

Harnessing the power of novel materials to build healing environments that can also boost health and prevent infections

Penicillin alone is estimated to have saved

200 million lives

At least

700,000

people die each year due to drug-resistant disease

WHY IT MATTERS TODAY

Our own immune systems are able to fight germs, but sometimes their response is not victorious over a harmful microbial or viral invader[211] – and this is where medicine comes in.

The battle against microbial infection through treatment started in 1796 with Edward Jenner's observation that cowpox vaccination protected against smallpox.[212] Since then, antibiotics have evolved and become widely used.

Penicillin alone is estimated to have saved 200 million lives. However, the list of bacterial strains that cannot be fought off with antibiotics is growing every year. Simultaneously, other disease-causing organisms – such as fungi, viruses and parasites – are developing drug resistance at an accelerated pace. At least 700,000 people die each year due to drug-resistant diseases; by 2050 such diseases could cause 10 million deaths annually.[213]

Available data suggests that the burden of infectious diseases generally leads to negative social and economic impacts due to absenteeism.[214] As an example, half of those who catch the common cold experience a 25% loss in productivity over the span of the illness and are absent for 1 or 2 days.[215]

In 33 OECD and EU/EEA countries, antimicrobial resistance (AMR) results in over 700 million extra hospital days annually, costing their health systems up to $74 billion.[216]

SECTORS

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THE OPPORTUNITY TOMORROW

New materials can be used to turn everyday surfaces that are conduits for infection into weapons against them, while aiding in the prevention and treatment of other diseases and mental health conditions.

Bioengineered surfaces can store and release substances in response to triggers from inbuilt sensors. This can not only ward off infection but enhance other aspects of health. For example, walls can be coated to emit stress-reducing pheromones or melatonin to improve sleep quality in minute doses that are absorbed when breathing or via the skin.

Biomimicry can be used to create self-cleaning surfaces to replicate nature's ventilation systems, such as those found in termite nests. Adaptive response materials, with properties such as heat regulation, can be used in flooring or linens to warm or cool homes for optimal temperatures. Naturally antimicrobial and antifungal plants can line indoor areas to prevent infections, and fermented vegetables can be used as coatings to release probiotics for better gut health.

BENEFITS

These include improved individual health, well-being and longevity. At a societal level, these solutions offer greater access to treatments with lower healthcare spending and enhanced productivity.

RISKS

Risks include making the human immune system less effective because of lower exposure to pathogens and the emergence of even more virulent drug-resistant pathogens. There is also a risk of malicious use of the technology to release harmful toxins.

OPPORTUNITY #23

CAN COGNITIVE ENHANCEMENT BE DRUG-FREE?

REBOOTING MEMORY

Neuroscience enabled cognitive enhancement to boost brain capacity over a lifetime

WHY IT MATTERS TODAY

Cognition, or the process by which we acquire and use knowledge and skills, generally diminishes as we age. However, not all cognitive capabilities decrease. For example, the ability to shift attention and avoid distraction in order to focus actually improves with age.[217]

Nearly one-tenth of the world's population is aged 65 years and above.[218] By 2050, one in six people in the world will be over the age of 65.[219]

The population in the Middle East is expected to expand to 520 million by 2030 and reach 676 million by 2050. Similarly to the rest of the world, the size of the older population in the region is expected to grow to nearly 50 million by 2030, or around 10% of the total population.[220] By 2050, people aged 60 and above will exceed 100 million; they will make up 15% of the total population of the Middle East region.[221]

More people are seeking to work beyond retirement to increase their income and respond to government programmes that aim to reduce the burden on social services.[222]

Studies show that older workers are more experienced, stay in jobs longer, take fewer days off, have a strong work ethic, train the next generation of workers,[223] are more engaged in the workplace and deliver better quality.[224]

Entrepreneurs aged between 50 and 80 years old make up a sizeable portion of all entrepreneurs, and older entrepreneurs are more likely to employ five or more people.[225]

SECTORS

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By 2050

1 in 6

people in the world will be over the age of 65.

THE OPPORTUNITY TOMORROW

Advances in neuroscience, particularly neuroergonomics and brain–computer interfaces,[226] as well as in nanomedicine, endocrinology, precision medicine and behavioural psychology, can facilitate cognitive enhancement and create the opportunities to learn nearly twice as fast as we usually do, irrespective of age. Personalised for each individual, difficult tasks such as research, writing, problem-solving and other complicated activities would become much easier as memory recall would be increased significantly.

Personalised treatments aimed at optimising cognition throughout one's lifespan can become part of healthcare to optimise brain development, boost intelligence, improve memory and maintain high-performing cognitive and creative functions.

BENEFITS

The benefits to individuals include better health and life outcomes.

RISKS

Risks include the abuse of cognitive enhancement to produce extreme levels in a few individuals but deny the advantages to a wider section of the population, increasing inequality. Long-term drug-based enhancement could also provoke unforeseeable side-effects in some individuals if the medication had irreversible downsides.

OPPORTUNITY #24

CAN WE EXPLOIT NANOSCIENCE RESEARCH TO TARGET SPECIFIC DISEASES?

MICROSCOPIC MIRACLES

Bringing nanomedicine from research to reality in areas that are most beneficial to society

WHY IT MATTERS TODAY

Consider this: DNA is 2.5 nanometers wide. By comparison, a human hair is about 90,000 nanometers in diameter.[227] Researchers are getting closer to being able to work on such a minuscule scale in order to treat diseases from cancer to obesity in a growing field known as nanotechnology.

Nanotechnology refers to an engineering activity applied to structures at the nanoscale, which is 1–100 nanometers, each nanometer being one-billionth of a meter.[228] The concept was first introduced by American physicist Richard Feynman in 1959, while Japanese scientist Norio Taniguchi coined the term in 1974.[229]

Nanomedicine, the application of nanotechnology to medicine, encompasses detection, diagnostics, drug delivery,[230] treatment and recovery.[231] Nanomedicine is still in its infancy. With growth led by start-ups and small and medium-sized enterprises (SMEs),[232] the field has rapidly advanced in the last few decades, supported in some ways by advanced intelligence and quantum computing. The market for nanomedicine is expected to grow from around $190 billion in 2020 to around $360 billion in 2025 at an annual growth rate of 13%.[233]

SECTORS

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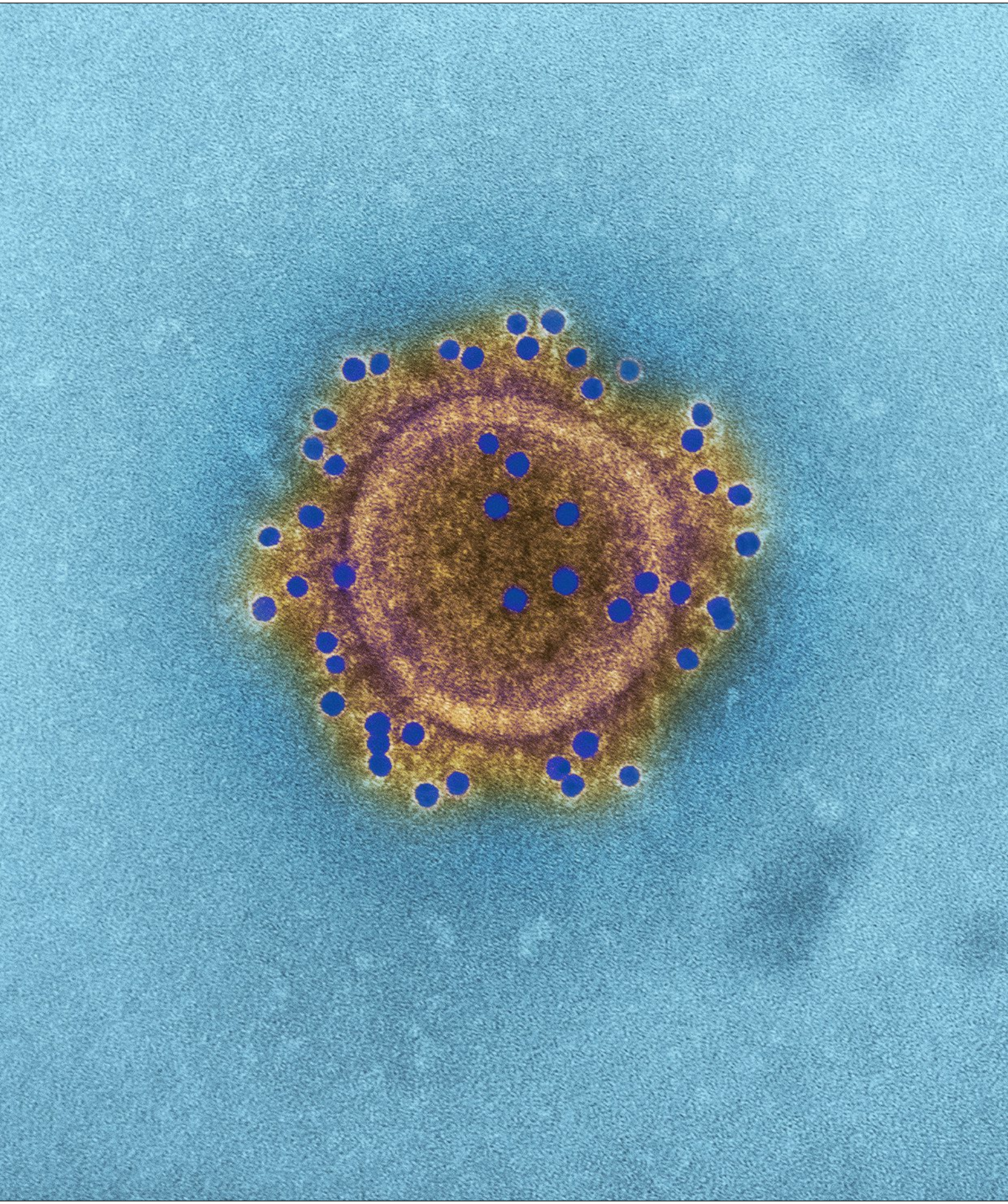
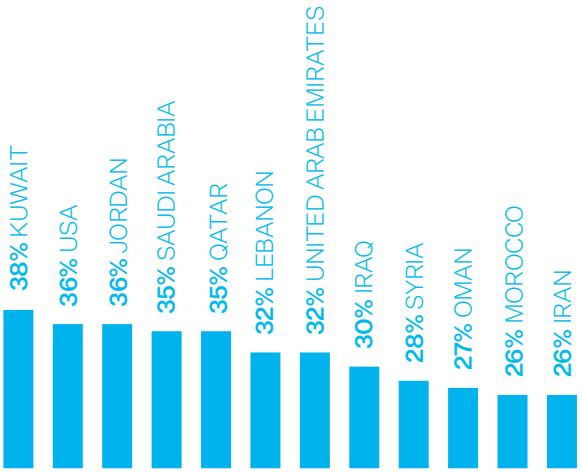




Based on data from the WHO's Global Health Observatory, **obesity continues to be a burden in some countries around the world.**

Meanwhile, two major global public health challenges continue to elude cures or treatments: cancer and obesity.

Cancer is one of the major causes of mortality and morbidity worldwide, with 10 million cancer-related deaths in 2021 and a total annual economic cost estimated at $1.16 trillion.[234] By 2030, current projections suggest that there will be a 180% increase in cancer incidence in the Gulf States and the eastern Mediterranean.[235]

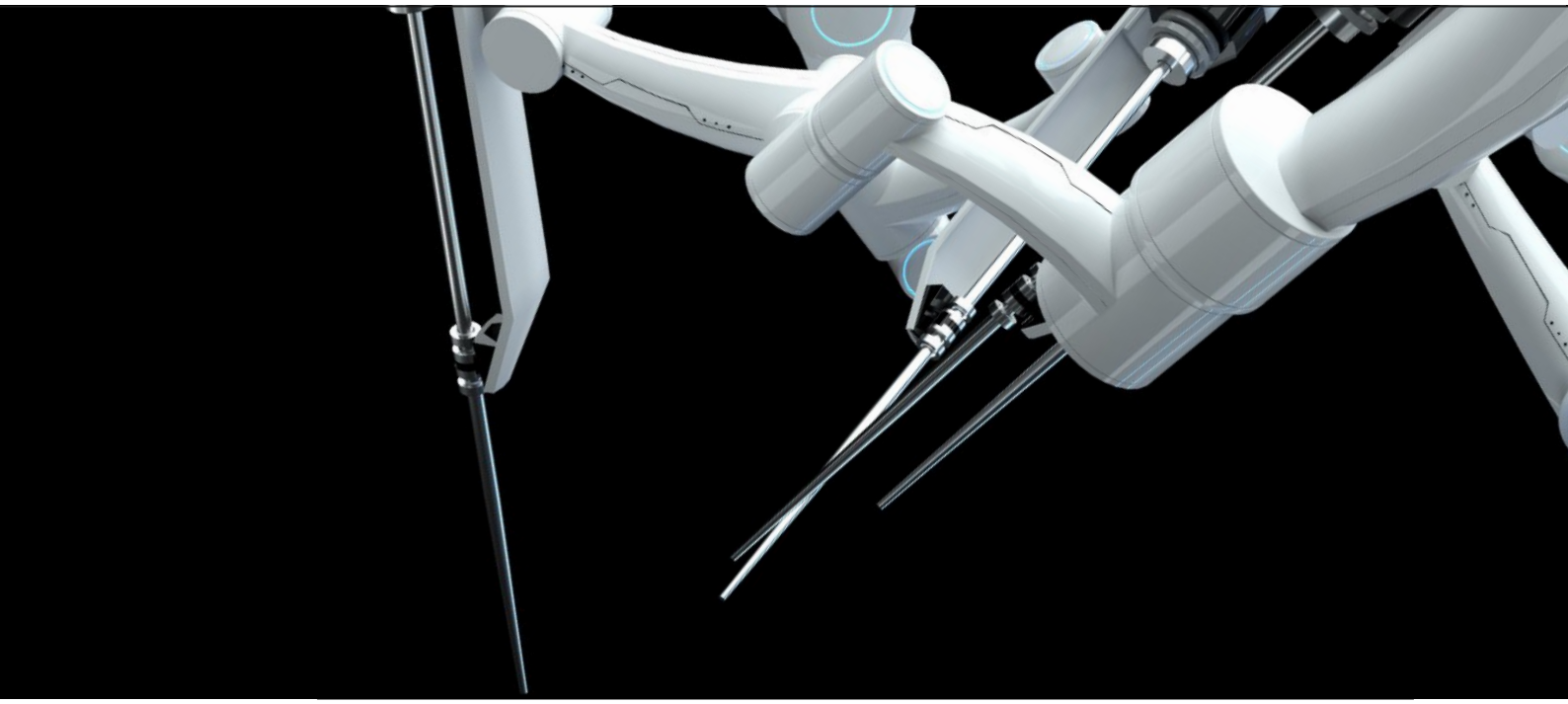
Based on the latest facts reported by the World Health Organisation (WHO), almost 2 billion adults (39% of the adult population) are overweight and 650 million obese.[236] Over 340 million children and adolescents worldwide were overweight or obese.[237] Obesity is estimated to cost health services globally $990 billion per year or around 13% of healthcare expenditure.[238]

Based on data from the WHO's Global Health Observatory, Kuwait has an obesity rate close to the global average for adults (38%) and was the 11th most obese nation in the world.[239] The United States is ranked 12th with an obesity rate for adults of 36%.[240] The next eight positions (13–20) were occupied by Middle Eastern countries: Jordan (36%), Saudi Arabia (35%), Qatar (35%), Lebanon (32%), the United Arab Emirates (32%), Iraq (30%), Bahrain (30%), Syria (28%), Oman (27%), Morocco (26%) and Iran (26%) for adults.[241]

THE OPPORTUNITY TOMORROW

Nanomedicine's applications for cancer and obesity could help to reduce the human and financial toll of both conditions.

Nanobots and nanoparticles can be used to analyse conditions and deliver treatments in a much less invasive and more responsive way than conventional practices, reaching all areas of the body, from the skin and internal organs to the brain. Therefore, the technology offers many possibilities, from the potential to diagnose cancer or delivering targeted medical treatments for diabetes to optimising brain development before birth and combatting obesity.



But it has been challenging to transform research advances in nanomedicine into cost-effective commercialisation.[242] Concerns over ethics, safety, intellectual property, scale of investment,[243] manufacturing, quality and government regulations have all hampered scaled advancement in the field.[244]

A greater understanding of the most effective strategies for growth is therefore needed. This can be met by establishing a multi-stakeholder group from the public and private sectors, research entities, future consumers and those leading projects in nanomedicine to set an agenda for the most promising proof-of-concepts.[245] Matching these concepts to needs can establish what would bring the greatest benefit for society. This then helps to target the specific safety, social and ethical issues that need to be assessed to establish specific regulations or control mechanisms.

BENEFITS

Nanomedicine can be applied to a wide range of health challenges, including cancer and obesity. A childhood 'nano-vaccination' could enable individuals genetically predisposed to obesity to maintain their optimal weight, enabled by nanotechnology, as well as genetics and understanding of metabolic, viral and microbiome profiles. The results of well-deployed nanotechnology could include better lifelong health, prosperity, socialisation and fulfilment.

RISKS

Risks include poor-quality nanomaterials, human error causing adverse reactions, deliberate sabotage and social divisions arising from unequal access. Unintentional toxicity may occur in the organs to which nanoparticles move.

SYSTEMS OPTIMISED

Improve and build more effective and resilient systems underpinning advancements to services and solutions at various levels of business, government and society.

OPPORTUNITY #25

WHAT IF DEVICES DISAPPEARED?

INTERNET OF HUMANS

Connection to the virtual world for all, without the need for devices

WHY IT MATTERS TODAY

By 2023 over 70% of the global population will have mobile connectivity[246] and by 2024 each person will have an average of 3.6 networked devices[247] and around 1.7 billion of devices globally will be active in AR use.[248]

Also by 2024 around one-quarter of the US population, some 110 million, is expected to be using AR.[249] Studies show that AR and VR could add as much as $4 billion to the UAE economy by 2030[250] and that by 2025 60% of the Gen Z and Millennial population in Saudi Arabia will be frequent AR users.[251]

A convergence is anticipated of AR and VR, allowing us to see each other and the real world at the same time as virtual content.[252] This shift is referred to as 'from hands-on to heads-up'[253] connectivity.

SECTORS

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THE OPPORTUNITY TOMORROW

The virtual and augmented experiences created by AR/VR could become available without headsets or other hardware if linked to powerful, microscopic biocompatible implants in the brain.

Today's wired and wireless networks are expected to make way for connectivity technologies such as charged air particles that can interface directly with advanced organic brain implants to enable deviceless, always-on connectivity. An estimated 50,000 people worldwide already have implanted chips[254] for purposes including e-tickets and club memberships, and the value of the bioimplant market is reported to exceed $100 billion, with anticipated growth of 8.6% per year to 2023.[255]

Freed from devices but with greater connectivity, people can benefit from easier access to essential and more advanced services that improve their productivity and well-being.

Anyone could access immersive content from any other person or company: private individuals uploading their personal imaginations to public spaces; companies offering tours of their latest products; governments broadcasting information about upcoming events for citizens to experience first-hand.

Widespread use of such technology for immersive experiences would require international protocols and standards for the use of implants and AR/VR content.

BENEFITS

New markets and possibilities in both virtual and physical worlds can enable individuals, companies and governments to exchange information, immersive content and experiences.

RISKS

Risks include fragmenting societies as online engagement replaces face-to-face contact. The risk of malicious harm is high as individual and systemic vulnerability to cyber threats rises as more of life becomes reliant on deviceless connectivity, creating the need for higher levels of cyber security for all.

UNINTENDED CONSEQUENCES

These all-digital realms becoming always-on 'echo-realities'.

OPPORTUNITY #26

COULD EVERY FACTORY PRODUCE EVERYTHING?

ON-DEMAND MANUFACTURING

Agile mass manufacturing hubs that can rapidly design prototypes then immediately test and launch multiple products

WHY IT MATTERS TODAY

Manufacturing is responsible for around 16% of global GDP,[256] but has a relatively large environmental footprint, consuming more than half of energy supplies and accounting for 20% of global greenhouse gas emissions.[257]

The time to market for most industrial and consumer goods today is one to seven years.[258] Manufacturing is also under pressure to change its model as consumers seek more personalised goods and services, delivered more rapidly to meet demand.[259] Manufacturers are seeking to respond to these forces by becoming more agile[260] and adopting a 'just-in-time' philosophy to meet demand cost-effectively.

Another feature of global business world is a productivity gap between small and medium-sized enterprises (SMEs) and large companies that ranges between 26% and 80%[261] between countries. A large share of the world's workforce works for SMEs, ranging from 50% to 90%, depending on the country.[262] Halving this productivity gap between SMEs and large companies would add around $15 trillion or 7% to global GDP (at 2020 levels).[263]

SMEs in the Middle East account for around 90% of registered companies, contribute between 4% and 40% to GDP[264] and create about half of new jobs.[265] They could therefore play an instrumental role in creating jobs for the 20 million young people expected to join the workforce by 2025.

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The time to market for most industrial and consumer goods today is

1 to 7 years

THE OPPORTUNITY TOMORROW

There is an opportunity to shorten times to market and supply chains by using increasing computational and modelling power to enable machines to monitor demand, collaborate and reconfigure themselves to create and test innovations, scaling up production within hours.

Such 'agile manufacturing' can transform how goods are produced and, if used in large-scale facilities, could take advantage of advances in machine intelligence and multipurpose materials to produce a wide range of products.

Such agile techniques will mean that consumers get quicker access to higher-quality products, while predictive demand modelling reduces waste. Regional and global trade can be transformed as individual regions become more self-reliant by producing a wider range of products themselves.

SMEs, for whom manufacturing is not currently the source of competitive advantage,[266] can set up agile and connected manufacturing hubs to increase capital efficiency and lower operating costs.

Small and medium-sized enterpises (SMEs) in the Middle East account for around

90%

of registered companies

BENEFITS

Agile processes can reduce waste, cut costs and boost efficiency in supply chains. Agile supply chains support multiple small processes for each product instead of one large process. They also produce goods in a way that reduces the effects on the environment and the communities they serve.

RISKS

Risks include the potential to encourage unsustainable consumer habits, regional or global dominance of a few leading firms and vulnerability of mass manufacturing hubs to outages or large production runs containing faults. The concentration of capacity exposes them to malicious attacks.

OPPORTUNITY #27

CAN WE SPEED UP SHIPPING?

SINKING LOGISTICS FOR SPEEDY DELIVERY

Submarine tunnels will transport goods over 20 times faster than cargo ships

WHY IT MATTERS TODAY

Economic growth and individual well-being rely on the efficient movement of goods that are critical for survival and everyday life.

The global maritime freight transport sector is expected to grow by 4% between 2021 and 2026[267] as more than 70,000 vessels sail the seas to transport goods all over the world, accounting for 80% of international trade by volume.[268]

However, shipping times vary and increased in the third quarter of 2021 compared to the same period in 2020. Cargo ships can sail from Tokyo to Los Angeles in 11 days, but security measures and customs mean they take 20–28 days.[269] In the third quarter of 2021 the average global shipment took 12–17 days, or around 25% longer than the same period in 2020.[270]

The shipping sector consumes 300 million tons of fuel and accounts for around 3% of the world's CO_2 emissions to the atmosphere.[271] Efforts are underway to develop new fuels such as hydrogen, ammonia and methanol. However, alternative fuels can increase the cost of shipping by anything from two to eight times.[272]

Recognising the impact, the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping, IRENA, DP World-MAN Energy Solutions, International Maritime Organisation (IMO) and others are exploring and advising on strategies towards decarbonisation for the shipping industry.[273, 274, 275]

SECTORS

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THE OPPORTUNITY TOMORROW

An alternative to conventional shipping is offered by submarine railway tunnels or 'hyperloops' that are linked directly to terrestrial transport networks and remove the need to offload or load goods in ports. These could re-engineer how shipping is conducted at a global scale, particularly for the 20% of goods that make up some 80% of the global shipping traffic.

Currently, the longest underwater tunnel for both freight and passengers is the 53.9km long Seikan tunnel connecting Hokkaido Island with the Aomori Prefecture in Japan.[276]

Further advances in tunnelling technology and ultra-high-speed rail technologies can together transform global supply chains and trade. In particular, advances in superconducting magnetic levitation technology have the potential to facilitate shipping hyperloops. Hyperloop train speeds, for example, are expected to reach 1,200km per hour,[277] compared with container ships that average 27–30 km per hour.[278]

BENEFITS

Faster transport solutions benefit both small producers and large manufacturing hubs, improving resilience by increasing supply routes and enabling time-sensitive products to reach markets more quickly. This results in reduced transport costs and increased choice for consumers, boosting growth and prosperity.

RISKS

Although submarine hyperloops have less environmental impact than conventionally powered transport, they also pose risks to marine ecosystems. Other risks arise from the disruption of incumbent shipping and logistics companies. There will also be risks of physical attacks on submarine hyperloops or cyberattacks on their command-and-control centres.

OPPORTUNITY #28

WHAT IF MACHINE-RUN ORGANISATIONS WERE BUSINESS AS USUAL?

GOVERNANCE BY MACHINE

Companies and government projects run by machine intelligence reporting to a human board

WHY IT MATTERS TODAY

Around 70% of businesses will use at least one form of artificial intelligence (AI) technology by 2030[279] and global spending on AI in businesses is expected to reach $110 billion annually by 2024.[280] AI decision-making is set to increase global economic output, with a possible boost of around $13 trillion[281] to $15 trillion[282] to the world economy by 2030.

Many governments have developed formal AI frameworks[283] as the adoption of AI could widen performance gaps between countries. Leading countries (developed economies mostly) are expected to capture an additional 20%–25% in economic benefits.[284] Some governments have already tested or already integrated AI into service delivery and policymaking. Quebec, for example, has used AI to analyse economic, labour and education differences among sub-regions and Australia has applied it to track reported symptoms and patient characteristics in hospitals to identify key public health concerns. In the UK, AI has helped to estimate the impact of a carbon tax on emissions and overall business productivity.[285]

In the Middle East, AI could contribute $320 billion to the regional economy in 2030, equivalent to 11% of GDP, particularly in the UAE, where it is expected to account for 13.6% of GDP by 2030. For Saudi Arabia it is expected to amount to 12.4% and for Egypt 7.7%.[286]

THE OPPORTUNITY TOMORROW

Advanced autonomous machine intelligence is progressing from solving specific problems using big data and algorithms to optimising business and policy strategies. This can eventually enable machine intelligence to augment the work of corporate leaders and government officials. These machine management teams would be answerable to shareholders and government decision-makers but require no human input into their proposed decisions.

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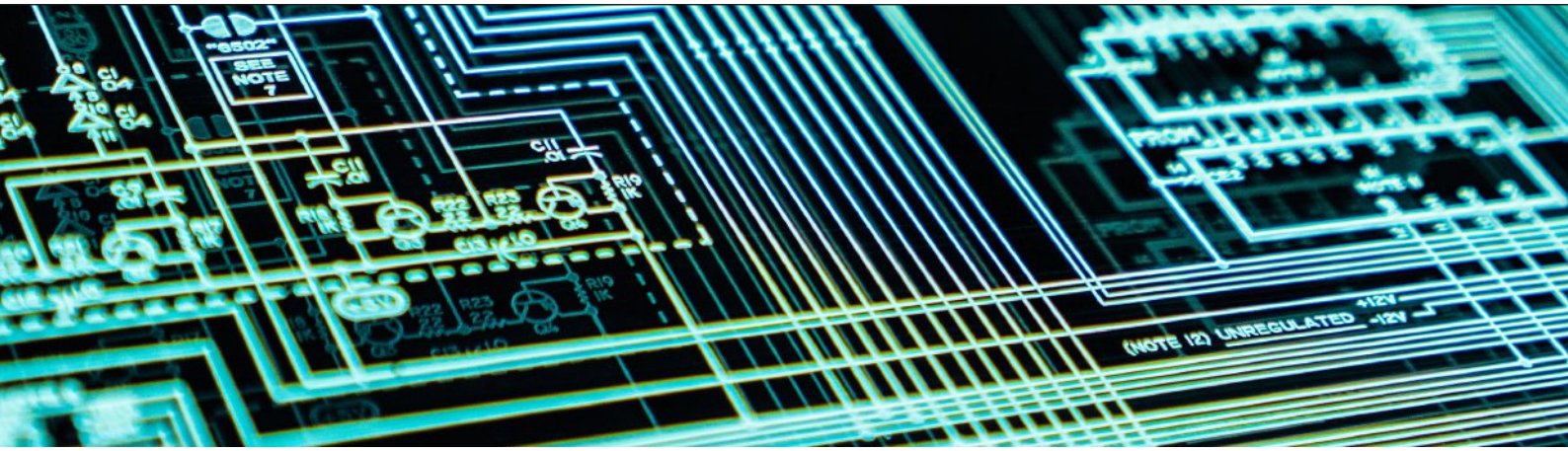

Machine intelligence can model decisions rapidly and notionally free from emotional bias, enabling impartial and professional decisions for complex problems. Machines would use data sets and powerful modelling technologies to simulate the costs, benefits and likely outcomes of projects, large and small, from infrastructure to buildings, business models and policies.

However, when machines initiate such important decisions, governments will need to develop guidance on the responsible use of AI,[287] with global and jurisdiction-level regulations and standards. Corporate governance would also need to align with these developments. This will include ensuring that board-level risk management committees are set up to understand risks associated with underlying algorithms and decisions.

Decentralised autonomous organisations (DAO),[288] enabled by blockchain and governed by a digital contract to ensure transparency, are an emerging phenomenon that may be of relevance in the future.

BENEFITS

Accurate projections can inform more effective decision-making, with fewer ‘white elephant’ projects, negative externalities and other unintended consequences. With greater transparency, citizens are more likely to support new initiatives and innovation can flourish as new approaches involve less risk.

RISKS

Corporate governance would need to evolve to prevent machine managers from attempting to dominate markets. Board and committee directors may not understand the factors and processes used in underlying AI algorithms that may exacerbate human biases. Other risks include worsening the consequences of cyberattacks or errors, perpetuating biases in decision-making.

UNINTENDED CONSEQUENCES

Perpetuating biases in decision-making and advice, and potentially closing off career paths affecting workers’ morale and ambition.

OPPORTUNITY #29

WHAT IF REGULATORS COMPETED TO REGULATE?

RAPID RESPONSE REGULATORS

Decentralised, forward-looking regulatory bodies responding with agility to the groups and issues that they govern

WHY IT MATTERS TODAY

Up until 1750, economic growth averaged an almost flat 0.01% per person, per year.[289] Based on this rate, it would have taken 6,000 years to double global GDP.[290] Since then, and as a result of the first industrial revolution, GDP growth per person has been 1.5% per year and each generation has been around a third better off than the previous one.[291]

Such growth has created large, complex, competitive sectors which governments have acted to regulate. The first regulatory body in modern history was established in 1887 in the United States to regulate railways.[292]

Despite the economic impact of the Covid-19 pandemic, the global economy is expected to grow at 5.3% in 2021, the fastest in nearly five decades,[293] before settling back to a rate of around 3.3% towards 2026.[294] In the Middle East, the IMF forecasts aggregate growth of 2.5% in 2021 across 11 countries, not enough to fully offset their 3.2% contraction in 2020.[295] However, governments in the Gulf Cooperation Council (GCC) delivered $122 billion in economic stimulus packages[296] which will continue to aid growth in the Middle East.

The sources of growth are changing, with much of the momentum coming from emerging technologies such as artificial intelligence (AI), augmented reality and virtual reality, blockchain, the internet of things (IoT) and 3D printing.[297] These markets are expected to grow at rates between nearly 20% in the IoT market to nearly 70% in blockchain. The healthcare industry also continues to evolve as machine learning and AI become more prevalent. Between 2017 and 2023 spending on AI in health is growing at an annual rate of just below 50% and projected to continue.[298] The global total transaction value of digital payments grew from $4.1 trillion in 2019 to $5.2 trillion in 2020,[299] and in the United States data-driven businesses have grown more than eight times faster than in the global economy since 2016.[300]

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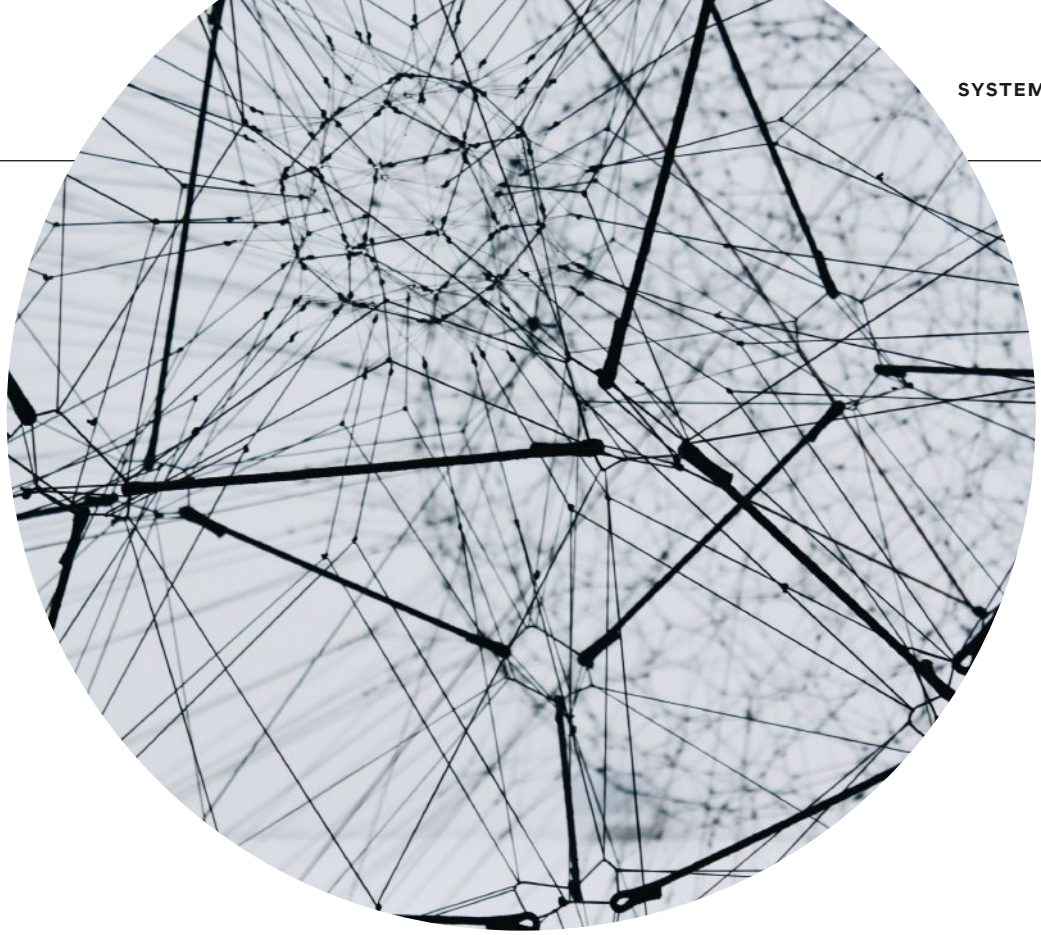

THE OPPORTUNITY TOMORROW

Dynamic growth in emerging sectors and technologies at the same time as wider availability of data both necessitates and enables more granular and nimble regulation, tailored to population groups, issues or regions.

Decentralised self-regulation, for and by end-users, can replace national regulators using advanced data monitoring capacity, making it easier to perform a watchdog role. Groups can opt to adhere to the regulatory bodies of their choice, with all reporting to the same 'super-regulators' who ensure that consistent standards are applied. This creates competition among regulatory bodies that enhances their efficiency, resulting in lower regulatory costs and boosting growth.

Regulation can thus be sufficiently agile to expand to new, fast-moving areas, such as the application of breakthroughs in genetics or advanced machine intelligence, making use of new technologies to set and communicate standards. The capacity for swifter regulatory change facilitates the spread of new business models, as well as technological and medical advances.

BENEFITS

Better adapted, more widely accepted regulation promoting shared societal goals for growth and prosperity.
Reduced regulatory lag for culturally sensitive or divisive issues through more inclusive and rapid consultation processes and decision-making.

RISKS

Increased competition could create a fragmented regulatory landscape, unintentionally creating loopholes for arbitrage.

OPPORTUNITY #30

WHAT IF WE HAD PERFECT INTEROPERABILITY?

THE REAL WORK-FROM-ANYWHERE REVOLUTION

Global software applications operating seamlessly and collaboratively across borders and sectors

WHY IT MATTERS TODAY

Proliferating software systems and expanding data volumes are causing major challenges for businesses.

Analysis within the last three years show that companies with more than 2,000 employees deployed around 130 different applications on average[301] while firms with fewer than 2,000 employees deployed an average of 73.[302]

Meanwhile, the total amount of stored data worldwide is expected to reach 175 zettabytes (175 trillion gigabytes) by 2025,[303] with the global volume of data doubling between 2018 and 2022 and doubling again between 2022 and 2025.[304]

As a growing segment,[305] using platforms-as-a-service (PaaS) and reliance on software-as-a-service (SaaS) does not resolve issues such as localised data protection or the ability to move data across systems[306] and the growing lack of interoperability will continue to be a challenge.[307] There are also various fragmented initiatives around the world to set up and support interoperable systems led by players in the public and private sectors, from Estonia's 'x-road' solution for interoperability[308] and the European Commission's proposed new interoperability strategy for EU governments and public sector flows across borders[309] to global consortiums for eHealth[310] and the Data Interoperability Collaborative.[311]

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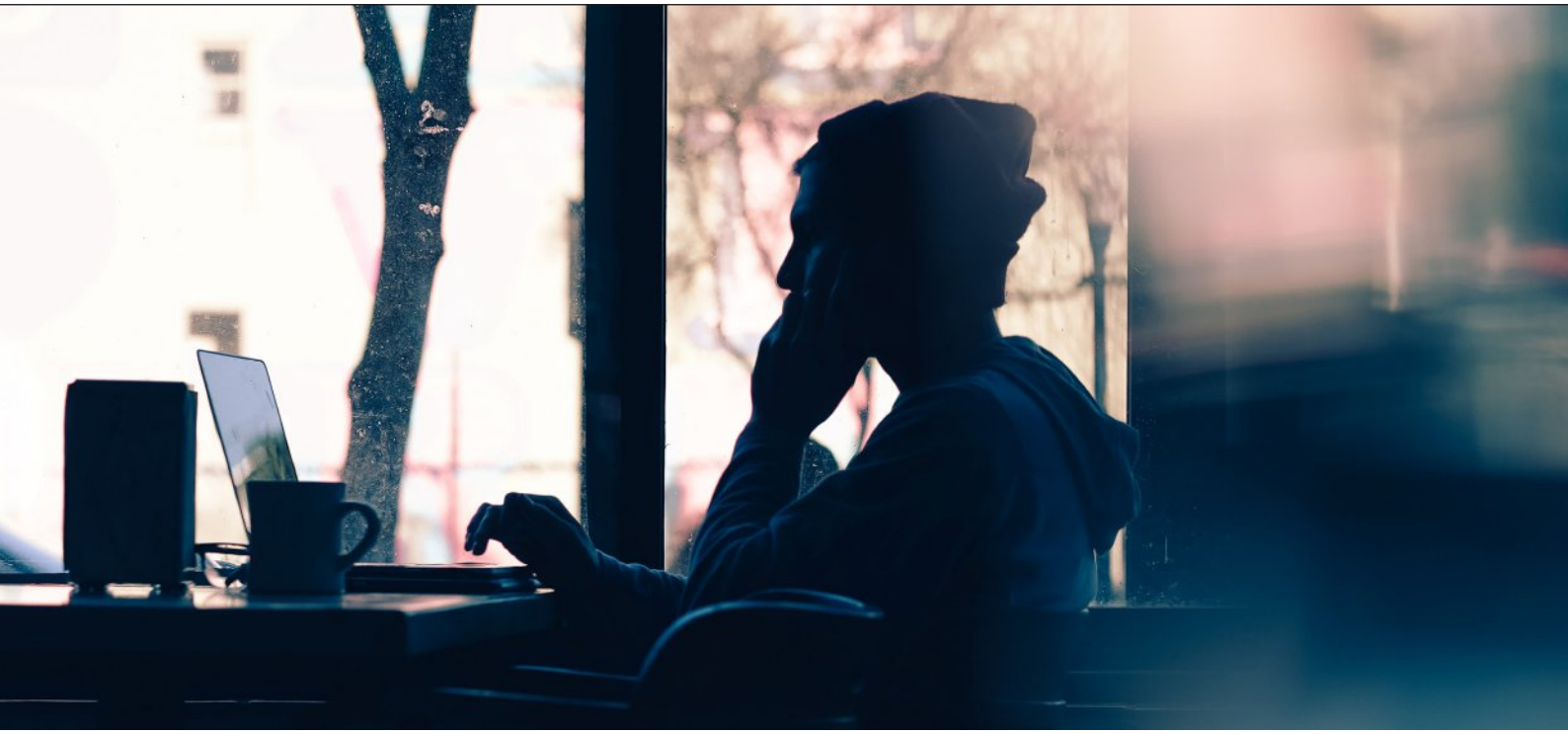

Analysis within the last three years show that companies with more than **2,000 employees deployed around**

130

different applications on average

while firms with fewer than **2,000 employees deployed an average of**

73

THE OPPORTUNITY TOMORROW

As the number of technologies and systems continue to multiply and connectivity becomes faster and more seamless, people become more aware of interoperability problems holding them back in their daily lives with devices or systems that do not connect easily with each other.

Global agreements on interoperability of specific critical systems in sectors such as health, eCommerce and financial services can be set up with supranational harmonisation of standards and advanced intelligence proactively creating interfaces between solutions with timely and secure access to a range of applications and platforms.

BENEFITS

Improved interoperability makes systems more efficient, with more intuitive and user-friendly technological environments, lowering the financial and time costs of a range of activities, enhancing people's life opportunities and well-being. Growth is boosted as there are fewer non-tariff barriers to innovation.

RISKS

There is a risk of dominant public or private players becoming the de facto standard setters. The widespread adoption of fewer, larger systems presents the risk of unintended consequences for systemic resilience. Fewer or more deeply integrated systems increases the potential impact of malicious attacks or accidental outages.

OPPORTUNITY #31

HOW CAN WE MORE QUICKLY HOLD COMPANIES ACCOUNTABLE?

24/7 360° COMPANY DATA

Fully automated, public reporting of a company's financial, environmental and social impact and the value it is creating

WHY IT MATTERS TODAY

Companies already report on their financial impact and now investors are increasingly demanding companies disclose the environmental, social and governance (ESG) factors and targets that are important in achieving their strategic objectives.[312]

ESG monitoring and reporting is widely seen to reduce risks and boost value creation,[313] enable cost reductions and increase employee productivity and retention.[314]

In 2019, the Global Reporting Initiative (GRI) revealed that 93% of the world's largest companies by revenue already report ESG performance.[315] Increasingly, more investors are seeking ESG disclosures that identify the factors and targets that are important to the company in achieving its strategic objectives not just in the short term, but over the medium and long term as well.[316]

Globally, ESG-labelled assets are expected to reach $53 trillion by 2025, representing more than a third of the $140.5 trillion in projected total assets under management.[317] Credit rating agencies and financial analysts such as S&P,[318] Fitch, Nasdaq,[319] Bloomberg, MSCI and Refinitiv[320] all provide offerings and services to assess and report on ESG metrics.[321]

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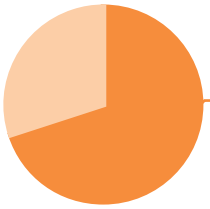
However, ESG monitoring and reporting is complex. Even if companies and governments have access to relevant data, not all of them are actively using software that support forms of data collection, analysis and reporting that demonstrate their full ESG-related impact.

In particular, beyond a company's core activities, those of third-parties need to be considered as, for example, they can account for 70% of a company's own carbon footprint.[322] The Organisation for Economic Cooperation and Development (OECD) looked into the environment reporting part of ESG and noted that environmental scores do not tend to align with actual current carbon emissions exposures, being difficult to interpret due to the multitude of diverse metrics on environmental factors.[323]

Taking steps towards common metrics and frameworks for ESG, the World Economic Forum and the 'Big Four' accounting firms (Deloitte, EY, KPMG and PwC) defined 21 core and 34 expanded metrics and disclosures[324] that have been adopted by over 50 companies.[325] Announced at the COP26 conference, the creation of the International Sustainability Standard Board (ISSB) aims to develop standards that are globally consistent and trusted.[326]



Third-parties can account for

70%

of a company's own carbon footprint

THE OPPORTUNITY TOMORROW

Access to traceable 24/7 360° data can allow companies to report on their ESG performance and impact in real time, going beyond turnover and profits. Investors, decision-makers and regulators would have full oversight of a company's activities and be able to attribute costs of ESG factors to their source.

Real-time reporting or 'fast data' gives investors more regular updates on performance than quarterly results. For example, data on daily or weekly sales can indicate trends in returns among retailers. Throughput data can show how manufacturers are responding to demand and provide early warnings of shortages or surpluses. Timely reporting of acquisitions or divestments can signal prospective shifts in the valuation of a business.

BENEFITS

Real-time 'triple bottom line' reporting informs corporate decisions and drives new incentives to be more efficient and reduce negative externalities, such as resource depletion or pollution. Greater transparency generates higher levels of trust in business among employees and consumers, giving companies a stronger licence to operate and rewarding those making a positive impact. Resource allocation and societal and financial outcomes are optimised, improving corporate bottom lines but also prosperity and well-being.

RISKS

Risks include malicious or accidental data corruption resulting in false reporting with financial consequences such as the share prices.


NEG7
BANKCALL
GOMARKF
FIXLOC
INTPRET
GETMKS
CDULOGIC
SCAXIS

OPPORTUNITY #32

WHAT IF INVESTMENT INFORMATION IS PERFECT?

THE ERA OF PERFECT INVESTING

Complete and real-time availability of data and models means that everyone can invest with perfect information, eliminating arbitrage and equalising financial returns

WHY IT MATTERS TODAY

Emerging technologies, from artificial intelligence (AI), big data and analytics, to blockchain, the cloud, Internet of Things (IoT) and robotics, have changed the face of the financial industry.[327]

The digitisation of investing has enhanced the client experience, increased efficiency and unlocked opportunities for individuals who previously may not have had access to investing or even contributed to better investment outcomes.[328]

Even though the number of new invest-tech companies fell from a peak of 81 launches in 2014 to single digits in recent years,[329] venture capital funding hit a record high of $2.8 billion in 2018, growing at a compound annual growth rate (CAGR) of 47% from 2008.[330]

Partly driven by a growing population of investors, the global financial technology market is expected to grow to $124.3 billion by the end of 2025 at a CAGR of around 24%.[331] In contrast to previous generations, 31% of millennials (aged 25 to 40) in the United States started investing before age 21[332] and 67% of investors aged 18 to 40 overall own stocks,[333] with 40% of these stock investors owning cryptocurrency. [334]

Fintech in the Middle East is growing rapidly with a CAGR of 30%.[335] By 2022, it's predicted that over 800 fintech companies in the Middle East will raise over $2 billion in venture capital funding[336] with demand partly driven by half of the 400 million people in the region who are under the age of 25.[337]

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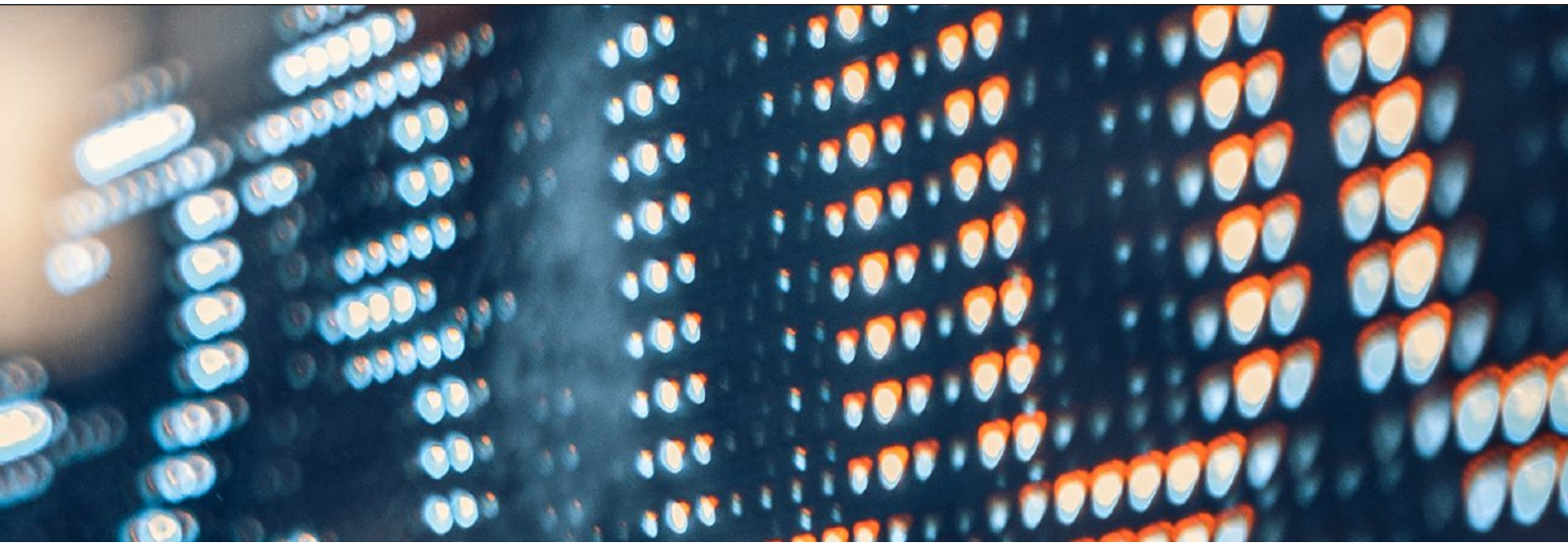
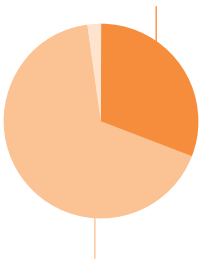


In contrast to previous generations

31% of millennials (aged 25 to 40) in the United States started investing before age 21



67% investors aged 18 to 40 overall own stocks

THE OPPORTUNITY TOMORROW

AI trading systems already execute multi-million-dollar transactions, replacing human decisions with precise computations based on complex formulas. However, financial markets remain characterised by uneven and partial information. Advances in machine intelligence and the emergence of quantum computing, powered by deeper and more accessible data, could reduce this asymmetry. Further, if regulators intervene to support open access to these technologies and data, everyone could use the same information to make their investments.

BENEFITS

Financial systems become simpler and capital allocation more efficient as arbitrage and speculation based on inconsistent information are eliminated. There are new opportunities for investors. Global market volatility is eradicated, and financial returns on investment become more stable and widely shared.

RISKS

The initial emergence of powerful investing models could foreclose this future by leading to a winner-takes-all dynamic as the market quickly becomes dominated by a few large companies using more sophisticated machine intelligence models. Alternatively, the displacement of incumbent financial companies could cause disruption. There is also a risk of the widespread impact of a malicious or accidental corruption of data.

CONSEQUENCES

Perfect investing may mark the end of investing altogether.

OPPORTUNITY #33

WHAT IF FMCGS BECOME FMRMS – FASTMOVING RAW MATERIALS?

REINVENTED MANUFACTURING

Relying on advancements in 3D printing, consumer packaged goods makers become suppliers of raw materials, sellers and end users become manufacturers

WHY IT MATTERS TODAY

Profit in the consumer packaged goods (CPG) sector grew around 10% per year from 2000 to 2009 but fell by around 3% annually between 2010 and 2019.[338] This trend was mirrored in the stock market, with the sector outperforming the S&P 500 from 2000 to 2009 and then underperforming from 2010 to 2019.[339]

Except for the bottom 30, which generally did not do well in the last decade, it was margin – not growth – that drove improvement in the Top 30 companies in the CPG industry.[340] That is, top performing companies largely got better at eking out profit from making things more cheaply, not by adding new customers, despite rising production costs and a growing global middle class.

Challenges are likely to continue for this ever-changing industry.[341]

Multiple factors are at play: manufacturing costs are up, due to a 50% rise in supply chain spending even though changes to raw material costs were minimal;[342] small CPG brands have grown faster than large brands recently;[343] and a billion new middle-class consumers are expected in emerging markets while shifting consumer preferences are expected to influence growth in the future.[344]

Also, in the Middle East and North Africa (MENA), for example, more than half of the youth would support the boycott of a brand known to damage the environment.[345]

Developing markets are likely to generate new consumer sales of $11 trillion by 2025 and local competitors will fight for that business in ways the multinational, fast-moving consumer goods businesses have not seen in the past.[346]

SECTORS

ADVANCED MATERIALS & BIOTECHNOLOGY · CHEMICALS & PETROCHEMICALS · CONSUMER GOODS · ENERGY, OIL & GAS · LOGISTICS, SHIPPING & FREIGHT · MANUFACTURING · METALS & MINING

THE OPPORTUNITY TOMORROW

A new model is possible for producing and selling consumer goods.

New technologies – including modular 3D printers and new materials – can combine to make it possible for entire value chains to be decentralised. That is, local businesses can take on the role of manufacturers with the businesses that traditionally produced goods becoming suppliers of raw materials. From food and small consumer goods to fashion, manufacturers can become providers of raw materials and techniques that enable local companies or individuals to produce their own personalised goods on-demand.

Various technologies can combine to effect this transformation. Multipurpose substrates created from programmable biological and synthetic compounds are easier and cheaper to transport. Retail and logistics can be transformed as leading players switch from fast-moving consumer goods companies to selling raw materials and know-how.

Manufacturers can sell these ‘ingredients’ and produce ‘programmable recipes’ for use in 3D printers in hubs or in homes. Customers can order staple and more bespoke materials from retailers or specialist suppliers.

BENEFITS

Consumers benefit from round-the-clock supply. Environmental benefits accrue from more sustainable logistics as finished goods do not need to be shipped as far as they are today and less waste occurs because of the absence of inventory overhangs.

RISKS

Risks include poor-quality raw materials not being discernible to consumers, accidental production errors or deliberate sabotage or contamination of production centres and materials.

OPPORTUNITY #34

WHAT IF OUR BRAINS WERE DIGITALLY IMMORTAL?

PREPARE TO UPLOAD

Replicating and storing the memory, knowledge and thought processes of the human brain for the benefit of individuals and society

WHY IT MATTERS TODAY

Less complex than a human brain, the fastest supercomputer at the time of writing is Japan's Fugaku at a speed of 442 petaflops,[347] or 1,000 trillion operations per second.[348]

By comparison, the brain contains 86 billion neurons, each connected to 7,000 other neurons in the body.[349] Impossible to precisely calculate, the highly interconnected brain is estimated to process information at up to 1 exaflop per second. One exaflop consists of 1,000 petaflops, or more than double Fugaku's computing capacity.[350]

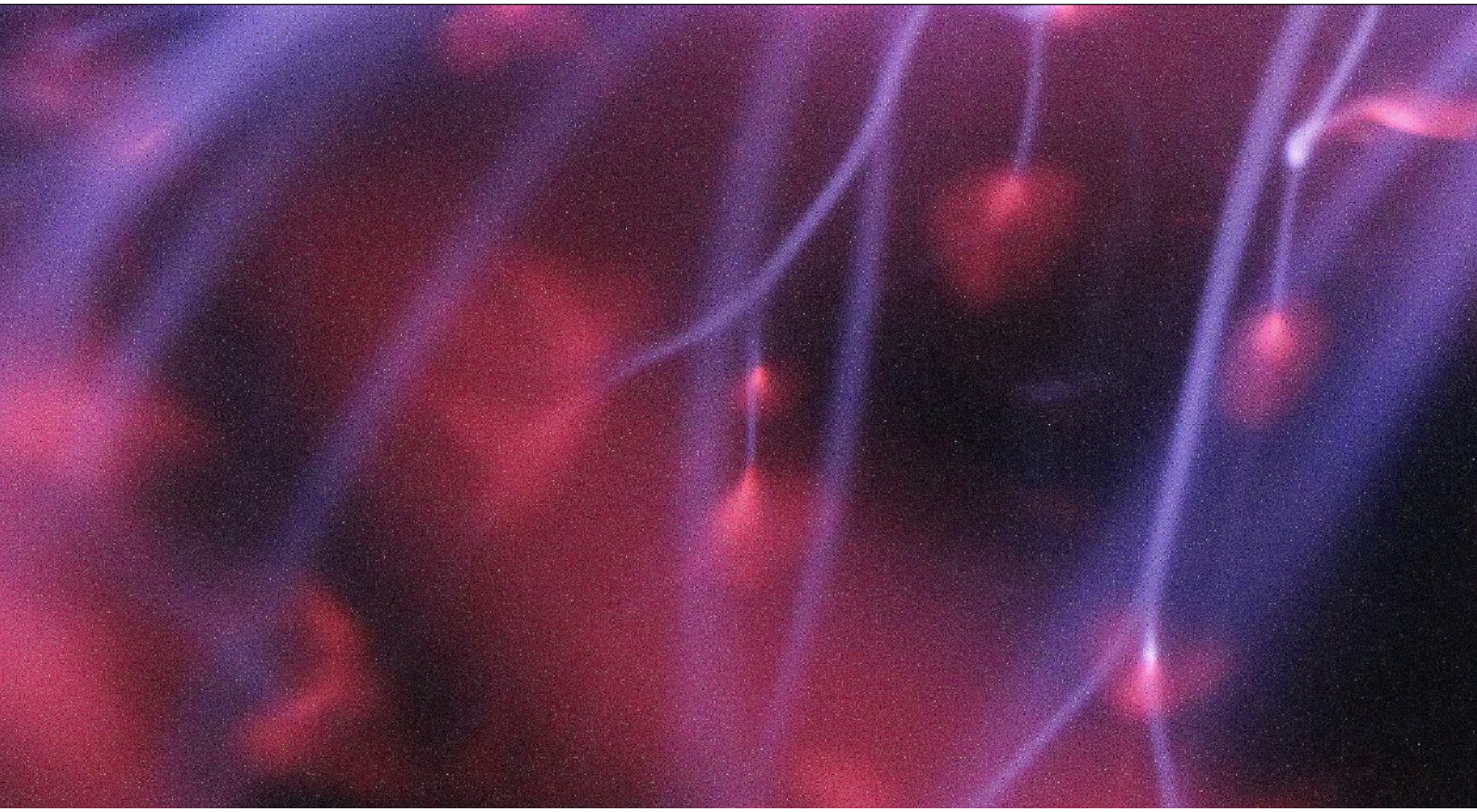
While much remains unknown, remarkable progress is being achieved in neuroscience. A 'cellular atlas' of the brain is now being developed[351] underpinned by earlier research projects like the Blue Brain Project, set up in 2005, which created a digital replica of a mammalian brain.[352]

The Human Brain Project, launched in 2013, is building new research infrastructure where teams of experts can collaborate to advance understanding, technology and medical applications.[353]

The global market for the application of neuroscience through technologies such as brain imaging is projected to reach $37 billion by 2027, growing at a CAGR of 3% per year since 2020.[354] The rate of growth may accelerate over the next 30 years as neuroscientists evolve beyond understanding how neurons and electrical signals make the brain work to a deeper understanding of the mechanisms underlying higher-level cognition and real-time observation.[355] Advances in therapeutic neuroscience are expected along with greater application of its insights in, for example, education, consumer markets and the justice system.[356]

SECTORS

EDUCATION · INFORMATION & COMMUNICATION TECHNOLOGY · PROFESSIONAL SERVICES



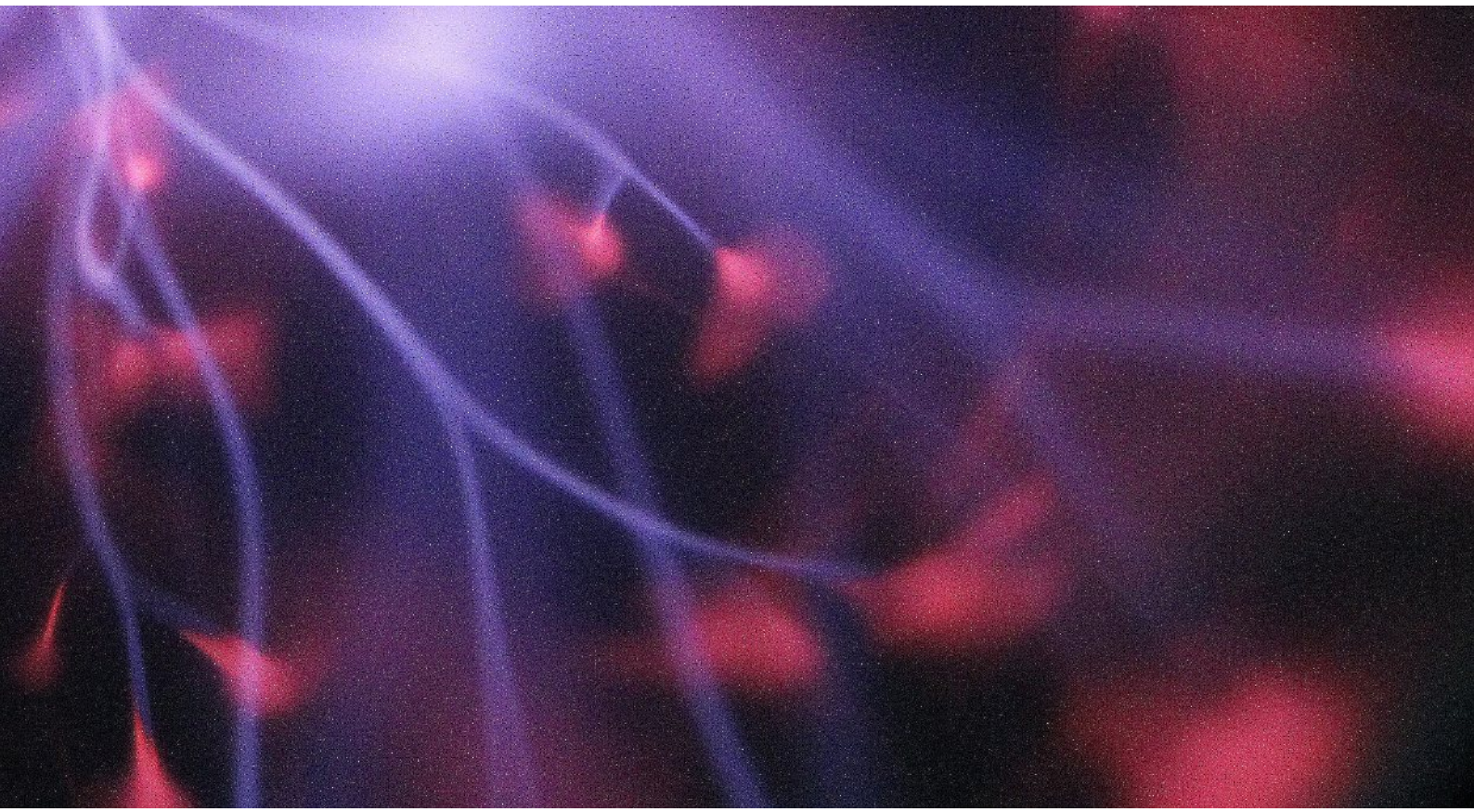
THE OPPORTUNITY TOMORROW

As computing power and neuroscience both advance, new opportunities will emerge to harness and ultimately replicate the capacity of the brain through the use of technology. So-called 'whole brain emulation' (WBE) will then be possible. WBE entails physically scanning a brain, building a software model of it and eventually simulating its activity.[357]

Whole brain emulation means that memories and thought processes, of our choice, can be captured in real time and stored externally, potentially forever.

The value of such an application is considerable. Individuals can use it throughout life to safeguard and access their personal memories. At the societal level, whole brain emulation preserves skills or critical knowledge for future generations. The practice would potentially open up access to large areas of personal information and therefore legal and ethical frameworks need to evolve to manage how it would be used in courts, retail and other environments.

The time frame within which whole brain emulation might be available is currently uncertain. Some scientists have argued it might be possible by 2045.[358] With advances in brain–computer interfaces (BCI) and advanced intelligence, uploading and storing the contents of human brains might arrive sooner than that.



The brain contains

86 billion

neurons, each connected to

7,000

other neurons in the body

BENEFITS

Whole brain emulation can boost creativity and productivity as collective brainpower can be harnessed for problem-solving in all aspects of life and the economy, generating greater prosperity and well-being, particularly for those who have experienced loss of cognitive function, dementia or movement difficulties.

Our brainpower can also be made available to others with brain trauma or neurological disease. Whole brain emulation allows individuals and societies to safeguard knowledge and memories for posterity. Important skills and capacities can be transferred from generation to generation.

RISKS

Risks to individuals include threats to personal data and privacy including unwanted and unacceptable thoughts which we might not want to publicly share. The risk of accidental data corruption or intentional harm, such as planting false memories or information, poses considerable challenges to the use of whole brain emulation in courts of law.

OPPORTUNITY #35

WHAT IF ALL DISPUTE SETTLEMENT IS INTERNATIONAL?

HUMANITY COURT

Dispute settlement in a borderless and digital world

WHY IT MATTERS TODAY

The sum of imports and exports of goods and services across borders accounted for 53% of global GDP in 2020, compared to 25% in 1970.[359]

The volume of cross-border trade, 'gig economy', flexible jobs and e-commerce are all set to skyrocket in the coming years, while flows of capital in and out of countries is also increasing. In the Middle East, two of the world's three largest remittance corridors, UAE and Saudi Arabia, handled $78 billion in payments in 2020, equating to 7% of GDP of the two nations combined.[360]

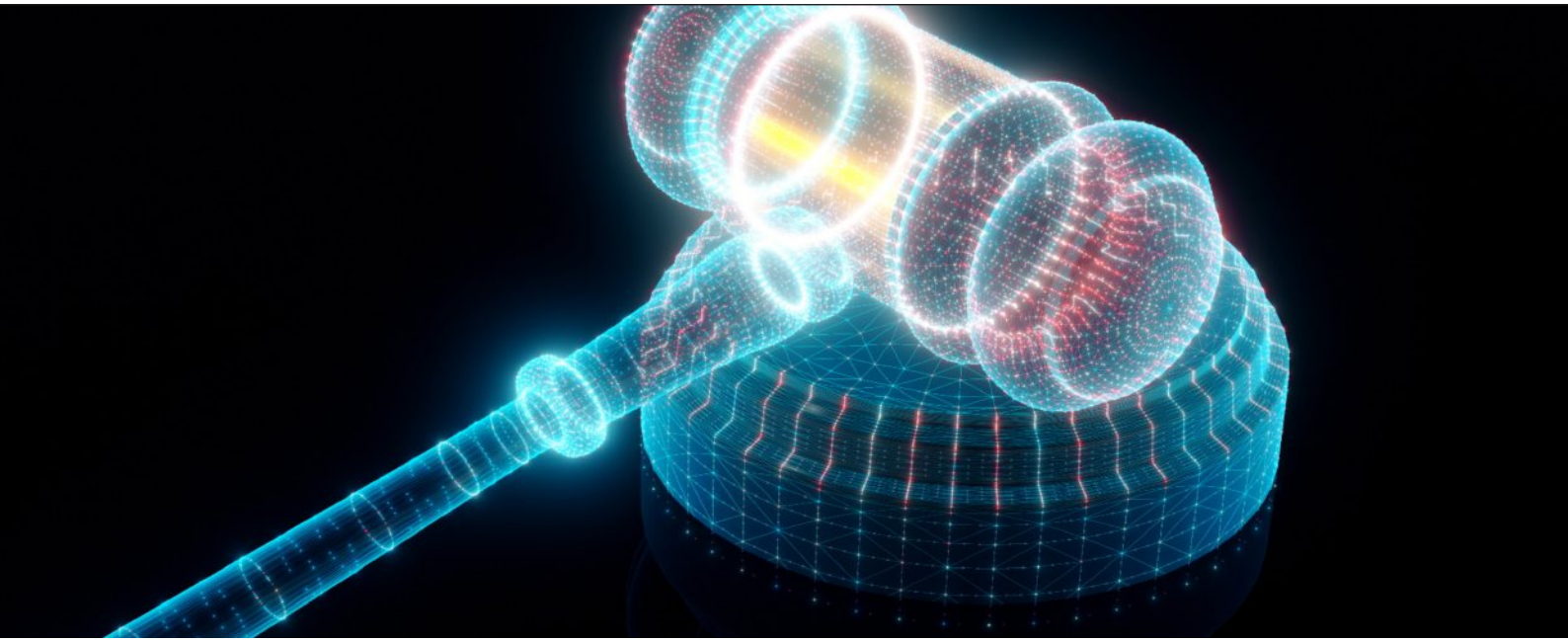
The number of people living outside their country of origin reached 281 million in 2020,[361] roughly equal to the population of Indonesia, the world's fourth most populous country. Emerging from the pandemic, hybrid models of remote work are likely to continue for the highly educated, well-paid minority of the workforce or in advanced economies where up to one quarter of their populations will be able to work remotely three to five days a week depending on their occupation.[362]

Beyond trade and migration, many aspects of our lives involve transnational factors. The COVID-19 pandemic has itself been termed **'the borderless virus'.**[363]

One impact of living in an increasingly borderless world is the rise of transnational disputes and litigation. This is reflected in the volume of record requests being received by the International Chamber of Commerce (ICC) for its arbitration and alternative dispute resolution (ADR) services.[364]

SECTORS

PROFESSIONAL SERVICES



The sum of imports and exports of goods and services across borders accounted for

25% OF GLOBAL GDP IN 1970

53% OF GLOBAL GDP IN 2020

THE OPPORTUNITY TOMORROW

In a world interconnected by trade, migration and digital technologies, an integrated and international legal system can enable rapid dispute settlement.

As personal and professional activities are migrated to the digital world there may be little reason to take judicial disputes to a bricks-and-mortar court in any specific country.

Experts believe that, by using connectivity and advanced artificial intelligence, evidence and arguments can be captured in real time so that disputes can be settled or, where applicable, judgements can be automated. Going beyond international settlement of cases under current laws, supranational legal institutions could also have the powers necessary to enact and enforce new laws.

The number of people living outside their country of origin reached

281 million

in 2020

BENEFITS

International dispute resolution driven by AI and other technologies can save time and money in resolving cases. Common international laws in a range of domains reduce the cost of cross-border trade for companies big and small, as well as simplifying formalities for individuals who live, work and consume in multiple jurisdictions real and virtual – and, someday, in outer space.

RISKS

The risk to the system is minimal if critical public and corporate stakeholders agree to collaborate and respect it.

OPPORTUNITY #36

WILL EXCHANGES AND RELATED PLATFORMS EVENTUALLY MERGE?

MERGED MARKETS

A single global exchange platform for all investors, big and small

Volumes of global M&A reached

$4.4 trillion

by mid-October 2021, compared with **$2.3 trillion** in the whole of 2020.

WHY IT MATTERS TODAY

Mergers and acquisitions (M&A) are driving consolidation across the business world and in the stock exchanges where financial trade takes place.

Volumes of global M&A reached $4.4 trillion by mid-October 2021, compared with $2.3 trillion in the whole of 2020.[365] Even the number of deals by mid-October 2021 was 28% above the 35,722 deals in the whole of 2020.[366] Deal-making activities worldwide could hit a record $6 trillion by the end of 2021.[367]

In the Middle East, deal volumes also increased with 307 deals in the first half of 2021, an increase of 59% when compared to the same period in 2020 and an increase of 48% compared to the second half of 2020.[368]

Increased M&A activity was also seen at the stock exchange level. There were 30 M&A deals valued at $21 billion in 2020 compared with 24 valued at $28 billion in 2019.[369] These deals not only apply to exchanges themselves but to other data providers, analytics and financial technology players that facilitate trading in the global markets.

SECTORS

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Deal-making activities worldwide could hit a record

$6 trillion

by the end of 2021

THE OPPORTUNITY TOMORROW

The trend of consolidation among stock exchanges and allied businesses is leading towards all global stock exchanges merging into one market or very few smaller markets, enabled by perfect high-speed, low-latency connectivity. This trajectory is supported by other trends such as digitisation, cryptocurrencies, the Islamic digital economy, foreign exchange markets and private trading platforms for financial assets. Regulation and supervision can then be consolidated into a single global authority which is able to set global rules.

BENEFITS

Harmonisation of regulation and supervision. More efficient markets, enabled by greater transparency and higher trading volumes, combine to drive transaction costs close to zero.

RISKS

The risks include loss of systemic resilience as there is no alternative if the market crashes or is attacked, potential loss of efficiency for smaller economies and homogenisation of investment stifling market innovation.

OPPORTUNITY #37

WHAT IF WE COULD SIMULATE EVERYTHING ABOUT EVERY PROJECT?

NO MORE 'WHAT IF...?'

Detailed simulations revealing the true costs, benefits and likely outcomes of decisions in business and government

WHY IT MATTERS TODAY

Bad decisions are costly in human and financial terms, whether they lead to business failures such as those of Barings Bank or Motorola, or loss of life such as the disaster of the Space Shuttle Challenger.[370, 371, 372]

The challenges that the world faces today are complex and involve growing global interconnectedness. Governments are seeking to make decisions on issues from the economy and health to climate change and education[373] while businesses are grappling with building strategies for growth, attracting talent and innovating in products and operations.[374]

While it is relatively simple to measure success in terms of outputs such as profitability for business or economic growth or health outcomes for governments, it is much more difficult to assess whether the inputs being made in terms of decision-making will drive successful outcomes.

For example, strong environment, society and corporate governance (ESG) performance is widely seen as a marker and driver of sustainable growth and responsible business practice. However, ESG ratings vary greatly from one ESG provider to another and ESG reporting and ratings approaches do not sufficiently clarify how financial materiality or non-financial materiality is likely to directly impact the finances of a company in the short, medium or long term.[375] The ability of large firms to dedicate more resources to reporting has given rise to a possible ESG scoring bias in favour of large-cap companies and against SMEs.[376] The newly established International Sustainability Standards Board (ISSB) emerging out of COP26 is the first step towards resolving this issue.[377]

SECTORS

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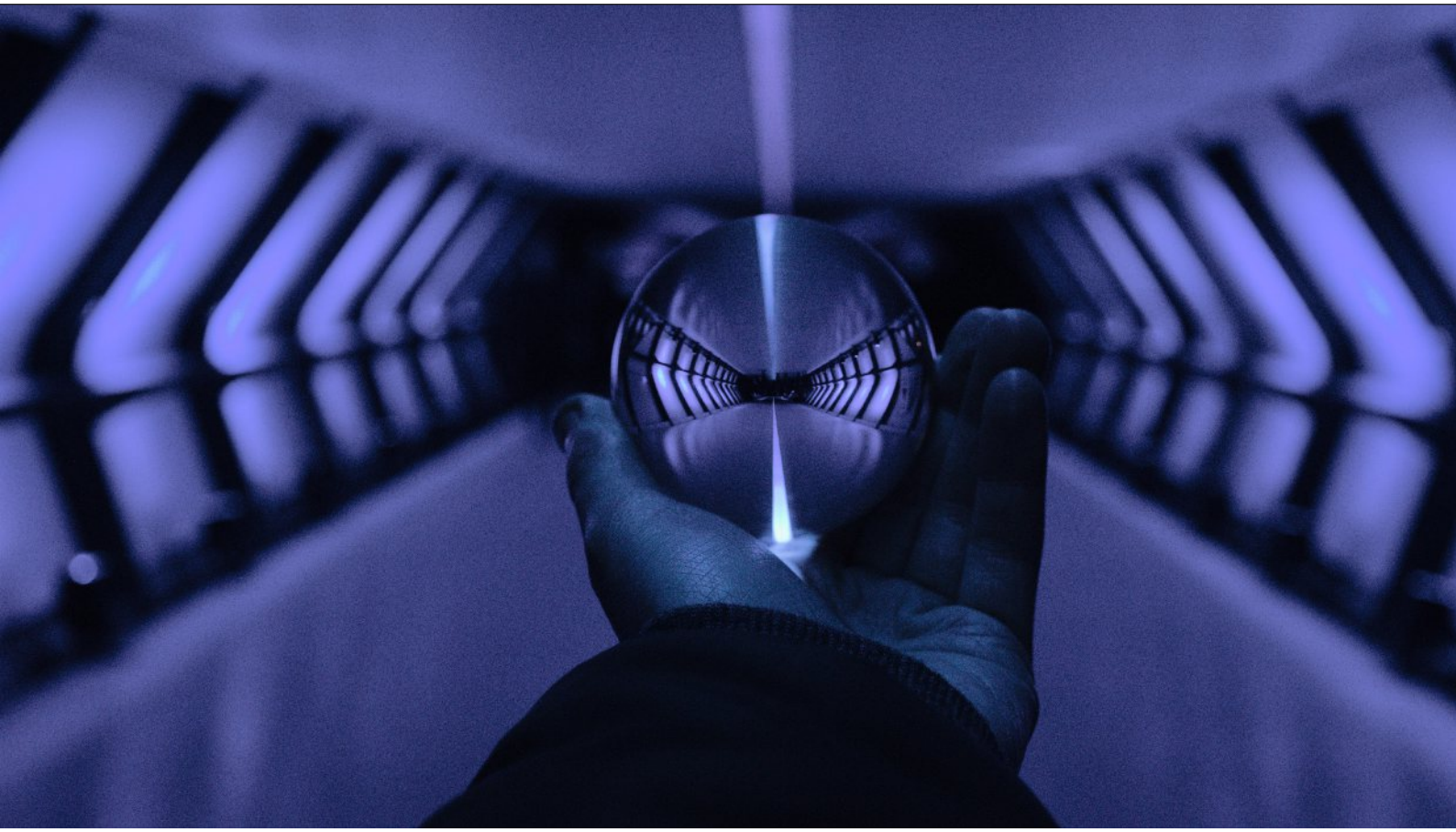


THE OPPORTUNITY TOMORROW

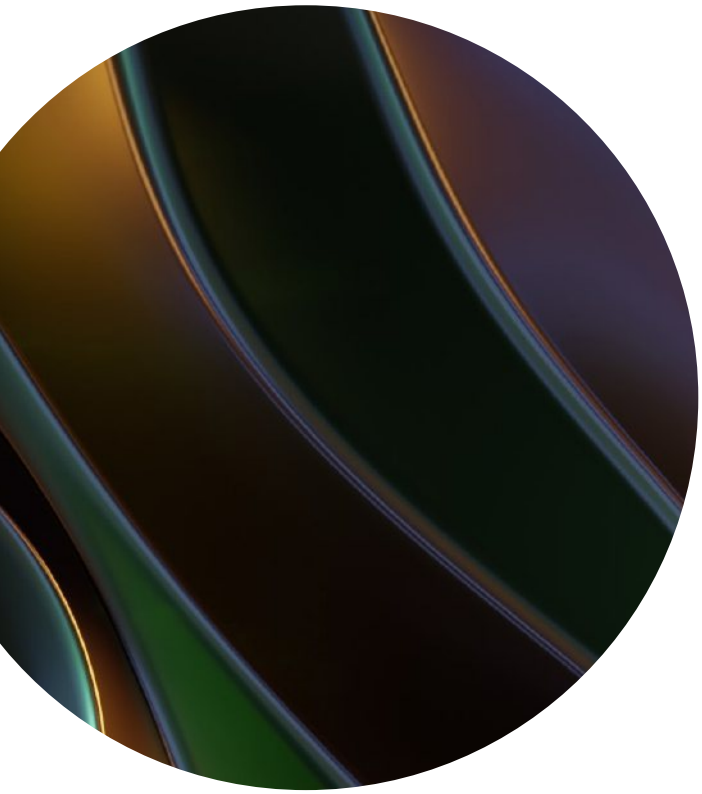
Vast data sets and powerful modelling technologies can enable detailed simulations of the full costs, benefits and likely outcomes of decisions in business and government. These relate to projects, large and small, from infrastructure to products, business approaches to policies. Models can accurately predict costs, duration, benefits and returns as well as environmental and social outcomes and both positive and negative externalities.

BENEFITS

These accurate projections inform more effective policy- and decision-making, with fewer 'white elephant' projects that fail to deliver on expectations, negative externalities and other unintended consequences. Resource allocation becomes highly efficient, freeing up budgets for other investments and projects. The process boosts accountability and holds decision-makers responsible for risks and impacts identified by modelling and simulation and not acted upon.

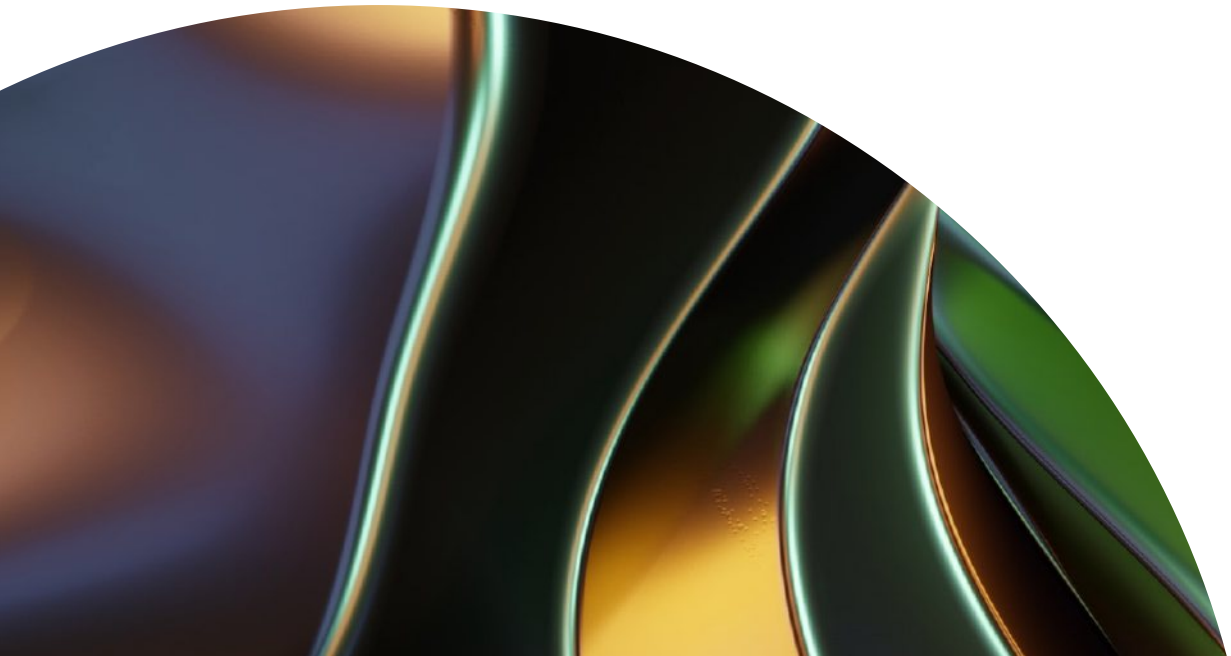
RISKS

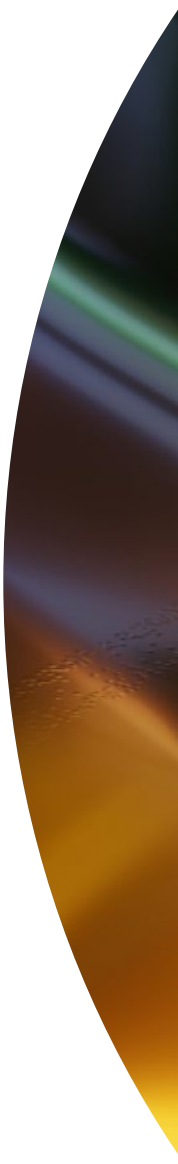
Accidental innovation that brings along impactful changes and outcomes[378, 379] decreases. Innovation shrinks as individuals, governments and corporations focus on the risks as opposed to the unexpected benefits.



TRANSFORMATIONAL

The power to radically change ways of life by replacing the models that countries, communities and individuals live by. They enable individuals and communities to innovate and improve and aid the transformation of humanity to new digital and non-digital realities.





OPPORTUNITY #38

WHAT IF WE DIDN'T NEED TO REFRIGERATE FRESH FOOD?

ZERO-WASTE FOOD

What we eat stays fresh – no matter what

Around
13%
of food is wasted each year because of a lack of refrigeration

WHY IT MATTERS TODAY

Around 13% of food is wasted each year because of a lack of refrigeration.[380]

Even if refrigeration was an option through increased access to energy,[381] refrigerators, along with air conditioners, account for a tenth of total CO_2 emissions.[382]

Poor handling or processing of food products causes foodborne diseases that affect around one-tenth of the global population with an annual death toll of 420,000.[383] Food waste totals around 930 million tonnes each year, the majority of which occurs at the household level.[384] Perhaps surprisingly, the global average of 74kg per capita of food wasted each year is similar in both lower-middle income and high-income countries.[385]

Putting waste into perspective, between 720 and 811 million people in the world faced hunger in 2020 and one in three people in the world (2.37 billion) did not have access to adequate food in 2020.[386]

SECTORS

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THE OPPORTUNITY TOMORROW

The prospect of a zero-waste food industry has been raised by new technologies such as bio-based smart packaging that keeps foods fresher for longer without the use of harmful chemicals and regulates temperature variations during transit.

These and other changes in the food industry can help improve access to fresh produce worldwide and have a significant impact on global health and well-being. Bio-based packaging technologies may provide answers to a variety of issues faced by people without electricity or safe storage conditions while still supplying high-quality food.

As well as smart packaging, advances in gene editing crops facilitates more resilient varieties, removing the need for a chilled supply chain.

BENEFITS

Producers of fresh food earn more income, while consumers – particularly those living in hot and humid climates – have a wider choice of safer, nutritious and more affordable fresh food.

RISKS

Risks include unintended consequences from genetic modification and hoarding of IP or knowledge, limiting the benefits of these new technologies. The waste disposal system itself may be inefficient and force a return to the old ways of rubbish collection and recycling.

UNINTENDED CONSEQUENCES

Excess fresh produce drives down prices for producers and eventually goes to waste.

OPPORTUNITY #39

WHAT IF BIOLOGY REPLACED CHEMISTRY?

DESIGNER CELLS

Bio-derived solutions replace chemicals in ways that transform industries, the environment and consumer habits

WHY IT MATTERS TODAY

Chemicals comprise one of the basic building blocks of industry, from manufacturing, agriculture and telecommunications to pharmaceuticals, consumer goods and beyond.

The chemicals industry is expected to grow at around 3% annually for the next 20 years, largely driven by growth in Asia and the Middle East.[387] Asia is expected to own two-thirds of the market by 2030[388] and half of the top 10 chemical companies are expected to be in Asia or the Middle East.[389] The industry growth rate is forecast to slow down to 1% in Europe[390] and, with the simultaneous focus on sustainability and decarbonisation, European players are expected to seek leadership in alternative energy sources, improved energy storage and intelligent materials.[391]

Throughout the last decade, the chemical industry has made efforts to reduce its impact on the environment.[392] Responsible for approximately 5.5% of global CO_2 emissions, 7% of global greenhouse-gases emissions and 10% of global energy demand,[393] the use of biology in materials, chemicals and energy is expected to rise to $300 billion[394] and, more specifically for chemicals, the market for bio-based chemicals is expected to grow from the current 2% of the total chemical market to 22% by 2025.[395]

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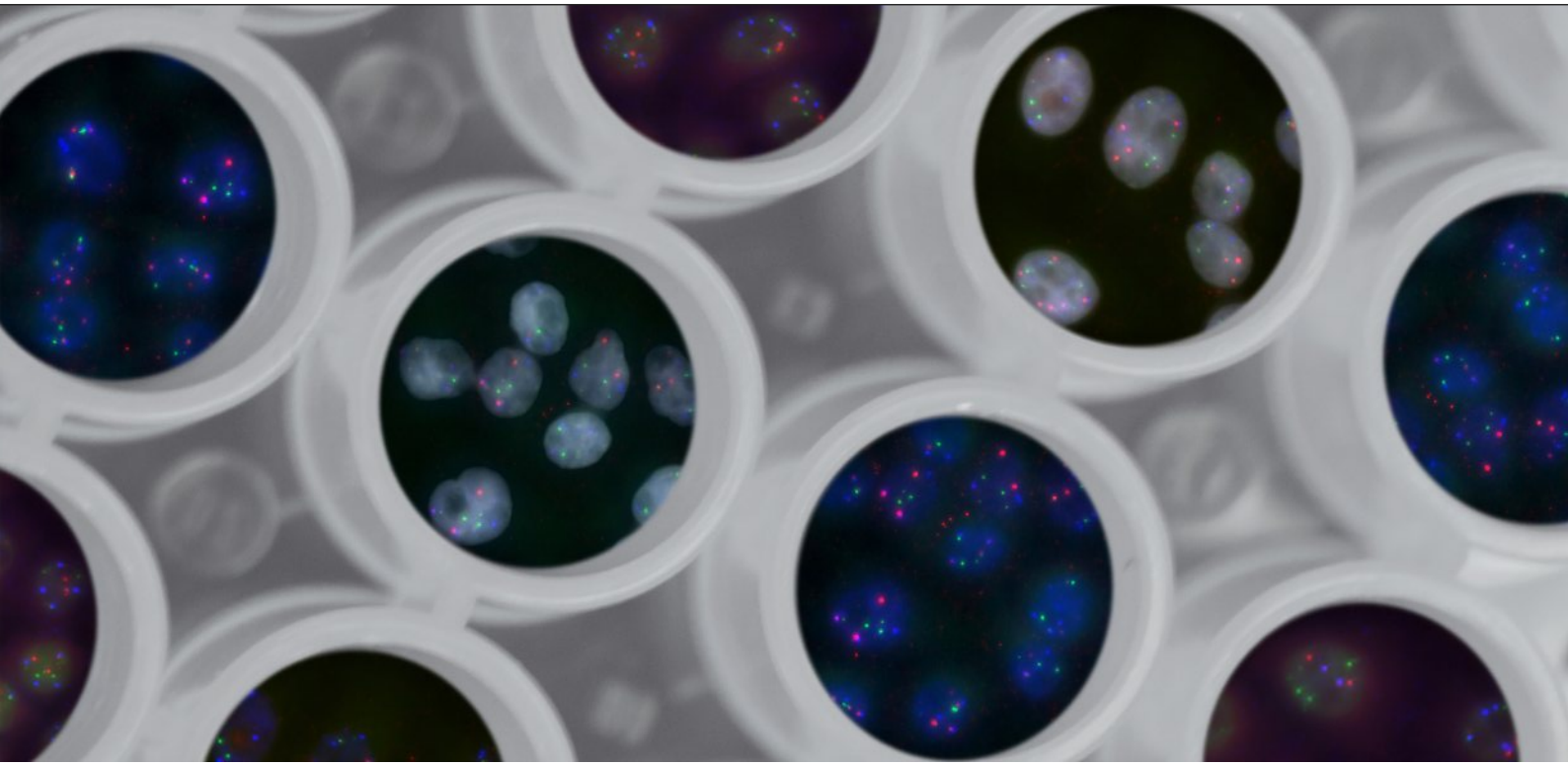

The market for bio-based chemicals is expected to grow from the current

2% → 22%

of **the total chemicals market by 2025**

THE OPPORTUNITY TOMORROW

Advances in biology offer the potential for solutions and materials that replace chemical-based products and processes. These materials can replace chemicals as inputs for consumer goods, healthcare, material and waste handling. Besides natural materials, cells, animal and plant DNA,[396] bacteria[397] and fungi make the future of biomaterials promising and expansive.

Such biomaterials will be manufactured in 'biofoundries' – integrated and highly automated facilities that undertake genetic engineering of living cells for specific applications, from the production of novel biomaterials or biofuels to cell-based meat. Industrial-scale biofoundries could make biomaterials that have the characteristics of plastics, metal and concrete, while being biodegradable and able to grow and repair[398] themselves.[399]

Half of the top 10 chemical companies are expected to be in Asia or the Middle East by 2030

BENEFITS

Greater availability and lower price volatility of raw materials for making these new bio-solutions lead to more diverse and resilient supply chains. The shift from chemical to biological waste reduces pollution.

RISKS

Risks include mishandling of biowaste, increasing emissions of methane and the accidental creation of novel biohazards. Malicious risks include biohacking or intentional damage to bio-foundries and processing plants.

OPPORTUNITY #40

WHAT IF FOOD IS PRODUCED AS NEEDED ANYWHERE IN THE WORLD?

ON-DEMAND FOOD

Food is produced on an as-needed basis anywhere in the world, freed from the constraints of land, light, energy and water

WHY IT MATTERS TODAY

Food is a basic need in human life, but food systems today are under stress.

More than 720 million people, or around 10% of the world population, faced hunger in 2020 according to UN figures.[400] Food price spikes, shortages, hunger and famine are caused by climate change-related catastrophes, environmental degradation, supply chain disruption and governance failings.

One driver of hunger is volatile food prices. In real, inflation-adjusted terms, prices in October 2021 surpassed those of 2011 and could soon match the highest levels as recorded in the mid-1970s.[401]

Even before COVID-19, UN agencies estimated that over 55 million people among the Middle East and North Africa (MENA) population of then 457 million were undernourished. Half of MENA's food is imported and the share rises to 90% in some Gulf Cooperation Council countries.[402] Half of the population of MENA already live under conditions of water stress and with the population expected to grow to nearly 700 million in 2050, per capita water availability will be halved.[403]

Meanwhile, the composition of the food market is changing, with key sectors consuming less meat. While growth in food imports to East Asia, one of the dominant import destinations globally, continues, its composition is also changing. Absolute growth in meat imports to the region in 2021 could amount to an increase of only $4 billion in 2021, compared with a surge of $15 billion in 2020.[404]

SECTORS

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More than 720 million people, or around

10%

of the world population, faced hunger in 2020

THE OPPORTUNITY TOMORROW

Laboratory-grown food and other advances offer solutions to one of the 21st century's most urgent global challenges.

Using mobile biofoundries that can travel to where food is needed and produce it on demand, lab-grown food has the potential to reduce the risk of famine and enhance childhood nutrition in developing countries. It can also reduce impacts on the environment, including using less water than needed to produce conventional food, as well as supporting economic growth by reducing reliance on food imports.

BENEFITS

Lab-grown food does not require agricultural land or feed inputs, but can still provide high-quality protein. Such a system could reduce greenhouse gas emissions from cattle farming and remove antibiotics from the food supply. It also requires significantly less water than traditional farming practices because it operates like a biological factory, recycling nutrients instead of relying on external sources such as rainfall or irrigation.

RISKS

The process creates a risk of disruption, especially in rural areas, through the loss of livelihoods from conventional food value chains. Additional challenges are increased dependence on technology and ensuring balanced nutritional production. There may be increased hesitancy about consuming food produced through bio-foundries due to psychological and cultural ties, even if there are food shortages.

OPPORTUNITY #41

WHAT IF WATER WAS A FOREVER RESOURCE?

AN ENDLESS WATER CYCLE

Water is ours to recycle and use as and when needed

WHY IT MATTERS TODAY

Water is fundamental to life on Earth. Around 50%–70% of our body weight is water (H_2O) and each adult needs an average of 3.2 litres of water per day.[405] 'Virtual water',[406] or the global average freshwater used to produce goods and services, also referred to as our water footprint,[407] per person is approximately 3,500 litres per day.[408]

While the UN's 6th Sustainable Development Goal (SDG6) is to ensure safe drinking water and sanitation for all, 26% of the world's population lacked safely managed drinking water in 2020 and 44% of household water is not safely treated.[409]

Three-quarters of water withdrawals are for agriculture, 16% by municipalities for households and services and 12% by industries.[410] When a territory withdraws 25% or more of its renewable freshwater resources it is said to be 'water-stressed' and 2.3 billion people live in water-stressed countries.[411] While SDG6 has aims related to reusing wastewater, they are mainly focused on wastewater collection and treatment, with data gaps remaining around the world.[412]

One means of creating clean water is desalination of seawater. Having steadily increased in number since the 1960s,[413] there are now nearly 16,000 operational desalination plants around the world and 48% of desalinated water is produced in the Middle East and North Africa (MENA).[414] While desalination helps resolve challenges related to drinking water by removing salts from saltwater to make it drinkable, it also emits brine, a highly concentrated salt solution that contains high levels of chlorine and copper that can damage coastal and marine ecosystems.[415] For every litre of drinkable water produced, about 1.5 litres of brine is created.[416]

SECTORS

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Three-quarters of water withdrawals are **for agriculture**

16% by municipalities **for households and services**

12% by industries

THE OPPORTUNITY TOMORROW

Advanced water treatment solutions can enable each home or building to endlessly recycle its own water.

Such technologies can be supported by policies that provide for these solutions to be included in new builds and retrofitted to existing buildings. Utility companies can refocus away from managing centralised water treatment facilities and towards providing waste management services at building level to remove particle and chemical waste. This trend is partly inspired by space stations like the International Space Station, which recycles 93% of its wastewater.[417]

One of the prestigious Earthshot Prize finalists has been working to build a small-scale decentralised water reuse system and autonomous control system for water treatment.[418]

BENEFITS

A self-sufficient water supply per household ensures no shortages or waste, leading to a massive reduction in domestic water demand and lessening the need for power to pump, desalinate or extract water. This improves people's quality of life in extremely water-stressed areas.

RISKS

There are potential risks to health if systems fail. Risks to health and lives can arise from either unintentional errors or malicious damage to water treatment systems.

OPPORTUNITY #42

WHAT IF WE COULD MEASURE THE TRUE VALUE OF OUR ECONOMIES?

GDP 2.0

A globally accepted measure of the full cost and true value of all economic activity, including social and environmental impacts

WHY IT MATTERS TODAY

Gross domestic product, or GDP, the value of goods and services produced and consumed, has long been accepted as the global standard for measuring economic growth.

Simon Kuznets, an economist with the US National Bureau of Economic Research, first coined the term in a report to the US Congress in 1937[419] and the world adopted it as a standard in 1944 at the Bretton Woods conference.[420] GDP measures the total quantity of goods and services produced in an economy over a given period of time, typically annually. While GDP is widely used to indicate how well an economy is doing generally, it is more realistically a measure of production and omits areas such as health and well-being.

Even before the Great Recession of 2008, a global movement had emerged to replace GDP[421] with a broader dashboard of indicators that could help steer countries to a healthier and more sustainable future.[422] As the world evolves into a future that is even more complex and varied, many believe that a new globally adopted measure for growth is needed to set future policies and priorities and to communicate failures that are hidden by the use of GDP.[423]

Several institutions and non-governmental organisations have put forward alternative measures to the GDP but none have been globally adopted, partly because metrics are loosely defined or difficult to measure, or for other unknown reasons.

SECTORS

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But now, even the World Bank[424] and the International Monetary Fund (IMF),[425] traditionally strong proponents of GDP, are paying attention to environment, equity and sustainability measures in economies.

Countries with the highest GDPs do not necessarily enjoy greater societal benefits. In 2020, the top five nations by GDP were the US, China, Japan, Germany and the UK.[426] Yet China (1) and the United States (2) are the worst emitters of CO_2, followed by Japan (5), Germany (7) and the United Kingdom (17).[427]

While the UN's Human Development Index (HDI), which seeks to measure well-being, is based on a per capita ranking as a proxy for how societies are faring, the same nations above were ranked even lower, with Germany (6) ranked higher than the rest followed by the UK (13), the US (17), Japan (19) and China (85).[428]

Alternatives to GDP include the Beyond GDP initiative of the European Commission,[429] the US state of Maryland's Genuine Progress Indicator (GPI),[430] the Better Life Initiative of the Organisation for Economic Cooperation and Development (OECD)[431] and the Inclusive Development Index from the World Economic Forum (WEF).[432]

THE OPPORTUNITY TOMORROW

Non-monetary forms of value creation – such as unpaid care work and biodiversity through wildlife protection – have been increasingly socially recognised over the past few decades, but GDP has not evolved to encompass it. Many approaches to adapting or replacing GDP have been proposed, but none have been widely adopted.

Novel ways of capturing and analysing data can lead to global agreement on ways to assign monetary values to environmental and social impact. With strong political will, conventions on how we measure growth and prosperity could change. The key indicator of a country's economic success could include changes to natural capital (for example, natural ecosystems), health and well-being. This would allow for adjusting for environmental and social externalities in the same way we adjust for inflation every year.

BENEFITS

Quantifiable evidence for the value of 'soft' capital can lead to new ways of establishing competitive advantage, improve decision-making and enable forward-looking government strategies and policy choices.

RISKS

Poorly defined measures may create the wrong incentives and ethical risks related to the wider application of monetary values assigned to life.

OPPORTUNITY #43

WHAT IF REMEDIAL ACTIONS TO REDUCE EMISSIONS WERE NOT NECESSARY?

CASH FOR CARBON

Rewarding those who avoid greenhouse gas emissions

WHY IT MATTERS TODAY

Climate change is caused by increasing concentrations of greenhouse gases in the atmosphere. Carbon emissions, mainly from fossil fuel consumption, and reduced carbon removal, such as from cutting down trees, are two key processes that increase levels of carbon dioxide, the most abundant greenhouse gas on Earth.

The use of fossil fuels and deforestation,[433] therefore, are at the heart of climate change.[434]

To counter the rise of atmospheric carbon, a number of actions are being taken, from making energy-dependent processes more efficient and substituting low carbon energy for fossil fuels, to planting trees and developing carbon-capturing technologies. For example, by 2040 electric passenger vehicle sales globally are expected to account for just under 90% of total sales,[435] resulting from growing and extensive legislation to curb sales of internal combustion engine cars.[436] At the same time, tree-planting initiatives around the world are proliferating[437, 438] in an effort to remove the carbon emitted into the atmosphere.

SECTORS

ENERGY, OIL & GAS · INFRASTRUCTURE & CONSTRUCTION

THE FUTURE OPPORTUNITY

Incentives can be devised so that countries responsible for rising greenhouse gas emissions, such as through oil production, deforestation or increasing farming of cattle, which emit the greenhouse gas methane, could be compensated for preventing emissions. Income from voluntarily selling a new form of carbon credits based on future estimates of emissions becomes more lucrative than the opportunity costs of activities such as extracting oil or removing forests.

The increasing returns from investing in assets and approaches to reduce emissions makes the world approach climate-related activities in exactly the opposite way to the conventional business model. It now makes better economic and social sense to conserve energy and reduce emissions than to produce and consume resources and increase emissions. Countries might take the initiative to phase out their activities that contribute to carbon emissions and be compensated by the carbon credits they obtain in return with clear legal, regulatory and auditing frameworks

BENEFITS

In addition to avoiding more CO_2 emissions into the atmosphere, there will be an accelerated shift towards renewable energy, along with the soft power that comes with demonstrated environmental leadership.

RISKS

Altering the structure of the energy market will affect prices and may not have the desired global affect as other producers might step in to make up for the shortfall. At current prices, carbon credits are less lucrative than oil, though this may change as the deadlines of 2050 approach and carbon credit prices are expected to increase.

OPPORTUNITY #44

WHAT IF WE COULD BUILD AND ACCESS A NEW REALITY?

AN IMMATERIAL WORLD

Entirely new immersive environments offer a complete range of business and social activities and experiences in virtual reality

WHY IT MATTERS TODAY

Today, digital content can be superimposed on our real world physical environments through a smartphone, a tablet or a virtual reality (VR) device such as a headset, lenses or glasses.[439] This creates what is known as augmented reality (AR). Mixed reality (MR) allows us to experience a blend of the physical and digital worlds at the same time.[440] Mixed reality is at the centre of the reality–virtuality (RV) continuum conceived by researchers Paul Milgram and Fumio Kishino.[441] MR gives us an immersive experience mainly driven by AR as it can potentially apply to all senses, augmenting or substituting missing smell, touch and hearing as well[442] – hence creating what are termed 'digital realities'.

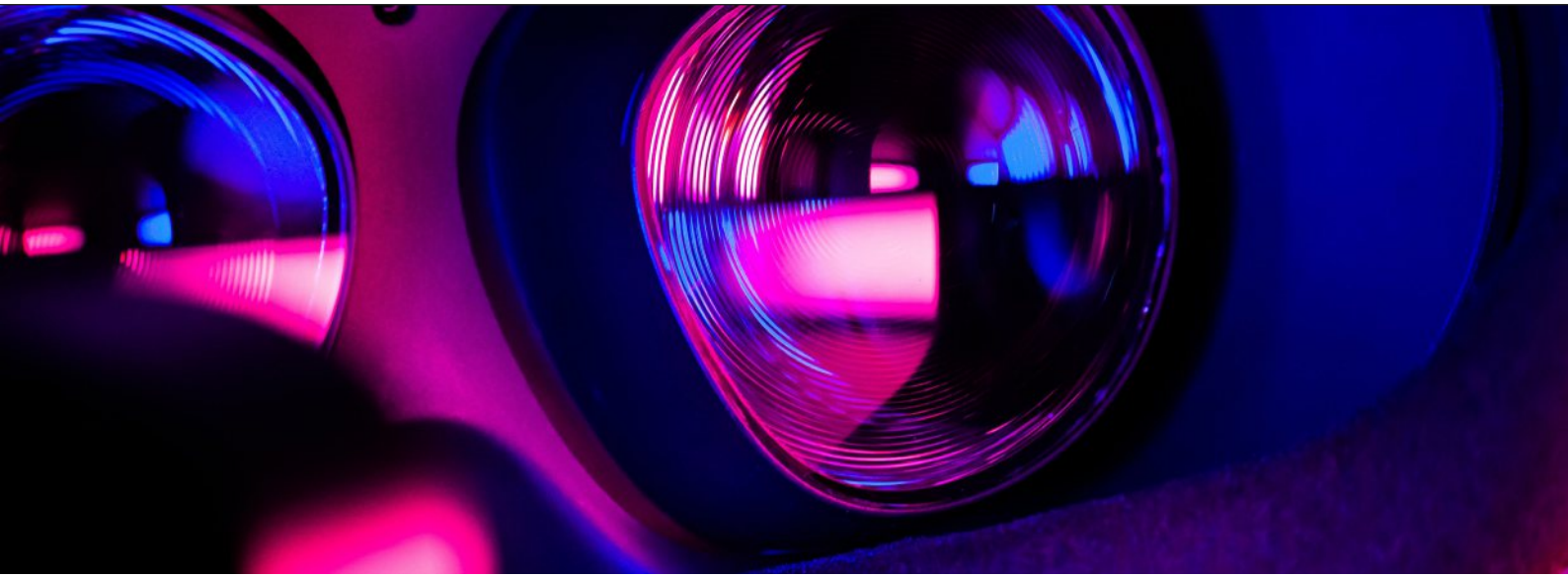
The market for AR/VR is expected to grow from just over $12 billion in 2021 to around $73 billion by 2024.[443] By 2030, AR/VR is expected to boost global GDP by a total of $1.5 trillion.[444] Around $204 billion of that growth is expected to be generated in the retail and consumer field, including film and gaming, as two-thirds of those who use AR use it for enjoyment and fun.[445] Other contributions to the value created by AR/VR will come from product and service development, healthcare, skills training and development, logistics, manufacturing, energy and maintenance.[446]

Companies with branded AR experiences are around 40% more likely to be considered by consumers, and nearly 3 in 4 consumers say they're willing to pay more for a product that promises the transparency that AR can provide.[447] Revenues in the digital media market are projected to reach nearly $300 billion in 2021 and around $420 billion in 2025 with video games driving just over half of the growth.[448]

Trade in digital assets such as videos, text, animated GIFs and audio is also growing fast. In the first four months of 2021 digital assets witnessed growth in trading volume of over $2 billion in the form of non-fungible tokens (NFTs).[449]

SECTORS

AUTOMOTIVE, AEROSPACE & AVIATION · INFORMATION & COMMUNICATION TECHNOLOGY · INFRASTRUCTURE & CONSTRUCTION · UTILITIES



Nearly

3 in 4

consumers say they're willing to pay more for a product that promises the transparency that AR can provide

THE OPPORTUNITY TOMORROW

Real-time data and advanced modelling power can enable the development of digital realities, including citizen avatars who interact virtually to simulate people's behaviour in response to different situations.

Globally agreed ethical and legal frameworks are needed to underpin more widespread access to information, transactions and relationship-building in AR, VR and MR worlds. Haptics (technology creating the experience of touch) and information overlays allow people to understand facts and form opinions by immersing them deeply in a virtual situation and providing all the necessary detail. In this way, realistic and immersive virtual environments increasingly help people improve their understanding of the issues and situations facing others.

Powerful immersive virtual systems can combine with new forms of value creation, driving economic, business and societal innovation. These environments open new possibilities for individuals in how they interact, work, express their own potential and engage with others.

BENEFITS

These immersive realities give decision-makers greater insight into the interactions across social, economic and ecological spheres. This also enables people to see other perspectives and to access different experiences, creating a greater sense of commonality.

RISKS

Risks include virtual environments being corrupted by deep fakes or cyberattacks and unequal access to VR systems, creating information divides. A risk of malicious harm due to large-scale misinformation campaigns and sentiment manipulation.

OPPORTUNITY #45

WHAT IF DATA DIDN'T MATTER ANYMORE?

THE END OF DATA AS CURRENCY

A world where data is open and available to all, disrupting business models based on arbitrage or mass data capture

WHY IT MATTERS TODAY

Data is everywhere.

On Facebook alone, with the participation of more than 3 billion people and 200 million businesses, more than 100 billion messages and 1 billion stories are shared every day.[450] In one minute, 167 million videos are watched on TikTok followed by 44 million videos on Facebook live.[451, 452] Also in 1 minute, 12 million messages are sent on iMessage, 668,000 messages sent on Discord, 5.7 million searches made on Google and 575,000 tweets published.[453, 454]

The amount of data created over the next three years is expected to be more than the data created over the past 30 years, and the world will create more than three times as much data over the next five years as it did in the previous five.[455]

The ratio of unique data (created and captured) online to replicated data (copied and consumed) is 1:9 and the trend is towards less unique and more replicated data, reaching a 1:10 ratio by 2024.[456]

Data related to the Internet of Things (IoT) and increasing amounts of metadata (data about data) are growing rapidly and will soon surpass all other data types. The growth of rampant information gathering creates dilemmas such as video surveillance at a time when jurisdictions are also acting to protect personal privacy. Finding an acceptable balance between security, personalisation, efficiency and privacy rights will be one of the great challenges for the coming decade.[457]

Despite many governments signing the Open Data Charter[458] or adopting the G20's anti-corruption open data principles,[459] fewer than one in five datasets are open and little progress has been made in the last decade.[460]

SECTORS

FINANCIAL SERVICES & INVESTORS · HEALTH & HEALTHCARE · INSURANCE & REINSURANCE · PROFESSIONAL SERVICES

The **ratio** of unique data (created and captured) online to replicated data (copied and consumed) is **1:9**

and the trend is towards less unique and more replicated data, reaching a **1:10 ratio** by 2024

THE OPPORTUNITY TOMORROW

Aside from the volume of data, opening data and unlocking it for the world to use can add $3 trillion in economic value globally each year through provision of readable information that can be shared and distributed at little or no cost. The sources of value from open data include new or increased revenue; savings or economic surpluses in consumer finance; consumer products; education; electricity; finance; health; oil and gas; and transportation.[461]

Increased availability of data, combined with wide access to powerful modelling capacity, can lead to everyone being equally able to assess useful information from education resources to details of the value and risks associated with a financial asset.

Business models that are based on asymmetric information will no longer be commercially viable. Data-harvesting and arbitrage industries, such as insurance and finance, that have depended on such unequal access to information will need to find new business models.

With fewer inefficiencies, societies can fully share the benefits of data. Open data access accelerates the rate of discovery, providing scientists with more resources to fuel their work. It makes it easier for researchers to identify trends and gives them more evidence to support their findings. Open data access also encourages transparency as it is critical to data integrity and good science practices.

BENEFITS

Freely accessible information means that individuals can make more informed choices about their investments and futures, bringing them greater agency and autonomy. Governments and organisations can improve their forecasting and strategic decision-making.

RISKS

Risks include people's privacy being affected by the disappearance of digital rights and less emphasis on protecting data, given its ubiquity. The capacity to innovate also becomes less of a source of competitive advantage, as everything can be copied or replicated.

UNINTENDED CONSEQUENCES

The disappearance of digital rights may impact on people's privacy.

OPPORTUNITY #46

WHAT IF WE COULD SHARE OR OUTSOURCE OUR BRAINS?

PUTTING OUR HEADS TOGETHER

Using brain–computer interfaces to exchange information with machines and other people's brains

WHY IT MATTERS TODAY

Researchers in neurotechnology are making progress in understanding the brain and how to make it interact with machines and other minds using brain signals alone. This is aided by brain–computer interfaces that also can be applied to stimulate nerves and help those who face restrictions in movement or control.

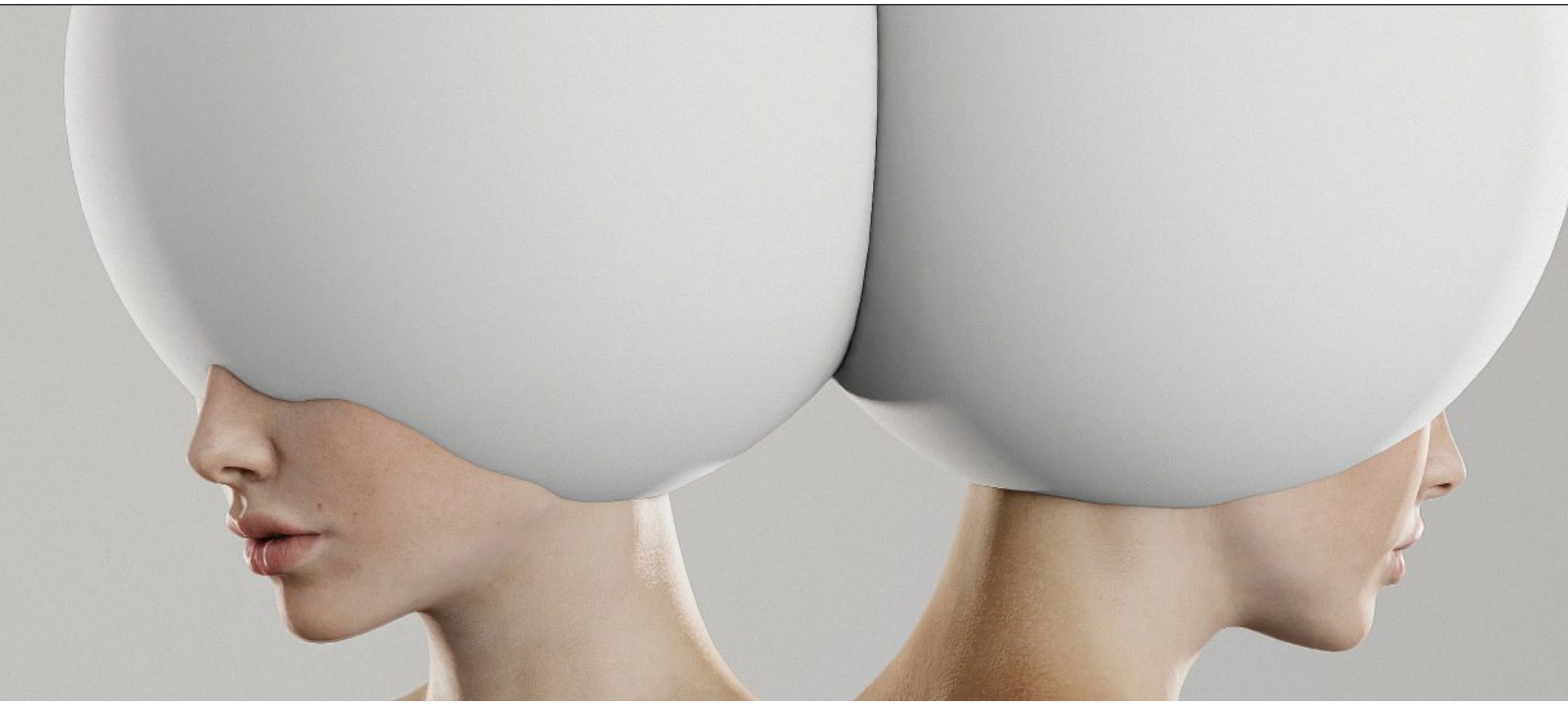
The technology can benefit many groups, from amputees who could control prosthetic limbs to improve memory for people dealing with Alzheimer's disease, stroke or head injuries.[462] Not without challenges, these interfaces are also used in gaming.[463] Bi-directional brain–computer interfaces could enable us to speak to each other without having to say a word.[464]

The global market for brain–computer interfaces is expected to grow from around $1.5 billion in 2020 to around $5.5 billion by 2030.[465] The market in medical applications is expected to increase from $1.4 billion in 2021 to $2.4 billion by 2026, while use of BCIs in entertainment and gaming applications rises from around $100 million in 2021 to nearly $190 million by 2026.[466]

Artificial intelligence (AI)[467] is a critical enabler of neurotechnology and by 2030 it is expected to have a $16 billion impact on the global economy[468] with $320 million occurring in the Middle East.[469]

SECTORS

EDUCATION · FINANCIAL SERVICES & INVESTORS · HEALTH & HEALTHCARE · INFORMATION & COMMUNICATION TECHNOLOGY · INSURANCE & REINSURANCE · TRAVEL & TOURISM



THE OPPORTUNITY TOMORROW

Brain–computer interface technology is in its infancy and there are multiple possibilities on the horizon, from moving devices and typing and communicating using thought to communicating with smart homes.

Advanced, non-invasive read-and-write connectivity between machines and brains can enable people to share information not only with machines but between themselves

Ultimate a 'brain cloud' can be created that contains the thoughts, knowledge and memories of millions. This offers unprecedented possibilities for communication, knowledge transfer, individual learning and the safekeeping of skills and knowledge for future generations.

The technology raises issues from safety to privacy and autonomy, making it important to draw up protective regulatory frameworks to ensure it is used ethically.

BENEFITS

Allowing people to explore other people's experiences and perceptions could improve empathy and social cohesion. A collective and connected intelligence might address and solve some of the most intractable challenges humanity faces. On a personal level, it can reduce pain and improve the quality of life for older patients and others who suffer from brain injury or disorders.[470]

RISKS

Risks include the potential for abuse or attacks to corrupt or plant false information, loss of control over personal memories and thought, or opting out becoming effectively impossible.

OPPORTUNITY #47

WHAT IF GENETIC SCREENING WAS STANDARD?

SCREENING FOR GOOD

Comprehensive non-invasive genetic screening, before pregnancy and for embryos, enables the prevention of debilitating congenital conditions

WHY IT MATTERS TODAY

The cost of mapping an individual's genetic sequence is falling fast.

Thanks to technological, scientific and operational advances, the cost of deciphering an entire human genome has dropped by an order of magnitude from $10,000 in 2011 to about $1,000 today.[471]

The global market for personalised medicine is growing rapidly, generating $44 billion in revenues in 2016 to a projected $140 billion by 2026.[472] The linked direct-to-consumer genetic testing market is predicted to grow at around 17% over the coming decade as awareness and acceptance of personalised medicine increases on a global level.[473]

Despite advances in genetic testing, around 6% of children born globally have a serious genetic or partially genetic birth defect. Gulf Cooperation Council (GCC) countries have a particularly high incidence, ranging from 7.3% to over 8%.[474]

The Centre for Arab Genomic Studies has identified 1,890 genetic diseases in the Arab population (based on the 23 countries' demographics tested by the Centre).[475] One of those genetic diseases is Diabetes Mellitus. According to the International Diabetes Federation (IDF), 55 million adults aged 20–79 were registered as diabetic in the Middle East and North Africa (MENA) in 2019.[476] This number is expected to double to 108 million by 2045.[477]

SECTORS

EDUCATION · HEALTH & HEALTHCARE

THE OPPORTUNITY TOMORROW

Genetic testing is likely to grow, particularly if it is non-invasive. Advances in genome sequencing and gene editing techniques make it feasible to screen and potentially treat all foetuses and babies for congenital conditions, minimising negative consequences for life quality or health.

It will also be possible to screen parents to exclude genetic conditions in their children during pre-implantation diagnostics as part of in vitro fertilisation.[478, 479] Dozens of specialist companies have been established in this field over the past decade, and many more will emerge. Combined with solutions for communicable diseases, genetic screening can significantly reduce childhood mortality, which in the Middle East stands at 1.8% according to UNICEF.[480]

Genetic screening prompts intense ethical and scientific debate. Scientific governance is being developed[481] but societies are nonetheless faced with sensitive choices about how far-reaching and comprehensive screening should be allowed to go as gene editing technologies advance. Where medical intervention is available to correct for congenital conditions – such as cystic fibrosis or sickle cell anaemia – screening results in healthier babies, extends lives and alleviates the suffering of children and parents.

BENEFITS

The further eradication of congenital conditions and genetic predispositions to other conditions results in children getting fewer illnesses and drives a population-wide increase in longevity. Lifetime healthcare costs reduce, leading to an increase in life satisfaction.

RISKS

The potential risk of extreme screening and editing for certain ‘cosmetic’ or presumed ‘intellectual’ characteristics raises ethical questions about the rights of children and parents and unintended harm to future generations.

UNINTENDED CONSEQUENCES

Attitudes could evolve towards lower social acceptance of differences and greater acceptance of eugenic tendencies.

OPPORTUNITY #48

WHAT WILL HAPPEN IF NO ONE ATE MEAT?

EATING WITHOUT ANIMALS

Novel food production technologies and evolving medical knowledge make meat superfluous

WHY IT MATTERS TODAY

Plant-based diets and alternatives to meat have been shown to have benefits for the environment as well as human health. A global switch to a vegan diet by 2050 would reduce greenhouse gas emissions by an estimated 15%[482] of the current total.[483]

But the deep psychological and cultural ties consumers have to meat and the nutritional benefits of protein and iron are not easy to give up.[484] Global demand for meat is projected to rise 50% between 2013 and 2050.[485]

Still, demand for meat alternatives has also grown and is expected to continue to rise. The global meat substitutes sector is set to grow from around $21 billion in 2020 to $23 billion by 2024,[486] while the market for cultivated meat could reach $25 billion by 2030.[487]

Such plant-based and cell-based meat combine ingredients in novel ways to deliver the culinary experience of meat without the need for a single animal. Plant-based meat uses less land than conventional meat.[488] Plant-based meat production emits 30%–90% less greenhouse gases and uses 72%–99% less water than conventional meat.[489]

However, the meat alternative industry still has hurdles to overcome. Only around 8% of the world currently identify as vegetarian[490] and if that proportion increases the sector faces capacity challenges. For example, at current levels of cell-culture productivity, the industry would need anywhere from 220 million to 440 million litres of fermentation capacity, up to 176 olympic-size swimming pools to reach just 1% of the market.[491]

SECTORS

ADVANCED MATERIALS & BIOTECHNOLOGY · CHEMICALS & PETROCHEMICALS · ENERGY, OIL & GAS · HEALTH & HEALTHCARE · MANUFACTURING

A global switch to a vegan diet by 2050 would reduce greenhouse gas emissions by an estimated

15%

of the current total

THE OPPORTUNITY TOMORROW

As consumers increasingly seek alternatives to meat, technological advances can make new forms of animal protein or their plant-based equivalents widely available, increasing capacity and reducing costs. Food value chains can be rethought around plant and bioengineered alternatives, such as lab-grown 'meat' or home-printed substitutes. Livestock numbers decline around the world, reducing agriculture's energy, water and carbon footprints and focusing on offering non-GMO and 'raised without antibiotics' (RWA) livestock.

Countries and regions can collaborate to set nutritional and safety standards for cellular agriculture, precision fermentation, animal protein alternatives and non-GMO feedstock.

Global **demand for meat is projected to rise**

50%

between 2013 and 2050

BENEFITS

Major benefits are seen in reduced greenhouse gas emissions and improved human health as meat is replaced with leaner and more nutritious options. Switching to leaner or meat-free diets improves cardiovascular health and, as plant-based meat requires no antibiotics, may halt the rise of anti-microbial resistance. Meanwhile, arable land use for commodity feedstocks can be converted to higher-value food crops.

RISKS

Risks include significant disruption of agricultural value chains and livelihoods as systems adjust and fluctuating land value as land-use models shift over time. There is some risk that poorly regulated substitutes are not of sufficiently high nutritional value or health effects are unknown. Areas where livestock is raised and livelihoods based on that may experience desertification, loss of biodiversity, increased urbanisation and even malnutrition.[492]

OPPORTUNITY #49

WHAT IF WE COULD SPLICE AND DICE INTELLECTUAL PROPERTY RIGHTS?

THE IDEAS ECONOMY

Widespread creation, ownership and trading of intellectual property rights through securitisation as a means of income

WHY IT MATTERS TODAY

As of 2020, around 6.5% of the global population was deemed to be unemployed, the highest level since 1991. In the Middle East and North Africa (MENA) more than 10% of the population are unemployed.[493]

While these numbers are partly a result of the COVID-19 pandemic, automation and technological adoption by companies were already transforming tasks, jobs and skills before the pandemic[494] and it may simply have just accelerated their impact.[495] More job losses are expected as there is often a time lag between new technology being introduced and impact on the workforce. One reports forecasts that, by 2025, humans and machines are expected to be spending equal time on current tasks at work.[496]

As a response to unemployment and inequality, 25 cities, none in the Middle East,[497] have tried the concept of Universal Basic Income with unconditional cash payments[498] to residents. Some are turning to entrepreneurship as an alternative to employment, with more than 80% of MBA students saying they are interested in entrepreneurship as a career path[499] and, with difficulties in accessing quality education and getting jobs, more young Arabs are turning to entrepreneurship[500] as well.

SECTORS

AGRICULTURE & FOOD · ADVANCED MATERIALS & BIOTECHNOLOGY · AUTOMOTIVE, AEROSPACE & AVIATION · CONSUMER GOODS · ENERGY, OIL & GAS · FINANCIAL SERVICES & INVESTORS · HEALTH & HEALTHCARE · INFORMATION & COMMUNICATION TECHNOLOGY · INSURANCE & REINSURANCE · MANUFACTURING · MEDIA & ENTERTAINMENT

THE OPPORTUNITY TOMORROW

As innovation cycles speed up and ideas supplant goods in importance in value chains and trade, intellectual property (IP) becomes much more important. Ideas can be patented and IP is fractionalised into smaller IP units among families, friends, neighbours and other citizens. While being protected by globally recognised IP agreements, as well as legislation and re-engineered processes that make it easier to file IP, these patents can be traded globally or used by others and become the main means of income generation.

Technologies offer a high degree of transparency to ensure creator confidence, and everyone becomes a small-scale innovator. This more dynamic IP system brings more rapid innovation in key areas such as health, food systems and novel materials, with positive implications for growth as well as individual well-being and prosperity.

25 cities,

none in the Middle East, have tried the concept of Universal Basic Income with unconditional cash

BENEFITS

These new approaches change ideas about the cycle of work and home life, enabling individuals to smooth their income across periods of work and non-work. People can devote more time to self-realisation through activities such as education, caring and contributing to the community.

RISKS

Risks include a refusal by larger economies to engage in or respect the new international mode and the fraudulent or criminal use of securitisation for financial gain or to hijack innovation.

OPPORTUNITY #50

WHAT IF ALL TRADE WAS DIGITAL?

GLOBAL TRADE, LOCALLY MADE

Physical goods are provided anywhere in the world at the touch of a button, but never cross borders

WHY IT MATTERS TODAY

Since the 1980s, globalisation has progressed through a rise in global trade flows.[501] But more recently it has also proliferated through ever-increasing data and information flows.

While protectionism could re-create physical borders through virtual boundaries,[502] proponents of market forces are likely to resist it. For example, the European Commission (EC) has calculated that a single market for the digital economy without regulatory restrictions can unlock just over $500 billion per year in the European economy.[503]

Growth in digital trade and the digital economy is inevitable. An estimated 70% of new value created in the economy over the next decade is expected to be based on digitally enabled platform business models.[504]

The size of the digital economy in 2021 ranges, depending on definition, from 4.5% to 15.5% of world gross domestic product (GDP); an average of 18.4% of GDP in developed economies; 10% of GDP in developing economies; and 4% in the Middle East.[505] The global digital economy could grow to account for one-quarter of global GDP by 2025.[506]

SECTORS

AGRICULTURE & FOOD · CHEMICALS & PETROCHEMICALS · CONSUMER GOODS · ENERGY, OIL & GAS · LOGISTICS, SHIPPING & FREIGHT · MANUFACTURING · METALS & MINING

The ‘gig economy’, though a sub-sector of the digital economy, is an increasingly important provider of transportation, asset sharing, handmade goods and professional services.[507] The gig economy is expected to grow by 17% a year from transactions to around $455 billion by 2023 with an expected 80% increase in the number of workers participating in it.[508]

The United States, where most of the leading global companies in the gig economy were established, such as Uber, Airbnb, Upwork and Etsy,[509] is the current hub for flexible and temporary work, accounting for 44% of the jobs.

Another aspect to the move towards a digital economy is related to cost reductions that will become key to future competitiveness in the consumer packaged goods (CPG) sector.[510]

As a result of shifts in consumer spending[511] and preferences[512] including localisation,[513] businesses are seeking to reduce costs through flexibility, speed to market, access to tools, agility[514] and innovative ways to benefit from digital technologies. Beyond budgeting 2%–3% for inflation, it is expected that companies would need to reset their cost structures by 20%–30% to remain competitive.[515]

One route towards cost reductions in the CPG sector is to have goods and services produced and created in export markets or countries other than that where the provider is based. Globally, the outsourcing operations and shared services (OSS) reached around $690 billion in 2018 and are expected to grow more than 7% per year to reach around $970 billion by 2023. At this rate, the OSS industry will exceed $1 trillion within the next 6 years.[516] Outsourcing reduces time to market by 20%–25% and improves costs and customer service by 18%–30%.[517]

An estimated

70%

of new value created in the economy over the next decade is expected to be based on digitally enabled platform business models.

THE OPPORTUNITY TOMORROW

As technologies enable highly decentralised manufacturing, 3D printing and new consumption models, more companies may seek to outsource more of their value chain, operating in a new business model where orders are received globally and produced through the push of a button, making trade flows increasingly intangible where not a single product crosses borders.

Data, intellectual property (IP) and know-how replace more tangible investment, trade and wealth creation. Fully digital trade relies on high interoperability, and economies collaborate on standards and protocols to prevent them from becoming non-tangible barriers to trade.

BENEFITS

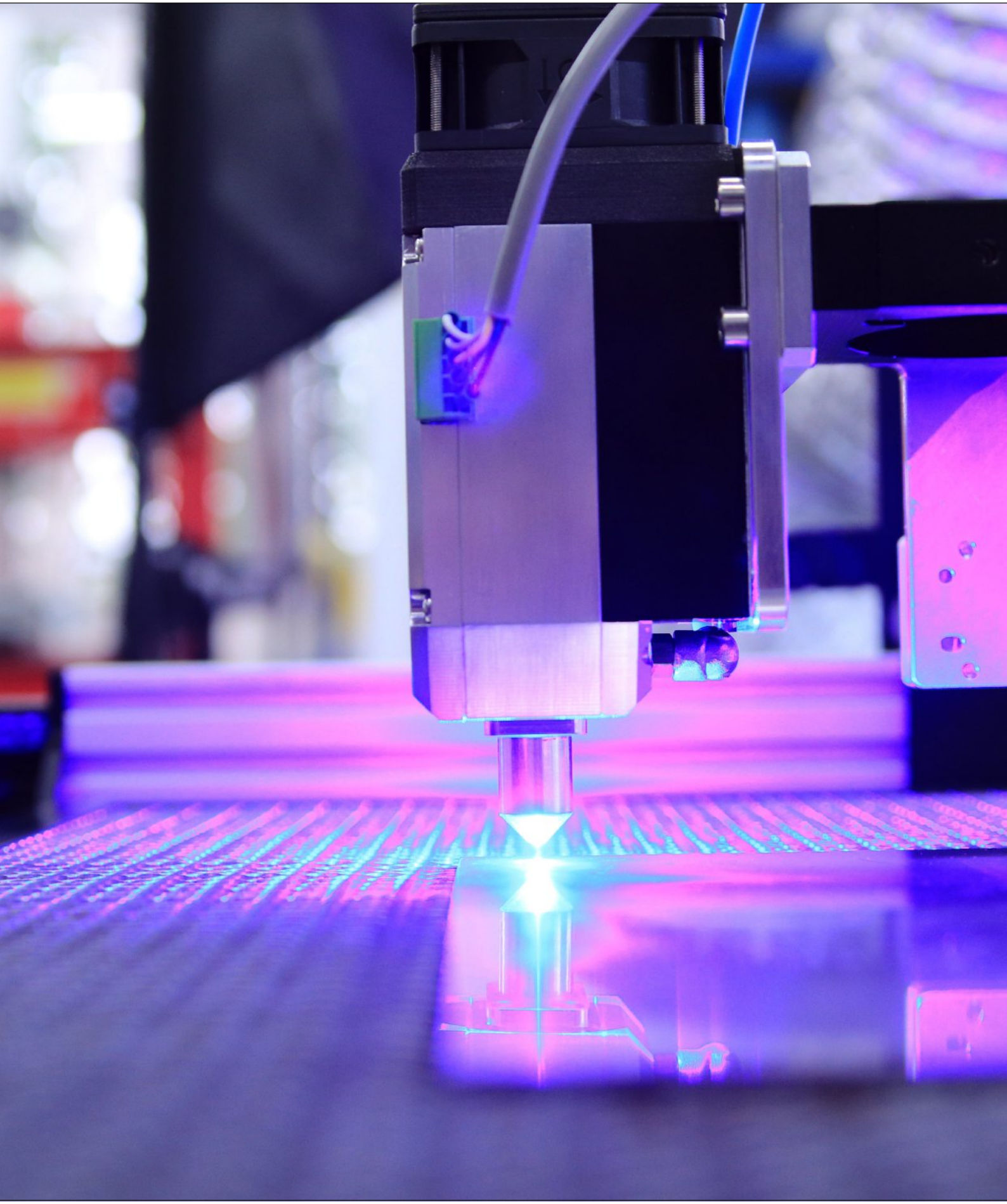
Invisible trade enabled by outsourcing is very mobile as digital flows can switch rapidly. Products no longer need to physically move across borders but can be manufactured close to markets, in line with traded IP and procedures for how to produce goods on demand and in an agile manner. The process is less environmentally damaging and promotes resilience.

RISKS

The borderless nature of digital trade creates risks for primary and secondary sector economies and for people lacking relevant skills. The dislocation of business activity and labour markets is a risk to economic growth, income and social stability during transition periods. There are also risks of malicious attacks on critical digital infrastructure or accidental technical errors bringing large parts of economic activity to a standstill.

UNINTENDED CONSEQUENCES

Those without access to technologies necessary to enable digital trade will not have access to globalised products and services.



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GLOSSARY

Adaptive materials

Adaptive materials are engineered at the molecular level to adapt their properties in response to changes in external parameters. For example, a material can change its ability to absorb or radiate heat in response to temperature changes in order to maintain the temperature within a predefined range. Examples include hydromorphic, photomorphic or thermomorphic adaptive materials.

Agritech

Agritech covers a range of technologies contributing to increased agricultural yields and efficiency. It includes genetic modification, chemical and biochemical pesticides, herbicides and fertilisers, technologies for water and effluent management, harvesting, animal husbandry and storage.

Advanced machine intelligence

Advanced machine intelligence is a product of algorithms, data and processing power that enables computers to learn from data and to analyse and model vast data sets at speed for advanced problem-solving and complex tasks.

Autonomous machines

Autonomous machines are machines programmed to operate on their own and that can perform a variety of complex tasks without the need for external controls or commands.

Biofoundries

Biofoundries apply engineering principles, such as prototyping, testing and standardisation, to the genetic engineering of living cells for specific applications, including the production of novel biomaterials or biofuels. They resemble highly automated laboratories with a high throughput of substrate liquids that enable rapid design–build–test–learn cycles.

Biomaterials

Biomaterials are any matter, surface or construct that interacts with biological systems. They can be natural or synthetic, incorporating metal, polymer or ceramic components. They are designed to have specific characteristics for use in, for example, medicine and healthcare, textiles, building materials and packaging.

Biomimicry

Biomimicry is the imitation of natural biological forms, properties or processes in engineering and design approaches to developing better products and processes.

Biotechnology

Biotechnology uses and engineers living organisms and biological matter (genetically or at the molecular level) to develop processes and products for healthcare, pharmaceuticals, materials, fuels and agriculture and food systems.

Brain–computer interfaces

Brain–computer or brain–machine interfaces are communication pathways using wires connected to the brain or an external device to 'read' the brain's neural signals (electron activity) or send signals to the brain using electric currents.

Carbon capture and storage (CCS)

Carbon capture and storage (CCS) or carbon capture and sequestration is the process of capturing and storing atmospheric carbon dioxide (CO_2). CO_2 can be stored through geologic capture – by converting the CO_2 gas into liquid under pressure and pumping it into porous rock or former oil extraction sites. Alternatively, biological carbon capture refers to the natural absorption of CO_2 by vegetation, soils and the oceans.

Compound annual growth rate (CAGR)

Average annual growth rate in a specific period of time that is greater than 1 year.

Cryptocurrency

A cryptocurrency is a digital currency relying on encryption for transactions and to produce new units (or coins). Cryptocurrencies are verified and traced using distributed ledger technology (DLT), one example of which is Blockchain. DLTs are decentralised databases that process, validate and record transactions that have been agreed upon by all parties involved. Validated transactions are timestamped with a unique encrypted signature. All participants on the DLT can view all records.

Decentralised autonomous organisation (DAO)

An organisation that is governed by code and not a CEO or board of directors. Governance tokens are held by various stakeholders who have an interest in a particular project or the organisation and subsequently vote on decisions.

Ecosystem

An ecosystem consists of all living matter and organisms in a space, their physical environment and the interactions among them.

Gene editing

Gene editing involves making highly precise changes to a DNA sequence using enzymes that have been engineered to target a specific sequence to remove and replace.

Gene therapy

Gene therapy involves modifying an individual's genes to cure or treat a disease. Therapies include replacing a disease-causing gene with a healthy copy, deactivating a disease-causing gene or introducing a new or modified gene to treat the disease. Gene therapies are in the research stage for cancer, genetic and infectious diseases.

Geoengineering

Geoengineering covers a set of technologies designed to manipulate the environment to mitigate or partially prevent climate change effects. Geoengineering approaches include solar radiation management, cloud seeding and carbon dioxide removal.

Gig economy

Economic activity that is based on flexible and temporary employment and contracts either as primary or supplementary income.

Hyperloop

A hyperloop is an ultra-high-speed transport technology using a sealed, low-pressure tunnel or system of tunnels. Electromagnetic levitation allows autonomous pods to be propelled through the hyperloop with almost no friction.

Interoperability

Interoperability is the capacity of different systems, devices, applications or products to process and exchange data without delay, disruption, errors or inconvenience to the end-user.

Just-In-Time

A concept found in many manufacturing, production and inventory management frameworks and approaches that refers to the way inputs are received when needed and not in advance, reducing both cost and time.

Machines

Machines are computers or robots with central processing units (CPUs) or connectivity to processing capacity. See also *Advanced machine intelligence*.

Net zero

The state in which the amount of greenhouse gases emitted to the atmosphere is equal to and balanced by the amount of greenhouse gases removed from the atmosphere.

Neurotransmitters

Neurotransmitters are chemical messengers that transmit signals between neurons across synapses. Neurotransmitters govern a range of functions and include serotonin and melatonin, which, respectively, play a role in mood and sleep.

Quantum computing

Quantum computing is based on the principles of quantum physics and exploits the ability of subatomic particles to exist in two states simultaneously (for example, 1 and 0), increasing exponentially how much data can be encoded (as qubits) and thus the potential computational power.

Securitisation

Securitisation involves pooling various assets into one group and then splitting or repackaging that group into tradable assets that can be sold to investors.

Superconductivity and ambient superconductors

Superconductivity is defined as the absence of resistance to a continuously flowing electric current. Several substances have this property at very low temperatures. Ambient superconductors are materials that have been engineered to have superconducting properties without needing to be cooled.

Synthetic biology

Synthetic biology is the redesign or re-engineering of organisms and molecules to give them new properties, for example synthetic enzymes capable of digesting plastic.

Whole brain emulation (WBE)

Whole brain emulation is the hypothetical process of scanning the whole brain to copy, one-for-one, every neuron (estimated to number some 86 billion) and connection so that all the brain's functions can be replicated on a computer, which can then operate as if it were the original brain.

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ABOUT THE DUBAI FUTURE FOUNDATION

Dubai Future Foundation aims to realize the vision of His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, for the future of Dubai and consolidate its global status as a leading city of the future. In partnership with its partners from government entities, international companies, startups, and entrepreneurs in the UAE and around the world, Dubai Future Foundation drives joint efforts to collectively imagine, design, and execute the future of Dubai.

Under the supervision and with the support of His Highness Sheikh Hamdan bin Mohammed bin Rashid Al Maktoum, Crown Prince of Dubai, Chairman of the Executive Council of Dubai, and Chairman of the Board of Trustees of Dubai Future Foundation, DFF works on a three-pronged strategy – to imagine, design, and execute the future. It does this through the development and launch of national and global programs and initiatives, preparing plans and strategies for the future, issuing foresight reports, and supporting innovative and qualitative projects. These contribute to positioning Dubai as a global capital for the development and adoption of the latest innovative solutions and practices to serve humanity.

Dubai Future Foundation focuses on identifying the most prominent challenges facing cities, communities and sectors in the future and transforming them into promising growth opportunities by collecting and analyzing data, studying global trends, keeping pace with and preparing for rapid changes. It is also looking at future sectors, their integration, and the reshaping of current industries.

Dubai Future Foundation oversees many pioneering projects and initiatives, such as the Museum of the Future, Area 2071, The Centre for the Fourth Industrial Revolution UAE, Dubai Future Accelerators, One Million Arab Coders, Dubai Future District, Dubai Future Solutions. Its many knowledge initiatives and future design centers contribute to building specialized local talents for future requirements and empowering them with the necessary skills to contribute to the sustainable development of Dubai.

For more information on the initiatives, projects, and programs of Dubai Future Foundation, please visit the website:

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