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Resource Scarcity

Addressing Scarcity in a Transforming World

19 April 2022

"This is a redaction of a 135-page BofA Global Research report published on February 23, 2022."

Key Takeaways

- We are living beyond our means and running out of natural, technological and human capital resources - 10 themes of scarcity:
- Water, Biodiversity, Rare Earths/Metals, Farming, Waste Disposal, Processors, Health/Wellness, Youth, Skills/Education, Time
- Scarcity is going to accelerate, but we have transformative thematic solutions and identified c$8tn of market cap in enablers across scarcity tech, circular economy, natural capital, infrastructure, materials and more

We are running out of... everything

A transforming world has transforming needs. The growth of the population and exponential adoption of technology mean we are entering an era of scarcity. Common wisdom usually associates scarcity with environmental challenges or a drain on natural resources. However, social and innovation megatrends widen the discussion to other areas like human capital or the "tech resources deficit".

- **Earth**: biodiversity loss, food scarcity, competition for land and water, and energy security are all moving closer to their tipping points.
- **People**: population and consumption growth and intensifying inequality and geopolitical tensions, and competition for strategic resources between major powers.
- **Innovation**: accelerating technologies exacerbating tech resource scarcity risk for the likes of critical minerals, human capital and processing power.

Scarcity is going to accelerate...

The mismatch between supply and demand could lead to unsustainable growth and a permanent rise in inequality as prices increase, making resources less affordable for those who are least well-off. We believe we are entering into a new structural phase of the transforming world, where demand continues to accelerate, and supply of many of our resources (natural, technological and human) cannot keep up. Absolute scarcity refers to the idea that all goods, including natural ones, are finite. Relative scarcity acknowledges natural limits, but argues that society can respond through price signals, with institutional and technological changes. For example, goods may be scarce and expensive until substitutes or new technologies render them more plentiful and cheap, also referred to as abundance.

...but we have transformative thematic solutions

However, where there is scarcity there is opportunity. We have mapped out a ~$8tn ecosystem with solutions across 'scarcity tech', the circular economy, metal recycling, ESG sustainability, natural capital, biodiversity & clean air, edtech, water infrastructure, healthtech, wellness, fertility benefits, semiconductors, capital equipment among others that can solve the structural problem. Sectors that could benefit include utilities, industrials, technology, entertainment & media, leisure, education, paper & packaging, metals & mining, chemicals and healthcare. For example, vertical farming has the potential to solve both water and food scarcity issues. Moonshot technology, such as deep sea, and even asteroid, mining can counter the metal scarcity risk. Natural capital like ocean aquaculture, forest carbon sequestration and clean air pollution can improve biodiversity. Those are just a few of the solutions that we provide to tackle the 10 areas of scarcity identified in this report.

$8tn in enablers to answer $191tn of scarce resources

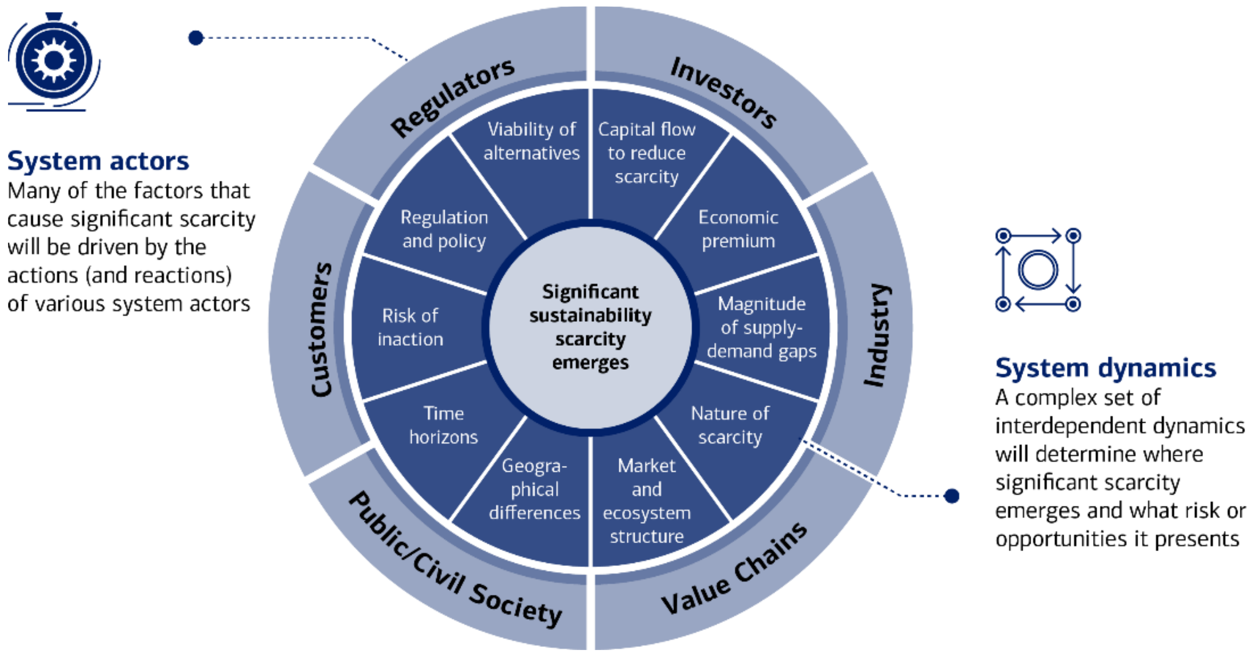
We highlight 10 themes in this note that explore global structural bottlenecks and/or resource scarcity. Via various sources we aggregated the market value of each of the 10 scarcity themes excluding time which summed up to an estimated $191tn. We also discuss how a combination of tech innovation and efficient sustainability measures such as the circular economy can mitigate some of the risks and create significant investment opportunities where we've identified $8tn in market cap of enablers.

What is scarcity?

Resource scarcity is essentially demand for a resource exceeding available supply. The mismatch between supply and demand can lead to unsustainable growth and a rise in inequality as prices rise, making the resource less affordable for those who are least well-off. We believe we are entering a new structural phase of the transforming world, where demand continues to accelerate, and supply of many of our resources (natural, technological and human) cannot keep up. Absolute scarcity refers to the idea that all goods, including natural ones, are finite. On the other hand, relative scarcity acknowledges natural limits, but argues that society can respond to various shortages through price signals, with institutional and technological changes. For example, goods may be scarce and expensive until substitutes or new technologies render them more plentiful and cheap.

Exhibit 1: Resource scarcity is driven by system actors and system dynamics

After identifying potential scarcities, companies can then assess the risk and materiality of each potential scarcity by analysing ten dynamic factors



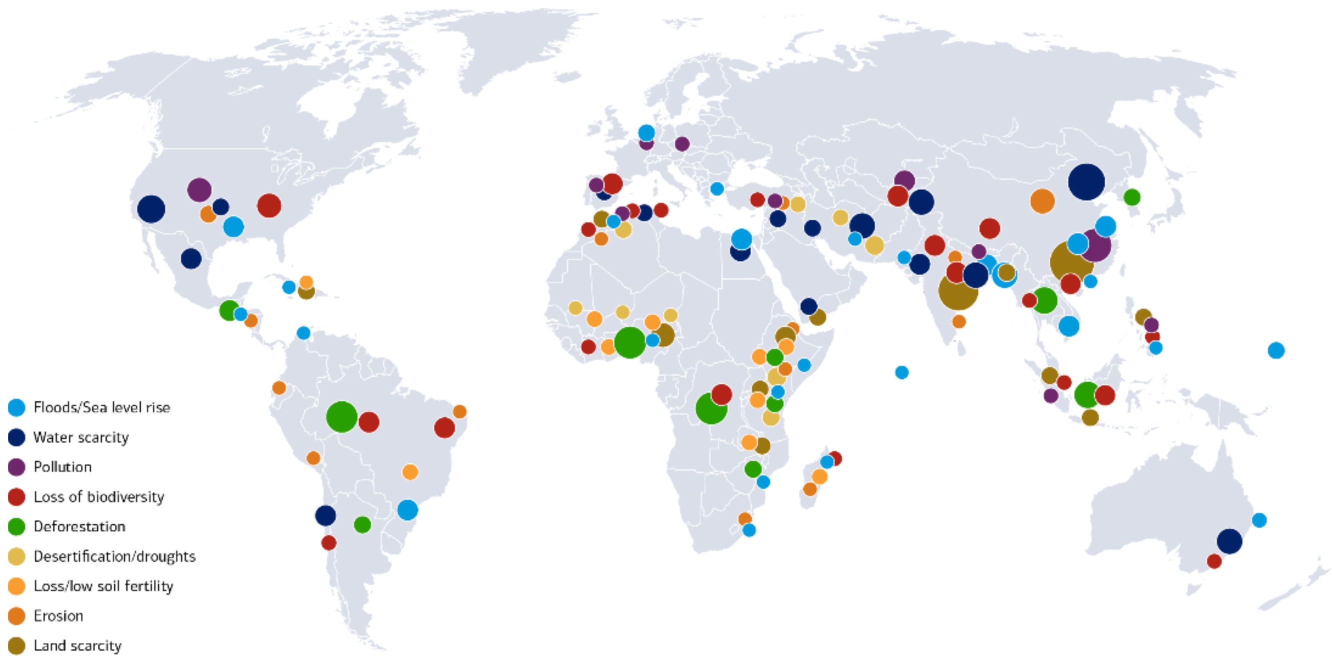
Source: BCG

Scarcity is now structural - we will not live within our means

The world is entering an age of scarcity, with climate change, food security, competition for land and water, and energy security all moving steadily closer to the center of the international agenda. In a world of increasing deglobalization, growing resource scarcity could undo the improvement in living standards for billions of people, brought about by globalization. Left unaddressed, scarcity of food, energy, water, land and other key resources has the potential to trigger geopolitical tensions, driving poverty, state fragility, economic instability, structural inflation, and strategic resource competition between major powers.

Exhibit 2: Schematic overview of global distribution of risks associated with main agricultural production systems

These systems at risk may simply not be able to contribute as expected in meeting human demands by 2050

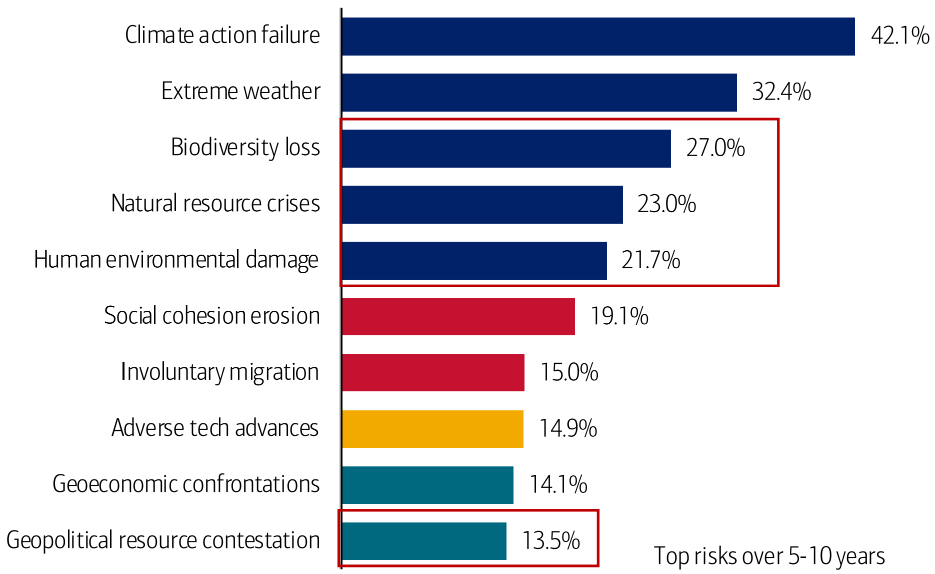


Source: UN FAO

These scarcity challenges share common drivers, including rising demand (a global population) and signs that the supply of key resources will struggle to keep pace. All are linked by complex and feedback loops, creating the risk of unexpected change, unintended consequences from policy, and multiplier effects that complicate attempts to manage risk. Scarcity issues could emerge as an important catalyst for collective international action to tackle global challenges, helping to ensure globalization that is efficient but more sustainable, equitable and resilient.

Exhibit 3: Top risks posing threat to the world in the next decade

Climate action failure will pose the biggest risk



Source: WEF

1. Water

Did You Know? Earth could run out of freshwater in 18 years – The World Counts

By 2025: up to 3.5 billion people could be living in water-scarce regions vs. 1 billion today – World Resources Institute

Market Size: By 2030, investment in water and sanitation infrastructure will need to be around US$900bn to US$1.5tn per year – OECD

UN says water scarcity is ‘the next pandemic’

We believe that water scarcity is one of the most pressing issues. Globally, 771mn or 1 in 10 people lack access to a basic drinking water service, and 1.7bn or 1 in 4 people have no access to basic sanitation/toilets. Per capita water supply has fallen 56% since 1962 with 57% of aquifers having passed their ‘tipping points’ (50% of the population and 43% of irrigation is supplied by groundwater). Supply is overextended with 36 countries having ‘extremely high’ levels of baseline water stress. Currently, 500mn people experience severe water scarcity all year round, but a staggering 3.6bn people spend at least 1 month of the year living in severe water stress (vs 5.7bn by 2050E). 1/2 of the world’s population will be living in water-stressed areas by 2025 and the world will face a global water deficit of 40% by 2030.

At the same time, demand seems set to grow 20-30% by 2050, driven by key megatrends including population growth, urbanisation and industrialisation, compounded by increases in food and energy demand. Consequently, industrial water demand seems set to grow 400% by 2050 (vs. 2000 levels). In particular, urban water demand is expected to increase 80% by 2050, resulting in water demand outstripping surface water availability for 27% of the 482 largest cities, risking growth and stability.

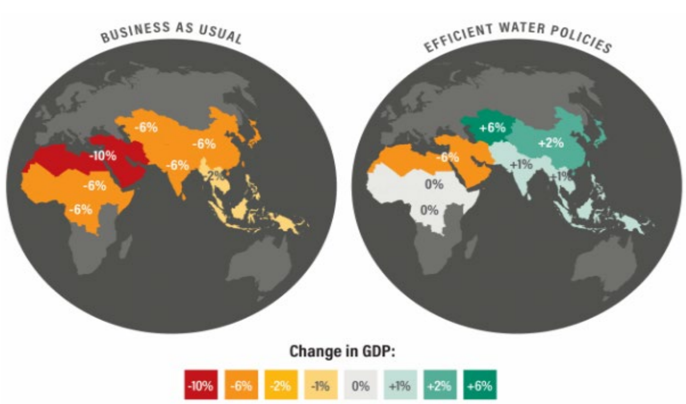
Human actions are creating further constraints as 80% of wastewater is released untreated, degrading the quality of available water supplies (40% of Beijing’s water sources is ‘unfit for human contact’). The financial implications of this will be huge – water insecurity already costs the global economy US$500bn pa (in 2017) and assets at risk from flooding may triple to US$45tn by 2050. The situation has been worsened by poor water governance – 2 trillion gallons of drinking water (15% of total water supplies) is lost to leaks in the US further reducing supplies.

However, solving water scarcity is within reach, we think. Some 2.6 billion people have already gained access to improved drinking water since 1990. And another US$735bn could provide universal access to basic water and adequate sanitation by 2030.

Cost of Water

Exhibit 4: Estimated change in 2050 GDP due to water scarcity

The World Bank found that failing to implement better water management policies could result in regional GDP losses from 2-10% by 2050



Source: Global Commission on Adaptation 2019, World Bank 2016

Non-Revenue Water: 32bn m^3 of water is lost annually

Non-revenue water (NRW) is the loss of produced water before it reaches the end consumer. It is estimated that globally 32bn m^3 of water is lost annually, with 45mn m^3 lost on a daily basis in developing countries, costing US$3bn a year. This is sufficient to provide water to over 90 million people (source: World Bank). Developed countries also have relatively high levels of inefficiency. US utilities lose 2 trillion gallons a year, equivalent to 15% of total drinking water. Much of this is due to ageing infrastructure and poor leak detection processes (source: WaterWorld). Other forms of NRW include unbilled and unauthorised consumption. Implementing better water management is fundamental to improving NRW rates.

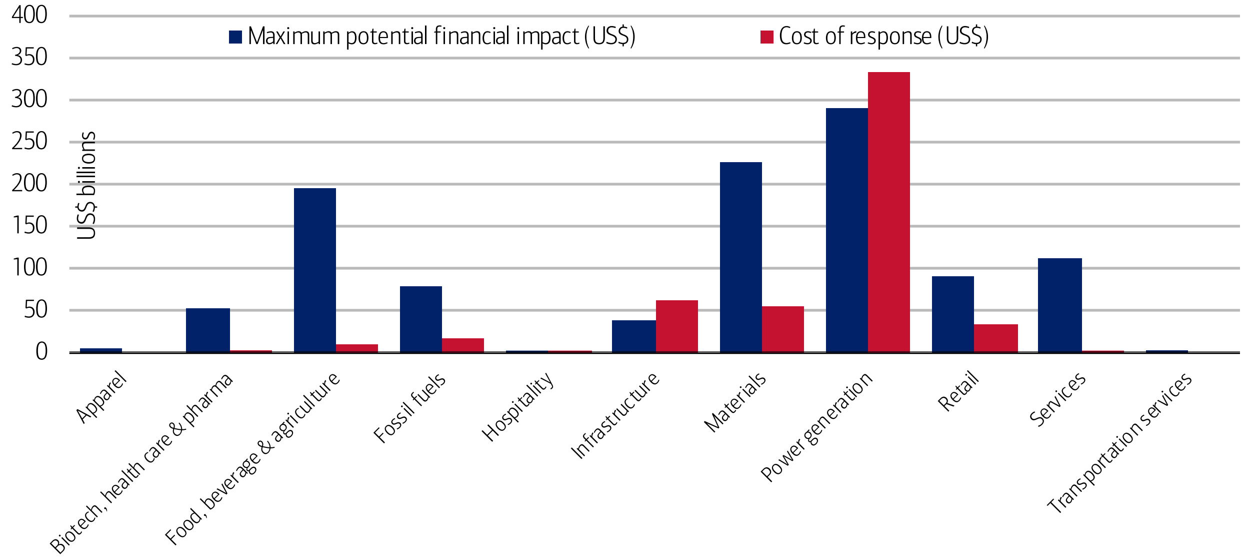
Water has different costs

To assess the true cost of water, we need to move beyond the water bill itself and employ traditional capex and opex calculations, with analysis of water risks and their financial implications.

It costs companies too

In 2020, companies reported maximum financial impacts of water risks at US$301bn– 5x higher than the cost of addressing them (US$55bn). Beyond risk management, there are also business opportunities when investing in water security estimated at US$711bn.

Exhibit 5: Cost of action is less than the cost of inaction in most sectors
Exceptions are Power generation and Infrastructure. This reflects large investments that energy companies are making to transition their energy portfolios



Source: CDP

Solutions

Circular economy provides a way out

As consumption increases and quality decreases, there is growing acknowledgment that water must be treated as a renewable resource as part of the circular economy. This is necessary to meet demand, particularly in water-scarce areas, and to prevent further degradation of the environment.

2. Biodiversity & Air

Did You Know? 1/2 of the world's rainforest have been destroyed in just one century – The World Counts

By 2030: We will only have 10% of the world's original forests left – The World Counts

Market Size: The notional economic value of nature is worth US$125tn – Costanza et al., 2014, WWF

Natural Capital

Natural capital is the stock of renewable and non-renewable natural resources. It is essential for our existence (the air we breathe and the water we drink are immediate examples). We use it directly as goods for consumption (fisheries) and indirectly as inputs in production (timber, fibres). It is also essential for our emotional wellbeing (green landscapes and sacred sites). Many forms of natural capital have multiple uses (forests, rivers, the oceans). We are embedded in nature; we are not external to it. In past decades, economists have developed methods for measuring the value individuals place on natural resources: natural capital. Biodiversity is a characteristic of natural capital, as diversity of aspirations, talents and drive are features of human capital (source: Dasgupta Review 2021).

Nature loss is accelerating

Ultimately all businesses depend on natural capital assets (such as water, forests) and ecosystem services (such as food, climate regulation) either directly or through their supply chains. The productivity and resilience of ecosystems along supply chains become weakened. The risk for businesses, but also for financial institutions that invest in, lend to, or insure those dependent on natural capital assets is also increasing. There is growing evidence that integrating sustainability and nature in investment decisions is becoming important according to UNEP and UN PRI.

What is driving nature loss?

Changes in land and sea use; direct exploitation of organisms; climate change; pollution; and invasion of alien species are the key drivers of nature loss (IPBES). These, in turn, are driven by human behaviour – the main driver of geological change on the planet.

Biodiversity loss is one of the top 5 global risks

In the past few years, the responsiveness towards climate change has improved with ambitious government policies and company measures to limit global warming to well below 2°C, with the ultimate goal to limit it to 1.5°C (as per the Paris Agreement). Efforts to mitigate climate change risk, and their adoption, are more mature than those related to nature risks. In 2020, the World Economic Forum GRR's comprehensive Global Risks Perception Survey identified biodiversity loss and ecosystem collapse as one of the top 5 risks in terms of likelihood and impact in the coming 10 years. For the first time, the top 5 global risks were all related to the environment.

US$125tn: nature's worth

In 1997, the global value of ecosystem services was estimated to average US$33tn per year. In 2011 the notional economic value of nature is now worth US$125tn. The economic value of natural land-based assets in the Americas stands at more than US$24tn per year alone. That is roughly equivalent to the region's annual GDP (source: Costanza et al., 2014, WWF)

Exhibit 6: Natural Capital is worth $125tn
This is more than the value of world GDP

Source: Intrinsic Exchange

3. Rare Earths & Metals

Metal Scarcity Risk: Increasing quantities of critical minerals for future technologies brings heightened supply risks, particularly due to the energy transition. Mineral intensity in power generation increased by 50% in 2010-2020 but is expected to grow 600% to 2050. Some metals will be impacted more than others: lithium demand could grow >40x to 2040 for example, and be in deficit as soon as 2024. Each nation deploying the same technologies and geographical concentration of mineral production heightens political risk. China controls 90% of rare earth processing for example, which could be used in a 'climate trade war'.

Solutions: Increased mining capacity, improving recycling, extraction efficiency, and lowering intensity of critical metals with substitution are all underway to mitigate metal scarcity in the long term, but they take time, cost, and R&D to implement. Short term supply & demand dislocations are likely as a result.

TAM: (Total Addressable Market). Market size for metals important for future technologies ('MIFTs') set to grow 50% to $1.3tn by 2030. Including steel, this is set to be $3.5tn in 2030 (vs annual crude oil production of $2.9tn as context).

Did you know: (the rare earth element) Europium is used in the Euro bank note as an anti-counterfeit measure. Meanwhile, just 1 smartphone contains a range of more than 50 minerals.

We are living in a material world!

The acceleration of technology and sustainability trends in particular is already increasing mined raw material demand. In many ways these minerals are fuelling innovation with the properties they can enable, such as conductivity, rigidity and stability at high temperatures as material science capabilities improve. So much so, that digitisation, clean energy, and even bank notes are increasingly dependent on them. With such innovation set to proliferate brings a potential scarcity risk, however. Total mineral demand for clean energy technologies alone increased by 50% in 2010-2020 for example, but a further 600% growth is projected to 2050 to decarbonise the global economy.

This brings physical capacity constraints to several metals important for future technologies (MIFTs) in the long term, and dislocation of supply and demand in the short term as is beginning to be felt, evident in price increases. This is further compounded by geopolitical risk, given the geographical concentration of these critical minerals, many of which dominated by China. A combination of recycling, substitution of materials, new local supply chains, and more efficient extraction in new locations (on land, sea, and even space!) are all potential investment opportunities to avert a metal scarcity crisis.

Innovation Fuels Metals Demand

Material science advances continue to play a critical role in digital innovations for the properties they can enable, such as strength, conductivity, fluorescence and brightness in individual or combinations of critical minerals. Like any basic economic problem, the challenge posed from rapid innovation comes with balancing these increased demands with finite supply of minerals, posing not only a risk to consumer tech demands, but even national security risks given their importance for several defence technologies.

Minerals critical for your mobile…and your money

Several consumer electronics products continue to exploit improving capabilities in batteries, touchscreens, compute power and screen resolutions, all with reduced weight and size. This is exemplified best in the evolution of the smartphone, often which utilise over 50 elements to create the finished product, such as lithium and cobalt for the batteries, indium tin oxide for the touchscreen, and rare earth elements to produce the required colours on it. It is not just technologies increasingly reliant on critical elements – even some bank notes utilise rare earth elements. The Euro uses europium for example as an anti-forgery measure given it glows under UV light, adding cost and complexity making them tough to counterfeit.

Electric Vehicles: powered by metals

Whilst the use of lithium, cobalt, and nickel are most commonly cited as the critical materials for EV batteries, several other essential materials are becoming more in focus as EV demand rises and chemistries shift. Anodes commonly use graphite for example, but are increasingly shifting to silicon to enhance energy density. Traction motors are also critical to powering electric cars, in particular requiring permanent magnets made with several rare earth elements such as Neodymium & Dysprosium, that combined give up to 10x stronger than conventional magnets that remain stable and don't demagnetise in case of a short circuit.

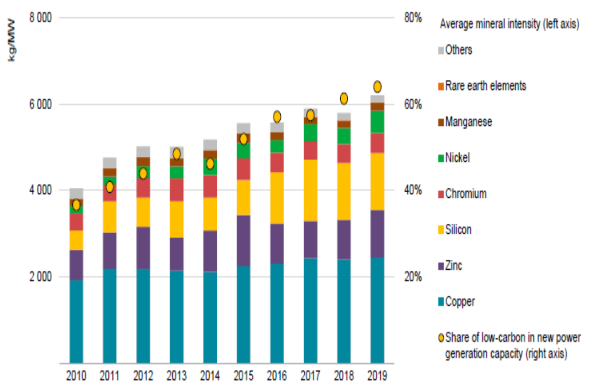
Renewable Energy. Exotic Materials.

Renewable energy technologies also rely on several exotic metals, increasing in volume and complexity as the scale of their deployment grows. Solar photovoltaic technologies are complex systems, with critical materials required in the solar cells, inverters and semiconductors in the power modules that enable them. Polysilicon and tin have already seen relative shortages owing to rising demand and supply chain challenges in 2021, highlighting the potential scarcity risk. Wind turbines use magnets with several rare earth elements for their generators in direct drive turbine systems. These are important for their strength to enable higher efficiency and lower malfunction rate relative to the earlier turbine technology using gearbox based systems with more moving parts.

Energy Transition = Metals Intensive

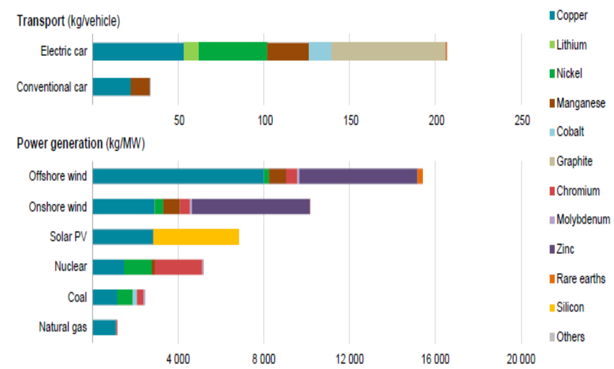
The transition from a fossil fuel dominated energy system to clean energy technologies thus requires an increasingly intensive use of metals. The average mineral intensity of new power generation increased by 50% between 2010 and 2019, owing to the increased share of low carbon power. This intensity varies depending on product and chemistry deployed. On average an electric car has 6x the mineral requirements per vehicle vs a combustion engine car. Wind power has between 9x (onshore) and 13x (offshore) the mineral content (in terms of kg/megawatt) than a gas power plant for example (source: IEA)

Exhibit 7: Mineral requirement for new power generation +50%
The mineral intensity of new power generation has increased as a result of rising low-carbon power sources



Source: IEA

Exhibit 8: Fossil Fuels to Clean Energy = mineral intensive
Clean energy technology requires higher upfront mineral input than fossil fuel alternatives; 6x more for an EV vs ICE, wind power 9x vs gas plants

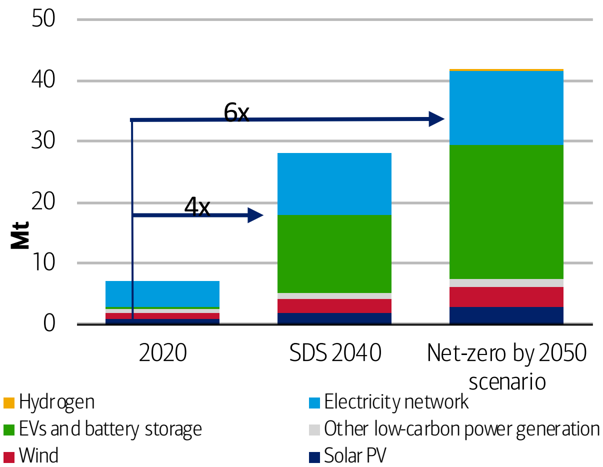


Source: IEA; EV = Electric Vehicle, ICE = Internal Combustion Engine vehicle

Net Zero – 6x mineral requirement to 2050?

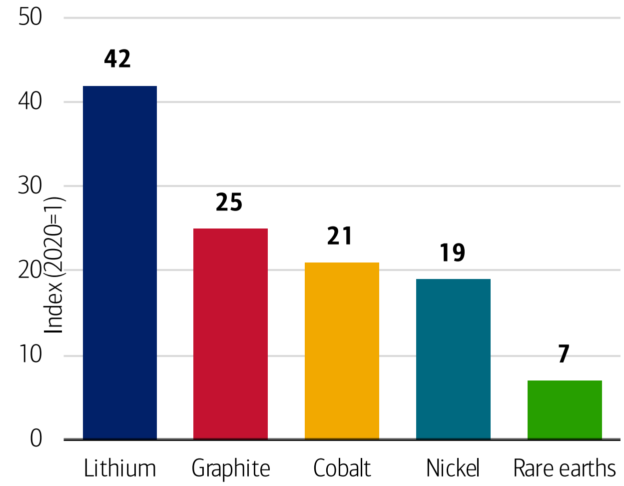
The accelerated transition of both energy and transportation from fossil fuel to clean energy sources simultaneously could increase mineral demand 6 fold to 2050 vs 2020 per the IEA's Net Zero scenario. The majority of this volume increase is attributable to electric vehicles and battery storage. The high mineral intensity required for batteries could lead to >40x the lithium required by 2040 per the IEA (vs 2020), and almost 60 fold in the EU by 2050 per the European Commission. Vast increases to other minerals such as nickel cobalt and rare earths relative to what is mined today are also expected.

Exhibit 9: Net Zero to increase mineral demand 6x
Accelerating clean energy technology demand to reach Net Zero emissions by 2050 would require 6x the mineral demand vs 2020



Source: IEA; EV = Electric Vehicle, SDS = sustainable development scenario to 2040; Mt = million tons

Exhibit 10: High growth for EV minerals: lithium >40x to 2040
Mineral demand growth for electric vehicle focused metals vs 2020 vary depending on quantity required per vehicle; lithium set to grow the most



Source: IEA, Growth of selected minerals in 2040 vs 2020 in "Sustainable Development Scenario

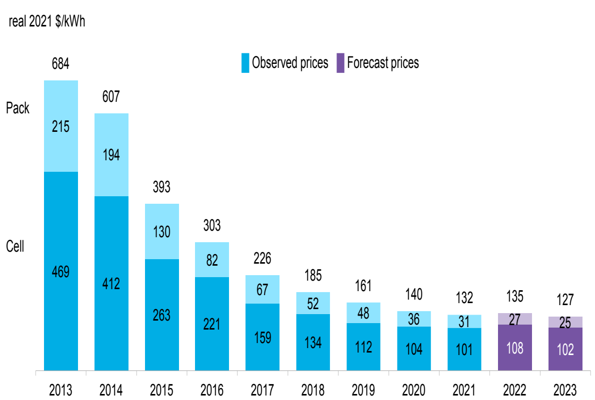
Electric Vehicles place highest strain on metal demand

Whilst all clean energy technologies are metals intensive, the accelerated transition underway to electric vehicles is expected to see an exponential rise in battery capacity (19x to 2035 vs 2020), and in turn metals demand (15x). To reach net zero emissions, battery demand could accelerate further to >14TWh by 2050 - an 88x increase on 2020 - per IEA, placing even further reliance on these metals.

Supply & Demand dislocation risk already impacting battery metal prices

Keeping both raw material mining and battery manufacturing capacity in lock step with demand is challenging owing to 1) the long lead times to bring new mining capacity online, often taking >10 years and facing civil opposition making it hard to match supply to price signals, and 2) technology/economic risks in battery capacity: the ability to deploy battery cell chemistry repeatable at increasing scale as innovation continues and prices decline). Meanwhile supply chain fragility, accelerating battery demand and future supply concerns have dramatically influenced battery material prices; lithium carbonate rising >700% year on year to January 2021 for example. With other rising costs in the supply chain, the falling battery prices observed in the last decade may temporarily flatten and even slightly increase in 2022 per BNEF, resuming price declines from 2023.

Exhibit 11: Lithium ion battery prices may rise in 2022
Rising commodity prices may delay the price deceleration in lithium ion batteries observed in the last decade, with a slight increase in 2022



Source: BloombergNEF;

$3.5tn strategic metal TAM by 2030. Up to 60% of supply used to achieve it

With increasing demand from more end markets, the market value of 8 major strategic commodities is set to grow >50% to reach $1.3tn by 2030. If including steel – critical for much of the clean energy infrastructure such as wind turbines – the addressable market is set to reach US$3.5tn by 2030. Annual crude oil production at Feb'22 spot prices was valued at $2.9tn, as context for comparison. However, this projected growing cumulative demand for these commodities to 2030 would already exceed more than half of the global known reserves for many of these metals, posing scarcity risk: Cobalt (47%) and Lithium (63%) in particular owing to the transition to electric vehicles.

Mitigating Metal scarcity with Technology & Recycling

The developments in rare earths and clean energy metals highlight some common trends: a combination of market forces (demand > supply) and geopolitical rhetoric around resource, industrial and national security influencing raw material exploration and extraction. There are potential solutions. To mitigate risk of metal scarcity could require a broad range of measures centred around deploying new technologies & circular economy principles. There are already several of such initiatives under development albeit at various stages of commercialisation thus far, all influenced by future market expectations for volume requirements and price of these metals, creating potential investment opportunity.

- **More efficient extraction**: utilising new technologies to increase extraction quality and speed and/or reduce environmental impact, such as direct lithium extraction, or hydrometallurgy leaching of copper
- **Greenfield development**: commercialising new material resources within "known reserves" and beyond – such as deep sea and even space mining. Increasing scale of mined materials required and improving exploration/extraction technology could require more radical location consideration to avert scarcity risk
- **Recycling & local supply chains**: can reduce the cost and carbon footprint of products and already becoming important in the planning and regulation of the energy transition
- **Substitution**: changing chemistry to reflect and use more abundant or less price sensitive materials, or reduce the quantity required per unit, as observed with the gradual reductions of cobalt used in batteries in recent years for example. Doing the same with lithium (to sodium or iron) and other such changes are all possible with sufficient market signals and R&D.

Mining CAPEX needs to double going forward

Whilst demand signals and scarcity risk are becoming clear, ramping up mining capital expenditure to meet this elevated demand is not yet visible: our commodities team suggest Capex may need to almost double going forward for the world to hit Net Zero by 2050. Increasing from the average $99.5bn in the past decade, to spend an additional $72bn annually to 2030 just to prevent bottlenecks in order to achieve net zero.

Shortened supply chains: reduced emissions and industrial threat

The relative footprint of EVs can be improved further with local manufacturing and battery recycling, reducing carbon footprint by 40-90% (per Redwood Materials and Infinity Lithium respectively). How? A combination of 1) new mining facilities and techniques in locations closer to current battery/vehicle production and usage, 2) increased battery content able to be recycled (with new technologies, and improving economic viability justifying it), and 3) regulation enforcing it (e.g. carbon border taxes, mandatory recycling quotas being implemented in the EU).

Recycling: Critical to reduce costs, scarcity, emissions. Recovery rates need to improve

Scaling up of new local supply chains alongside increasing recycling recovery and efficiency rates will be crucial to mitigate supply constraints and reduce the cost and relative carbon footprint of batteries. Whilst recovery rates of most base metals used in batteries exceed 30%, lithium and rare earths are much lower, <1% per the IEA. A combination of sufficient scale of the end products, with supportive regulation, product design, and improving recycling technology is set to enable higher recycling rates. Regulation is beginning to impact this. The EU's battery directive and subsequent Fit for 55 proposals include 1) minimum material recovery targets (90% for cobalt, copper, 35% for lithium in 2025 rising to 70% by 2030) and 2) mandatory minimum levels of recycled content used in batteries: 4% of lithium and nickel in 2030 rising to 10% (lithium) 12% (nickel) in 2035 respectively. The US are considering similar initiatives (per Reuters, July 2021). The significant carbon footprint saving of recycled metals relative to primary extraction could also become an increasing driver of their use, particularly in markets where carbon prices are levied to finished goods.

Battery recycling Tech: Increasing efficiency & flexibility of recycling process

Current battery recycling recovery rates of materials could be increased with new processes. Recycling operations for lithium-ion batteries are estimated to recover only about 40 to 50 percent of the materials, with most recycling technologies primarily geared to recover only nickel and cobalt, the most expensive minerals. Not only is this inefficient, technologies in place to obtain them are at risk from changing battery chemistries that use less of those metals over time, such as lithium ion phosphate (LFP) for example, growing share of the battery market which uses none of either.

4. Farming Agriculture

Did You Know? The planet will need to produce more food in the next 40 years than all farmers have harvested in the past 8,000 years – Jason Clay, WWF

By 2030: We could reach 'peak phosphorus' which is as essential to food systems as water irrigation because it is a key input for inorganic agricultural fertilizers

Market Size: The value of the global food system is roughly $8tn (World Bank).The gross value of global primary agricultural production is estimated to be worth just over $5tn (UN FAO). Primary agricultural value-added is worth about $3.2tn (World Bank)

Peak Food: bleak future vs. new technology paradigms?

Based on current supply and demand factors for agricultural commodities, some experts believe that we are at peak food for many food/commodities and are predicting long-term annual production shortfalls (source: Seppelt et al, Ecology & Society 2014). Peak food is where agricultural production plateaus and does not grow any further and may even go into permanent decline. If this is the case, it must be counter-balanced by the advances made possible in moonshot technology solutions.

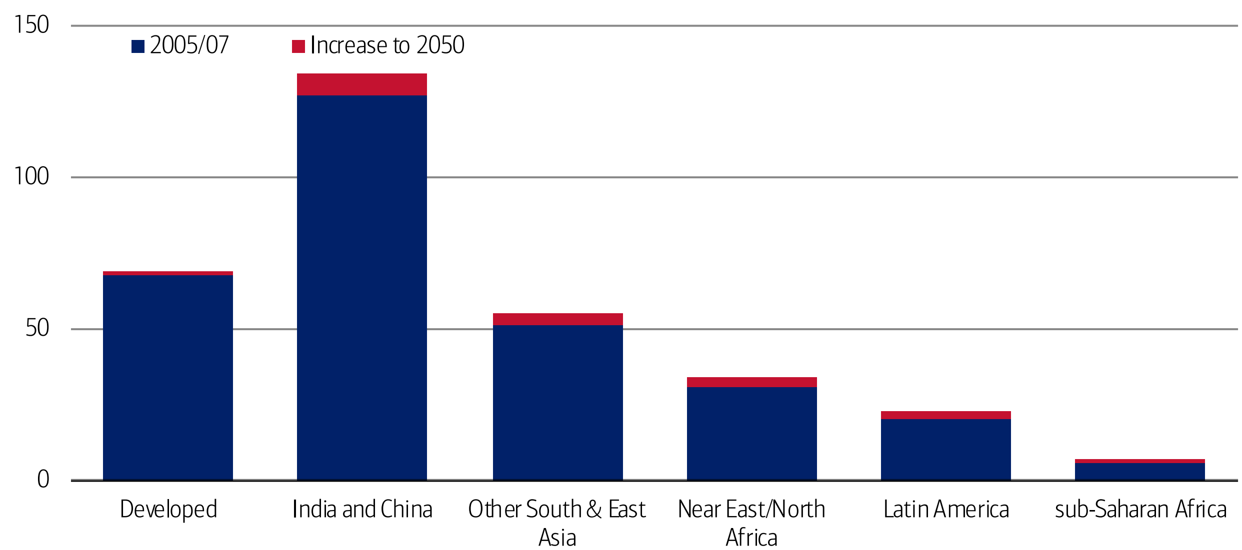
Furthermore, we are also running out of arable land globally. New arable land is not easy to develop given the cultivation of new land is more capital-intensive than chemical use and is considered less environmentally-friendly. The conversion of natural landscapes into farmland can reduce biodiversity and increase greenhouse gas emissions.

Potential for expansion of irrigated land is limited due to water stress

Irrigation has been an important contributor to yield growth that has underpinned much of the production increases over the past decades. Yields of irrigated crops are about 2.7x those of rain-fed farming. Irrigation will continue to play an important role in food production – with a shift from rain-fed to irrigated production systems per se implying an increase in average yields. However, the potential for further expansion of irrigation is limited by growing water stress, increasingly inadequate sources of renewable water, and climate change.

Exhibit 12: Irrigated area to 2050E

Irrigation will continue to play an important role in food production – with a shift from rain-fed to irrigated production systems per se implying an increase in average yields



Source: UN, FAO, BofA Global Research

5. Waste Disposal

Did You Know? 1 garbage truck of plastic is dumped into our oceans every single minute today…by 2030 it will be 2 trucks and by 2050 it will be 4 trucks – The World Counts

By 2025: landfills could account for 8-10% of human activity-based GHG emissions without action – ISWA

Market Size: solid waste management is now a US$1tn market – Global Marketing Insights

Landfills, which dispose of waste by burial, remain the most popular form of waste disposal across the globe. Their popularity is driven by ease, cost and inadequate alternative infrastructure to deal with increasing quantities of waste. We see landfills remaining dominant in most regions, with the exception of Europe and countries with limited space such as Japan and Singapore, which lead the way in reducing landfill use driven by stakeholder preferences and public policy.

As the global community focuses on ESG, the "circular economy" and life cycle assessments have become a focus. These make the case for recycling through efficient raw material selection and usage; effective product design and closed loop supply chains. Yet, beyond just the focus on the environment, and with metals demand growing sharply, recycling can also help ease resource constraints.

Recycling really starts with collection, but product design, which happens much earlier, already determines the viability of metallurgical processing and the quality of the recycling output. Indeed, the success of recycling in each stage depends on the preceding ones, so identifying the weakest links in the chain is crucial for policy makers and businesses. Inefficient collection infrastructure and hibernation are uncertainties, along re-purposing and heterogeneous products; as to the latter, extended producer responsibility could help. Product design also impacts material liberation, so Design for Recycling could come in useful here. Finally, there are concerns over inefficiencies and a lack of profitability at recycling operations, alongside safety issues.

The US non-hazardous solid waste industry generates approximately $60-65bn of revenue. The industry (collection + disposal) appears rather fragmented with 45% from publicly owned companies, 35% privately owned, and 20% is municipalities. Based on conversation with industry sources, the consolidation is much higher on the disposal/landfill side with some speculating 50-60% of landfill assets (capacity) in the hands of the public players. Regulations regarding handling, treating, transporting, storing and disposing of waste have added a layer of costs. The big three invest heavily in permitting and expansion of landfill capacity, providing +30-40 years of life. One trend that can develop is municipalities and local government organizations, privatizing disposal assets due to environmental complexities and capital requirements.

6. Processing Power

The pandemic has exacerbated the demand for semiconductors

The pandemic brought about new ways of working, studying, and communicating through videoconferencing and other technologies. Demand for chips rose significantly as consumers increased their use of PCs (sales volume up by 18% in 2021), 5G smartphones (30-40% higher content, volumes up 3x by 2022E), gaming systems and other electronic equipment. Demand for computer chips was as much as 17% higher in 2021 than 2019 (source: US Department of Commerce). In parallel, demand for semiconductors in medical equipment including ventilators and defibrillators has been heightened due to the increased number of people falling sick. This demand surge and supply chain disruptions were the main reasons behind the semiconductors shortage and these trends are becoming structural.

IoT and data explosion are strong tailwinds for semiconductor companies

Demand for semiconductors was accelerated by a secular growth in connectivity. The number of connected devices is expected to reach 350 billion by 2025 and 1 trillion by 2035. By 2025, we could be interacting with connected devices as often as once every 18 seconds (4,785 times a day) vs every 2.4 minutes today (source: IDC 2017, IoT Analytics 2018). The exponential growth of the Internet of Things (IoT) has been followed by an unprecedented rise in data. We are creating 2.5 quintillion bytes of data, every day, and this is doubling every 2-3 years. With so many devices online that need to communicate with each other, chips are needed to transmit/receive data. 5G and its successor 6G bring new requirements, such as a rise in network capacity and required speeds, thus driving up chip demand. Microchips are the enablers of this increased performance, with each cellular generation amplifying semiconductor content within the RF FEM (radio frequency front end modules).

Cloud: 30-40% annual growth needs to be supported by higher semis capex

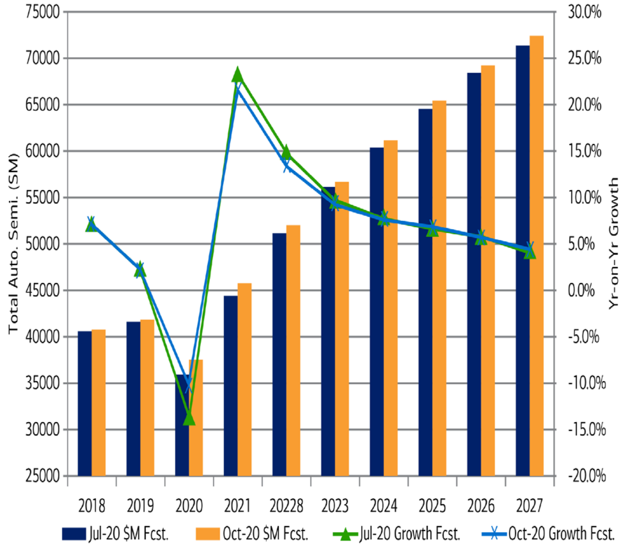
The exponential growth in data and its increasing complexity have created significant need for chips that can compute, network and store data quickly and efficiently. With the rise of digital transformation and collaboration platforms, comes a large demand for cloud computing services and therefore semiconductors used in servers. Cloud computing global spending reached new highs at $50bn in 21Q3 and industry revenues are set to grow to $791bn by 2028. In 2022, our tech team sees strong data center demand across both hyperscalers (as customers scale their deep learning and AI workloads) and enterprise customers. As cloud sales are expected to rise by 30-40%, top hyperscalers need to invest at a similar pace in semis and data center capacity to support that growth. Product cycles across the key building blocks (CPUs, GPUs, switches, memory) should drive particular strength for semiconductor components

Connected car trends are accelerating the rising chip content, 3x more in EVs

Today's cars are growing ever-more digitalized and compute-intensive, which has precipitated a boom for automotive semiconductors (a $34bn global industry). Automobiles are increasingly more connected, becoming "software defined cars", incorporating predictive safety functionality (automated emergency breaking, adaptive cruise control), electrified drivetrains and more artificial intelligence into the car (ADAS, Active Park Assist). EVs have the potential to carry 110% higher semiconductor content; HEV/EV contain respectively about $900/$1,000 worth of semis per vehicle. Hence, semiconductor content growth has been a clear secular trend over the years and we expect it to accelerate as consumer appetite continues to expand for more in-vehicle electronics, infotainment systems that deliver greater connectivity, enhanced security for safer vehicles and for electric vehicles. Over the next 4 years, Gartner projects ADAS, electric/hybrid electric vehicles (EV/HEV requiring 3x avg. semi content), and instrument clusters (move to digitization) will be the fastest growth areas for semis.

Exhibit 13: Autos semis demand expected to rise from 2021 driven by ADAS and electrification

Major auto semis vendors (40% of mkt) will grow auto sales +15% in FY22E



Source: Semiconductors.org

The world has entered a real and structural de-globalization phase

The past three decades have witnessed a dramatic expansion in international trade and the globalization of supply chains. We believe that the world has entered an unprecedented phase during which supply chains are brought home, moved closer to consumers, or redirected to strategic allies. This would have profound implications for the capex cycle and manufacturing, and creates myriad opportunities for the geographies to which supply chains are being redirected. The biggest de-globalization shifts are being undertaken by tech hardware and semiconductors among other sectors due to the mounting tensions/restrictions between the US and China. Some foreign governments including China are encouraging re-shoring in semiconductors as they are critical to national security.

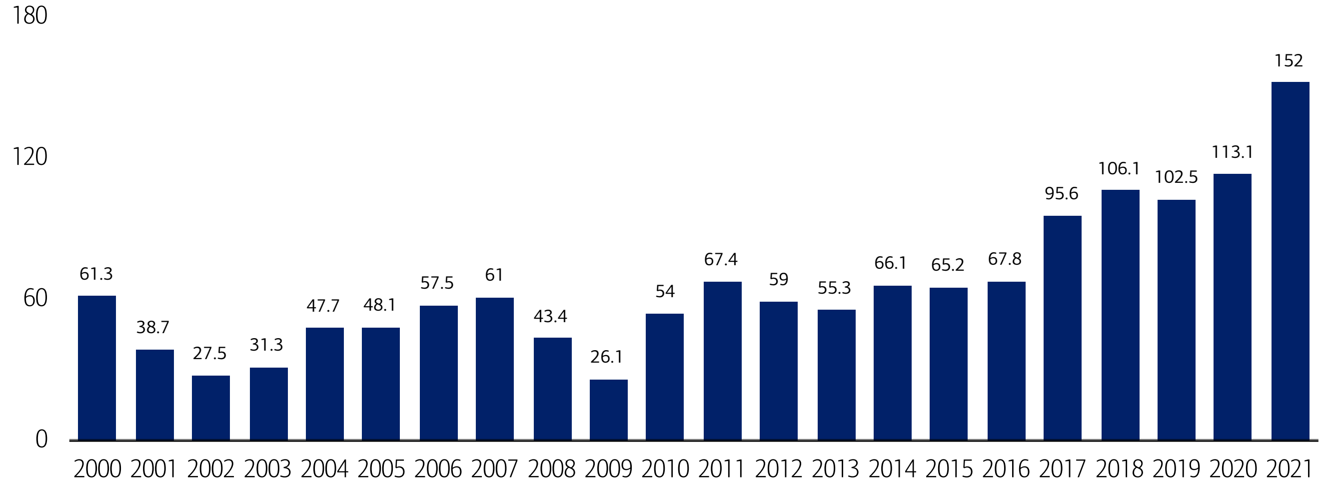
Semiconductor industry supply issues could stretch into structural shortage

Covid19 exposed the bottlenecks of semiconductor supply chains. Lead times for chips can be as long as 26 weeks and up to 1 year for specific variants. The shortage will likely incur losses of $500bn globally from 2020 to 2022 (source: Deloitte). Semis industry players have had to adjust their output in response to increasing demand. In 2021, nearly 1.15 trillion chips were sold, an all-time high. That is about 146 chips for every person on the planet. Is this sustainable in the longer term? Semiconductor sales are expected to rise further due to secular growth in 5G, Electrification/Renewables, Automation, AI/Cloud, EV/driver assist systems, IoT, gaming and datacentre. Although part of this demand shock is temporary, there is a structural dimension to the rapidly expanding semiconductor usage.

Deploying capex cannot address all the semiconductors demand bottlenecks

While chipmakers spend billions to tackle the semiconductor shortage, there are risks related to deploying capex in a downturn. New chip factories are complex to build and require about two years from construction to production in high volume. Thus, semiconductor players have to forecast market conditions 2 to 3 years in advance. Total capex for the industry jumped by 34% in 2021 vs 6% only from 2017 to 2020 and is expected to see another 27% rise in 2022 (source: IC Insights). One reason for this is the rising costs of chip factories and high-precision equipment needed to manufacture chips. A machine used to manufacture a generation of chips could become obsolete in under five years yet demand for legacy equipment is rising. The value of used equipment has more than doubled over the past year alone with chipmakers increasing spending by 54% from 2019 to 2020. However, the type of capacity being added doesn't address all the demand bottlenecks. "Old generation chips" shortages, like 200mm equipment, can't resolved by capex on leading edge equipment, for instance, as most OEMs (original equipment manufacturer) no longer produce these.

Exhibit 14: Capital spending soars to $152bn
(in billion US dollars)



Source: Gartner, IC Insights

Silicon, the second most abundant element on Earth has become scarce

Silicon is becoming scarce despite it being the second most abundant element on earth. Its ubiquitous use in semiconductor wafers is making it more and more desirable. China, the largest global Silicon producer, has cut its production in 2021 in an effort to meet strict energy quotas. This has sent prices up by 300% in less than two months through December 2021. Demand for silicon is growing from sectors such as solar power and electronic equipment. Industrial silicon prices might remain elevated with knock-on effects on the semiconductor industry: chips are set to remain in short supply as they mainly depend on silicon.

US is losing ground in semis manufacturing and wants to regain independence

US semiconductor manufacturing capacity remains limited although it dominates global sales. While the US rules in R&D, semi IP and design, only 12% of global manufacturing is based in the country (vs 37% in 1990), with >80% in. The US is losing ground due to rising manufacturing and technology costs and mounting overseas competition. An opportunity for the US to regain chip independence might come from some manufacturers adding capacity: Still, enhancing US manufacturing capacity will take years given the complexity (only 3 leading-edge chipmakers left), expense ($10-$15bn for a new fab) and time (2+ years). However, federal incentives of $50bn would create as many as 19 fabs and 70,000 high-paying jobs in the US over the next 10 years.

Semiconductor manufacturing suffers from a skilled workers shortage

Geopolitical competition in semiconductor manufacturing is likely to exacerbate the talent shortage in the industry. Talent is in short supply in the semiconductor industry globally. Given the skills chipmakers require are highly technical and specialized, the talent pool is limited both in Asia and the West. Asian countries produce nearly 60% of global semiconductors. Among the key producers, Korea and Taiwan have unrivalled and grounded positions in high-end chip manufacturing capacity. But given the goal of expanding and reclaiming chip manufacturing self-sufficiency, China and the US require talent in bigger numbers, while both Korea and Taiwan confront tight supply already. China will need to close a talent gap of roughly 300,000 engineers to meet its policy goals (source: The Chinese Semiconductor Industry Association). As closing the talent gap takes years of education and development, many companies look to "import" talent for recruitment.

Semiconductor supply chains need a revamp; there is no size-fits-all solution

No single solution can solve the semiconductor shortage. Building overall capacity appears to be a common solution but won't be enough to cover any future shortage. Chip manufacturers are also attempting to build more local capacity in the US, Europe and China. The aim is to reduce local concentrations and over-dependency and alleviate supply shortages. Chip makers have shifted their manufacturing strategy from "just-in-time" to "just-in-case" but stockpiling is not the answer either. Just-in-case can only be efficient if suppliers can predict demand for chips and optimise production. One way to achieve this is the use of the Internet of Things (IoT) to enable real time data exchanges in semi plants with smart connected equipment, for instance. Breaking the bullwhip can alleviate future chip shortages, and increase productivity and efficiency by offering greater visibility into demand patterns.

7. Health & Wellness

$8trn industry, 40% wastage and megatrend burdens

Medical resources are finite and a structural scarcity seems inevitable as diverse health needs continue to outpace the limited supply. There is a growing shift in demography and the global population is getting old, suggesting higher need for healthcare services to treat age-related diseases. The providers of funds – government and private – see rising cost, with global spending on health reaching $8.5tn in 2019, a doubling in real terms over the past two decades and expected to grow faster than GDP. Up to 40% of current total spending goes to waste and Covid19 created an emergency that rechannelled limited funds. Technology adoption is expected to solve the imbalances and create more access but the investment required to upscale has not been achieved.

Scarcity of finance for the increasing healthcare cost

Healthcare spending is expected to continue to exceed GDP growth in wealthy countries and in an increasing number of emerging economies. US healthcare spending is estimated to be >24% of GDP by 2040, with healthcare and long-term care in the EU and Norway reaching 13% of GDP by 2060. In the face of this reality, the payers for healthcare – private and public likewise – are struggling to find funds to keep up with the high annual growth of healthcare costs while pass-through pressure is placed on healthcare providers to deliver high-quality care affordably. EIU expects global healthcare spending to rise 4% y/y in 2022 vs 9% in 2021 when governments spent heavily on vaccines. However, from 2022, EIU expects growth in healthcare spending to slow as governments seek to reduce budget deficits and pay down foreign debt.

Growing lack of skills

Current human capital shortages in the healthcare system put a strain on the existing workforce. Covid19 has exacerbated this bottleneck since 2020. The Global Health Workforce Alliance and WHO estimated a gap of 7.2 million professional health workers in 2021, set to rise to 12.9 million by 2035. The global supply shortage has long been driven by underinvestment in education, which led to permanent shortages as defined by market-based-demand, as well as the increasing retirement age of existing health care workers, which would lead to obsolete skills – in the US, 1/3 of nurses are over 50 and 16% of active physicians are >65 years, with an additional 26% between 56 and 65 years.

Globally, the number of doctors per 1,000 has stayed roughly the same since 2013 and the distribution is very uneven. While the US had 2.61 practicing physicians per 1,000 people in 2017, India had only 0.86. Japan, which has the oldest population in the world, suffers from a chronic shortage of medical personnel and has only 2.41 per 1,000.

Tech adoption is still lagging behind in healthcare

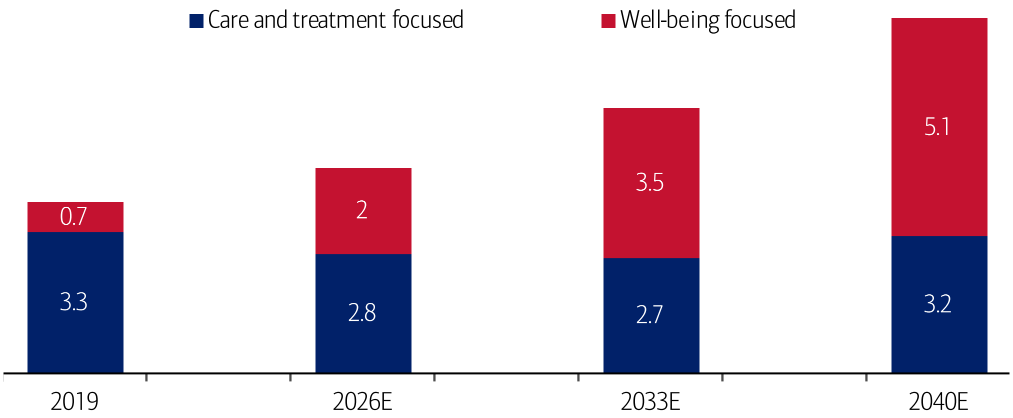
There has been slow adoption of the technology that can disrupt and accelerate the healthcare industry. In Europe, 11% of GDP is spent on healthcare. Of this figure, c.7.6% is attributed to medical technologies, less than 1% of GDP. This compares to spending on medical technology across European countries, ranging from around 5-12% of total healthcare expenditure. Upscaling investment is a double-edged sword. While technology will improve health status and the quality of care, new technologies will contribute to rising healthcare costs, medical technology will account for 10-40% of the increase in healthcare expenditure, and yet access to finance remains limited.

Adoption has also been slow due to a lack of customer trust. A survey by Invoca found that only 20% of patients would trust AI-generated advice for healthcare. Risk remains high as a software fail in a hospital leads to much a worse outcome than the lack of it and medical devices that make up the internet of medical things (IoMT) increase the risk of cyberattacks.

Health is the new Wealth

Our quality of life has improved and people live longer than previously. The global life expectancy was 72 years in 2015, more than 2x vs 31 years in 1900, and is expected to reach 83 years by 2100. With longer lives and a growing population, the major concern is living a healthy live. Poor health results in a loss of nearly 8 years of our healthy lifespan vs. total life expectancy, which costs the US $4tn alone. New technologies on the horizon could bring a quantum leap in the quality of human lives. Innovations in genomics, big data & AI and ammortality could mean living healthily past 100 years but we are not there yet. There are also challenges with the growth of app-based meditation, mindfulness, and therapy. Therapy apps can only do so much when the supply of professional resources for mental health is limited across the globe, and there are no live, human therapists available to answer urgent calls. At present, patients pay more for treatment than prevention. In 2019, about 80% of health spending went toward care and treatment. By 2040, 60% of spending will go toward improving health and well-being.

Exhibit 15: Healthcare spending by categories
More health spending will shift to well-being by 2040



Source: Deloitte

Wellness expenditure ($4.2tn) is not much more than half of total global health expenditure ($7.3tn). The wellness industry represents 5.3% of global economic output. However, as the wellness economy grows, most of the latest products, services, technologies, and innovations are catering to the wealthiest consumers. For the wealthy, there is now a plethora of options – superfoods, boutique studios, wellness resorts, alternative healing modalities, DNA testing, sleep aids, microprocedures, injectable/edible substances, gadgets, and more – to aid in their quest to feel good and be "forever young," or better yet, immortal. Meanwhile, income inequality is rising across the world; poor people are growing sicker and more depressed, and are dying younger than those who are better off. Clearly, the wellness market will not be 'healthy and sustainable' if this polarization continues or worsens and hence 'inclusive wellness' must be a core focus looking forward (source: Global Wellness Institute).

8. Skills & Education

The ongoing talent shortage doubled to hit a 15-year low

The pandemic accelerated the skilled labour scarcity with 69% of global companies reporting talent shortages in 2021, up from 35% in 2013 and reaching a 15-year low point (source: Manpower). Skilled labour is more difficult to find than ever before, impacting 'knowledge-intensive industries' such as financial services, technology, media and telecommunications, and manufacturing. The mismatch between low supply of skilled professionals and higher demand exacerbated the ongoing talent shortage, which could turn to a structural scarcity of skills in the long run.

Global talent shortage to cost us more than the GDP of Germany and Japan

The global talent shortage could double to 85.2 million people by 2030, from 40 million in 2020 (source: US Labor statistics). This talent shortage could also result in the loss of $8.452tn in unrealized annual profits by 2030, equivalent to the combined GDP of Germany and Japan. The US alone could miss out on $1.748tn in revenue due to labour shortages, or roughly 6% of its entire economy (Source: Korn Ferry).

Manufacturing is headed towards a talent shortage of 8 million workers by 2030

77% of manufacturers say ongoing difficulties in attracting skilled workers are expected to continue (source: Deloitte). The skilled labour crunch in manufacturing will cost the global economy $607.14bn and a deficit of 7.9 million workers by 2030. China is expected to have an abundance of manufacturing talent, a sector accounting for 35% of its economy. But this abundance is peaking and by 2030, it will face a skilled labour deficit. The US, being the world's most important manufacturing economy, will suffer from a skilled manufacturing talent shortfall of 2.5 million workers in the next decade. Japan is also projected to fail to realize $194.61bn by 2030, 3% of its economy, worsened by low birth rates, an ageing population and tight immigration restrictions. German will see the next biggest impact after Japan in its unrealized output due to manufacturing labour shortages. Although Germany is a leading manufacturing hub today, by 2030, unrealized revenue due to sector labour shortages could reach $77.93bn. Although automation is being implemented in manufacturing, the global sector lacks the necessary skills to execute automation projects.

Investment opportunities in equipment, automation and software

Employers can invest in labour-saving technology to boost workers' productivity. Business investment in equipment and software has already been notably strong in countries facing labour shortages. Those investments may already be paying off. Labour productivity in US manufacturing posted its strongest year-ago rate in more than a decade. In the UK, productivity growth in manufacturing, wholesale, retail, and auto repair, went up. Solutions may also include automation, nearshoring/reshoring production or reorganizing supply chains impacted by significant labour shortages.

Closing the global skills gap could add $11.5tn to global GDP by 2028

Reducing skills imbalances in the labour market could add $11.5tn to global GDP by 2028 (source: WEF). Closing the skills gap will lower hiring costs, increase productivity and enhance the ability of firms to innovate and implement new technologies. Yet, the labour shortage is no longer a short-term bubble; it is becoming a structural labour market impediment with enduring implications for economies.

The knowledge economy needs millions more educated citizens

Over 1.5bn adults will have no education beyond primary school in 2030E. We need millions more educated citizens of at least 1 year of post-secondary education to adapt to the knowledge economy. However, access to education is still unequal. There remain 263mn children out of school, 758mn illiterate adults, and a 100Y education gap between Developed Markets and Emerging Markets. At the current pace, universal primary education will be achieved only by 2042E and secondary by 2084E. Failure to act on EFA could cost $1.8tn in global GDP by 2050E, the brunt of which will be borne by low-income "countries".

9. Youth

Youth "timebomb": the world's population is reaching 'peak youth' in 2057

A consequence of the demographical changes is a scarcity in youth. The number of children is projected to peak at 2.09 billion in 2057 and fall below 2 billion by the end of the century (source: UN). Globally, the fertility rate is expected to decrease from an average of 2.5 births per woman in 2019 to 2.2 in 2050 and to 1.9 in 2100. That is below the replacement rate at which new births are sufficient to maintain a steady population. Falling fertility rates imply that the global population could be shrinking by the end of the century, to its slowest pace since 1950. Taiwan's fertility rate is already below 2, the last child in Japan could be born in 3011 and the last citizen in South Korea would die around 2750 (source: National Assembly Research Service).

Lower birth rates are a response to economic incentives

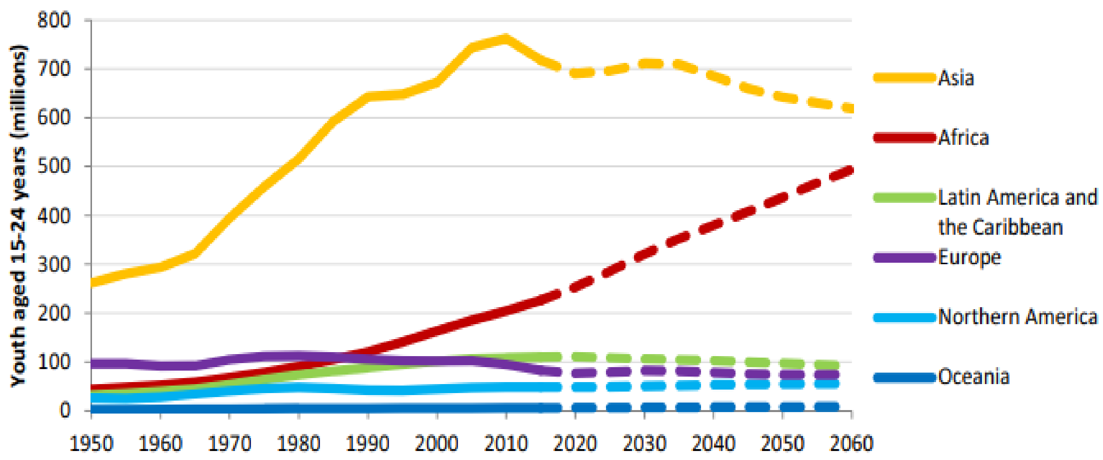
On the one hand, the baby bust can be explained by increased access to education and contraception for women, delayed marriage, and higher female participation in the labour force. On the other hand, higher living costs, burden of care and college tuition fees are disincentives for couples to have more children.

Geographical scarcity ...as youth size peaks in all regions but Africa

While the size of the youth population peaks in all regions, Africa will continue to grow, resulting in a geographical scarcity. The number of young people aged 15-24 in Asia is projected to decline from 718 million in 2015 to 711 million in 2030 and 619 million in 2060. Asia will have more youth than any other region until around 2080 when it could be surpassed by Africa.

Exhibit 16: Youth population (15-24 years) by region, 1950-2060

Youth population to grow in Africa and Asia, with Africa overtaking in 2060



Source: UN

"Eco-anxious" Gen Z are less keen on having kids on climate change issues

Younger generations are key activists on climate change. A Swedish study estimated that having one fewer child could save approx. 58.6 metric tonnes in carbon emission, the equivalent of taking 25 cars off the road or taking 37 fewer transatlantic flights. The growing fears around the climate should impact fertility rates quicker than any preceding trend in the field of birth decline.

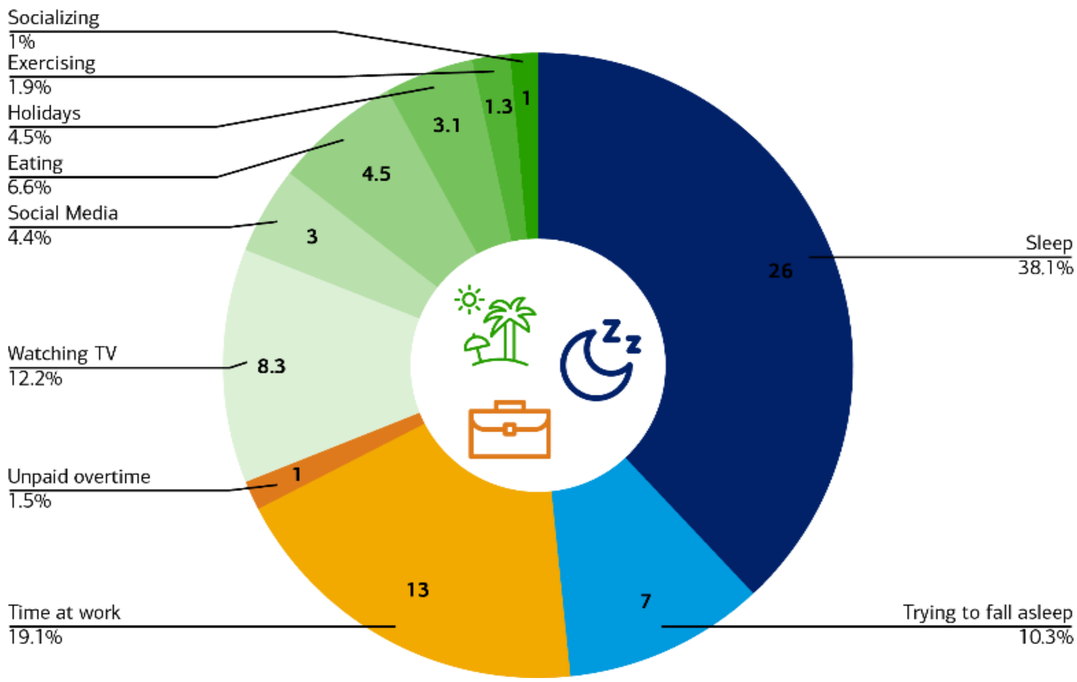
BANK OF AMERICA INSTITUTE

10. Time

Time is a finite resource facing deflation owing to technological progress

Most of us feel that we simply lack the time to do all that we would like to do. Time is an increasingly scarce and non-renewable resource. A moonshot to "create more time" has not been invented yet. Time is facing deflation: an hour today is worth more than an hour 10 years ago as a lot more can be done in a shorter timeframe owing to innovation and technology. In an era of digitisation, and abundant information, goods and services, free time cannot keep pace with increasing demands in 24 hours. We still have 24 hours a day, 7 days a week, yet what has changed is how we use our time. This had led to the concept of time scarcity: the feeling that one lacks enough time to do all things that one would like to do. Technology has spurred our efficiency enabling us to focus on productive vs mundane tasks by working fewer hours a day. We may feel like we're working more in a world of continuous working from home, but we are actually working less. In 1870, people worked more than 3,000 hours annually — equivalent to a gruelling 60-70 hours each week for 50 weeks per year. But those extreme working hours have been roughly cut in half.

Exhibit 17: How we spend our life
In years



Source: US Bureau of Labor Statistics

From future of work to future of leisure? More leisure, less work time

Time scarcity has given rise to a segmentation between work and leisure. As we work fewer hours, the future of work might tilt towards more leisure time. Today, 1 in 6 men of working age in the US is not employed. Many are believed to spend ~489 minutes per day on average "socializing, relaxing & leisure". Just as we have labour-market policies to shape people's working lives today, we might also need 'leisure market policies' to shape how people spend their spare time in a world where nearly all jobs have been automated and no wages are being paid. On average, people in developed countries have more leisure time than they used to. This is particularly true in Europe, but even in America leisure time has been inching up since 1965. The pandemic has accelerated this trend with lockdowns and teleworking giving workers more choice on how to spend their time. Services companies are competing for our time as we are more interested in foreign travel, restaurant meals, and wellness products of the leisure economy, such as health clubs and equipment.

We will be spending more time in the metaverse than 'real life' by 2030

Virtual reality will be totally realistic and compelling and we will spend most of our time in virtual environments by 2030, according to Ray Kurzweil. Virtual worlds have the potential to capture our attention and allow us to use our time in different ways. In enterprises, most meetings will be virtual, increasing our time efficiency, reducing time wasted due to traveling, cutting down on duplication of effort and pulling more people into the metaverse. Tech companies are investing billions in new ways to distract and entertain us, competing for our time.

Upgrading technology, downgrading human attention

Our attention span has decreased markedly in just 15 years from 12 to 8.25 seconds. Our attention is a finite resource but is being captured by devices rather than being voluntarily regulated. Whatever gets the most attention wins. Catching human attention is getting harder: companies need to produce catchier, more impactful media campaigns. While brands' influence on social media has grown, the timeframe to attract individuals is shrinking rapidly.

The dawn of hyper-convenience business models benefiting from our lack of time

Imagine a drone delivering your coffee when you look tired, food delivered to your fridge directly, gas refuelling services directly delivering fuel to your car and a robot doing your gardening. In an era of digitisation, abundant information and time scarcity, companies playing the hyper-convenience theme are gaining traction and optimising users' time. This fits well with the idea that we can do more with our waking hours. Self-cleaning robots, automatic cooking machines, hands-free and smart connected devices are some of the products that are already enabling customers to save time and effort. Cashless, automated payments, grab-and-go/click and collect products are among the methods used by the retail industry to save time. The industry was shaken by the rise of online food delivery services and we now live in a world where groceries can be at our door in just 10 minutes. Convenience is on the rise, habits are changing, our lifestyle is evolving and time is money. Will we ever have enough time?

Sources:

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Disclosures