

The Pictet Group explores opportunities ahead

Megatrending 2025



Foreword

For more than two centuries, Pictet has been taking the long view. It is a guiding philosophy that has served our clients well. And it lies behind our pioneering work on megatrends, the powerful social, economic, environmental and technological forces that transcend normal economic cycles to shape the world and our future.

Throughout our history, we have helped investors navigate the complexities of the world, withstanding wars, crisis and market turmoil. By understanding the structural trends in both public and private markets, we uncover insights that serve us well in tailoring our extensive investment capabilities to our clients' needs, be they institutions or individuals.

This publication gives an insight into the breadth and depth of analysis, insight and debate about structural trends from across the whole of the Pictet Group. The document explores a variety of themes and topics, from modelling the financial impact of biodiversity loss to assessing the impact of anti-obesity drugs. We also survey private equity professionals on the impact of artificial intelligence on companies. And we estimate the shortfall in climate change investment against what's needed to meet net zero obligations.

One of our strengths is knowing that we can't know everything – but also knowing the people to call on to help build our understanding. For instance, our keynote article is by Professor Vaclav Smil – Bill Gates' favourite author and stalwart member of the Pictet Asset Management Climate Government Bonds Advisory Boards – who offers a dose of realism against some of the wilder claims being made about AI and anti-obesity drugs. Another is Dr Hannah Ritchie, whose work at Oxford University's Our World in Data did so much to keep the world abreast of how the Covid-19 pandemic was developing during those terrible years. We draw on the experience of industrialists like Ignacio Sánchez Galán of the utility giant Iberdrola, which is shaping how electricity is produced and distributed around the world. They all appear in these pages, together with Pictet's own investment experts.

We are in the midst of an exceptional era. Our task is to maintain perspective on unfolding events for our clients, while also understanding long-term trends to avoid falling prey of the complexities or myopia of the short term.

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PRIX PICTET

Pictet sees the world differently.

It's why we established and continue to sponsor the Prix Pictet, widely acknowledged as one of the world's most esteemed photography prizes. Created in 2008 by the Partners of the Pictet Group, the award showcases outstanding photography as an artistic medium to invigorate debate on global environmental sustainability.

In 10 cycles to date, the Prix Pictet has addressed the themes of *Water, Earth, Growth, Power, Consumption, Disorder, Space, Hope, Fire* and *Human*. Submission is by nomination. More than 350 independent experts are invited to recommend portfolios from up to five photographers. Including the tenth and most recent cycle, *Human*, more than 5,500 photographers have been nominated, with over 150 exhibitions in more than 25 countries.

Cover page and featured
photography by Luca Locatelli.

The world's first experiment
in underwater farming in Noli,
in the Liguria region of Italy.
The project began in 2012 to
recreate ideal conditions for
growing basil.

*Biosphere underwater farming
series, #5, Italy, 2021*

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The original five bio-spheres arranged in a pentagon around a central fulcrum. Four more were added over the years (one of the diamonds in the middle visible in the upper right corner).

Biosphere underwater farming, #1, Italy, 2021

LUCA LOCATELLI

Luca Locatelli was nominated for two of the Prix Pictet cycles – *Hope* and *Human*. His photographs, which grace the whole of this publication starting with the front cover, focus on the relationship between people, science, technology and the environment.

His photographs have featured in leading publications on both sides of the Atlantic, including National Geographic Magazine, The New Yorker, The Guardian and The Sunday Times Magazine. He has won a number of leading photography prizes, including: World Press Photo, 2018 and 2020; World Photography Organization, 2018, 2020, 2021 and 2022; Leica Oskar Barnack Award, 2020; and Nanen Prize, 2017. In 2024, his exhibition *The Circle* was featured at the Museum of Photography Gallerie d'Italia, Turin, in partnership with the Ellen MacArthur Foundation. Locatelli is also a founding partner of a non-governmental association that helps to protect 600,000 hectares of the Amazon's tropical forest.

The photographs included in this magazine are from Locatelli's "Future Studies" project, which explores the future of human welfare as we respond to the challenges of climate change.

"Future Studies is an ongoing piece of research spanning more than 10 years," he says, "aimed at triggering the viewer to join the critical debate on our precarious balance on Earth, and hopefully contribute to restoring hope for the future of mankind."

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Innovation with grains of salt

Professor Vaclav Smil cautions about the hyperbolic claims being made for new headline-grabbing technologies

VACLAV SMIL
*Distinguished Professor
Emeritus at the University
of Manitoba and Fellow of
the Royal Society of Canada*

The early 21st century is obsessed with innovation. Google’s Ngram shows that the term “innovation” appears nearly 2.5 times more frequently than it did 20 years ago. Searching the Web of Science, which indexes nearly 10,000 periodicals, now returns more results for “innovation” than for “economy”. Innovation has become a new mantra, more than just a universal promise of relentless progress but increasingly a casually bestowed label for all kinds of sweeping AI-driven planetary transformations. I urge deep scepticism or at least abundant caution.

In medicine, recent promises have included not only groundbreaking advances in the repeatedly invoked and relaunched war on cancer and in delaying and beating age-related cognitive decline, but also the arrival of individualised medical care based on a deep understanding of a person’s genetic make-up. While there have been welcome and important treatment gains, such as the rapid deployment of new mRNA vaccines to control the Covid-19

Innovation has become
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of relentless progress.

pandemic and rising survival rates for head and neck cancers, we have not seen any sweeping, grandiose progress. We must also reckon with some notable retreats in overall health outcomes, including average life expectancy and the availability of basic medical care.

By 2023, life expectancy in the US had declined to its lowest level in two decades. In some affluent countries, including Canada, Australia and Norway, patients (many in pain) are waiting longer for common surgeries such as hip and knee replacements. Europe’s ageing population is facing a shortage of 1.8 million health workers, and no country with an ageing population, with China currently topping the list in absolute terms, is prepared to cope with

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61%

rise in CO₂ emissions
since 1997 by 2024.

Source: <https://www.iea.org/reports/co2-emissions-in-2023/emissions-grew-in-2023-but-clean-energy-is-limiting-the-growth>

the rising tide of physical and mental care that will be required in the near future. None of these challenges will be solved by the mass consumption of anti-obesity drugs.

As for the state of the global environment, we often hear about how high-tech advances – from offshore wind mega-farms to cheap green hydrogen, and from high-gain heat pumps to the electrification of everything – will decarbonise global energy use by 2050. However, since the Kyoto Protocol set the first goals for reducing global CO₂ emissions back in 1997, emissions have risen by 61 per cent. In 2023, they reached yet another record level (see FIGURE 1). The chances of reversing this trend suddenly are vanishingly small. To reach net zero by 2050, the drop would have to average about 1.5 gigatonnes (Gt) CO₂/per year, an annual cut equivalent to the combined 2023 emissions of Germany, France, Italy and Poland.

What is more, available technical fixes face two daunting challenges: mass scaling and affordable costs. The world will produce some 0.4 megatonnes (Mt) of green hydrogen this year compared to about 95 Mt of black hydrogen derived from hydrocarbons. Decarbonising the global primary steel and synthetic ammonia production projected for 2050 alone would require nearly 150 Mt of green hydrogen. Producing this amount by water electrolysis would require scaling its 2024 output nearly 400-fold, with even more green hydrogen needed for other hard-to-electrify decarbonisation uses, especially in industrial production and transportation.

We are also not moving away from but rather adding to new fossil fuel converters: more than a thousand new jetliners (requiring aviation kerosene), hundreds of giant container ships (burning diesel fuel and heavy fuel oil) and dozens of new large blast furnaces (charged with coke, coal dust and natural gas) and rotary cement kilns (running on any low-quality heavy fuel) are being added each year. None of these have any non-carbon commercial alternatives that would be readily available at scale and widely affordable. And while installing a heat pump (at CHF30,000 or USD34,000) may seem like a (subsidised) bargain to wealthy Westerners, that sum is about 10 times the annual average income in Nigeria, making this option entirely irrelevant for billions of people in low-income subtropical and tropical climates where air conditioning is in the highest demand.

Both health- and energy-related innovation hypes have been cautious compared to the exaggerated claims made on behalf of artificial intelligence – especially those made over the past 25 years by Ray Kurzweil, an American computer scientist, inventor and a former director of engineering at Google. In

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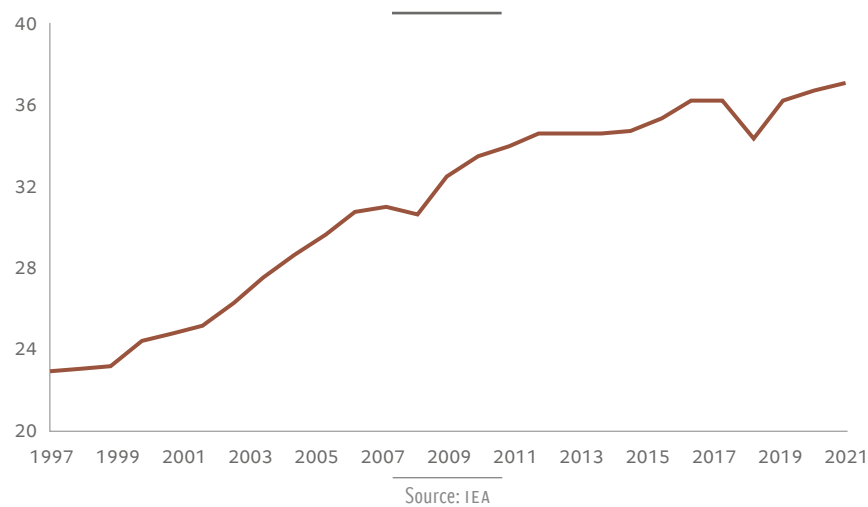
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FIGURE 1
Carbon loading
Total increase in energy-related
CO₂ emissions, Gt, 1900-2023



2005, he claimed that the singularity, as in when “machine intelligence will surpass human intelligence, leading to The Singularity – technological change so rapid and profound it represents a rupture in the fabric of human history” is near. His latest book published in June 2024 argues it is “nearer” (no later than 2045), predicting that the merger of biological and nonbiological intelligence will produce immortal software-based humans “and ultra-high levels of intelligence that expand outward in the universe at the speed of light.”

Kurzweil believes that when AI “gives us full mastery over cellular biology”, the annual increase in life expectancy will greatly accelerate and that “for people diligent about healthy habits and using new therapies, I believe this will happen between 2029 and 2035 – at which point ageing will not increase their annual chance of dying.” So, just hang on until 2029, and eternal life on an AI-ruled Earth is yours! Admittedly, most of the recent media-propagated AI logorrhoea, as overwrought as it has been, does not go as far as Kurzweil’s irrepressible claims, but it is still firmly in the realm of super-naïve hype.

When Marc Andreessen, a general partner of a leading US venture capital firm, says that “AI will save the world” and that it “can make everything we care about better”, does he mean that, or does this hyperbolic claim apply only to information management? If the former, then I urge readers to make their own short lists of such “save” and “care” measures and ask what AI will do for them in five or 10 years. My list, with inclusions guided by their overall potential to save lives, would include the

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complete elimination of nuclear weapons, the economic development of Africa and the end of malnutrition. I do not see the vaunted large language models (LLMs) and generative AI (Gen AI) triggering fundamental transformations in society, crime or politics. And if not, what then is that “everything we care about” which AI will do for us? Writing personalised rejection letters or drawing cartoons in Picasso’s style?

The last 150 years have been an age of unprecedented scientific advances and technical inventions, but a critical look reveals that their pace has not been generally accelerating. Computing capabilities have been the single most important exception as we moved from vacuum tubes to solid state electronics (by the mid-1950s), then to integrated circuits (starting in the late 1950s) and microprocessors

Health- and energy-related innovation hypes have been cautious compared to the exaggerated claims made on behalf of artificial intelligence.

(starting in 1971), whose soaring performance enabled the extremes of supercomputing and personal portable devices. But the physical (truly existential) fundamentals of modern civilisation have not seen any similarly radical changes over the past 50 years.

We generate most of our electricity using large steam turbogenerators, make primary steel in blast and basic oxygen furnaces, process cement in rotary kilns, power intercontinental flights with gas turbines, and run rapid trains with electric motors and large ships with massive diesel engines. We achieve high crop yields by applying synthetic fertilisers and keep finding new uses for hydrocarbon-derived plastics. The world of 2024 is just a version of the world of 1974. What has changed in all these cases are the incremental gains in efficiency and performance, and hence the cost and environmental burden of these fundamental activities. These have been the most consequential innovations. Thanks to them, we need less energy per unit of product or service, making these more affordable and more acceptable, and they have improved many lives by providing better nutrition, better housing and higher incomes. Keep this in mind when coming across yet another uncritical claim about the latest transformative, epoch-making, world-changing innovations.

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The world's first experiment in underwater farming in Noli, in the Liguria region of Italy. The goal of this project, started in 2012, is to achieve complete sustaina-

bility in the life cycle of growing plants by reusing what the sea naturally donates. Each structure, called a biosphere, resembles a large balloon and holds

about 2,000 liters of air. The biospheres are anchored up to 10m deep.

Biosphere underwater farming, Italy, 2021

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The key trends in science, technology and sustainability over the next 12 months – and beyond

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*Sustainability and Research
Manager, Thematic Equities,
Pictet Asset Management*

TECH BEYOND AI

1

AI has dominated the headlines for the past two years, but it is not the only tech trend worth watching. Advancements in robotics and automation are transforming industries by boosting efficiency, productivity and safety. From autonomous vehicles to robotic process automation, these technologies are reshaping various sectors, including manufacturing, healthcare and logistics. For instance, one pioneering start-up truck maker providing Autonomous Transportation as a Service (ATAaaS) is due to launch driverless freight services in Texas in 2025, while Tesla plans to deploy 1,000 humanoid robots in its factories by the end of the year.¹ Meanwhile, AI will also continue to evolve, with promising areas for growth in biotech – such as drug development, data and image analysis and drug repurposing – and in consumer services and the workplace, where technology can enhance productivity.

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¹ <https://www.contechs.com/blog/2024/06/tesla-to-introduce-humanoid-robots-to-factories-from-2025>

3D CHIPS

2

Your smartphone, computer, car and even your country's military equipment all rely on semiconductors. Companies worldwide are scrambling to make these chips smaller, while increasing computing power and energy efficiency. As the stacking of transistors on silicon wafers reaches physical limits, we expect the industry's shift from 2D to 3D architecture to continue. Chip designers are increasingly thinking in three dimensions, stacking tiny squares – known as “chipselets” – that would normally form one chip on top of a base silicone layer using hybrid bonding. High bandwidth memory is a high-performance, low-latency memory technology built from stacks of advanced DRAM (dynamic random access memory). One benefit is cost as not all the chipsets need to be equally sophisticated and some can thus be produced using cheaper manufacturing techniques. Samsung Electronics is one of the companies planning to introduce a new 3D chip in 2025.²

CDMOs – NEW KIDS ON THE BLOCK IN PHARMA

3

The growing complexity of new medicines and treatments is spurring demand for a group of companies called CDMOs (contract development and manufacturing organisations). These specialised service providers focus on specific areas of drug development and manufacturing. By outsourcing some of these activities to CDMOs, pharma companies can share some of the risks and ultimately accelerate the delivery of new therapies. CDMOs add value by streamlining the research and manufacturing process across the industry – often leading the way with new technologies, including AI. They have a growing role to play in modern medicine, including in the development of personalised treatments and cell therapies.

Smart grids

Green

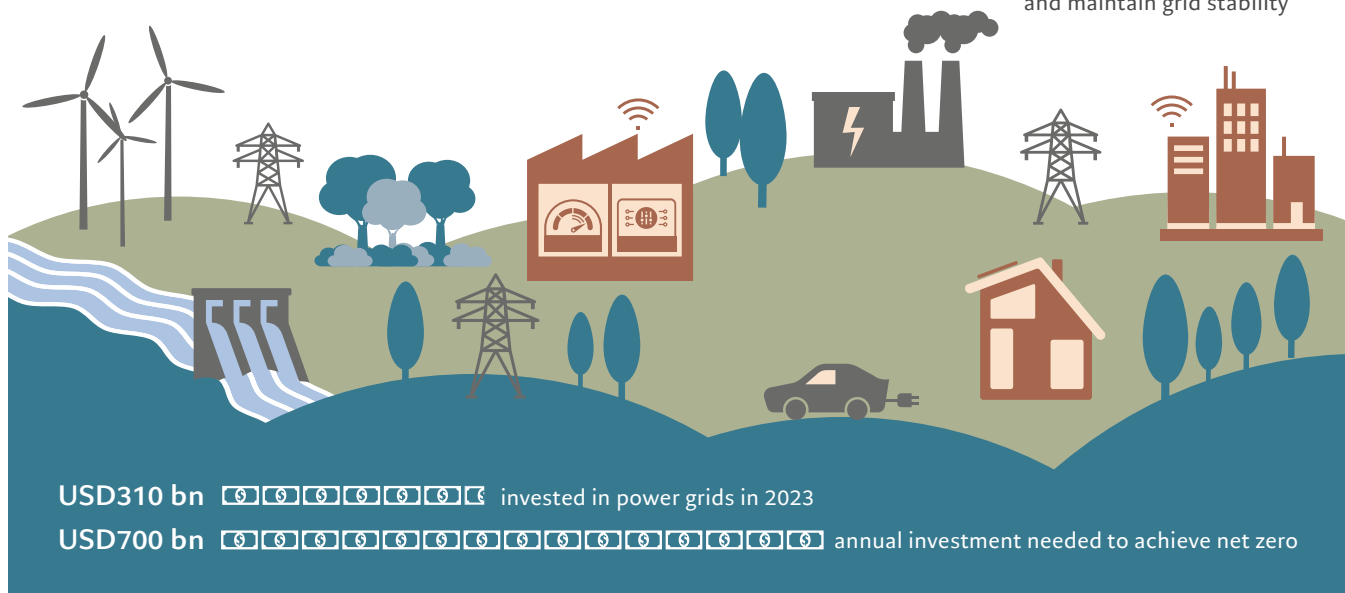
Incorporating many energy sources, including renewables

Digital

Sophisticated sensors, automation, forecasting

Efficient

Match supply and demand in real time, minimise costs and maintain grid stability



Source: Mega, IEA

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² <https://www.kedglobal.com/korean-chipmakers/newsView/ked202404020016>

TREES REIMAGINED

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Wood, one of the world’s oldest materials, is enjoying a resurgence. Its popularity is rising as a packaging material, driven by green consumerism and the growth of e-commerce, but also as a building material. Thanks to new technological advances such as cross-laminated timber and a raft of new environmental building regulations, wood is becoming a significant component in construction projects. But it is also a key ingredient in new materials, such as wood-based PET used in clear Coca-Cola bottles, and biodiesel that can be used to dilute or substitute traditional diesel for lorries and cars. Timberlands are increasingly being used for renewable energy infrastructure, including wind turbine towers and structures for mounting solar panels in open areas. And many are realising that wood can also play a more direct role in the world’s quest for carbon capture and storage, either through credits or bioenergy carbon capture and storage (BECCS).

SOLVING THE GRIDLOCK

5

A greener planet needs significantly more electricity – and from clean sources. To achieve that, we need a smarter power grid. The International Energy Agency (IEA) estimates that to meet net zero emission goals, we need to build or modernise 25 million kilometres of electricity grids in the next five years.³ Firstly, the increased use of renewables requires investing in network interconnections to transport power from remote solar- and wind-rich areas to demand centres and connect renewable energy production to the grid. Secondly, sector electrification such as the rise of electric vehicles and heat pumps will increase electricity demand, requiring grid reinforcement and modernisation. Thirdly, grids will need to be able to withstand extreme weather events resulting from climate change to avoid power outages.

³ <https://www.reuters.com/business/energy/renewable-energy-fall-short-un-goal-triple-by-2030-iea-says-2024-10-09/>

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FIGHT AGAINST FLOODS

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Floods cause USD40 billion in damage each year and affect millions of people.⁴ It's not just climate change, but also broader weather events and the urbanisation of flood-prone areas that make it essential to build structures and develop landscapes that are more resilient to these natural disasters. For instance, in 2024, Europe was hit by some of its worst flooding in over two decades.

Flood resilience is a key pillar of climate adaptation, including constructing flood defences and managing flood water. Cities are focusing on creating more resilient infrastructure and using technology to better plan defences – such as using digital twins to model potential flood impacts. New York is one of the cities enforcing new building regulations to ensure flood resilience, with stringent standards for critical infrastructure such as hospitals and power plants, and has initiated a project to fortify its defences against coastal flooding.

SMART NUTRITION

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Food is fuel, and we are getting smarter about what we consume. The USD45 billion sports nutrition market is expected to expand at a compound annual growth rate of 7.5 per cent through to 2030,⁵ driven by strong demand for supplements that can enhance performance, fitness and post-exercise recovery and reduce the risk of injury. Increased focus on health is also boosting demand for functional products such as food fortified with key vitamins and probiotics. Additionally, the growing use of GLP-1 weight loss drugs has created a market for related products which can help preserve lean muscle mass, manage digestion issues and ensure adequate micronutrient intake while consuming fewer calories. Companies like Nestlé and Herbalife have already launched GLP-1 companion products, and we expect to see more product ranges catering to GLP-1 users on the market in 2025.



STEVE FREEDMAN

Steve joined Pictet Asset Management in 2019. He has worked as a senior client portfolio manager for environmental strategies, chaired the Thematic Advisory Boards and is now responsible for research and thought leadership initiatives in Thematic Equities. He was previously at UBS Wealth Management, where he began his career in 1998 and served among others, as head of sustainable investing solutions and head of investment strategy for the Americas, based in New York. He has taught environmental finance at New York University and was the founding co-chair of the seminar on sustainable finance at Columbia University.

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⁴ <https://wmo.int/topics/floods>
⁵ <https://vitaquest.com/exploring-the-trends-for-2025-in-the-dietary-supplement-market>

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Hope in a multi-pandemic world

Cutting-edge therapies meet the challenge of intractable diseases

YANN MAURON
*Executive Director, Principal
Thematics - Private Equity,
Pictet Alternative Advisors*

Covid-19 exposed and exacerbated many societal challenges – but it didn’t create them. So, while that pandemic was ultimately managed successfully, the underlying problems, many health-related, remain as a sort of multi-pandemic, with often chronic and debilitating effects on individuals and whole communities.

Almost 20 million *new* cases of cancer were diagnosed in 2022 worldwide, the most recent year with comprehensive data, with 9.7 million patients dying from this class of diseases.⁶ Obesity – which is associated with many conditions, including diabetes, heart disease and depression – affects more than 890 million adults and 160 million children.⁷ And approximately 300 million people live with at least one of the 7,000 identified rare diseases.⁸

The greatest weight from these health issues is borne by the sufferers. But there are also huge societal costs, from the direct strain on personal and government finances to the indirect opportunity costs of allocating substantial private and public resources to healthcare.

Given the scale of these overlapping challenges, medical innovation is the only credible solution. We are already seeing how companies are increasingly succeeding in rapidly transforming cutting-edge scientific research into products and services that have an immediate impact, from mRNA vaccines to GLP-1 agonists, whose full potential beyond diabetes and weight loss is still being explored.

And these well-known examples are just the beginning, with many breakthroughs on the horizon. For instance, Generate:Biomedicines is using AI to accelerate drug development. In a recent conversation with its chief executive, Michael Nally, summarised in an interview on page 33, he made clear the mutually reinforcing relationships across the healthcare ecosystem that can create virtuous cycles of discovery, commercialisation, mass availability and reinvestment in research.

“We’re a small organisation,” he told me. “We have 300 people. We’re working on about 20 different programmes, which is extraordinary by any historical metric. But we know we’re going to need

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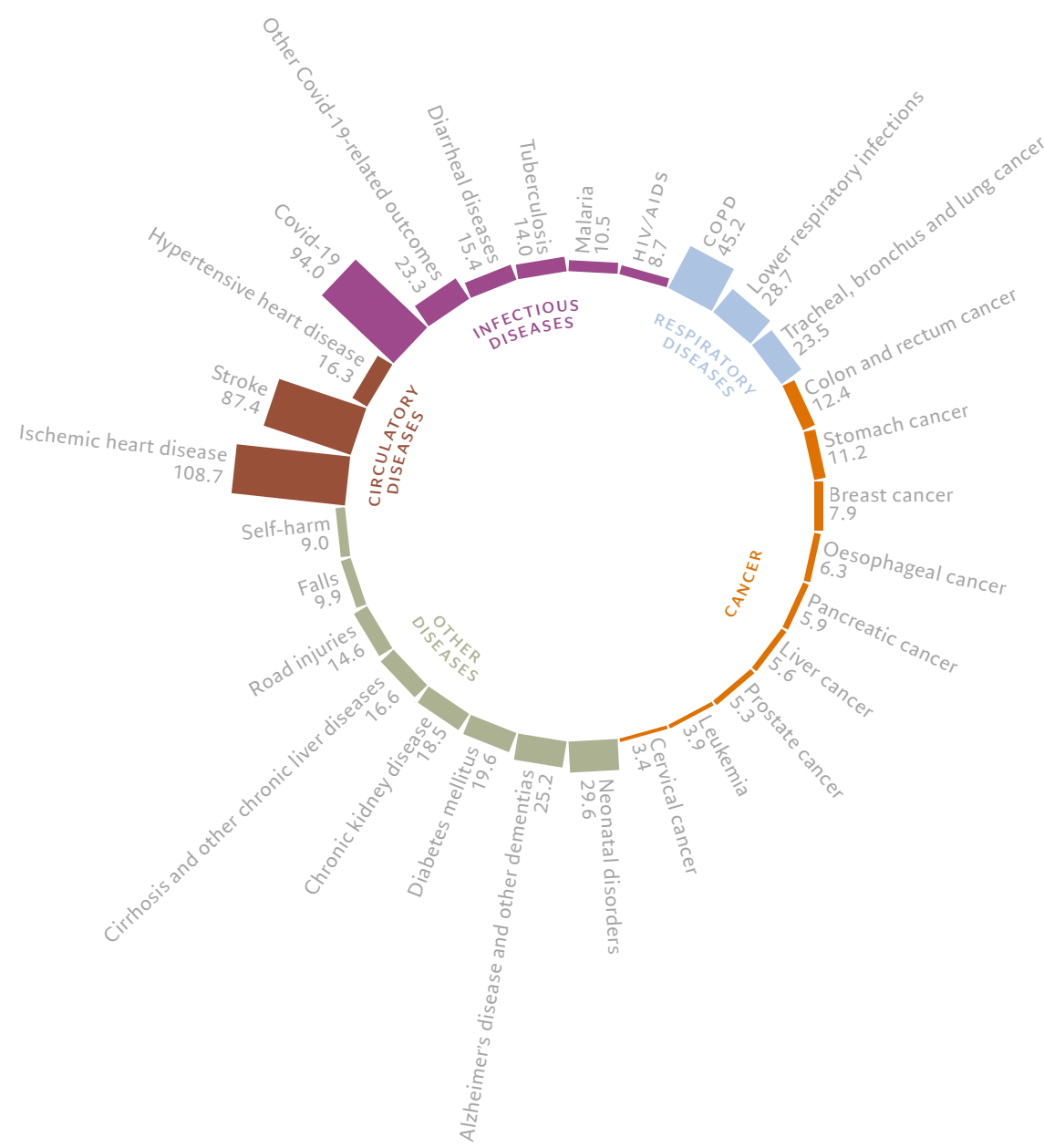
6 Source: Bray F., Laversanne M., Sung H., et al., Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024; 74(3): 229-263.

7 Source: World Health Organization, 1 March 2024

8 Source: The Lancet Global Health, The landscape for rare diseases in 2024, March 2024

What kills you

Leading causes of death,
global deaths per 100,000 population



Source: The Lancet, Global Health Data Exchange, 2021

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20 million

new cancer cases
were diagnosed in
2022 worldwide.

Source: World Health Organization,
<https://www.who.int/news/item/01-02-2024-global-cancer-burden-growing--amidst-mounting-need-for-services>



YANN MAURON

Yann joined Pictet in 2016, first as a strategy project director, before becoming a private equity investment manager. Yann is also responsible for the group corporate venture capital initiative. He is a biologist by training and started his career working for several blue-chip pharmaceutical companies. His PhD in Bioinformatics gave rise to multiple applications in the identification of biologicals and emergency medicine.

to bring in other expertise to help us deliver the full potential of this technology. As we go forward, I think partnerships will be a core component of our model in a way that maybe they haven't for many companies before."

These themes are explored in greater detail in the articles about the future of biotech on page 26 and the impact of GLP-1 drugs on the economy on page 36.

Not only is it a tremendously exciting time to be a healthcare investor but there is also a genuine case for optimism about resolving some of these longstanding social challenges. As Nally said: "We're operating on a timeline that was previously unimaginable, getting better answers for patients faster and more efficiently. That's an important formula for the world, because unfortunately the world is struggling to afford healthcare. Companies that can come up with answers are going to be a big part of both improving human health, addressing really awful patient conditions and helping improve the world's economic condition."

As Dr Hannah Ritchie explains in our interview on page 22, it's important to remember how far we've come as we grapple with what sometimes seem to be insurmountable challenges.

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The Kalkar nuclear reactor was completed shortly before the 1986 explosion at Chernobyl in Ukraine, and was never used. It is now an

amusement park with a mer-go-round inside what would have been the cooling tower.

2050 nuclear ride, Germany, 2015

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Climate anxiety

Oxford's Hannah Ritchie explains why optimism is sustainable

Pictet: Hannah, you call yourself a pragmatic optimist. But that wasn't always the case, was it?

Ritchie: I think I would have definitely framed myself as a pessimist 10 years ago. Back then, it seemed like everything was getting worse and worse. It was really hard to see any type of progress. But, over the last 10 years or so that has really flipped; I can now call myself a pragmatic optimist. We have the potential to drive change and we are actually seeing change on the ground. It's just about accelerating it.

Pictet: Yet climate anxiety is a phenomenon that we particularly see in young people as well as the broader population.

Ritchie: Climate anxiety is a growing problem. For me, it's always been there. I recall experiencing a deep sense of anxiety, worry and concern about the future since I was 12 years old. Over time, these feelings got progressively worse to the point of being quite crippling [...] There's this notion that we're headed for doom,

We've massively improved human wellbeing, but it came at the cost of the environment.

and there was nothing we can do about it [...]. You can see it in surveys of young people across the world. These feelings and the fact that young people don't feel like they have a future act as key drivers of this climate anxiety.

Pictet: But you write that the world has never been sustainable.

Ritchie: The world has never been sustainable. I think we have this notion that we've only become unsustainable very recently, like in the last 50 to 100 years with the rise of fossil

fuels. When you go to the basic definition of sustainability, it has two halves. There's one half which is the need to protect the environment; to protect future generations and not rob them of opportunities, and also protect other species. So that's the environmental lens.

But there's another whole dimension, which is also wanting to provide a good life for everyone today, to reduce human suffering, of having everyone in the world deserve a good high standard of living. And for me, sustainability is balancing both of those things at the same time.

I don't think we've actually done that in the past. Our ancestors might have had a very low environmental footprint, but often living standards were very poor. One example I use is that child mortality rates were extremely high, and obviously led to immense human suffering. Now over the last few centuries, that's moved the other way. So we've massively improved human wellbeing, but it came at the cost of the environment.

I think we could be the first generation that achieves both of these things at the same time. We're now at the stage where we have the technologies, we have the political power, we have the economic power, where these things are no longer incompatible.

Pictet: What is going to push us towards sustainability then?

Ritchie: The major issue with sustainability [...] is that the true cost of these goods is not completely factored in. So, when you burn fossil fuels, the price you're paying on the market does not reflect the future environmental and social damages. Now, there are ways that you can start to try and correct that, you can put a price on carbon.

It was really hard to convince countries to buy solar wind when coal or gas were much cheaper, that was just not in their short-term economic

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DR HANNAH RITCHIE
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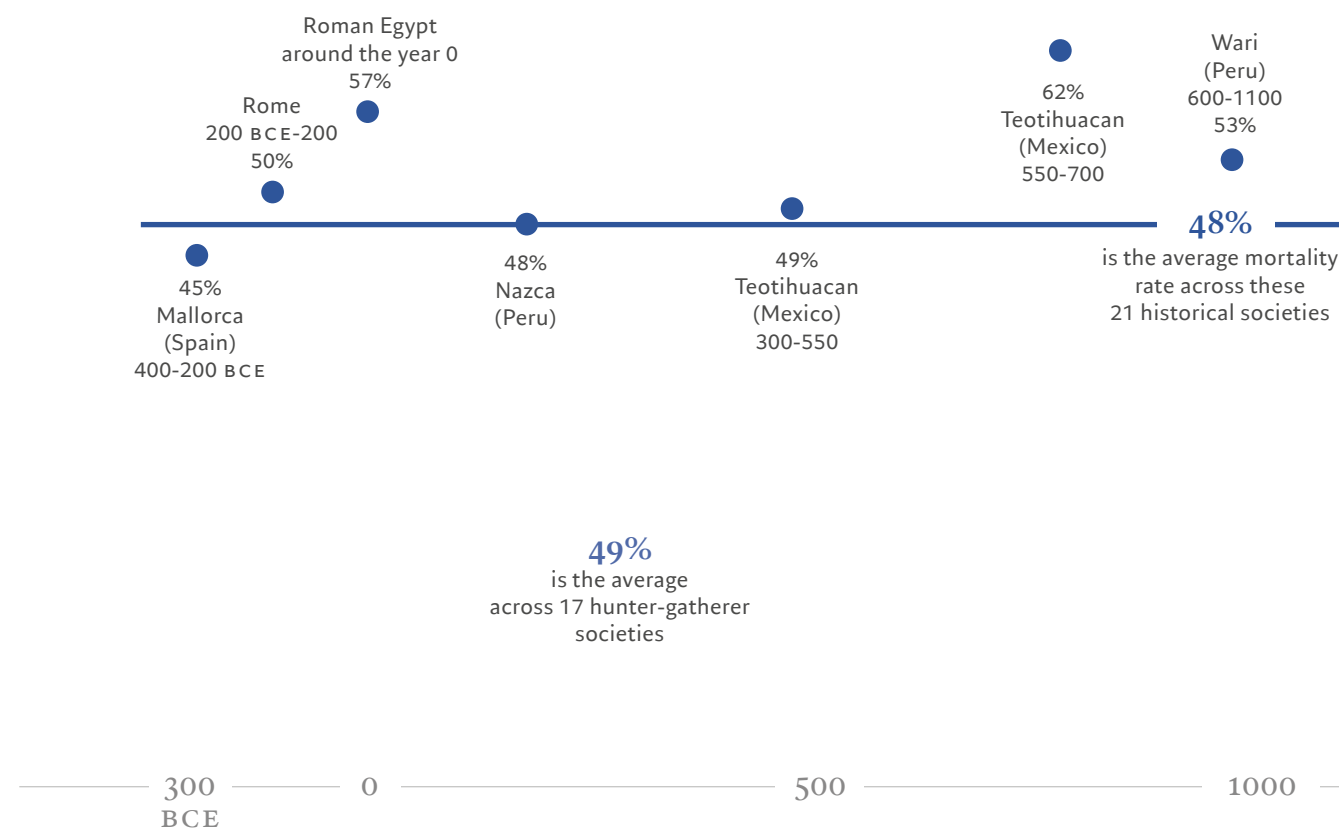
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THE LONG-RUN HISTORY OF CHILD MORTALITY

Percentage of children who died before reaching the end of puberty. The exact age cut-off differs slightly between studies, but is around the age of 15.

Source: Our World in Data



interests. What we've seen over the last decade is the plummeting cost of these low-carbon technologies. Solar and wind power were the most expensive 10 years ago, now they're the cheapest. For electric cars, the batteries were so expensive 10 years ago, they're now getting comparable with petrol and diesel cars [...]. Why I'm more optimistic now is that I also see the short-term economic opportunities aligning with sustainability.

Pictet: But we know that part of the biggest challenge is not the rich world, but the poor world. And we

know that those developing countries need USD2.4 trillion every year to deal with climate change.

Ritchie: Low-carbon technologies are falling very quickly in price [...]. And the price per unit of energy is now less than coal or gas. But when it comes to finance, it's really important to reiterate how different the cost structures of renewables are compared to fossil fuels. When you're building a solar plant or a wind plant, all of the costs are upfront. [But] once they're in the ground or on the farm, the energy is basically free [...] You may have some maintenance costs,

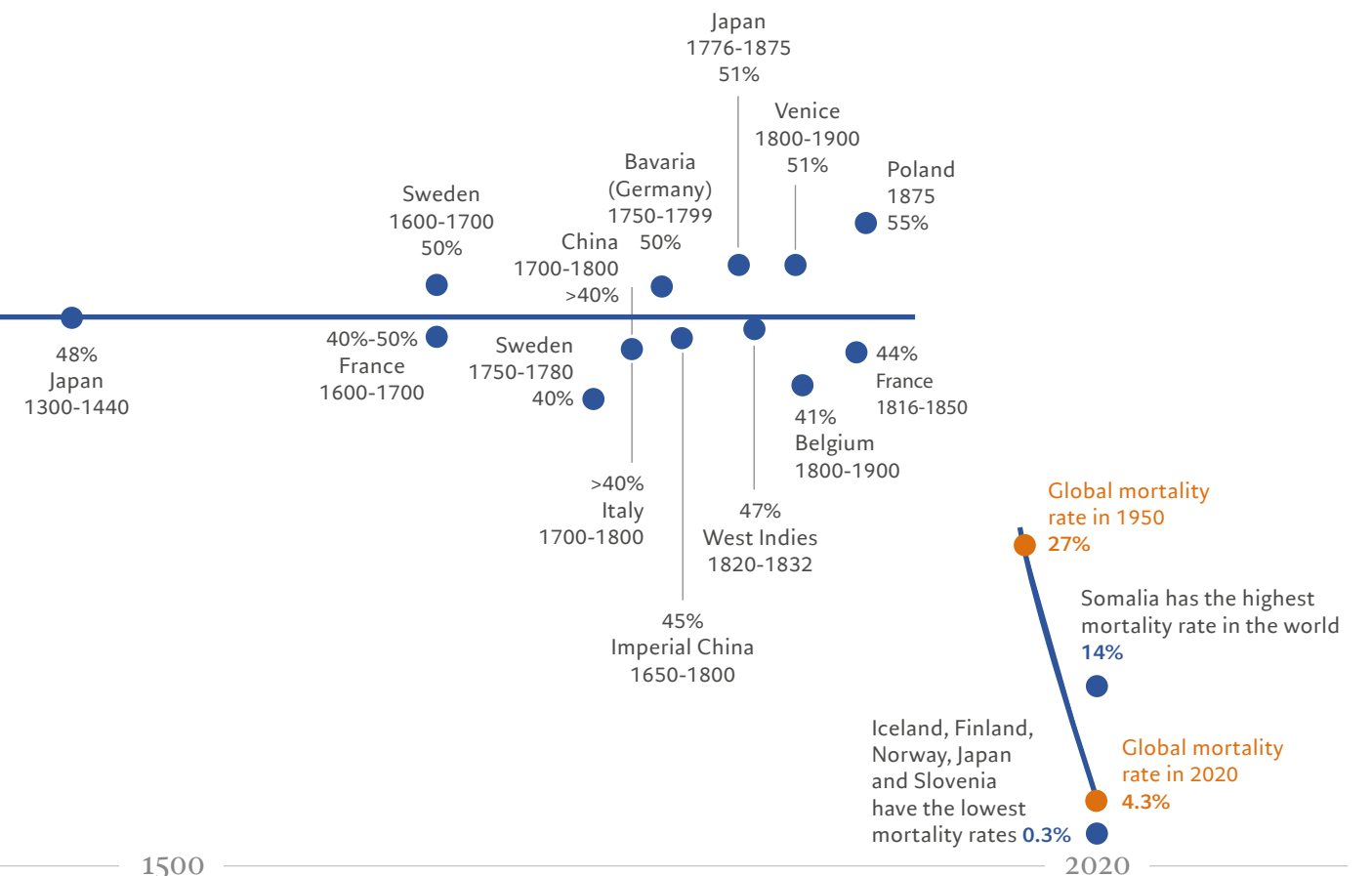
but the costs are very front loaded. That's also why these technologies are so vulnerable to high interest rates because all of the cost is front loaded. With fossil fuels, on the other hand, there's some cost in building the plant but the majority is actually buying the fuel, buying the gas and coal, and that's spread over decades, which means that the costs are not so front loaded.

If people don't have the capital to build renewable energy infrastructure in the first place, then it won't get built. So yes, these technologies are cheaper, but there is a really crucial upfront capital cost that we need to take into consideration. And if we don't have investors, primarily from the rich world, playing some role in financing this, that transition will just slow down.

Pictet: Do we have to choose between mitigation and adaption?

Ritchie: Regardless of how fast we move on reducing emissions, we are just going to see temperatures rise for a while. And we need to make sure

THE LONG-RUN HISTORY OF CHILD MORTALITY



that everyone in the world, but primarily the poorest who have contributed least, are resilient to those disasters. When it comes to disasters over the last century, we've actually made incredible progress. One of the reasons I was so pessimistic in the past is because I was getting so many headlines of disasters. My assumption there was just that more and more people were dying from disasters than ever before. However, when you step back to look at the data, you can see this very long-term decline over the last century. And that's not because disasters are not getting worse, or they're getting less intense. We have become more resilient to them. We have early warning systems, people are richer, they can live in earthquake proof buildings and have more resilient agriculture. So that's a massive gain. And the point is that going into the future, we need to continue to see this progress.

Pictet: Is it up to youth to fix this?

Ritchie: The generational divide is actually a little bit too exaggerated. There's often this common percep-

tion that young people really care about climate change, but no one else does. I've just not found that to be true. I think it's quite unfair. Most people actually care about climate change and want to do something about it. There's this constant finger pointing. And to me, that's just not that productive. There's larger inequalities that we need to bridge, but it is a collective exercise.

I have this framework in the book and it's from my colleague Mark Showalter, where he has this Venn diagram. I think the core point is that we have to be able to hold multiple thoughts in our head at the same time. So one of those is that the world is still awful. And you can pick almost any metric in the world and see where we are today. We should be dissatisfied with the current status, we're not where we want to be on any of the health, hunger or poverty metrics or any of the environmental problems; the world is still awful. But part of the work that we have done in mapping out where we've come over the long term reveals that the world

is much better than it was. Many of these metrics are moving in the right direction, so the world is getting better. And humans actually can make progress. And the data shows that. I think you need to use those tools to galvanise action, understanding that the world can be much better. And that's where I think some of the anxiety alleviation comes, from understanding that we face these challenges. So it's fine to be anxious, it's fine to be concerned. But you need to understand that we've made progress in the past, so we should be able to make progress in the future if we actually have a good go at it.

When you burn fossil fuels, the price you're paying on the market does not reflect the future environmental and social damages.

Why it's time to invest in biotech again

Biotech to flourish on infusions of new technology

FLORA LIU

Client Portfolio Manager,
Thematic Equities,
Pictet Asset Management

SHANIEL RAMJEE

Co-Head Multi Asset London,
Pictet Asset Management

The biotech industry has been on a roller coaster ride in recent years. The success of the Covid-19 vaccine showcased its innovation capability, helping draw record levels of investment and propelling IPOs to all-time highs. But then the industry was hit by surging inflation and sharp rises in interest rates, pushing it off the radar for most investors.

We believe the time has come for a biotech comeback. The Federal Reserve has started to cut rates, and the market is ripe for a broadening out from big tech into other under-loved sectors.

Valuations for biotech are very attractive. The Russell 2000 Biotechnology Index, a good proxy for small- to mid-cap biotech, is still 50 per cent below the 2021 highs despite healthy long-term fundamentals for the industry.

GOLDEN AGE OF INNOVATION

The healthcare industry is set to boom over the coming decade. And a substantial part of that will be driven by innovations in biotech. As people grow older and richer, demand for newer therapies will only increase – not least to treat diseases associated with ageing, like cancer, and of wealthier societies, like diabetes.

We have seen robust pipelines and breakthrough therapies approved across many indications in recent years. Over the last year, there has been significant advancement in obesity treatment with the arrival of GLP-1 drugs. Next generation therapies are already on the horizon, such as GLP-1 combinations, oral GLP-1 drugs or amylin-targeted therapies. Early data have been promising and could further improve on weight loss efficacy or tolerability and the field remains one of the hottest areas for clinical trials and investor interest.

Another exciting area is cancer drug development, spurred on by new technologies and better scientific understanding. Promising advances include antibody-drug conjugate (ADC) products in which a drug is coupled to an antibody that specifically targets tumour cells without damaging healthy cells. Bispecific antibodies can bind to not just one but

600 million

protein structures
discovered with
the help of AI.

Source: Nature,
[https://www.nature.com/
articles/d41586-022-03539-1](https://www.nature.com/articles/d41586-022-03539-1)

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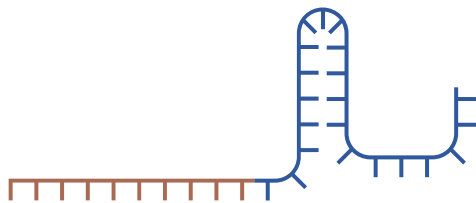
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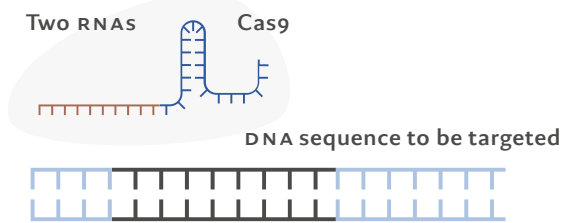
Gene therapy with CRISPR and Cas9

- 1 Two RNA sequences are created in a laboratory. They are identical to the DNA sequence that needs to be replaced.



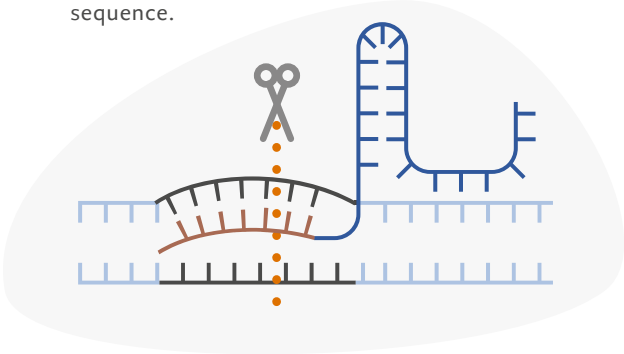
Two RNA sequences

- 2 Those two RNA sequences are joined with the protein Cas9. This protein can break the genome at specific places.

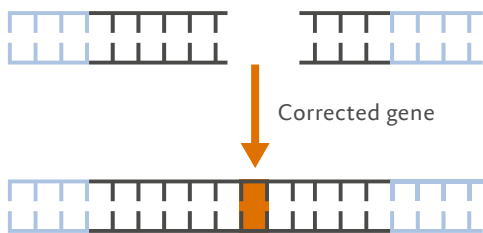


Gene to be replaced

- 3 The two pieces “find” and latch onto the matching DNA sequence to be replaced. Cas9 cleaves the sequence.



- 4 The break is filled with a correct gene that is injected into cells via a virus.



Source: Our World in Data

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two different types of cells (e.g. a cancer cell at one end and a T cell at the other) to activate anti-tumour responses. Then there are improved cancer diagnostic technologies such as liquid biopsy, which identifies tumour DNA circulating in the blood, helping early detection and improving cancer prognosis.

At the same time, the advent of advanced AI and other cutting-edge technologies makes it increasingly possible to create bespoke therapies. We believe biotech is by far the best placed sector to ben-

The healthcare industry is set to boom over the coming decade. And a substantial part of that will be driven by innovations in biotech.

efit from AI, not least because it's been an early adopter – there are already some 1,500 vendors in health AI – and because of the huge volumes of data and models the industry has generated on which to train AI systems. AI has already made inroads into discovering possible cures for chronic diseases and has accelerated drug discovery. In just the past few years Meta's AlphaFold and rivals have predicted



FLORA LIU

Flora joined Pictet Asset Management in 2023, having previously worked within the investment unit of the Canada Pension Plan Investment Board, both in Toronto and London.

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600 million protein structures, which are key to drug development. By contrast, just some 200,000 were discovered in the 50 years before AI.

This could prove a golden age of medical innovation, and biotech will be at the forefront.

M&A BOOM

Such innovation is one key way for the pharmaceutical sector to address the cliff of patent expiries – affecting some USD150 billion of revenue over the coming few years. This creates a strong incentive for the bigger players to step up investment into research and development – but also into acquisitions of small, innovative companies. Which brings us to another key tailwind for the sector.

M&A in Europe and the US hit a record high in 2023, and we expect activity to remain strong over the medium term. Large cap pharma companies have a lot of money on their balance sheets to deploy and the patent cliff presents a strong incentive for them to do so. As markets tend to price in the prospect of declining sales in advance of actual patent expiries, it is crucial for them to act now to demonstrate new pipelines to support future sales. The acquisitions are particularly attractive now given the favourable valuations.

For us as asset managers, this M&A boom creates an opportunity to generate alpha as some of our investments are snapped up by bigger firms at sizeable premiums. The Biotech strategy at Pictet is well exposed to this theme thanks to its focus on smaller and mid-sized companies. Since the start

of 2023, eight of the companies in our portfolio have been taken over, with premiums ranging from 30 per cent to 100 per cent.

BIOTECH FUNDING RESURGENCE

We are also seeing renewed investment appetite for biotech, in both public and private markets which should further underpin the sector. In the first half of 2024, biotech secured USD29 billion in public funding – a 72 per cent increase year on year, driven by high follow-on offerings. IPOs are also showing signs of continued rebound from the 2022 lows, albeit at a much slower pace, indicating renewed investor appetite. Importantly, companies that are becoming public are of much better quality compared to the IPO frenzy in the 2020/2021 period.

While near-term macroeconomic conditions and Donald Trump's presidency could bring some bumpiness along the way, biotech remains one of the most compelling sectors for investors with significant growth potential driven by cutting-edge innovation and attractive valuations.



SHANIEL RAMJEE

Shaniel joined Pictet Asset Management in 2014, having previously worked at Barings Asset Management for seven years as an investment manager for multi-asset strategies. He holds an MSc in Finance from the University of St Andrews and a BA Hons in Economics and International Business from the University of North Carolina at Chapel Hill (US). In 2016, Shaniel was one of Financial News' 40 under 40 Rising Stars in Asset Management.

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Flying over the Westland in the Netherlands, the most advanced area in the world for agro-farming technology.

Climate-controlled farms such as these grow crops around the clock and in every kind of weather.

*Ultra farming,
Westland landscape,
The Netherlands, 2017*

Artificial intelligence powering a healthcare revolution

Machine learning leading us to new therapies says Generate:Biomedicines' Michael Nally

MICHAEL NALLY
Chief Executive of
Generate:Biomedicines

YANN MAURON
Executive Director, Principal
Thematics - Private Equity,
Pictet Alternative Advisors

What would it take to persuade you to quit a secure job to join a start-up? For Michael Nally, chief executive officer of Generate:Biomedicines, a meeting with a Nobel laureate did the trick.

The encounter in question was with Frances Arnold, who was awarded the Nobel Prize in Chemistry in 2018 for conducting the first directed evolution of enzymes – creating more deliberate and targeted catalysts for chemical reactions.

“Mike, nature has only sampled one drop of water in all the Earth’s oceans of potential proteins,” Arnold told Nally. “And you now have a technology that can survey the oceans.”

At the time, this technology was most commonly referred to as machine learning, but it has now evolved into what is called generative artificial intelligence (Gen AI). Arnold’s contention was that such immense computing power could be applied to the process of associating DNA sequences with the function of proteins. Proteins are the molecular links of life, but we still don’t fully understand the biological function of every chain they form. Investigating them has traditionally relied on extremely labour-intensive research that aims to translate knowledge of these relationships into novel therapeutic programmes.

Nally grasped the potential, and it was enough to convince him to leave his leadership role at a large multinational pharmaceutical company with 72,000 employees to join Generate, then a 30-person start-up near Boston, in 2021.

“Many people thought I was crazy,” he recalls. “But what was troubling me when I looked across the entirety of the biopharma ecosystem was that

the industry was fundamentally struggling with two big challenges. One was that research productivity had been going down for four decades in a row. And the second was that the pricing of medicines led to inadequate access, ultimately undermining the reputation of the industry. I believed that in order to address these challenges, you would ultimately need a revolution in research productivity.”

A key insight in this revolution was that the technology could do more than simply cut costs or automate basic tasks. “Our view was that the real value in artificial intelligence was ultimately going to be how it aids the creative process,” Nally says. “What generative AI allows us to do is expand the universe of functional proteins beyond what nature has discovered on its own.”

This is no longer just theory. The company has identified a monoclonal antibody (a lab-made protein that can target specific bacteria or viruses) that is already in a phase I trial for a spike protein in SARS-CoV-2, and has successfully dosed the first patient in a study of another monoclonal antibody for the treatment of mild-to-moderate asthma.

“This technology will change the way drugs are made,” Nally argues. “It will transcend the human condition in a number of different disease areas. What excites me the most is seeing the impact, from the theoretical to the real. We’ve just seen our early phase I results, and they’re extraordinary. This technology is going to give us a lot of answers for some of the worst conditions that face humanity.”

Much more is expected. For example, the company’s AI platform can generate molecules entirely through

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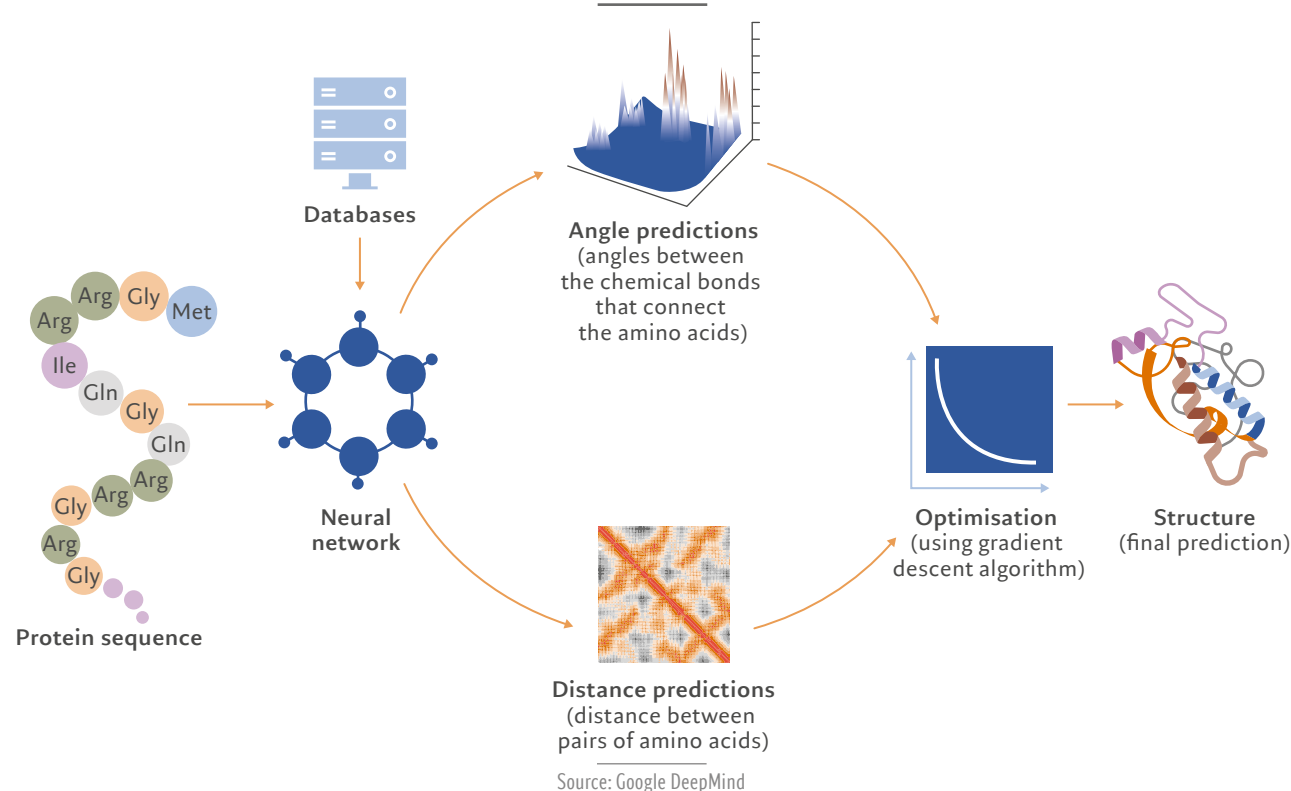
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Protein prediction

Using AI to predict properties of a protein from its genetic sequence



computing power without a template in order to hit historically hard-to-drug or undruggable targets – the biological structures in the body with which a drug interacts to produce an effect – with great accuracy. This process of producing and validating “de novo” antibodies has now been demonstrated across nine distinct targets.

CHROMA BROWSERS

A fascinating aspect of Generate’s research is that last year the company published full details of Chroma, its generative AI model, in *Nature*. It also released the code behind Chroma as open-source software. Nally admits it was a counterintuitive move for a life sciences business, where patents have long been cherished.

“One of the big challenges we were facing was how to become the destination of choice for unicorn talents,” he explains. “We thought the best way to do that was to show how we were embracing these cutting-edge techniques.” After publishing Generate’s Chroma manuscripts, Nally

recounts, the company had five machine learning internships available the next summer.

“We had 2,000 applicants for those spots. People could actually readily look and see that the capabilities and the people that we were attracting were among the best in the world. These are the people that they wanted to be close to in order to learn and grow from. We can’t win talent versus mega-cap tech companies if we’re in a dollar-for-dollar arms race. What we can do is provide people with a distinct sense of purpose. The fact that their work will not add to website clicks but will actually be around how you solve and cure cancer drives a certain type of scientist to a company like Generate.”

Attracting, embracing and training this next generation of scientists could propel research to even greater heights. “When I joined Generate, there were 90 people on the planet skilled at the intersection of protein engineering and machine learning,” remarks Nally. “We had historically trained people in these different silos. We’ve never broken through these

silos and said, ‘It’s actually the intersection of these disciplines where the magic happens.’”

This prospective combination of human intelligence and artificial intelligence is compelling, given the scale made possible by the latter. Nally observes that, when Generate launched, the biggest experiment they could undertake would involve around 100 data points on an individual target. “Now we routinely do datasets of a million defined variants to an individual target, and we can do them in about a quarter of the time it would normally take historically,” he states.

For all the optimism, it is of course far too soon even to think of curing all diseases as a phenomenon. “Whenever I hear people say, ‘We’re going to solve biology purely computationally,’ I kind of laugh at that concept,” Nally says. “We just don’t have the data to have the answers that we ultimately need.” But the rapid progress made so far warrants a little dreaming about what the future holds.

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The German biotech company, co-founded by a husband-and-wife team of scientists, developed the vaccine that became not only the first to earn

authorisation in the US for Covid-19 but also the first ever based on a new technology involving the genetic material mRNA.

*BioNTech,
Germany, 2021*

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Measuring the impact of anti-obesity drugs

The next wave of GLP-1 treatments will do more than just shrink waistlines

With an estimated one in eight Americans having taken weight loss drugs such as Ozempic in the past two years, their widespread use could bring considerable economic benefits and reshape the medical, food and leisure industries.

These are the findings of a survey of Pictet investment managers and analysts that oversee more than USD10.5 billion of assets across our health, biotech, consumer and nutrition equity portfolios.⁹

Assessing the pipeline of new anti-obesity drugs, our investment professionals find that the next generation of treatments can improve on the current crop in three main ways, potentially boosting the size of the addressable market.

To begin with, there's the promise of fewer – and less severe – side effects.

A drawback common to all the current GLP-1 medications is that users often experience long bouts of nausea, vomiting and gastrointestinal discomfort. While these side effects can dissipate over time, many patients end up not being able to tolerate the treatment at all.

This has prompted a group of pharmaceutical and biotech firms to focus on developing new anti-obesity drugs with an emphasis on increased tolerability.

Another potential improvement newer drugs could deliver is the type of weight loss patients experience. Many current anti-obesity medications cause both fat and muscle loss, which can lead to other health complications. In response, drug developers are now looking at treatments that

⁹ Contributing to this survey were the following Pictet Asset Management investment professionals: Flora Liu (client portfolio manager, Thematic Equities), Gillian Diesen (senior client portfolio manager, Thematic Equities), Mayssa Al Midani (senior investment manager, Nutrition), Alex Howson (senior investment manager, Nutrition), May Hammoud (investment manager, Nutrition), Marine Jacque-

moud (investment manager, Nutrition), Caroline Reyl (head of premium brands, Thematic Equities), Laurent Belloni (senior investment manager, Premium Brands), Aline Reichenbach (investment manager, Premium Brands), Marien-Baptiste Pouyat (senior investment manager, Human), Dominique Lachal (investment manager, Human), Pamela Saliba (investment manager, Hu-

man), Grégoire Biollaz (senior investment manager, Health), Moritz Dullinger (senior investment manager, Health), Tazio Storni (senior investment manager, Health and Biotech), Lydia Haueter (senior investment manager, Biotech), Marco Minonne (senior investment manager, Biotech), Eugénio Martin-Fougeroux (investment manager, Biotech)

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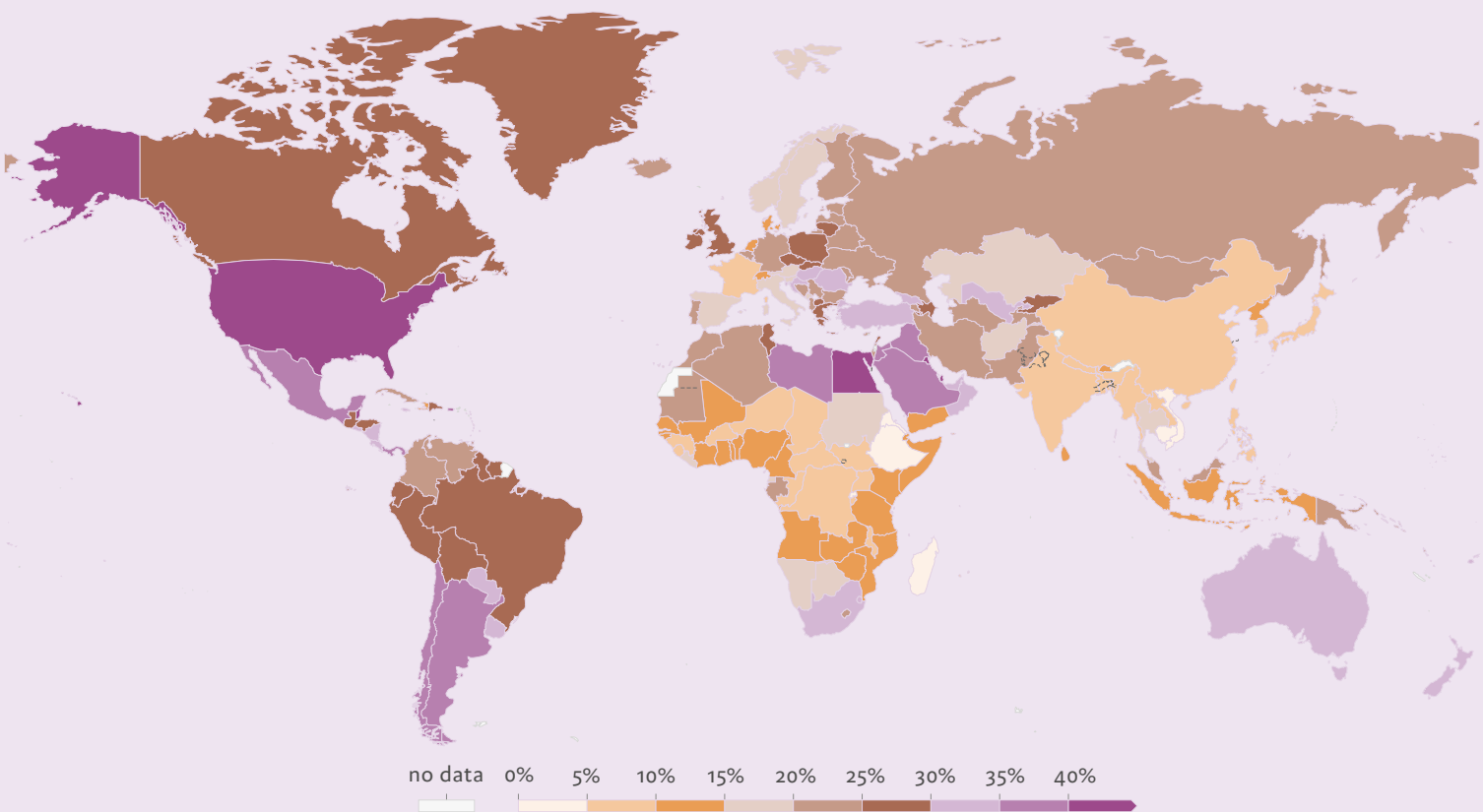
In London, a start-up company farms black soldier flies, feeding the larvae on local food waste. The insects are converted into protein to feed pets and farmed animals such as fish and livestock.

Insect farm, UK, 2019

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Weighty matters

Percentage of population classed as obese
(BMI above 30)



Source: WHO Global Health Observatory (2022)

1 in 4
adults

in the developed
world is obese.

Source: <https://ncdrisc.org/data-downloads-adiposity.html>

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can reduce weight without degrading muscle. And there are various ways to do this by adapting existing medications.

Lastly, the new crop of anti-obesity drugs could pave the way for more personalised weight loss treatments. One of the many difficulties in tackling obesity is that the condition is often accompanied by other medical problems, or comorbidities, such as hypertension, osteoarthritis or diabetes. In the future, we may see different combinations of treatments tailored to patients' specific comorbidities being made available.

By our reckoning, there are dozens of such hybrid products undergoing early stage clinical trials. All in all, these potential improvements suggest patients could see a permanent 25 per cent reduction in their weight. This translates into a bigger commercial opportunity. Better-performing treatments with fewer side effects could push the market for weight loss drugs to USD75 billion within three years and USD100 billion by 2030.

The broader economic implications would be significant too. One in four adults in the developed world is currently obese and if present trends continue, obesity could end up costing the global economy up to USD4 trillion in lost output every year, or 3 per cent of GDP by 2035.

Yet GLP-1 drugs' potential extends beyond treating obesity.

Research shows that patients using anti-obesity drugs suffer fewer cardiovascular problems such as strokes and heart attacks, even when weight reduction is not rapid or significant. The drugs have been found to have anti-inflammatory properties and also appear to have a positive effect on certain types of cancer, particularly those of the digestive system.

Another positive side effect reported by patients using GLP-1 agonists is reduced craving and addictive behaviour as these drugs, in addition to appetite control, have also been found to affect the brain circuits that regulate addiction.

What is more, there is growing evidence suggesting GLP-1 agonists can also treat Alzheimer's. Novo Nordisk, the maker of Ozempic, is soon expected to release data from phase III clinical studies of GLP-1 on cognitive decline.

For all this promise, though, it isn't clear yet whether GLP-1's apparent capacity to treat other serious illnesses will spell the end for many of the medical products and procedures we use today to treat heart conditions, cancer and brain diseases.

Indeed, the impact of anti-obesity drugs on the healthcare industry as a whole is difficult to assess as opposing effects may be at work.

For example, in orthopaedics there are anecdotal reports claiming that demand for specialist orthopaedic equipment is declining. As people lose weight, strain on their joints decreases and, at the margin, they need fewer knee replacements.

On the other hand, as severely obese people lose weight, they become better candidates for surgery, potentially increasing demand for knee replacements and the like. At the same time, if anti-obesity drugs end up increasing life expectancy by reducing the incidence of diabetes, kidney disease and coronary diseases, then people will probably need other medical interventions as they get older.

Insurers and state healthcare providers will have to weigh the high cost of GLP-1 drugs, and the fact that they need to be taken indefinitely – evidence suggests people revert to their old eating habits and weight once they stop taking the drug – against their undeniable benefits.

Easier to see, though, is how the success of anti-obesity drugs is being felt – albeit very gradually – among the food retailing and leisure industries.

Take food first.

Anti-obesity drugs work by suppressing a patient's appetite. So the more they become part of everyday life, the greater the likelihood of a slump in sales of certain foods and beverages. Calorie intake will, on average, drop for a large portion of the developed world's population.

Better-performing
treatments with fewer side
effects could push
the market for weight loss
drugs to USD75 billion
within three years
and USD100 billion by 2030.

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In our view, unhealthy products such as soft drinks, processed foods, alcohol and confectionary – all of which are major revenue generators for some of the world’s largest food retailers – are especially vulnerable to a drop-off in demand. While it is too early to draw definitive conclusions given the lack of hard data, we cannot rule out the possibility of a radical change in consumer attitudes towards – and consumption of – unhealthy food.

Traditional weight loss products and services will also be adversely affected. While some may be able to position themselves as complements to anti-obesity drugs, GLP-1’s represent an existential threat to businesses operating in this industry.

Conversely, some specialist businesses operating in the food supply chain could reap significant commercial rewards if anti-obesity treatments become widespread – particularly manufacturers of healthier foods.

There is growing evidence suggesting GLP-1 agonists can also treat Alzheimer’s.

Investment managers within Pictet Asset Management’s Nutrition strategy believe that firms that manufacture vitamins and dietary supplements will be among the major beneficiaries.

This is because even if a person’s calorie intake falls by some 20 per cent to 30 per cent – which is what tends to happen when users take anti-obesity medication – their fundamental nutritional requirements do not change.

In other words, as obese patients lose weight and reduce food consumption, dietary supplements, vitamins and functional foods – which are used by as many as one in three people in the rich world – can be expected to become a bigger part of their daily intake. Anecdotal evidence from food producers within our investment universe supports this thesis, while a recent survey of GLP-1 users showed that more than one third of respondents began taking food supplements such as probiotics and vitamins at the same time.

The leisure industry might also witness a GLP-1 growth boost. While the adoption of healthier lifestyles has been gathering momentum for some time, demand for products and services within the wellness economy could rise even faster as the clinically obese population shrinks. This includes segments such as sportswear and sports nutrition as well as wearable health and fitness devices.

25%
reduction

in weight possible by using new hybrid anti-obesity drugs.

Source: Pictet Asset Management estimate as at November 2024

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Situated in a lava field, the water for this open-air spa is a by-product from the nearby geothermal power plant where superheated wa-

ter is vented from the ground near a lava flow and used to run turbines that generate electricity.

Blue lagoon, Iceland, 2019

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Tracking the energy transition

Renewable energy presents investors with opportunity and complexity

ALEXANDRE TAVAZZI
Head of CIO Office
and Macro Research,
Pictet Wealth Management

It takes skills worthy of a Swiss watchmaker to fully comprehend all the moving parts involved in the energy transition.

Fossil fuel production is expected to peak by 2030, not least because of the rise of electric vehicles. This shift will drive a significant increase in electricity demand. And so will the boom in power-hungry artificial intelligence (AI), the rapid economic development of emerging countries and global population growth. Climate change concerns mean this demand for electricity must be met with renewable energy sources like solar and wind energy, possibly also nuclear power, and not with fossil fuels. This will also be accompanied by the vast expansion of power storage systems, particularly batteries, requiring major growth in metal and mineral extraction.

Tracking the economic implications of all these elements is perhaps one of the most important challenges investors will face over the next five to 10 years, and beyond.

BURYING FOSSIL FUELS

Peak demand for fossil fuel is in sight. Electric vehicles are already having an impact on oil consumption. Transport makes up 45 per cent of global oil demand, of which a large proportion is cars. Sales of petrol and diesel cars peaked in 2017, while sales of electric vehicles soared from 3 million in 2020 to 20 million in 2023 (see FIGURE 2). This trend is expected to continue as trucks become increasingly electrified, while more than half of global rail is already electrified, with the proportion rising.

Even demand for gas is slowing, with gas-fired boilers being increasingly replaced by heat pumps. However, cutting fossil fuel use enough to meet net zero commitments will be challenging, given that total energy consumption is dominated by industry (at 38 per cent), building consumption (at some 30 per cent) and transport (26 per cent).

Many industrial applications – particularly in iron and steel, chemicals, glass, and paper production – still rely on fossil fuels to achieve the very high temperatures they need to operate. This is a

GIGAWATTS
500

added to global
renewable electricity
generation in 2023.

Source: <https://www.iea.org/reports/renewables-2023/executive-summary>

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FIGURE 2
Electrifying
 Percentage of new cars
 sold that are electric



Source: International Energy Agency,
 Global Ev Outlook 2024; Our World in Data

major issue because emerging economies, as they develop, tend to require heavy industries which are the largest consumers of fossil fuels.

Meanwhile, coal remains a major fuel for industrial applications and power plants. And although it's a good sign that it is being relegated to back-up for spikes in electricity demand or when solar and wind power ebbs, it is still a major input for developing economies and, outside of China, is expected to remain so over the coming decades.

HEAVY METAL

The shift to electrification is unrelenting. More than 500 gigawatts (GW) are estimated to have been added to global renewable electricity generation in 2023 – one gigawatt is enough to power 700,000 homes or 100 million LED lightbulbs. Renewables now account for some 40 per cent of total electricity generation globally. This, together with consequent growth in demand for power storage, is driving rampant demand for key commodities necessary to build generators, motors, power linkages and batteries, among other applications.

The market for critical minerals used in the energy sector doubled in the five years to 2022 when it reached USD320 billion. Over that time, demand for lithium tripled, while demand for cobalt and nickel jumped 70 per cent and 40 per cent, respectively. To meet climate change targets, installed capacity of renewables needs to triple by 2030, according to the International Energy Agency (IEA). That, in turn, will drive more than a tripling of demand for key minerals.

OPPORTUNITIES (AND RISKS) AROUND

For investors, the drive towards renewables and electrification represents a major set of opportunities – and also risks. Critical mineral production and extraction will require major infusions of capital. But with the top three producer countries representing some 90 per cent of rare earths, lithium and platinum extraction (see FIGURE 3), 80 per cent of cobalt and 60 per cent of nickel, geographic concentration is a concern. These countries tend to be in the developing world – 70 per cent of platinum comes from South Africa, 70 per cent of cobalt from the Democratic Republic of Congo and 60 per cent of natural graphite from China. And inelasticity of supply sets the stage for significant price volatility, even under relatively minor swings of demand.

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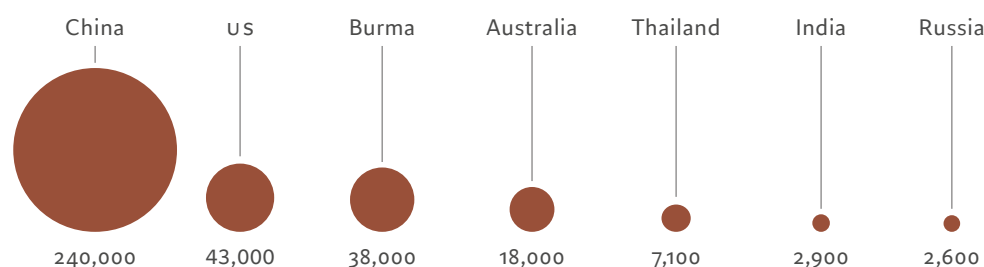
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FIGURE 3 Chinese rarities

Rare earths production
by country, 2023, tonnes



Source: USGS Mineral Commodity
Summaries 2024

On the other hand, the shift to renewables has the potential to accelerate the development of emerging markets. For one thing, these countries tend to be rich in sunlight, which would allow many to relinquish dependence on imported oil. For another, demand for their commodities has the potential to cut poverty and boost government coffers, as happened in Peru and Chile when real wages grew by 30 per cent and 45 per cent, respectively, between 2003 and 2008, spurring employment growth.

The road to renewables is a bumpy one and there is a significant risk that climate change targets will be missed. But progress could yet accelerate thanks to innovation as the articles that follow show. Ignacio Sánchez Galán, executive chair of the utility giant Iberdrola, outlines some of the key innovations power companies are introducing to push forward the energy transition in a conversation with Pictet Wealth Management's Chief Invest-

ment Officer César Pérez Ruiz. What's important is that in seeking moonshot solutions, we don't lose sight of the incremental changes that can become hugely important as they accumulate – as Pictet Asset Management's Investment Manager Katie Self argues. One of those could be the use of biofuels to make aviation cleaner. For details see our infographic on page 48.

But renewables are only one of a number of critical avenues into which capital needs to be allocated. Another is biodiversity. Climate change threatens widespread extinction, leading thus to wholesale changes to our environment. Here we offer a summary of the latest research by Pictet Asset Management's Investment Manager Viktoras Kulionis into biodiversity finance. More generally, a new report by Pictet Asset Management and the International Institute of Finance highlights the financing gap we face in achieving net zero.



ALEXANDRE TAVAZZI

Alexandre joined Pictet 1997 as a senior equity analyst covering the Japanese market and co-managing the bank's Japanese equity fund. Prior to joining Pictet, Alexandre worked at Wako Finance, Lehman Brothers and spent three years with Ferrier Lullin as a senior equity analyst and fund manager on the Japanese market. He holds a degree from the University of Lausanne.

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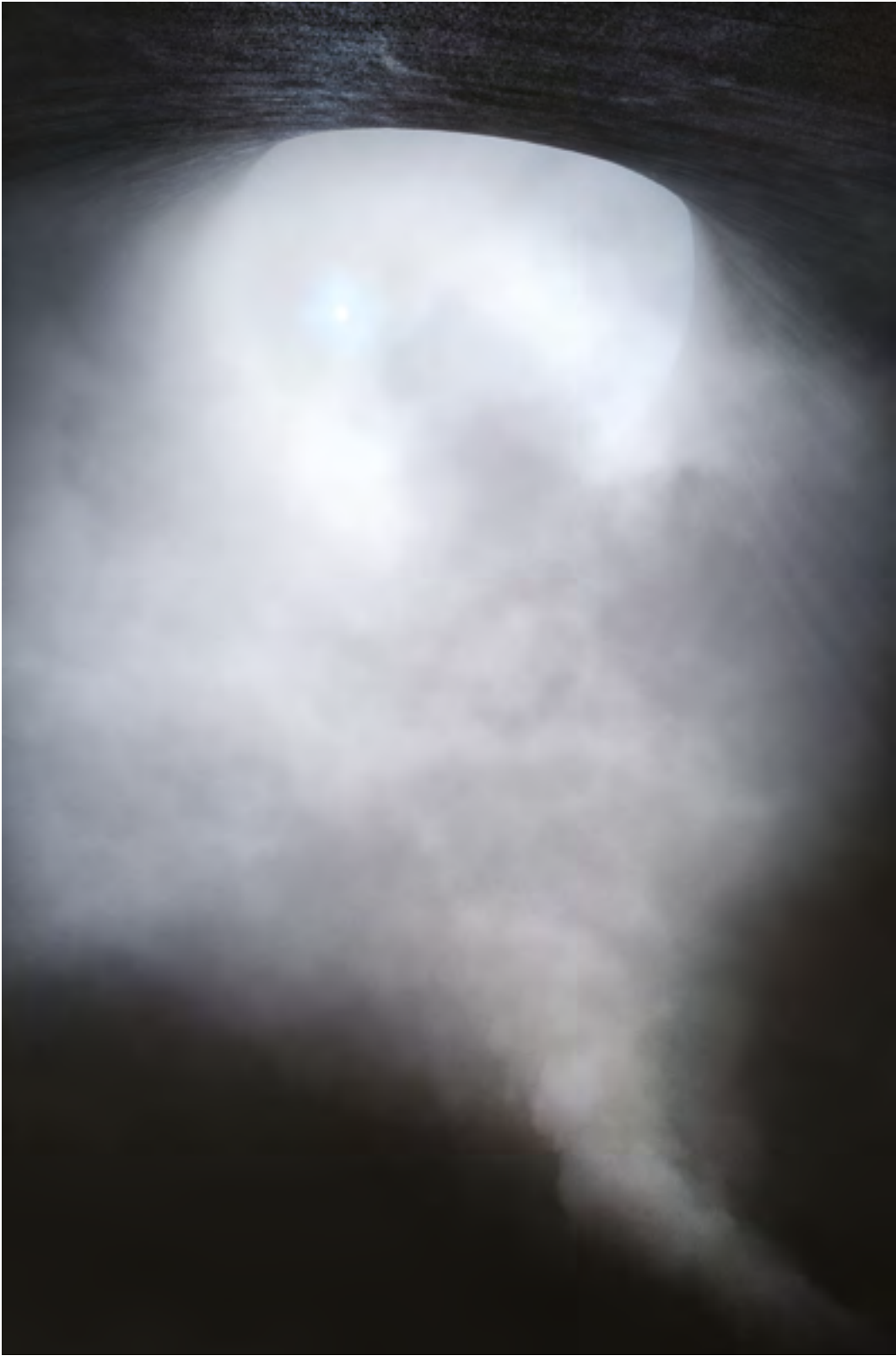
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In 1911, Larderello became home to the world's first geothermal power plant. By 1916, the plant was able to supply energy to the Larderello area and also to the city of Volterra. The photo shows the inside of one of the cooling towers.

Geothermal landscape, Italy, 2022

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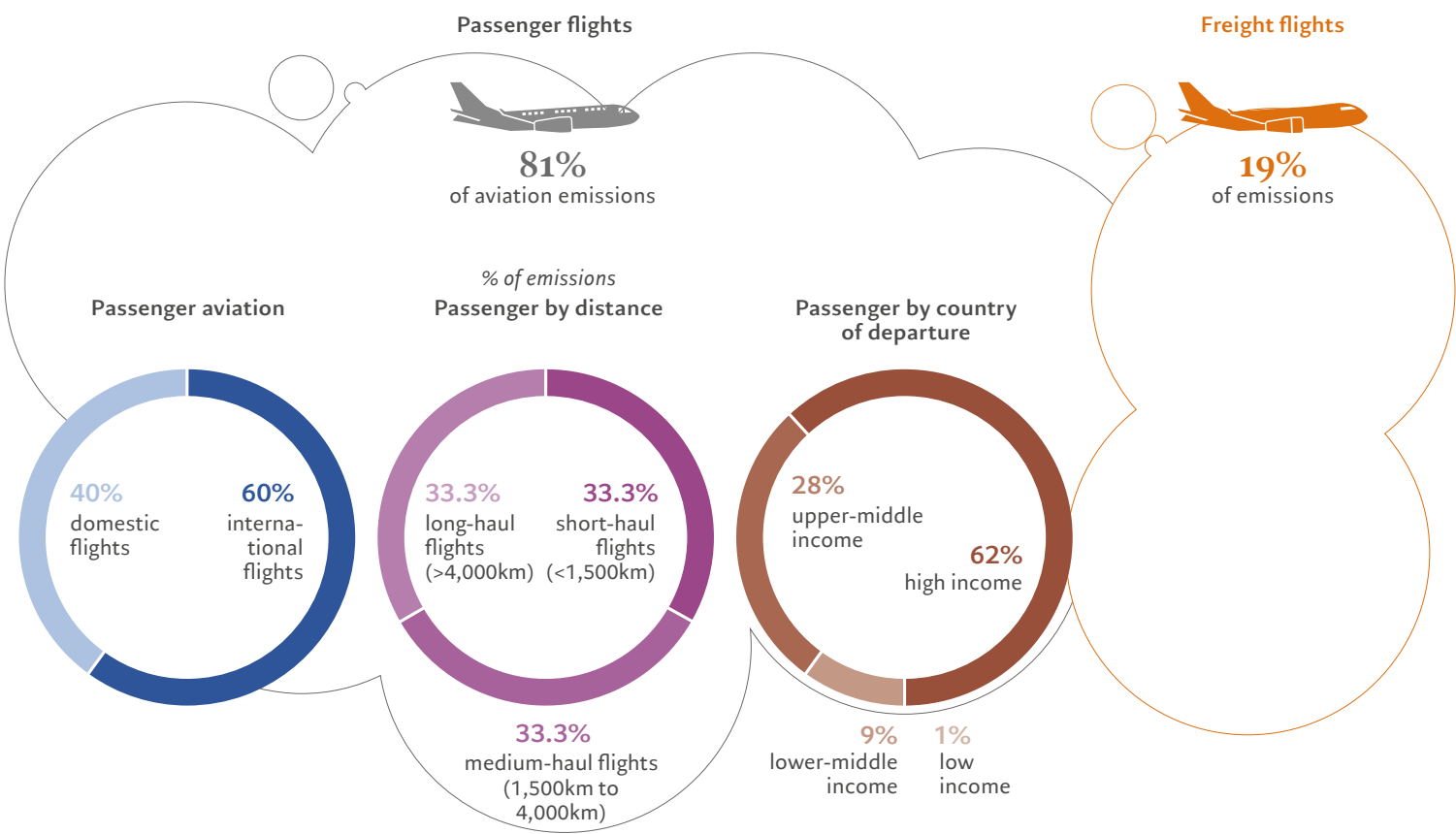
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Global CO₂ emissions from commercial aviation



Source: Our World in Data

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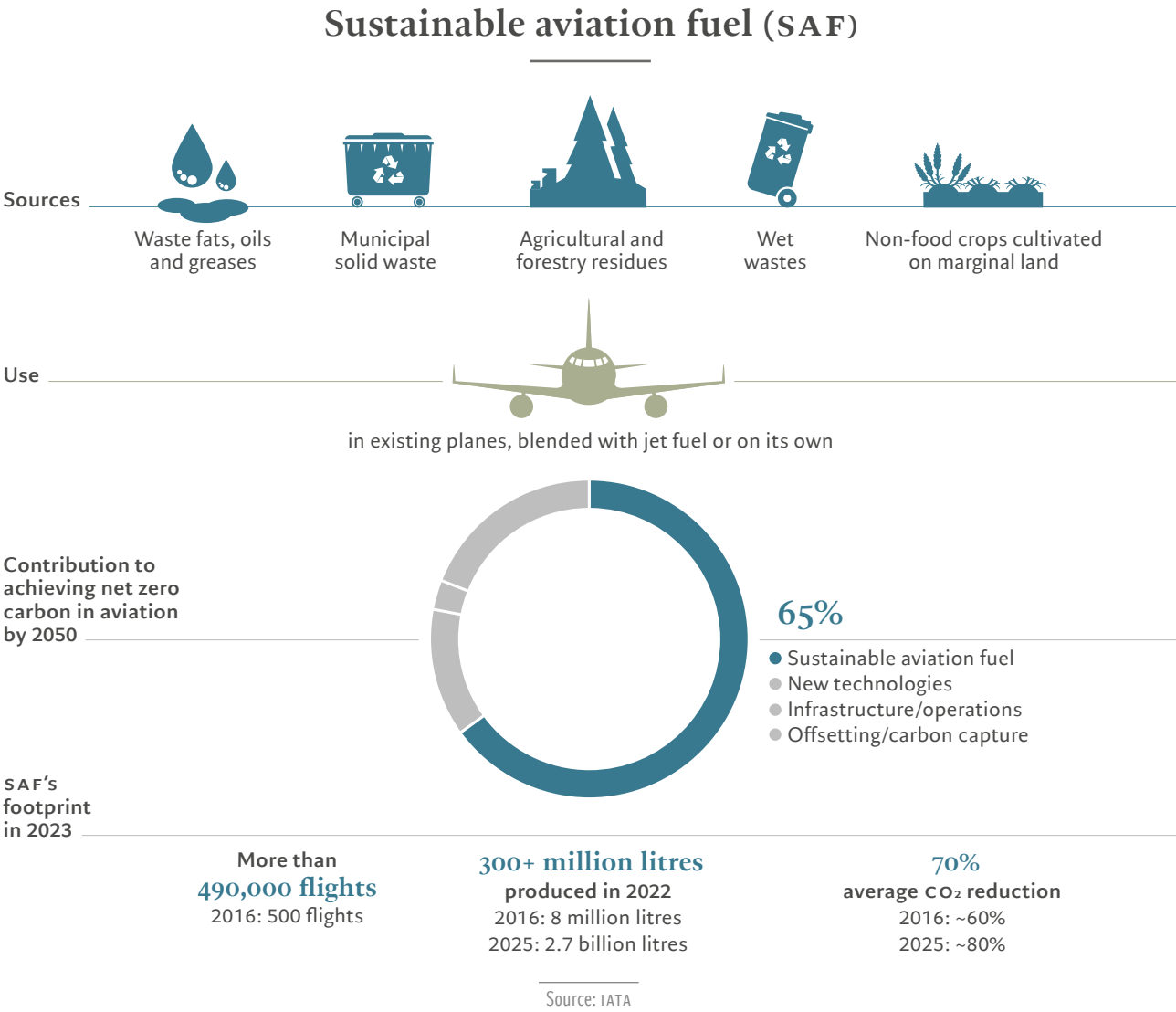
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Iberdrola's path to sustainable energy

Iberdrola's Ignacio Sánchez Galán explains how a utility giant is navigating the energy transition

IGNACIO SÁNCHEZ GALÁN
Executive Chair at Iberdrola

CÉSAR PÉREZ RUIZ
*Chief Investment Officer,
Pictet Wealth Management*

Pérez Ruiz: You started with a small Spanish utility 23 years ago that has since grown into the second largest in the world, with activities in the Americas, the UK and continental Europe. What was your vision and how did you drive this growth?

Galán: When I joined, we were a traditional company, traditional in the sense that we were generating electricity with coal, oil and gas.

The 1997 Kyoto Protocol on climate change had already been adopted a few years before, and we saw it not only as a social responsibility to protect the planet but also as an opportunity. Since then, we have closed 17 oil and coal power plants and invested more than USD160 billion in new power generation, networks and supply. We are now the world's largest producer of wind-generated electricity and have expanded our activities from Spain to France, Germany, Brazil, Mexico, the US, Australia and beyond.

We understood that providing electricity in a cleaner and more efficient manner was not only good for our customers but also good for our investors. Our company, which is 120 years old, has always generated hydroelectric power. Our sales benefited and we saw a seven-fold increase

in our business value. We are now the largest utility in Europe and the second largest in the world.

But generating electricity is not enough; we need to bring it to consumers with an ever more reliable and capable transmission and distribution grid. At the same time, we are using our hydropower capabilities to store power when other sources, like solar or wind energy, generate more electricity than needed. We reverse the process by pumping water up to a reservoir for periods of higher demand.

Pérez Ruiz: Consumers are benefiting from stable electricity prices. But there are both supply and demand risks. For instance, data centres account for 1.7 per cent of total demand, but that's projected to go up to 7 per cent. How do you see this demand developing? Is demand as a function of the size of the economy going to change significantly? Have consumer habits changed post-Covid-19?

Galán: When we talk about energy, most people think about electricity, but it only accounts for around 20 per cent of total energy consumption. This means we have a tremendous opportunity to electrify the economy. So, while economic growth is a driver of electricity demand, there's also this transformation.

We've largely generated heat by burning things, but that's no longer necessary. Heat from heat pumps is five times more efficient than boilers. When people realise this, it not only helps the planet, but also helps their pockets, which I think is very important. Additionally, new battery technologies also make storing electricity more convenient.

Providing electricity
in a cleaner and more efficient
manner was not only good
for our customers but also good
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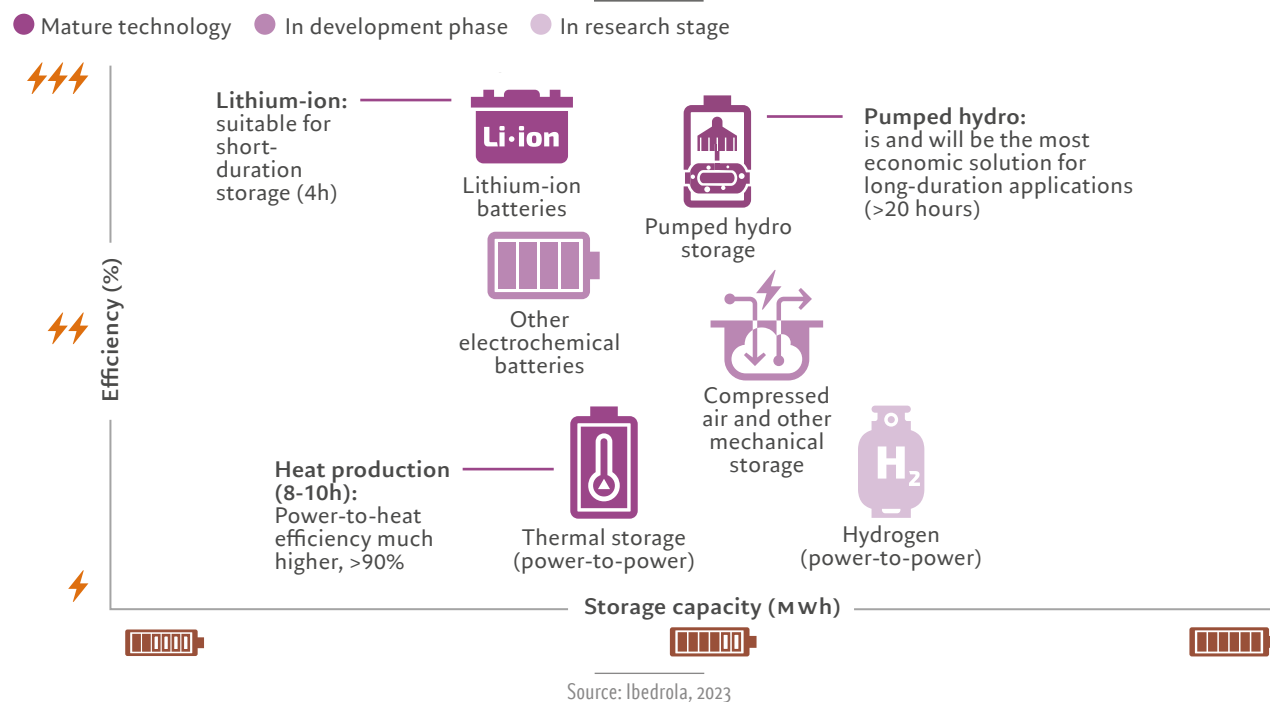
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Store it up

Energy storage technologies,
efficiency vs capacity



A few months ago, I spoke at a conference on digitalisation at Bilbao University. People there were much more knowledgeable about digitalisation than I was. I pointed out that the digital world is all very good, but without electricity, there is no digitalisation. And we need to provide this additional electricity in a sustainable manner.

Europe was hit by an energy crisis because of our reliance on Russian gas. Why not use our own resources instead? We have renewable sources like hydro, wind and solar energy.

Pérez Ruiz: Let's talk about the supply side. Does oil still have a role to play? Is nuclear energy part of the answer?

Galán: Oil and gas still have a role to play and will do so for a long time. The story is different with coal. Some argue that coal is cheaper because the power plants are fully depreciated, fully amortised. But when it comes to building a new power plant, it's more convenient, cheaper and more efficient to build renewable sources. The investment is lower and there are no variable costs. Maintenance costs are lower as well. This applies to offshore wind too. And all that will make coal obsolete.

As for nuclear power, we already operate nuclear reactors. The key consideration is whether to extend their lifespans. From a technical standpoint, there is no doubt that they can stay operational for longer. The question hinges on economic factors. If governments continue to impose taxes and charges on nuclear power, those reactors will have to be shut down.

The second aspect to consider is the substantial investment per megawatt in nuclear power, which is three times higher than the amount required for the most expensive renewable source, namely offshore wind. In the UK, new reactors cost more than double their planned capital expenditure. As such, I would not recommend this for private investors unless governments can ensure adequate pricing mechanisms to allow for a proper return.

Pérez Ruiz: I have an investment question. Europe wants to be energy independent, so they are putting a lot of capacity in place. And we're starting to see some countries with negative electricity prices. What do you think about the industry over-investing and possibly not getting the required returns for investors?

Galán: Negative electricity prices occur at certain hours of the day due to an excess of non-manageable renewable production, mainly from solar energy. But this excess energy can be stored and allocated to other time periods. We saw this potential and started making our hydroelectric power plants reversible 23 years ago. This means when prices are very low, we use the electricity to pump water. Right now, we have more than 100 million kilowatt hours in pumping installed capacity, equivalent to more than two million domestic batteries. When prices are cheap, we pump; when they are expensive, we send the water back to the generators.

We have incorporated this process into our financial models and focused our investments in assets and geographies that will not be adversely affected by this trend or may even benefit from storage solutions.

Pérez Ruiz: How do you handle regulatory changes when the rules of the game change in so many countries?

Galán: Let me provide an example. We recently presented our plans for the next three years, which include a total investment in the range of USD45 billion by 2026, with 60 per cent allocated to regulated power networks.

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We are focusing on countries where we already have regulatory agreements on what investment is needed, and what the return will be, so the risk is minimal. If you look at the regulatory frameworks being approved in the US, the UK and Europe, you can see that regulators recognise the huge need for additional investment.

For instance, we have been in the US for the last 20 to 25 years, with 80 per cent of our business there in regulated electricity networks. We provide electricity to the citizens of New York, Connecticut, Massachusetts and Maine. These investments are made based on 3- to 5-year tariff frameworks, depending on the respective state, so they are not even affected by the federal government.

Additionally, 30 per cent of the total investment will be allocated to renewables and we will also not be relying on spot prices because we sell our energy to customers through long-term power purchase agreements (PPAs) or regulated contracts such as contracts for difference (CFDs). This allows us to avoid unexpected surprises, our business is not centred around price volatility.

For instance, in the US, our customers range from Google and Amazon to Nike. There is already huge demand to power their data centres, so the risks are minimal.

When we talk about energy, most people think about electricity, but it only accounts for around 20 per cent of total energy consumption. This means we have a tremendous opportunity to electrify the economy.

We also benefit from geographical diversification. If a country were to change its rules, we have the flexibility to invest elsewhere. We have a truly international footprint.

Our investment allocation depends on regulation and investment needs, driven mainly by demand. It is not just the push for decarbonisation; countries also want to diminish external dependencies and increase the competitiveness of their energy sources. In Europe, this means more indigenous renewable electricity. Most large consumers in most countries are already learning the lesson of what can happen if you are dependent on other parties. Since the last energy crisis, the number of large corporations knocking on our door to sign long-term contracts has boomed.

Pérez Ruiz: What are the biggest risks you face? Is it that storage technology is not advanced enough?

Galán: When we make investment decisions for our projects, we approach them pragmatically. Revenues are generally secured through multi-year

contracts. We also prioritise the security of our supply chains. We have long-term agreements with our vendors, and we are financially secure – 80 per cent of our debt is fixed, with most of it having long-term maturities. We also issue debt in the same currency in which we receive our revenues, which further reduces financial risks.

All in all, our growth plans are well secured. We are in the right sector, at the right time, with booming demand prospects due to electrification. And we command a leading market position.



CÉSAR PÉREZ RUIZ

César Pérez Ruiz joined Pictet in March 2016 and has more than 25 years' experience running investment strategies in both wealth and asset management, with a strong bottom-up equity portfolio management track record and substantial multi-asset class investment strategy expertise. He most recently served as the global head of investment strategy at J.P. Morgan Private Bank.

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New research by Pictet with the Institute of International Finance highlights the stark gap between actual investment and what's needed to reach net zero

At first glance, the world appears to have made solid progress towards building the green economy it urgently needs. In 2023 capital investment in clean energy hit a record USD2 trillion, double the amount allocated to fossil fuels, with the number of listed companies with net zero targets almost trebling since 2020.

Scratch the surface, however, and those achievements look far more modest.

New research by Pictet Asset Management and the Institute of International Finance shows there are significant gaps between the financial and commercial commitments contained within net zero pledges and what investors and big business are currently delivering.

Specifically, we have identified the following key findings:

- To reach net zero by the middle of this century, the ratio of low-carbon to fossil fuel energy investment must rise from 2:1 to approximately 7:1 by 2050. This means that climate investment will need to increase by as much as USD8 trillion annually through to the end of this decade.
- The funding shortfalls are substantial across every major sector (see FIGURE 4). If green investment remains at current levels, the energy industry alone will face an annual funding shortfall of some USD2.5 trillion by 2030.
- The transport, construction, heavy industry and agriculture sectors will each have USD1 trillion less capital per year than they need to become carbon neutral.

- The funding problem is more acute in the emerging economies. Our estimates show that India will need to invest up to 10 times more in clean energy than in fossil fuels to reach net zero; for China and Brazil, the ratio needs to rise to 7:1 and 5:1, respectively.
- Less visible but no less important is the failure by big business to act decisively on its net zero pledges. While a growing number of companies are adopting ambitious net zero goals, over half of the world's listed firms continue to operate in a business-as-usual mode. The implied temperature rise (ITR)¹⁰ of their day-to-day activities exceeds the 2°C safety threshold.
- This misalignment is particularly pronounced in countries where publicly listed firms are heavily involved in carbon-intensive activities, such as South Africa, Canada, India and Brazil (see FIGURE 5). Consequently, the longer these changes are deferred, the greater the risk of encountering costly errors, particularly for companies with already stretched financial resources.

This is a summary of one section of the report "Climate crunch: a closer look at the transition risks of net zero." To read the full report, visit <https://am.pictet.com/ch/en/institutions/investment-research/clean-energy-supply-chain>

¹⁰ The implied temperature rise (ITR); ITR is a forward-looking metric, expressed in degrees Celsius, designed to show the temperature alignment of companies, portfolios and funds with global temperature.

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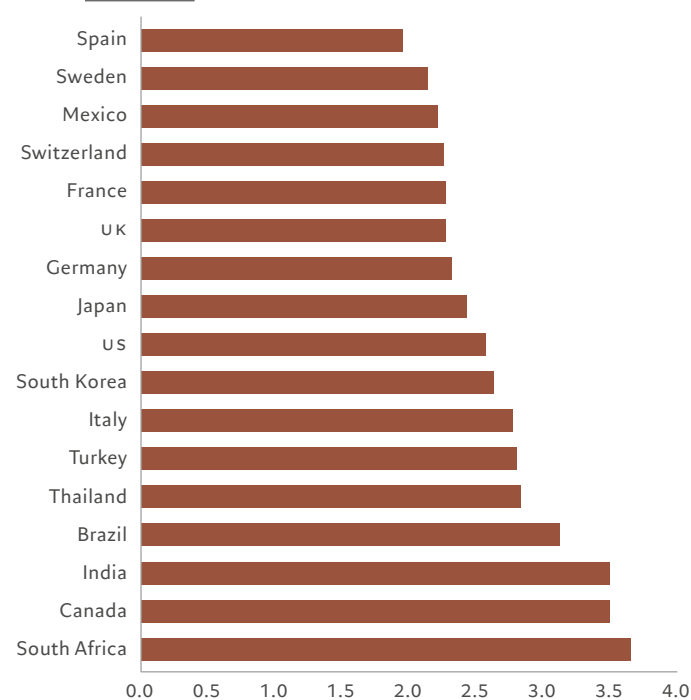
FIGURE 4
Mind the investment gap
Annual net zero funding shortfall, in USD tn,
by sector, through to 2030



Source: Climate Policy Initiative, IIF,
forecast period 31.12.2023-31.12.2030

FIGURE 5
**Companies still some distance
away from net zero**

Listed companies'* impact on global warming,
by country, expressed as implied average temperature
rise attributable to corporate activities



Source: IIF, Bloomberg, MSCI;
*excludes financial and Chinese companies;
data as at 31.12.2023

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The injection site where CO₂ is naturally and permanently turned into stone. Here, these natural processes are imitated and acceler-

ated: carbon dioxide is dissolved in water and interacts with reactive rock formations, such as basalts, to form a safe carbon reservoir.

Carbon capture machine, Iceland, 2022

Solving climate change demands more than moonshots

Improvements to existing technologies are just as important in the fight against climate change

KATIE SELF
Investment Manager,
Thematic Equities,
Pictet Asset Management

To a growing number of economists and scientists, the battle against climate change hinges on the adoption of ambitious, mission-oriented thinking by the world's governments.

In the book *Mission Economy*, an account that draws inspiration from the 1969 Apollo moon landings, economics professor Mariana Mazzucato argues that the state, rather than big business, should bear the risks in the development of vital green technology.

Governments, she says, need to embrace a “whatever it takes” approach to tackling problems like global warming, taking the risks that corporations can't.

It is difficult to argue against such logic. Policymakers have a major role to play in steering the world towards a more sustainable energy mix. Public investment, regulation and taxation can each help speed up the development and adoption of clean technology worldwide.

That said, it would be wrong to suggest that grand, top-down projects are the only answer.

When governments try to impose green technology on industries, their efforts aren't always successful. Tech that is shoe-horned into sectors where it doesn't quite fit brings its own problems, particularly when the subsidies disappear.

In our experience, a better approach is to harness relatively simple solutions that use existing technologies. Many of these can go a long way in reducing pollution, waste and energy use.

Take energy efficiency technology.

Often quick and simple to deploy, devices such as smart electric motors for heavy industry or energy efficient domestic household appliances can provide major environmental benefits.

That is particularly true for manufacturing, which has a huge carbon footprint. Heavy industry accounts for some 50 per cent of global energy consumption and about 20 per cent of greenhouse gas emissions. Yet many of these emissions could drop by a quarter from their current levels simply by making better use of energy efficient technologies that are already commercially available. Advanced commercial heat exchangers are one such solution. It is estimated that the poor maintenance and low replacement rate of devices used for industrial cooling, refrigeration and heating are responsible for 2.5 per cent of all carbon emissions. By replacing existing exchangers with the latest technology, businesses can reduce energy use by as much as 25 per cent.¹¹

Currently, over half of the Fortune 100 companies are saving approximately USD1.1 billion annually through initiatives focused on energy efficiency,

USD
18 trillion

potential boost to global economy from investment in energy efficiency by 2035.

Source: https://newclimateeconomy.net/sites/default/files/2023-11/NCE-2015_Exec_summary_web_11.pdf

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¹¹ 2023 the_case_for_industrial_energy_efficiency_3.870f90b2406d.pdf



The first high-altitude floating solar park on Lac des Toules, an artificial lake which was built to produce energy. The installation consists of 2,240m² of solar panels and covers 2 per cent

of the lake's surface area. The solar panels are double-sided and transparent; light passes through them, so they capture light reflections on both water and snow.

Lac des Toules, Switzerland, 2022

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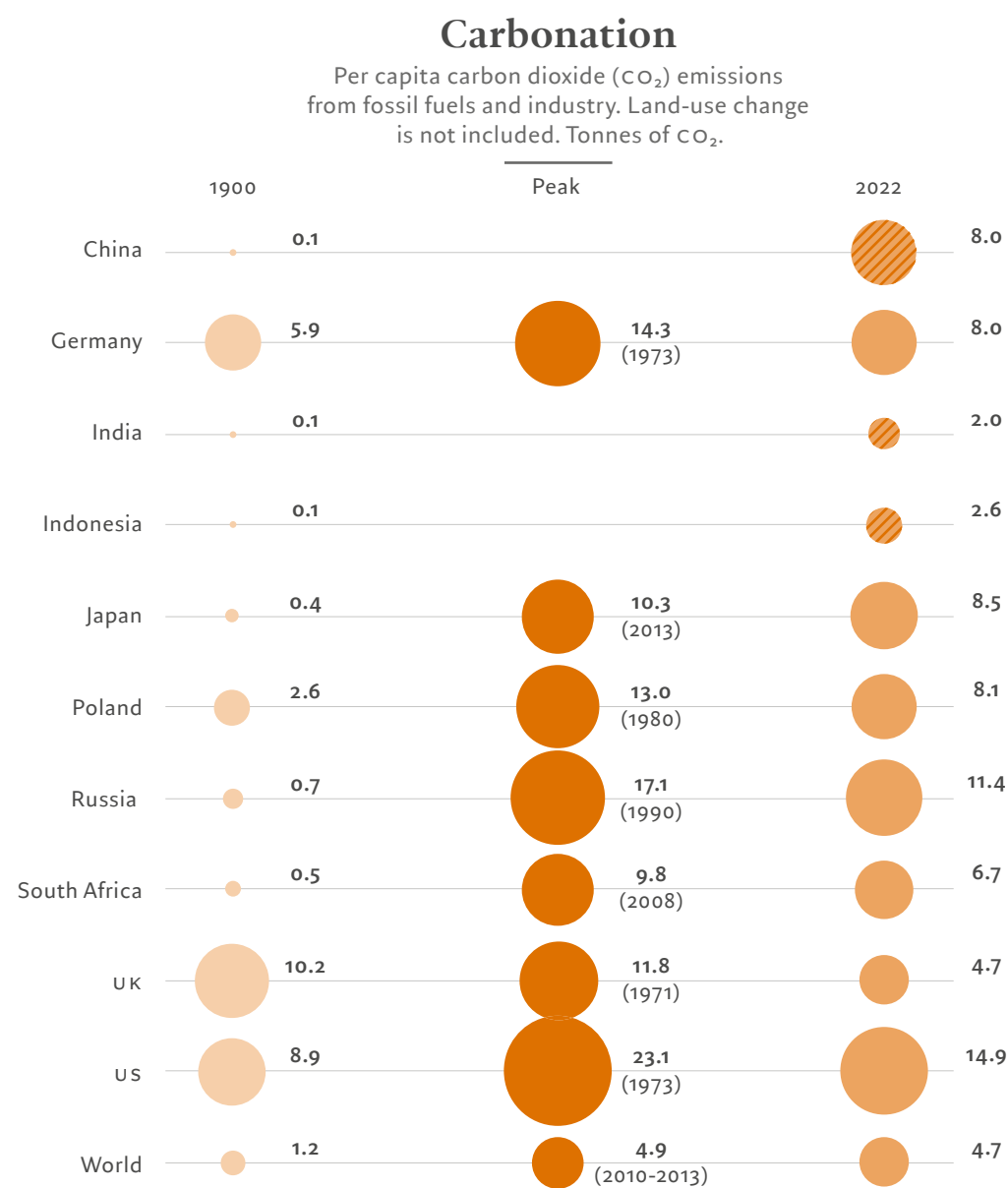
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Source: Our World in Data

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renewable energy and reducing emissions.¹² By investing in energy efficiency, there is a potential to increase global cumulative economic output by USD18 trillion by 2035.

Pollution control technology offers another cost-effective way of containing environmental damage. Studies have shown that pollution mitigation and prevention can yield large net gains for the economy.

Investing to improve air quality could prove especially cost-effective. The fine particulate matter that pollutes the air we breathe caused 6.4 million premature deaths worldwide in 2019 and resulted in 93 billion lost working days due to illness according to data from the Global Burden of Disease (GBD) study. The World Bank estimates that the health problems caused by air pollution amount to a staggering USD8.1 trillion globally, which is equivalent to 6.1 per cent of global GDP. The US has seen an estimated USD30 in economic benefits for every dollar invested in air pollution control since 1970.

Smart city infrastructure can also bring major environmental and economic benefits. Installing smart meters to lower the consumption of water and electricity – tech that is already readily available – can cut household and commercial utility bills and improve resource management across urban centres worldwide.

Barcelona, for example, achieved a 25 per cent reduction in water usage by incorporating smart

technologies into its extensive (and often outdated) water systems.

More efficient farming techniques, many of which are easily deployable, offer another affordable way to reduce carbon emissions. Efficient irrigation systems and satellite crop monitoring systems have reduced the use of fossil fuels across the farming industry by approximately 6 per cent, the equivalent of 18,000 long-haul flights. And if such technologies are used more widely, fossil fuel use could fall by a further 16 per cent.¹³

Used to power satellites in the 1950s, solar energy is an old technology that is rapidly becoming the most cost-effective source of electricity generation. Utility-scale solar photovoltaic (PV) power generation is now the least expensive option in many countries. According to the IEA, solar energy is on course to become the dominant source of global electricity generation and could account for 13 per cent of supply by 2028.¹⁴

None of this is to downplay the importance of national governments in the transition to a more sustainable economy. Given the risks involved and the funding required, the state will have a pivotal role to play. Yet, the world doesn't have to rely exclusively on grand plans to engineer a transformation. Sometimes, change can come through the scaling up of existing technologies.



KATIE SELF

Katie joined Pictet Asset Management in 2022, having previously spent several years working as an equity analyst for Morgan Stanley, where she specialised in renewable energy, rail energy efficiency, warehousing and semiconductors. She also spent a year as an R&D scientist with SDC Materials and holds a PhD in Chemistry and an MChem in Materials Chemistry, both from the University of St Andrews.

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14 <https://www.iea.org/reports/renewables-2023/executive-summary>



Singapore’s commitment to a green vision dates back to its independence in 1965 and includes the creation of national and community parks and initiatives for tree planting. Singapore serves as a model for Asia and the world on how to create business through sustainability, inside a metropolis.

Gardens by the bay, Singapore, 2010

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Costing biodiversity loss

Pictet Asset Management's thematic team designs a new model to measure the corporate sector's biodiversity impacts

VIKTORAS KULIONIS

Senior Environmental Economist
and Investment Manager,
Thematic Equities,
Pictet Asset Management

It would be easy to look at a new, cutting-edge automobile assembly line in a country with strict green credentials – built on a brownfield site, its water recycled, its roof covered in solar cells, and much of the work done by energy-efficient robots – and assume it has a minimal impact on biodiversity.

What this misses, however, is that many, if not most, of the components that go into making state-of-the-art cars are sourced from other countries, often in the emerging world and potentially under lower environmental standards. And those components are made of other subcomponents. Furthermore, raw materials essential to making those components are mined or extracted on an industrial scale.

Factor in these secondary effects and the environmental impact of car manufacturing becomes much more significant, albeit far from where the car is “built.” So, for example, Asia represents just 6 per cent of the equity universe, but the impact in the region is the highest in the world after the US due to fragmented global manufacturing processes.¹⁵

In order to fully understand the environmental impact of any company, wherever it may be based, whatever industry sector and subsector it operates in – whether it produces goods or services – it is essential to track the full length of its supply chains. That holds true for providers of educational materials just as it does for automobile manufacturers, because even firms with minimal direct environmental impacts will have secondary indirect impacts through their networks of inputs.

Global supply chains and the complexity of even the most basic economic activity make it exceedingly difficult to draw out all of the effects of any particular good or service. But we've been able to build an in-depth model that lets us track exactly that.

The model also allows us to analyse not only the impact of corporate activity on biodiversity but also their dependencies on ecosystem services. This

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¹⁵ MSCI All-Country World Index

represents a two-fold relationship between biodiversity and the financial sector, a concept known as “double materiality”.

Double materiality offers a risk profile for individual companies. While high materiality does not automatically suggest avoiding such companies, it is important to identify and address it. This is because this information can point the way to where companies ought to shift their production or, alternatively, where they should focus their greatest efforts on improving their processes.

UNDERSTANDING BOUNDARIES

The Planetary Boundaries model, a globally recognised sustainability framework originally developed in 2009, shows the current pace of biodiversity loss markedly exceeds what is considered sustainable.¹⁶ The latest update to the framework shows that over 10 per cent of genetic diversity – which dictates species’ ability to adapt to new environmental conditions – may have been lost over the past 150 years for both plants and animals.¹⁷

In response to a rapidly developing policy and regulatory scene to combat this crisis, the business world is beginning to treat biodiversity loss as a material financial risk and developing a range of new approaches, tools and datasets to better understand their impact on biodiversity and dependencies on ecosystem services.¹⁸

Measuring biodiversity loss, however, presents inherent challenges. Biodiversity systems are fiendishly complex; frameworks to assess and monitor risks stemming from nature degradation – all of which have the potential to affect investment returns – are still in development.

OUR MODEL IN BRIEF

Our method focuses on two key aspects: biodiversity impacts and ecosystem service dependencies.

It is built by integrating the latest databases and insights from diverse fields such as ecology, economics, engineering and finance. In order to analyse the impact of listed equities, the model considers over 400 million data points. We then calculate how far biodiversity richness has declined as a result of human pressures, such as land use, water and various emissions, using an indicator called Potentially Disappeared Fraction of species (PDF). This metric measures the fraction of species richness that may be potentially lost due to an environmental pressure.¹⁹ This allows us to understand the pressures generated all the way down to a company’s suppliers and customers.

COMPANY LEVEL ASSESSMENT

As part of a case study, we assessed the biodiversity impact of the MSCI All-Country World Stock Index which has about 3,000 large and mid-sized companies, from 23 developed and 24 emerging countries (see FIGURE 6).

The land use category accounts for the largest percentage of the overall impact. Water stress is the second most significant, highlighting growing issues of limited water availability and its effects on nearby ecosystems and their biodiversity. Climate change ranks as the third most important impact category, contributing approximately 10 per cent to the index’s overall impact.

Analysing the geographic distribution, the Americas emerge as the primary contributor. Asia is the next biggest, despite its low representation in the index’s country weighting. This could be due to either less efficient resource use in the region or the presence of more diverse and vulnerable ecosystems, but also due to the supply of the products in the primary sector to companies in other regions. Europe shows the least impact.

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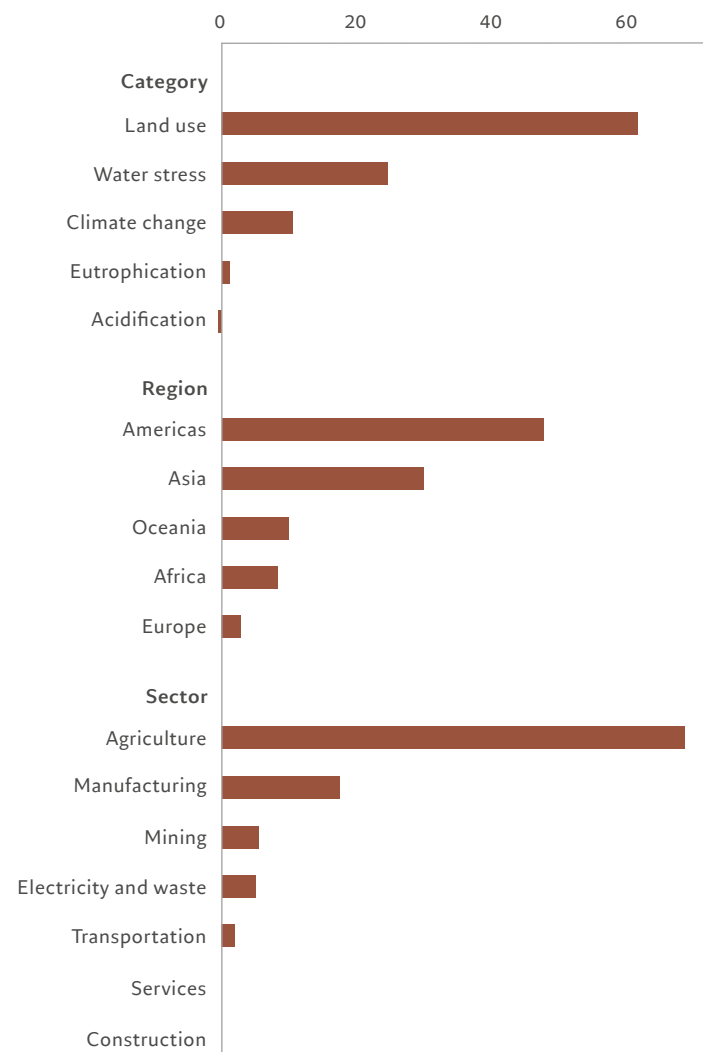
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16 Richardson et al., <https://doi.org/10.1126/sciadv.adh2458>
17 <https://am.pictet/en/globalwebsite/global-articles/2020/expertise/thematic-equities/planetary-boundaries-and-environmental-footprint-of-businesses>
18 <https://am.pictet/en/us/global-articles/2023/expertise/esg/corporate-impact-on-biodiversity>
19 https://lc-impact.eu/ecosystem_quality.html

FIGURE 6
Makes an impact
Aggregate impacts for the index by impact category, region and sector, % of total impact on each by sector



Source: Kulionis V., et al., “Biodiversity impact assessment for finance”, Journal of Industrial Ecology, 13.08.2024

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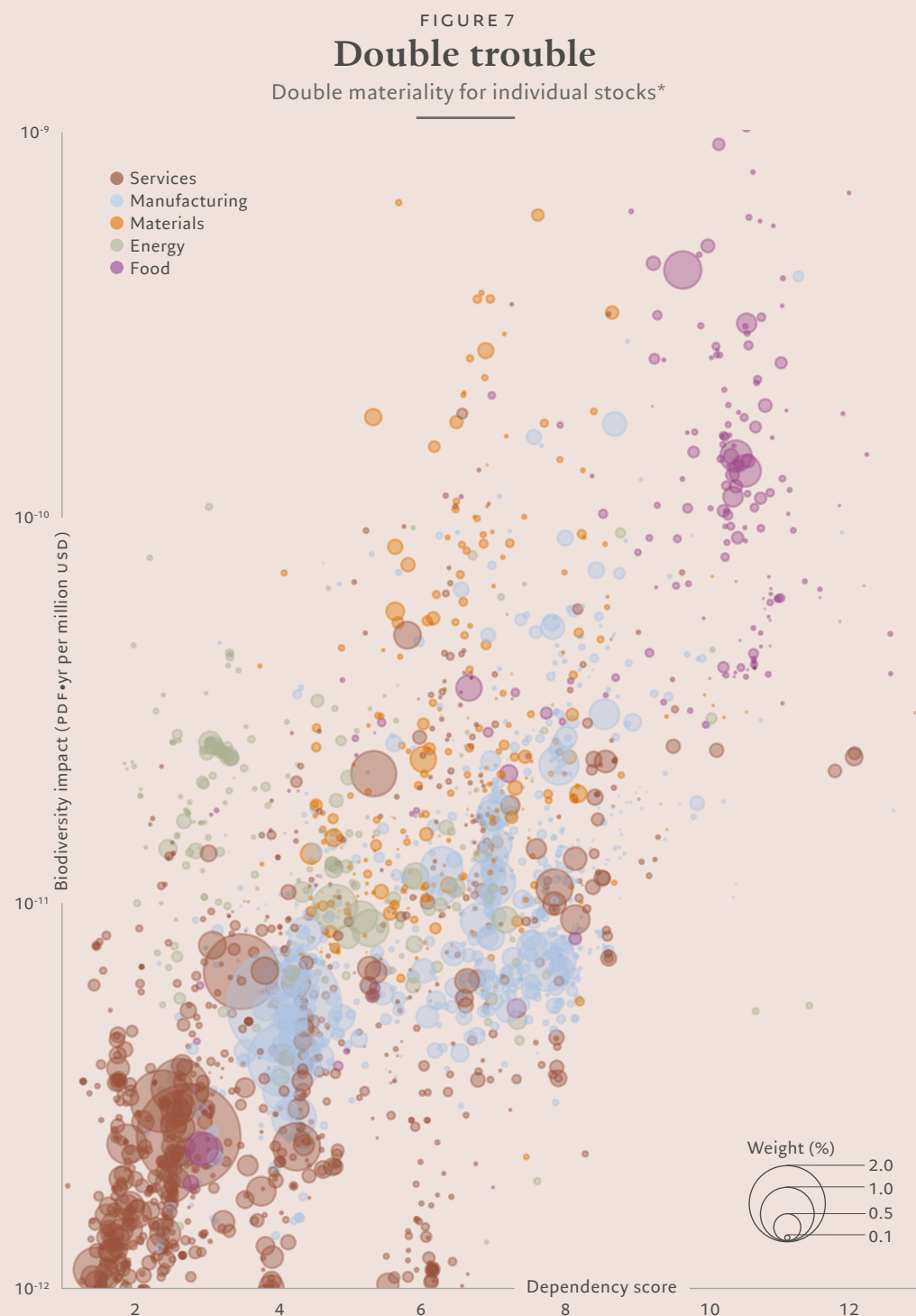
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*Potentially disappeared fraction of species per year per million dollars of revenue, by company. Industry sectors indicated by colour; company weight in index represented by size of circle. Dependency score indicates relative dependency on nature and natural inputs, high score = greater dependence. Source: Kulionis V. et al., "Biodiversity impact assessment for finance", Journal of Industrial Ecology, 13.08.2024

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Among industries, agriculture stands out as the biggest contributor. This is because farming uses a lot of land, water and fertilisers that can harm the environment. Manufacturing comes next, due to resource-intensive processes, and pollution, associated with manufacturing activities. In relation to the index, food, beverage and tobacco, and materials account for the largest contribution to the overall index impact.

DOUBLE MATERIALITY

The concept of double materiality helps us adopt a comprehensive risk management approach. We consider not only the exposure of companies we invest in to biodiversity-related financial risks but also their role in contributing to these risks.

Take agriculture. As ecosystems degrade, the population of insects that are crucial for pollination may decline and crop yields may fall. This could impact the bottom line of agricultural firms that rely on these ecosystem services. Financial institutions, which finance these companies, are thus exposed to these risks.

If the current trajectory of ecosystem degradation persists, the operational and financial stability of many businesses could come under pressure, potentially posing significant challenges to the broader financial sector.

The top right of FIGURE 7 represents companies with strong double materiality – high impact and high dependency. Sectors in this quadrant significantly impact the environment while being heavily dependent on it. This poses a risk, as further damage to the environment could adversely affect their operations and thus is an incentive to mitigate the impacts. What's more, companies neglecting these impacts risk financial setbacks, making it a crucial concern for investors.

KNOW YOUR CHAIN

At Pictet Asset Management, we use this model to identify investment opportunities, inform engagement activities and monitor the performance of portfolios.

Our results emphasise the need to account for the increasingly fragmented production process of goods and services in today's global economy. These complex global supply chain linkages mean products sold in one country may have significant biodiversity impacts elsewhere due to the sourcing of production inputs. While knowing the location of a company's operations is important, understanding their supply chain linkages is arguably even more crucial. This is important because most of the companies in the investable universe are operating in secondary and tertiary sectors.

This is a non-technical summary of an academic paper titled "Biodiversity impact assessment for finance" published in the Journal of Industrial Ecology. To read the original, visit: <https://onlinelibrary.wiley.com/doi/10.1111/jiec.13515>



VIKTORAS KULIONIS

Viktoras joined Pictet Asset Management in 2022, having previously worked as a post-doctoral researcher at ETH Zürich's Ecological Systems Design group, where he developed methods and metrics to assess the environmental performance of countries, cities and industries. He also has provided scientific input for organisations such as the UN Environmental Programme.

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Revolutionary innovations in computing hardware and software make AI possible

PETER LINGEN

Senior Investment Manager,
Equities, Equity Partner,
Pictet Asset Management

The pace of technological innovation over the past year or two has been remarkable, particularly in chip design and manufacturing, not to mention the software solutions they enable. The building blocks are now in place to ensure that this transformative process continues for decades to come.

One of the key innovations has been the flowering of artificial intelligence and machine learning. These technologies have the potential to accelerate the development of new products and solutions, driving efficiency gains across the whole economy. Of course, the advances in AI are fundamentally tied to developments in related technologies such as cutting-edge semiconductor design and increasingly sophisticated chip manufacturing equipment. Continued advances in hardware and software will propel AI further: we are only at the beginning of the AI revolution.

While AI has dominated the conversation, other significant, albeit more incremental, changes are occurring across the technology landscape.

For instance, improved AI algorithms, including deep learning and generative AI (Gen AI), will enhance a robot's decision-making, adaptability and ability to interact with people. Enhanced sensors and computing power will enable robots to navigate complex environments autonomously and perform intricate tasks with greater precision. Digital twins – digital models of real world products or systems – will improve predictive maintenance and workflows across industry.

This all has the potential to revolutionise robotics. Robots will play an increasingly significant role not only in manufacturing, where they've been a staple

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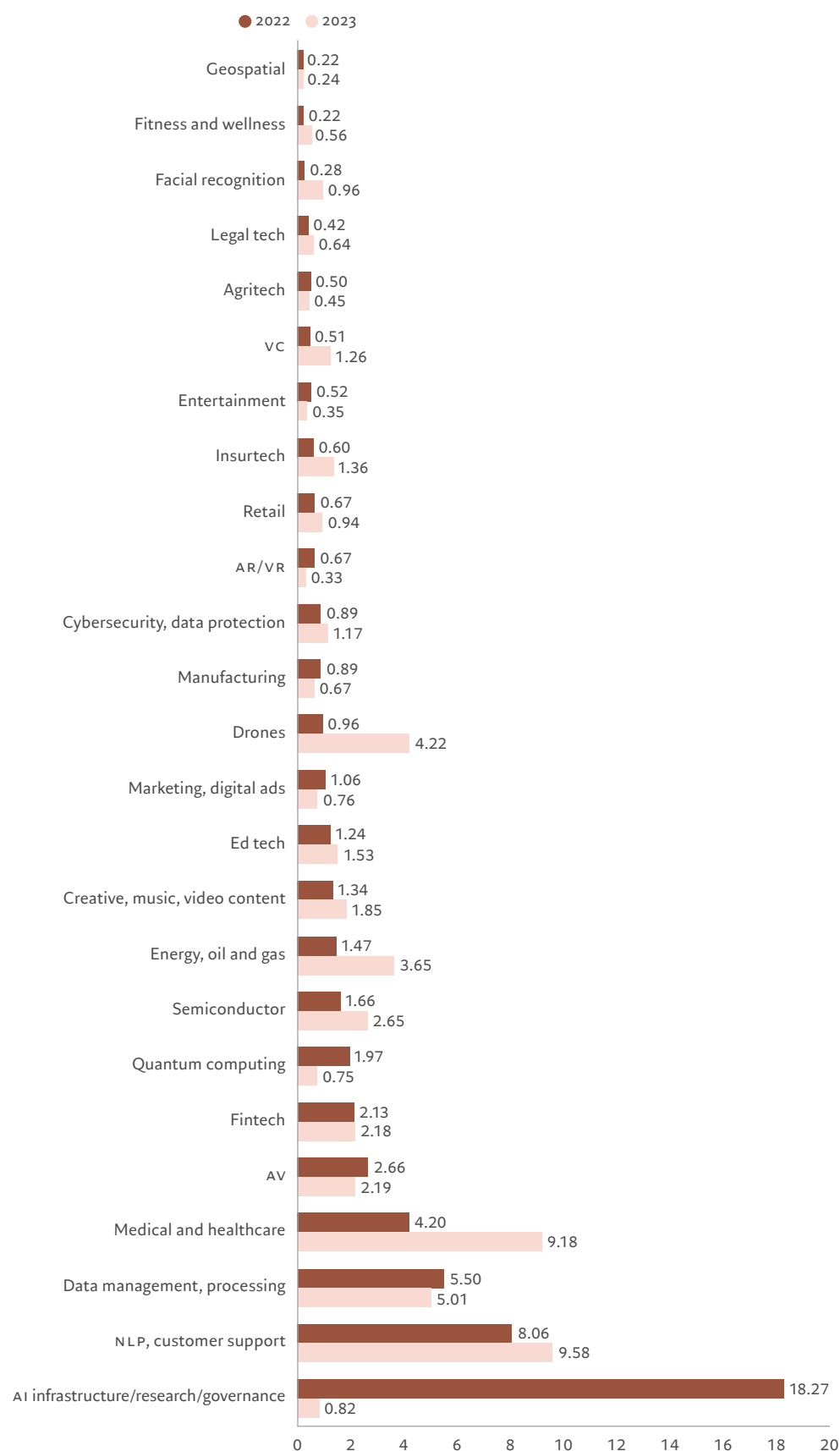
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Targeted AI

Total investment in AI by focus area
(USD, bn)



Source: Quid (2023),
Chart as in 2024 AI Index Report

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for three quarters of a century, but also in health-care and logistics. It won't just be AI driving this transformation – new battery technologies will arguably be just as important in enhancing power solutions and enabling new applications. For more information, see our infographic article on page 94.

But while AI has dominated the conversation, other significant, albeit more incremental, changes are occurring across the technology landscape. 3D printing, once primarily a prototyping tool, is increasingly showing its potential in manufacturing. Virtual reality (VR) and augmented reality (AR) are becoming... reality. Both are moving from the world of gaming and entertainment to fields like architecture, medicine and logistics. With the establishment of 5G communication networks, industries are starting to take full advantage of the technology's possibilities, particularly in creating true digital factories.

Underpinning nearly all technological progress today are advances in semiconductors. For some time, the industry has worried that the physical limits to transistor scaling had been reached, and yet researchers manage to make them smaller still. But beyond squeezing more transistors onto a silicon wafer in two dimensions, they are now creating semiconductor chips in 3D using a technique called hybrid bonding. This involves creating conductive bridges between layers of silicon, allowing them to be stacked. The miniaturisation here is extraordi-

nary – reportedly seven million links per square millimetre of silicon.²⁰ The result is higher transistor and memory density, increased speed (higher bandwidth) and improved power efficiency.

At the same time, research in quantum computing continues apace, offering the potential to solve calculations that elude conventional computers. Here too, AI is starting to show uses in developing and discovering new materials and methods to create these exceptionally advanced new machines. Quantum computing may eventually enhance the processing power of robots, enabling them to handle more complex computations quickly.

The move from lab to assembly line isn't just a matter of technological solutions. It demands a whole ecosystem, including user trust and readiness, business model economics, appropriate regulatory environments and the ability to find and retain talent. This is particularly true in the field of cybersecurity. According to Gartner, global end-user spending on information security is forecast to reach USD212 billion in 2025, up 15 per cent year on year.

The articles in this section highlight the broad spread of technological developments, many of which will reshape the technological landscape. Among these, we interview economist Chris Miller about semiconductors, explore the investment implications of AI, survey businesses on their use of the technology and consider its economic impact.



PETER LINGEN

Peter joined Pictet Asset Management in 2016. He previously worked as an investment manager at Swedbank and before that, he worked for Arthur Andersen's global corporate finance team.

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20 <https://spectrum.ieee.org/hybrid-bonding>



Each of these containers contains the data of many companies that have relied on one of the greenest data centres in the world, built in a former mine.

Circular data centre, Norway, 2022

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How generative AI has reignited investor enthusiasm for tech stocks

STANISLAS EFFRONT
*Investment Manager,
Thematic Equities,
Pictet Asset Management*

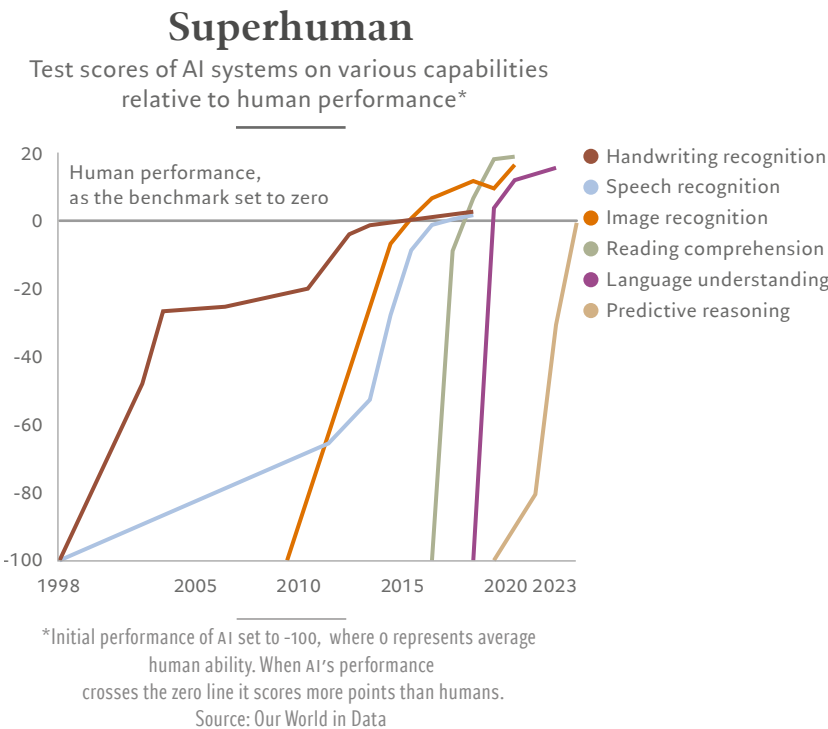
While the ideas behind artificial intelligence (AI) have been around longer than most investors have been alive, what was once previously regarded as the preserve of computer science departments has gone mainstream. Even so, the AI revolution is still in its infancy.

The key foundation models – the neural networks of AI trained on huge datasets – are rapidly increasing in size, delivering major gains in capability with each iteration. Google’s new Gemini model is an addition to the large language models (LLMs) already in use.

The wave of interest in generative AI (Gen AI) is testament to the core attractions of the technology sector and its ability to find new growth.

WHERE ARE THE OPPORTUNITIES?

When Microsoft founder Bill Gates said of LLMs: “I knew I had just seen the most important advance in technology since the graphical user interface,” he



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wasn't exaggerating. Such technology will create numerous business and investment opportunities in the years to come.

To see how these might emerge, it is useful to compare the burst of innovation taking place today with the rise of the Internet in the 1990s. The Internet proved relatively slow to take off as it took time to build up connectivity around the globe; in 1990 only 0.5 per cent of the global population was online. Similar observations can be made of AI.

At present, most of what is being invested in AI is flowing to infrastructure. Companies like Google, Microsoft, Amazon, Meta and Tesla are still constrained by the availability of high-performance graphics processing units (GPUs) that are needed for both model training and inference. But once the infrastructure is built, the next wave of investment will see AI models rolled out into applications.

The potential breadth of these applications looks almost limitless. Drug discovery and diagnosis in healthcare as well as education, art and finance will each be transformed by AI in time. And that, in turn, will fuel demand for new software, hardware and semiconductors.

There are three scaled use cases today. The first is developer code assistants, with Microsoft's GitHub Copilot being the most visible. They are already ubiquitous and developers are reporting a 20 per cent to 40 per cent increase in efficiency from using the leading tools. The second use case is customer service – companies are quickly training AI agents on internal data to solve customer issues more quickly. The third is the meaningful improvement in online advertising from Gen AI.

One development that distinguishes this tech investment cycle from its predecessors is that it favours incumbent technology companies over new entrants.

Today, established firms are frequently the ones leading in AI. There are several reasons why. To begin with, AI requires large amounts of data and training AI models is extremely expensive – making it easier for large, scaled companies to develop than for start-ups. Similarly, almost every firm can integrate with the LLMs – there is no natural advantage for start-ups here. Finally, AI favours companies with large existing user bases, since new AI product capabilities will be easier to roll out across well-established products. For investors, that means there are many attractive opportunities to gain exposure to the AI theme via larger, established listed technology companies.

BUMPS IN THE ROAD

While the long-term promise is there, caution is always warranted. Tech consultancy Gartner recently summarised the feeling of a number of commentators (and investors) when it said AI was currently at the “peak of inflated expectations”.

That means investors seeking AI opportunities will need to become more selective. It will become increasingly important to understand the nature of individual products and the competitive positioning of the different companies operating within the industry. We also think that time to revenue is an important issue. This is the kind of work we in the Pictet Digital strategy team are focusing on, identifying the companies with a strong investment case.

We are clearly at the beginning of another major technology shift, one that will transform most technology (and non-technology) markets over time. It is inspiring to see how quickly companies are adapting to take advantage of AI. We look forward to seeing the break-out products that start to define this new AI era.



STANISLAS EFFRONT

Stanislas Effront joined Pictet Asset Management in 2016. He is an investment manager in the Thematic Equities team, with a focus on PAM's Digital strategy. He graduated from St Gallen University in 2016 and earned an MSc in Investment and Wealth Management from Imperial College Business School, London, in 2018.

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The data centre is installed within a former olivine mine, a unique cooling solution with low construction costs. The former mine now consists of six levels divided into

75 rooms, with a potential white space area of 120,000m². The entry point leads to a 1,300m-long access road 14m wide and 8.5m high.

Circular data centre, Norway, 2022

Chips with everything

The world depends on semiconductors. Professor Chris Miller highlights the industry's latest innovations and their implications for our future.

CHRIS MILLER
Associate Professor
of International History
at Tufts University

ANJALI BASTIANPILLAI
Senior Client Portfolio
Manager, Pictet Asset
Management

Bastianpillai: What are the implications of the artificial intelligence (AI) boom for the semiconductor industry?

Miller: The immediate implication is higher demand for AI-related chips. The US semiconductor company Nvidia has been the most obvious winner, but many other companies have seen demand surge. Yet this first wave of spending on AI chips has been focused primarily on the data centre. In the longer term, many AI systems will be processed largely on the edge of networks, in devices like smartphones, cars and wearables. We're just beginning to see a new set of chips for these devices that are optimised for AI.

Bastianpillai: Which innovation in the world of semiconductors excites you most at the moment?

Miller: The biggest immediate focus of innovation is the production of better chips for AI. Improved chips have been the primary driver of better AI systems over the past decade. Companies that manufacture graphics processing unit (GPU) chips,

like Nvidia, and high-bandwidth memory chips, like SK hynix, can today produce chips that are multiple times more capable than a decade ago. This is why big AI systems are trained on multiple times as much data – and thus are far more effective than older generations of AI.

Bastianpillai: What are the most interesting use cases beyond AI?

Miller: I think AI will be the dominant theme for some time. In the longer term, I'm excited about the intersection between chips, biotech and medical devices. There are already an interesting set of start-ups building chips that can sense certain biological markers, for example.

Bastianpillai: How will the competition between the US and China affect the industry? Can it be a driver for innovation?

Miller: The downside of US-China competition is that supply chains are being duplicated, making them less efficient and adding to costs. The upside is that the US and other countries are pouring more money into research and development, which – if executed well – should accelerate innovation.

Bastianpillai: The industry is notable for its negative environmental impact. How can it best address this?

Miller: Making chips requires many toxic chemicals, but the industry has made substantial progress in mitigating their impact. The next

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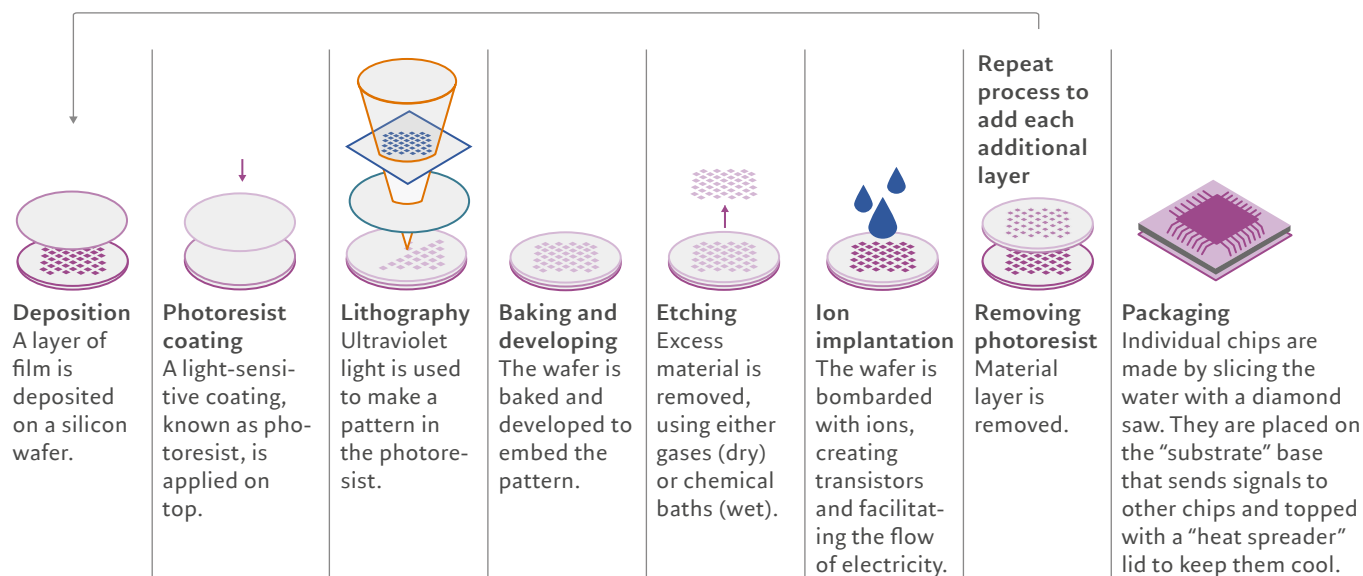
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Making chips

Semiconductor manufacturing process



Source: ASML, Pictet Asset Management

13,328
million
square inches of silicon
wafers to be shipped in 2025.

Source: SEMI Worldwide Silicon
Wafer Shipment Statistics, Silicon
Manufacturers Group 2024

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The downside of US-China competition is that supply chains are being duplicated, making them less efficient and adding to costs.

major effort is to replace a category of chemicals called PFAS that take a particularly long time to degrade. This will take major innovations in chemistry.

Bastianpillai: Despite this, do semiconductors also have a part to play in the green transition?

Miller: Yes, they are critically important, though in a complex way. The short-term impact of AI will delay the green transition because new AI data centres will be powered with more fossil fuels. But semiconductors are the key drivers of electrification. New electric vehicles, for example, have over a thousand dollars' worth of semiconductors inside, and many of them play a key role in managing the battery and power distribution.

Bastianpillai: Some 60 years ago, Moore's Law observed that the number of transistors in an integrated

circuit doubles every two years. That, in turn, means that chips can become ever smaller while doing the same (or even better) job. Most recently, we have moved from 7-nanometre (nm) chips to 5-nanometre chips. What does that mean – are 5nm chips actually 5nm?

Miller: The nanometre numbers are mostly marketing terms. It used to be possible to compare chips based on a single measurement. Now chips are 3D, so there are multiple dimensions on which one could measure them. Roughly speaking, between each generation (i.e. 7 nm to 5nm) we get a tremendous increase in computing power.

Bastianpillai: Given the rising demand for semiconductors, are we going to see bigger capex spend to ramp up capacity?

Miller: We've already seen a major uptick in capital expenditure. I think chip manufacturers are cautious about expanding much more beyond their current commitments. They know the industry has historically been cyclical and want more visibility into what AI data centre demand will look like towards the middle of the 2020s. The key question is whether big tech firms will keep spending tens of billions annually on AI infrastructure, or whether they will pause and wait for more profitable applications to emerge.



ANJALI BASTIANPILLAI

Anjali joined Pictet Asset Management in 2016, working initially with the total Total Return Equities team before moving to her current role in Thematic Equities. She joined from Tide Pool Capital, where she was head of credit and risk and began her career as a securitisation analyst at Standard & Poor's.

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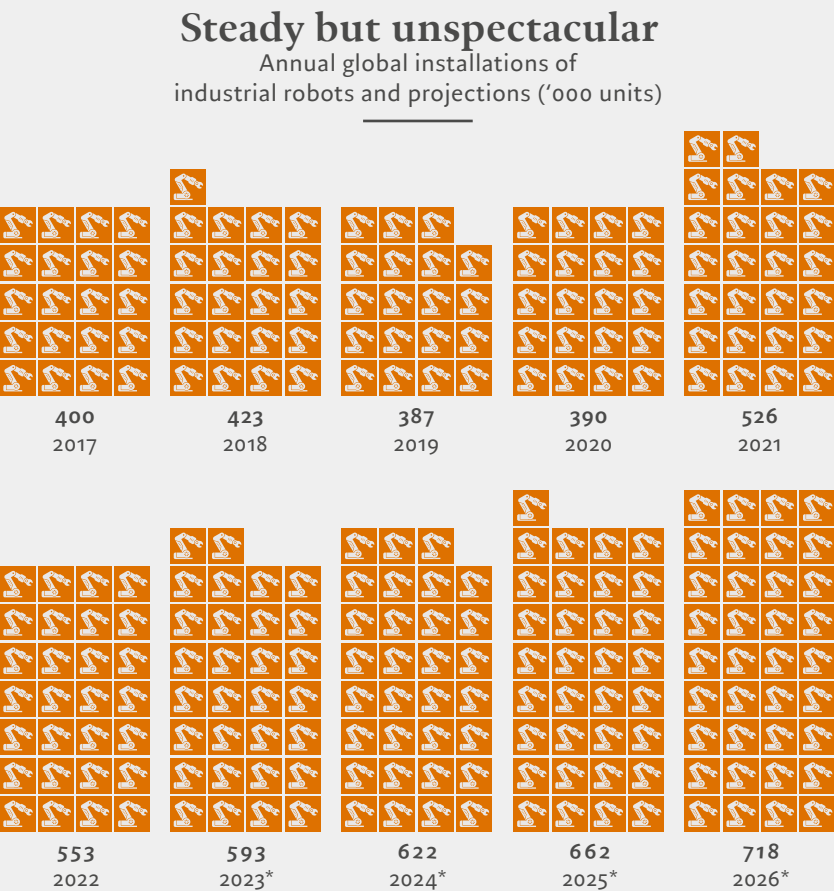
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We, Robot

In popular imagination, robots have near-unlimited powers: superhuman strength, agility and intelligence. The reality has been much more prosaic, argues Daegal Tsang

Robots have primarily been confined to routine tasks, delivering tireless and quick precision, but within fairly limited industrial applications – though these have been expanding steadily. But there’s good reason to believe that two trends in innovation will trigger a major shift in robotics: artificial intelligence and lighter, more powerful batteries.



Source: World Robotics 2023
* forecast

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“
Artificial intelligence
will make robots much more
adept at navigating their
environments independently by
allowing them to analyse
and process information captured
through their sensors
and then act on it in a logical way.
”

DAEGAL TSANG
Senior Investment Manager



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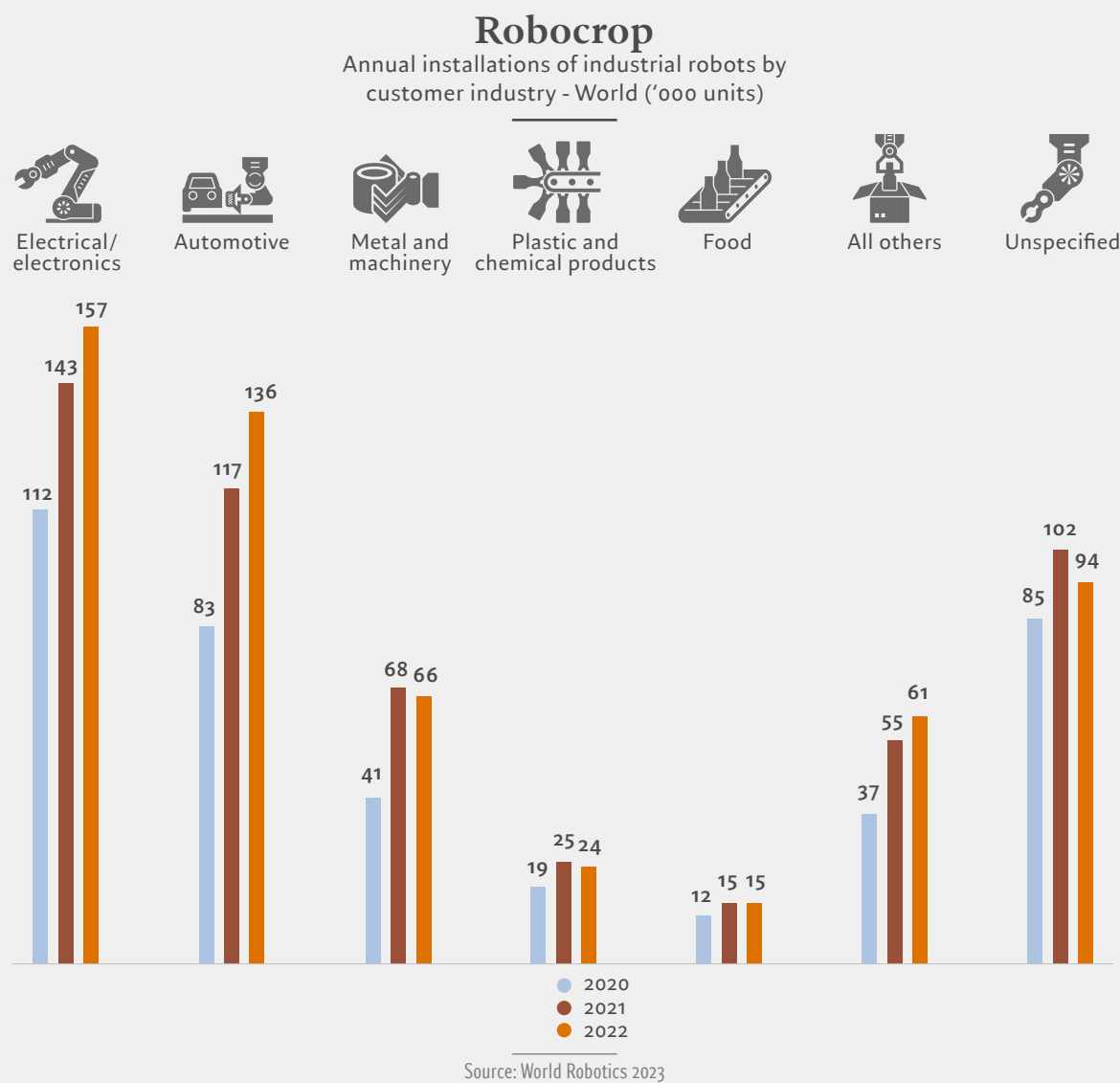
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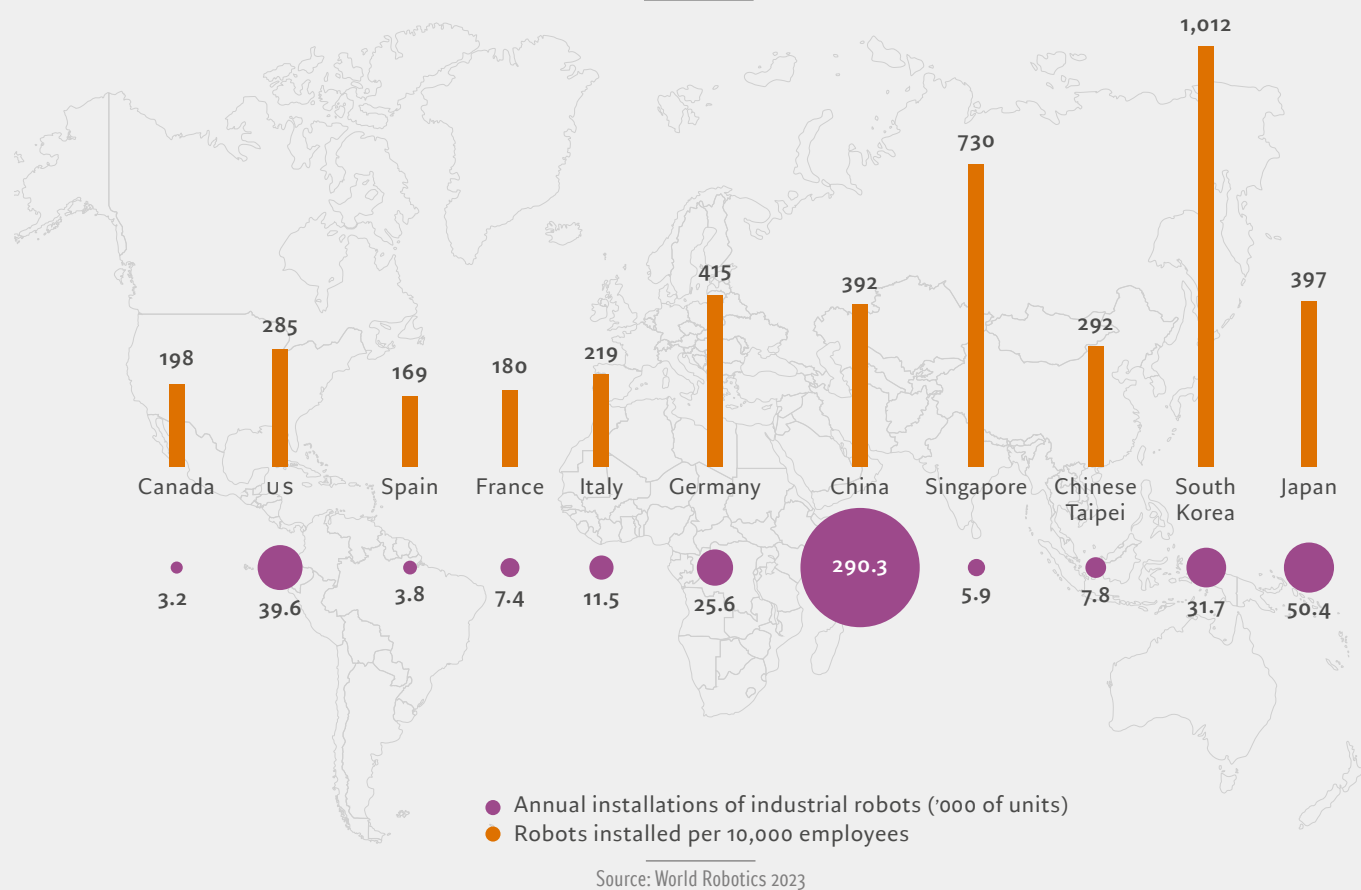
Much of this industrial demand has been within manufacturing, particularly in electronics and automobile manufacturing. Both sectors were pioneers in the use of industrial robots, with the car industry adopting hydraulically-driven robots for heavy lifting from the 1960s. Electronics and automotive applications continue to dominate. Unsurprisingly, countries with big electronics and automotive industries and facing demographic challenges tend to have the greatest demand for these robots – for example South Korea.



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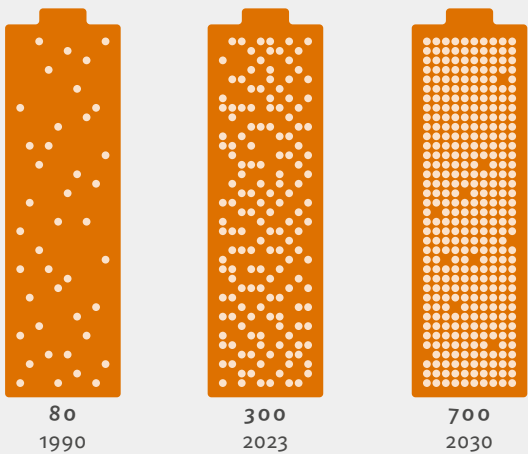
Hungry for robots



More powerful batteries will give robots greater capabilities, allowing them to travel further, operate longer and handle heavier loads. This will significantly expand the role of robots in logistics, transportation and agriculture, far beyond their current capabilities.

Packing in the electrons

Battery energy density
(watt hours per kilogram)



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At the same time, artificial intelligence will make robots much more adept at navigating their environments independently by allowing them to analyse and process information captured through their sensors and then act on it in a logical way. This will be particularly important for cobots, robots that work collaboratively with people.

AI will help grow the market for service robots, opening up new possibilities for both professionals and consumers.

At your service

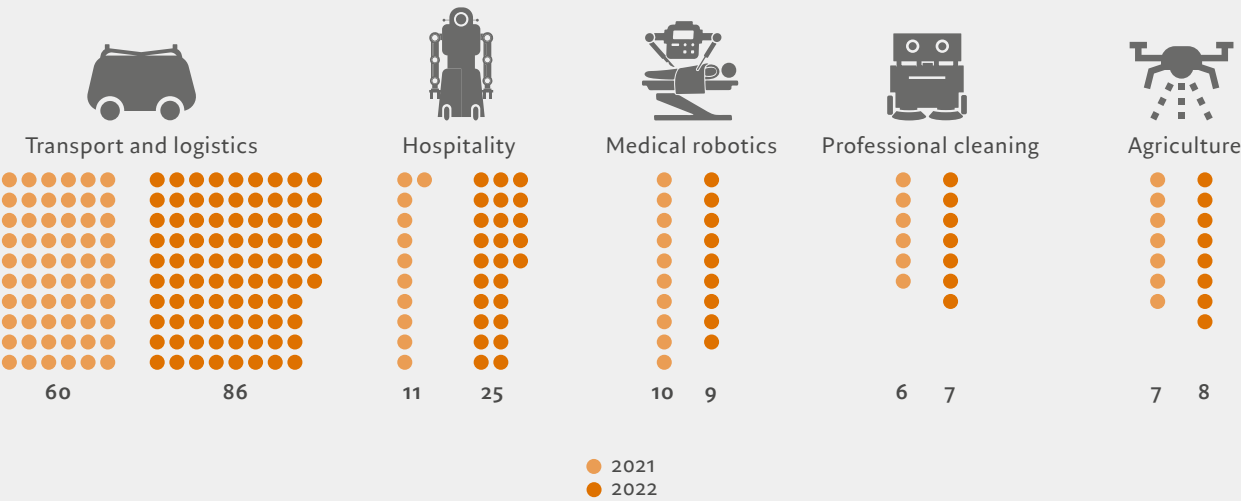
Service robots* by type

PROFESSIONAL SERVICES	CONSUMER ROBOTS	MEDICAL ROBOTICS
Agricultural robots	Domestic tasks	
Professional cleaning	Social interaction and education	
Inspection and maintenance	Care at home	
Construction and demolition		
Logistics and transportation		
Search and rescue		
Hospitality		

Source: International Federation of Robots
*International Federation of Robots classification scheme
<https://ifr.org/wr-service-robots/>

Small beginnings

Service robots for professional use, top five applications (sales, '000 units)



Source: World Robotics 2023

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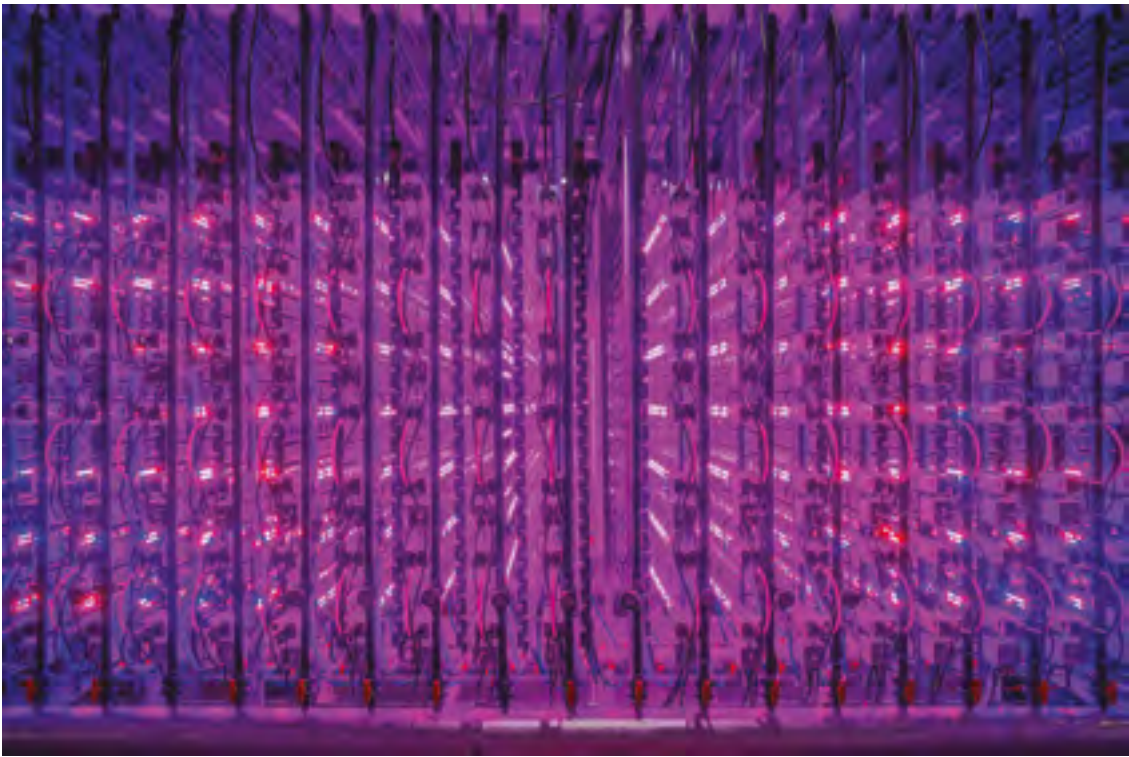
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An algae bioreactor that produces algae both for human consumption and as fish food. Based on machine

learning technology, their crop and light management is fully controlled and optimised for growth.

Micro-algae farm, Iceland, 2022

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How big will generative AI’s economic footprint be?

PATRICK ZWEIFEL
Chief Economist,
Pictet Asset Management

MICHAEL STOLLENWERK
Risk Manager,
Pictet Asset Management

Generative AI has generated an enormous amount of hype. Even if some of the more extreme predictions do not come to pass, we think it has the potential to substantially lift economic growth in the medium term.

It is likely to do so by automating routine tasks, optimising operations and enabling the more efficient use of resources – all of which are likely to enhance economic productivity. That’s important because ageing populations worldwide point to decreasing per capita output from labour.

The extent and timing of AI’s economic impact remain the subject of debate. Adoption of AI has been rapid – in the 24 months since the launch of ChatGPT, some 40 per cent of Americans are using it, which is double the adoption rate of the Internet over a similar period following its introduction. Nearly a quarter used it at least once in the week before the survey was conducted and more than one in 10 use it daily at work.²¹

And in certain niches, AI’s economic impact is already being felt. The online education company Chegg lost 99 per cent of its value as students began turning to ChatGPT for help with their homework.²² But so far, while individuals have embraced generative AI, companies outside of the tech industry have been more cautious.

PRODUCTIVITY DEBATE

This, however, hasn’t prevented experts from making predictions about its transformative effects.

Several academics and consultancies have tried to forecast AI’s impact on economic productivity (see TABLE 1). Overall, they anticipate significant economic gains – with one notable exception. Daron Acemoglu, the most recent Nobel laureate in economics, estimated a mere 0.07 per cent annual boost

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21 Bick et al., “The Rapid Adoption of Generative AI”, <https://www.stlouisfed.org/on-the-economy/2024/sep/rapid-adoption-generative-ai>

22 <https://www.wsj.com/tech/ai/how-chatgpt-brought-down-an-online-education-giant-200b4ff2>

TABLE 1
AI impact on productivity growth, academic and industry forecasts

SOURCE	ANNUAL PRODUCTIVITY INCREASE	FRACTION OF TASKS THAT CAN BE AUTOMATED	SCOPE	NOTES
Acemoglu (2024)	0.07%	6%	US, to 2034	Academic
Aghion and Bunel (2024)	0.68%	23%-80%	US, to 2034	Academic, same methodology as Acemoglu
Goldman Sachs (2023)	1.50%	25%	US, to 2033	Sell side, moderate impact until 2027, then large impact
	1.25%	25%	World, to 2033	
	0.7%-1.3%		Emerging markets	
McKinsey (2024)	0.5% (early adoption scenario), 3.4% (late adoption scenario)	63%	World, to 2040	Sell side, automation of tasks estimate to 2045
PwC (2017)	0.60%		World, to 2030	Sell side, pre-Gen AI; World GDP impact 1.38%

Source: Acemoglu (2024), The Simple Macroeconomics of AI, NBER working paper; Aghion and Bunel (2024), AI and Growth: Where Do We Stand?, working paper; Goldman Sachs (2023), Upgrading Our Longer-Run Global

Growth Forecasts to Reflect the Impact of Generative AI; McKinsey (2024), The economic potential of generative AI - The next productivity frontier; PwC (2017)



PATRICK ZWEIFEL

Patrick joined Pictet in 1997, and has been Pictet Asset Management’s chief economist for more than 15 years. Before joining Pictet he was a research assistant in econometrics and monetary theory and worked on international research projects for the World Bank and the European Union.

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to US productivity over the coming 10 years.²³ By contrast, rival academics Aghion and Bunel²⁴ forecast 0.68 per cent annual productivity gains for the US over the same period, using the same methodology. Industry estimates for productivity gains range from 0.5 per cent to 3.4 per cent per year, with most clustering around the 0.7 per cent to 1.3 per cent range.

We believe the most likely outcome is a slow or even negative impact on productivity over the next few years before the beneficial effects of AI start to snowball.

People will first need to discover AI’s full capabilities, learn how to use it and integrate it into various functions before we can expect productivity effects to flow. This follows the dynamic of all major innovations – from steam to silicon. The key question is how quickly these effects will start to flow, as the adoption of new technology can be a slow process.

Meanwhile, the capital spending on energy and silicon chips needed to run AI systems will prove a drag on overall economic productivity in the near term, with AI operators even talking about owning their own nuclear power plants. In a recent article, Bertin Martens of Tilburg University argued that “without significant productivity gains, the current investment cost trajectory is unsustainable.”²⁵ He estimates “that 3 per cent annual produc-

tivity growth across advanced economies would be required to sustain AI model cost extrapolations to 2030.”

One additional near-term cost of this capital investment could be higher inflation, especially if productivity gains lag significantly. Longer term, though, the increase in productivity should be disinflationary if, as we expect, wages don’t rise as quickly.

LABOUR MARKET FRICTIONS

Generative AI productivity gains will come with an additional short-term cost: labour market disruption.

The transport sector stands out as one of the most obvious sectors where workers are at risk. Fully autonomous vehicles are already operating in several cities and AI is likely to make this widespread. In the US alone, there are some 4 million driving-related jobs, of which 3.1 million are truck drivers, according to the Occupational Outlook Handbook. While the replacement of professional drivers by AI is a negative for labour, saving time for commuters is a positive. Those using autonomous



MICHAEL STOLLENWERK

Michael joined Pictet in 2023. He is an investment risk manager for fixed income strategies. Before joining Pictet, Michael was a researcher at the Chair of Empirical Economics, University of Heidelberg, where he worked on research projects in financial econometrics. He also taught econometrics and macroeconomics at master’s level. Michael holds a PhD in Economics from the University of Heidelberg.

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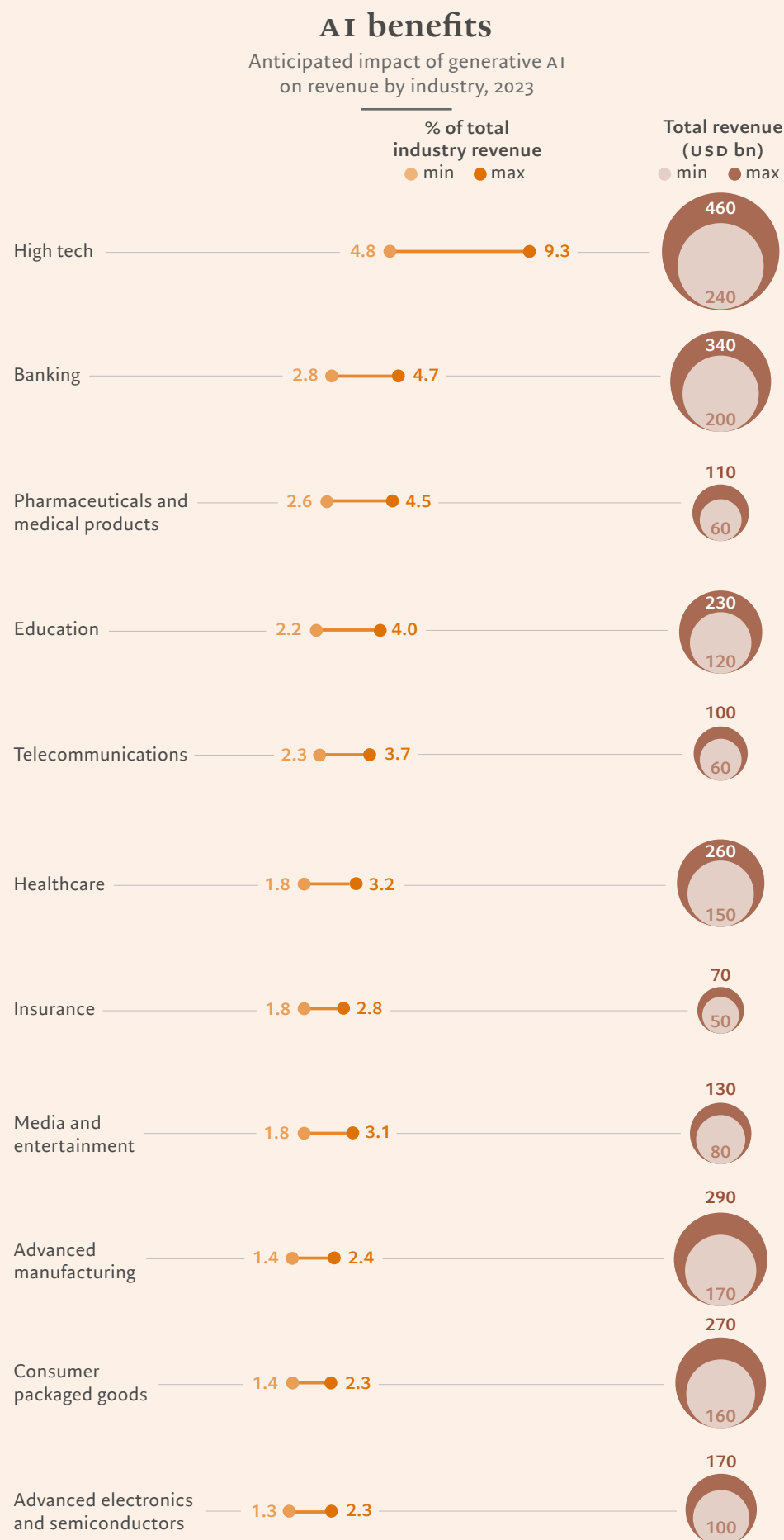
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vehicles will gain, on average, an extra hour each day to spend on more productive or pleasant activities instead of concentrating on the road.²⁶

It's not entirely clear where the most gains will be. Some early indications suggest that AI can help bring lower-skilled workers up to the average. But by the same token, AI might replace them entirely. Higher-skilled workers in some industries will be able to offload their more routine tasks to AI, allowing them to focus on where they truly add value.

INDUSTRIOUS AI

Industries with the highest investment in AI – healthcare, pharmaceuticals, biotechnology, IT infrastructure and hosting, media, social platforms and marketing – are likely to see the greatest productivity gains and the most significant impact on their workforces.

McKinsey surveyed industry experts for their estimates of the impact of generative AI on expected revenues by industry.²⁷ High tech is seen benefiting the most, with a 4.8 per cent to 9.3 per cent increase in revenues, followed by pharmaceuticals and med-

ical products at 2.6 per cent to 4.5 per cent, healthcare at 1.8 per cent to 3.2 per cent, and media and entertainment at 1.8 per cent to 3.1 per cent.

The differences in forecasts of likely productivity gains are largely down to different estimates of what fraction of tasks in an economy can profitably be performed by AI. The majority of forecasters use the same data source, O*NET. This database contains information on 800 different occupations, with data on average income, industry affiliation, required skill levels on 35 skill constructs and detailed task descriptions.

Estimates of task-fractions that can be automated profitably range from 6 per cent to 80 per cent. Acemoglu, whose forecasts lie at the lower end of that range, does not factor in that AI may create new products, services and jobs or shifts in labour concentrations to reflect changes in industry focus. We think higher estimates are more likely to be accurate than Acemoglu's.

3% annual productivity growth

across advanced economies would be required to sustain AI model cost extrapolations to 2030.

Source: <https://www.bruegel.org/working-paper/tension-between-exploding-ai-investment-costs-and-slow-productivity-growth>

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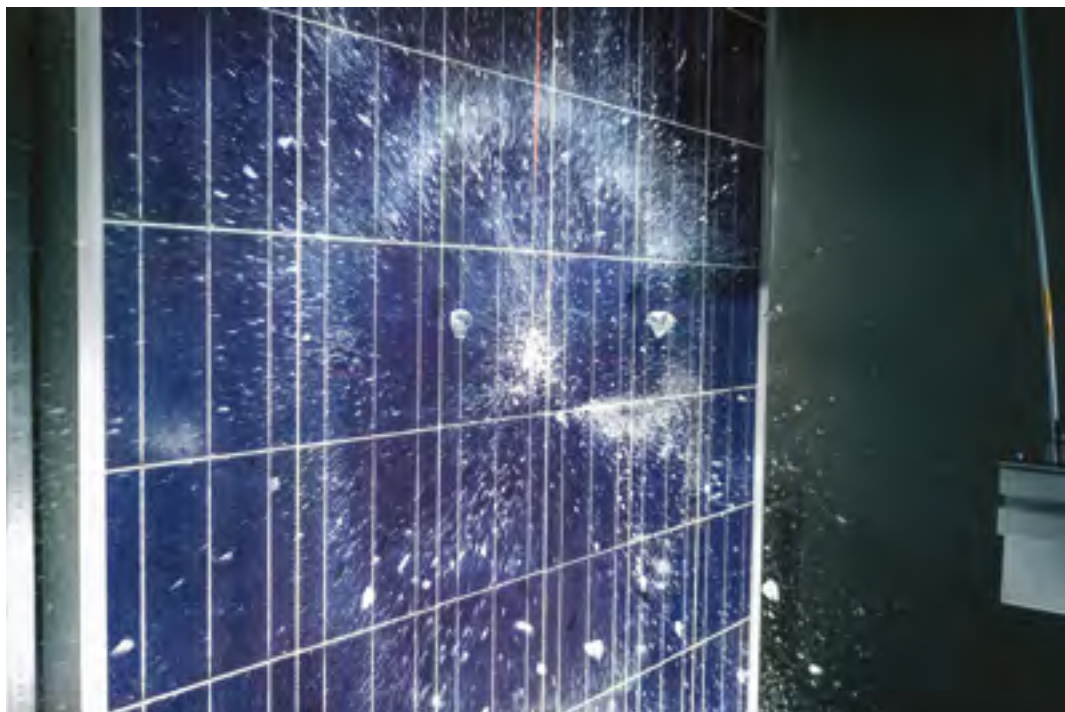
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Hail testing inside an environmental chamber for solar panel testing at TÜV Rheinland — a leading testing company in the solar industry.

TÜV Rheinland,
Germany, 2015

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Pictet surveys the private equity industry about what AI means for business

More than 40 per cent of private equity fund general partners (PE GPs) surveyed by Pictet Alternative Advisors²⁸ now have an AI strategy for their own business – although surprisingly, those focused on technology investments are, by and large, the ones without such a strategy.

Overall, they see data and output quality as the biggest barrier to adopting AI, with privacy and cybersecurity issues also posing significant challenges. They are least concerned about finding staff with the skills to implement AI systems or the cost of adopting AI.

Privacy “is a subject that companies care about a lot, while unsolved this will be a barrier. Though for many use cases there are solutions that entirely eliminate this as a barrier,” noted one PE GP.

As for data quality, “even when current data/output quality is not satisfactory, models are constantly improving and for most applications are constantly improving in quality.” Cost is also expected to fall: “the trend so far has been that as newer models are released, the older models drop in price exponentially.”

Nonetheless, nearly all PE GPs recognise AI’s importance – just over a quarter think it is overhyped. Only a tenth are not using it or prohibiting it. Some two-thirds are exploring the uses or have got as far as testing AI applications, while the remainder are already integrating AI into at least two or three of their processes, such as customer engagement, data analysis or IT coding. More than half are offering AI expertise or consulting to their portfolio companies.

One firm – albeit an exception – has a detailed strategy. It said that it “has an established generative AI framework, both in terms of the firm’s existing investments where the focus is on building leadership within the portfolio companies with a dedicat-

²⁸ General partners of 22 private equity funds, 19 of which manage more than USD1 billion, participated in a survey conducted by Pictet Alternative Advisors during October and November 2024 about the implications of AI for their own business and that of the companies in which they have invested. Roughly half of the respondents are headquartered in North America, with the remaining funds split between Europe and Asia. About half of the firms specialise in technology, three in health and the rest in a mix of sectors. Eleven of the firms are in the buyout strategy segment, three focus on growth and six on venture capital and one was a turnaround fund.

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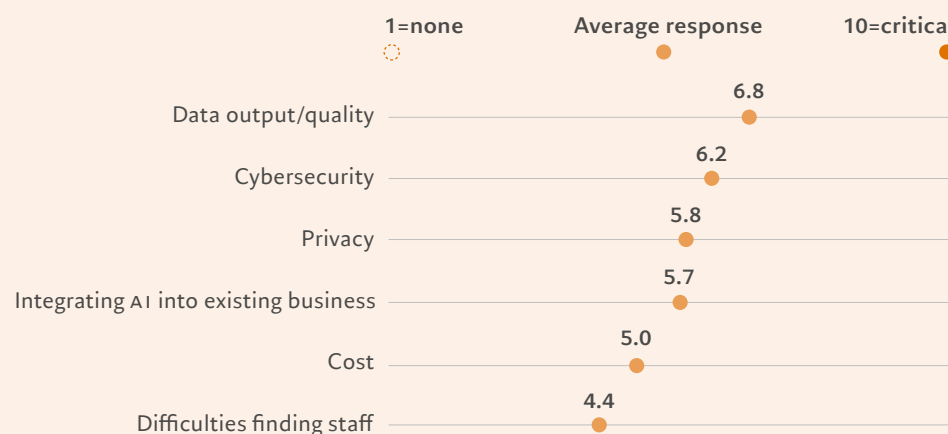
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Hurdling

Expected barriers to adoption of AI, range 1=none to 10=critical, average response



Source: Pictet Alternative Advisors, Pictet Asset Management.
Survey of private equity general partners conducted by Pictet Alternative Advisors between October and November 2024. 22 PE funds surveyed, response rate for individual questions ranges from 14 to 16.

ed Gen AI product strategy and adopting new tools, and in terms of new deployment, with the Gen AI framework helping to test the risks and opportunities associated with Gen AI and ultimately leading to investment in companies that are expected to benefit from AI tailwinds.”

Turning to their portfolio companies, only around 15 per cent of PE GPs reported that more than a quarter of their portfolio companies do not use or prohibit the use of AI. Around two-thirds of PE GPs reported that more than a quarter of their portfolio companies were testing or piloting AI use. And nearly 40 per cent of PE GPs reported that more than a quarter of their portfolio companies used AI in at least two to three processes.

“We believe all [portfolio companies] will eventually incorporate AI,” according to one PE GP. Indeed, firms are already starting to reap benefits. More than 60 per cent of respondents reported some revenue increase at their portfolio companies due to AI, with one reporting that more than 25 per cent of their revenue growth was down to AI.

Almost all PE GPs expect technology companies to benefit most from AI over the coming 24 months, while fewer see significant benefits for firms in the consumer, industrial, financial and health sectors.

“Portfolio companies are engaging heavily in this,” said one PE GP, “even if it’s to rule AI out as a threat/opportunity. We provide expertise ourselves, as well as relying on third parties with particular use case expertise.”

In order of ranking, the corporate functions that PE GPs see benefiting most from the adoption of AI are: AI coding; business process automation, such as improving efficiency of software, and data analysis (equal); customer engagement/experience; content generation, editing and translating; sales and marketing, supply chain and logistics, and digital strategy (equal); and, finally legal. None cited AI as being among the most beneficial to cybersecurity or human resources.

Fund GPs were divided on whether the adoption of AI would allow their portfolio companies to reduce the size of their workforce or cause no change. Nearly a third of respondents thought it would result in smaller workforces, with the rest expecting no change.

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“For the most part the workforce will stay the same, but increase in productivity,” said one fund GP. “For some companies the workforce will be reduced.”

Another added that “given portfolio growth, we don’t expect to reduce the workforce but to drive productivity and reduce the need for future hires.”

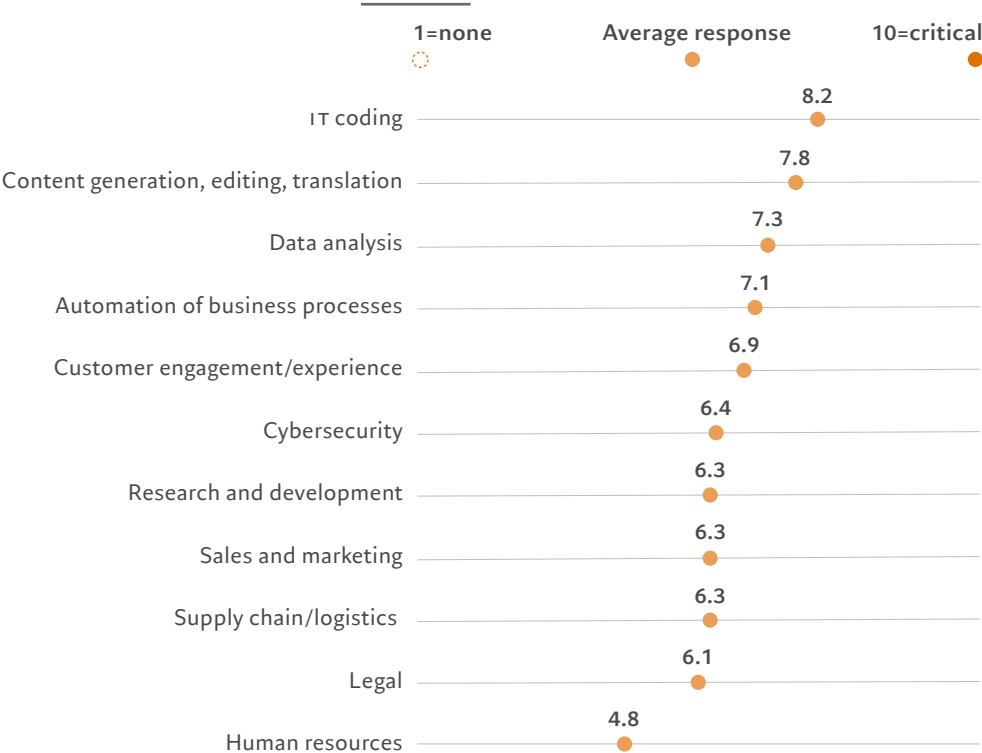
None of the fund GPs thought that AI would take their own job.

Despite AI’s high energy consumption, three quarters of respondents thought it was environmentally justified.

“Generating a single image using ChatGPT costs almost as much energy as charging a smartphone,” acknowledged one respondent. “Models need to become smaller, more task-specific and be used more intelligently. Energy production needs to be greener, both energy storage and transmission need to be optimised to minimise losses. All these things are possible, and the usage of AI will likely drive the economic argument for their development. Therefore, while current energy usage is not environmentally justified, the pressures to enable AI usage may ultimately lead to green energy breakthroughs that all industries benefit from.”

AI taking over?

Degree to which AI is seen as relevant for business activities, range 1=none to 10=critical, average response



Source: Pictet Alternative Advisors, Pictet Asset Management.
Survey of private equity general partners conducted by Pictet Alternative Assets between October and November 2024. 22 PE funds surveyed, response rate for individual questions ranges from 14 to 16.

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ATLAS is the largest volume detector ever constructed for a particle collider. It weighs 7,000 tonnes, similar to the weight of the Eiffel and sits in a cavern 100m be-

low ground. The detector tracks and identifies particles to investigate a wide range of physics, from the study of the Higgs boson and top quark to the search for

extra dimensions and particles that could make up dark matter.

ATLAS, Switzerland, 2015

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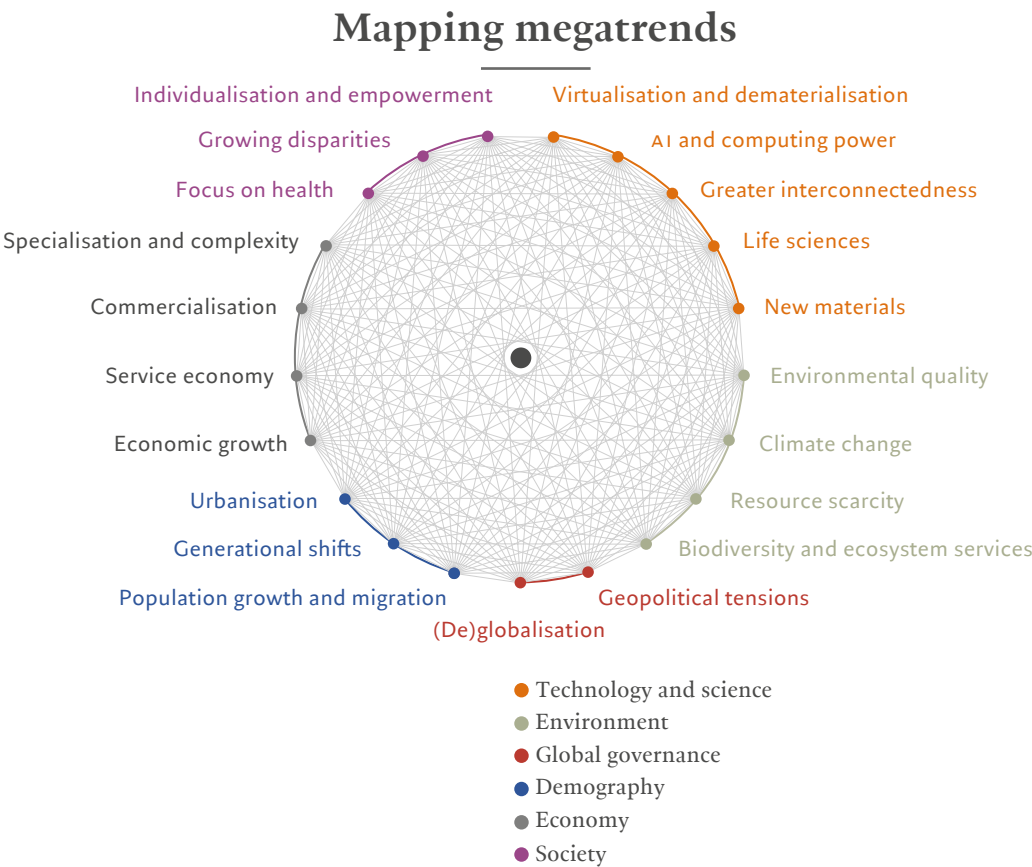
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Megatrends are the powerful socio-economic, environmental and technological forces that shape our world

The virtualisation of the economy, the rapid expansion of cities, the depletion of the Earth’s natural resources, ageing populations and climate change are just some of the long-term structural trends that will transform how countries are governed, how companies are run and how we live our lives for generations to come.

The broad and long-term effects of megatrends – which are independent of the economic cycle – create commercial opportunities for some companies and risks for others.



Source: Pictet Asset Management

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MEGATRENDS AND THEMATIC INVESTING

Megatrends have the potential to exert a lasting impact on large parts of the global economy over a time horizon of at least a decade and act as catalysts for long-term growth and give rise to new business opportunities.

At Pictet Asset Management, a key feature of our thematic equity investing strategy centres around identifying areas of the economy that can provide superior growth over the long term - industries and sectors that owe their dynamism to powerful forces of change known as megatrends.

We believe megatrends are a crucial source of long-run revenue and earnings growth. As such, they also have a bearing on long-term investment returns. That's why we use them as the basis for each of our thematic equity portfolios. Yet identifying, analysing and monitoring these secular sources of growth is far from straightforward. It is a complex task that requires experience and a broad range of skills.

We addressed this challenge by developing a megatrends framework in collaboration with experts at the Copenhagen Institute for Futures Studies (CIFS), a global research and advisory think tank. This framework is specifically designed for application in thematic equity portfolios.

We also draw on the insights provided by Pictet's 13 Thematic Advisory Boards.

These groups of distinguished industry practitioners and academics help us monitor the structural trends transforming our world and ensure the continued relevance of our investment themes and their investment opportunity sets.

THE MEGATRENDS FRAMEWORK

The megatrends framework incorporates a level of granularity that we deem appropriate for investment purposes. It defines megatrends as secular growth drivers and enables the systematic, empirical tracking of their evolution across our investment themes.

The framework consists of 21 megatrends organised into six clusters, with additional subrends in some megatrends.

The first step involves determining the extent to which each megatrend acts as a secular growth driver for each segment of a thematic universe. This analysis is conducted by the investment teams, sometimes with the involvement of CIFS and the respective Thematic Advisory Board. The results are then aggregated at portfolio level and the five to eight most significant megatrends are selected.

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● ECONOMY

Economic growth

This trend reflects the increase in (real) income per capita driven by productivity growth, though it may conceal growing disparities. Subtrends that highlight rising incomes in specific subsets of the global economy or population include the income convergence of emerging markets and faster income growth for women.

Commercialisation

This trend reflects the monetisation of previously implicit and hidden aspects of society, with the attachment of commercial or market value. Subtrends include privatisation, the growth of second-hand markets and the pricing of externalities.

Service economy

The share of global output generated by services, as opposed to agriculture or manufacturing, is on a structural upward trend. This shift has implications for the composition of the economy. Subtrends include financialisation (the broadening and deepening of the financial sector), the knowledge society (higher knowledge content embedded in economic and social relationships and higher value placed on information and knowledge in society) and Everything as a Service (EaaS) (the shift towards subscription-based business models).

Specialisation and complexity

Economic growth is not just about expanding the size of an otherwise fixed economic framework. It is also associated with an increasing diversity of activities, complexity and specialisation. Increasing complexity drives the need for a range of services that help us navigate it.

● TECHNOLOGY AND SCIENCE

Virtualisation and dematerialisation

This trend involves substituting physical objects and processes with digital alternatives, including areas such as web portals, mobile apps and cloud services.

AI and computing power

This trend involves substituting human effort and work with machine-based processes, including robotisation and automation, with AI now becoming the dominant form. Economies benefit from enhanced performance and productivity gains. However, rapid changes pose challenges for the current workforce to adapt and retool. Increasing computing power is closely linked to this trend as an enabler. And while growth in computing power under the traditional paradigm (Moore's Law) may

be slowing, commercial applications of quantum computing are expected to take the lead over the coming years.

Greater interconnectedness

This trend reflects an increasingly interconnected world, highlighting the connectivity among people, between people and objects and among objects (IoT). It includes advancements in speed, reliability and bandwidth.

Life sciences and applications

Rapid advancements in fundamental research as well as R&D centred around living organisms are set to continue in various fields of biology, including biotechnology, biochemistry, genomics, epigenetics, neuroscience and microbiome research.

New materials

The need for materials with the highest attainable quality and performance at the lowest economic and environmental cost is driving manufacturing and technological breakthroughs. Progress in materials technology, including nanotechnology, is increasingly viewed as a possible solution to environmental and health challenges.

● SOCIETY

Growing disparities

Growing economic and social inequality has the potential to drive consumer and political behaviour, but also lead to growth disparities between market segments within the economy. While the statistical methods behind the measurement of inequality are debated, there is a perception that inequality is growing. Moreover, the impact of COVID-19 will exacerbate inequality in the near term and may continue to do so if the productivity gains from technological acceleration do not accrue evenly, as has often been the case.

Focus on health

There is a growing trend of prioritising health considerations in society at both individual and public level. This includes a greater focus on healthy lifestyles, preventive health, mental health and the primacy of public health, including pandemic preparedness and biosecurity.

Individualisation and empowerment

This trend involves an increased focus on individual characteristics and preferences, coupled with greater personal empowerment in some dimensions and is reshaping numerous aspects of consumer behaviour. Subtrends include a DIY society, waning trust in institutions/self-empowerment and customisation.

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● **DEMOGRAPHY****Urbanisation**

The benefits of agglomeration lead to productivity differentials between rural and urban areas. At the individual level, greater employment opportunities, social benefits and services as well as network effects are powerful drivers of urbanisation. This trend is expected to continue globally until 2050. However, the nature of the trend appears to be evolving, at least in developed nations. As part of a post-Covid-19 rethink, people are increasingly moving to suburbs than to central business districts.

Generational shifts

Generational dynamics are influenced by cohort size, socio-economic conditions, technological shifts and times of war. These factors shape how each generation interacts with the global economy. We distinguish between two subtrends: ageing, which reflects the general trend towards greater longevity and is compounded by the bulk of the baby boom generation now in retirement; and the hashtag generation, where millennials/echo boomers and Gen Z are exerting a growing influence on consumer and labour markets, accompanied by a shift in preferences and values.

Population growth and migration

With improvements in health and declines in mortality, the global population has quadrupled over the last 100 years. Population growth has mixed implications for both individual countries and the global economy. While the UN expects global population growth over the coming decades, the distribution of this growth is becoming much more mixed: Europe and large parts of Asia are expected to see declining populations, while the bulk of population growth is expected to occur in Africa. Pressure from international migration flows will likely intensify as a result of these developments.

● **ENVIRONMENT****Climate change**

Growing understanding and awareness of the risks and impacts of climate change are leading to a greater willingness to act to limit greenhouse gas (GHG) emissions, both through policy-making and individual and business decisions (mitigation). At the same time, warmer temperatures, rising sea levels and extreme weather are becoming increasingly noticeable, leading to a greater focus on resilience and climate change adaptation.

Resource scarcity

Economic and population growth continue to drive demand for raw materials, energy, water and agricultural supplies, creating growing pockets of

scarcity and resource stress. Evidence of such mounting challenges is fostering a growing collective awareness of resource issues, which, in turn, is increasingly influencing policy actions, consumer behaviour and business decisions. The resource scarcity megatrend encompasses the full chain from information through to awareness and action. One critical implication is the growing focus on resource efficiency solutions aimed at decoupling resource consumption from economic and business growth.

Environmental quality

The environmental impacts of industrialisation have increased the pollution levels in water, air and soil. Deteriorating environmental quality adversely affects health and wellbeing and also has economic costs. As a result, environmental protection and improvement have become growing priorities, influencing policy-making and business practices.

Biodiversity and ecosystem services

The dramatic pace of biodiversity loss has led scientists to talk about the sixth mass extinction. Awareness of the costs associated with biodiversity loss is rising rapidly among policymakers and the business community. The adverse impact on ecosystem services and natural capital, along with the associated economic cost, is becoming better understood. Policy and behavioural change to address these concerns will be powerful drivers of change in the coming decades.

● **GLOBAL GOVERNANCE****(De)globalisation**

This trend reflects the growing interlinkages and interdependencies across nations within the global economic and social system. Globalisation includes different dimensions, some of which are strengthening while others are weakening. Trade, which peaked in 2007, is now likely reversing at least in some areas. The direction of the trend is unclear for investment and travel/migration, while for information and culture, globalisation is likely still increasing.

Geopolitical tensions

The rivalry between the world's main geopolitical protagonists appears set to continue increasing. China's rise to superpower status continues both economically and geopolitically, while the US struggles to maintain its leadership and actors such as the EU and Russia continue to exert selective influence.

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