



Sustainable Portfolio Management Report 2023

 **BARCLAYS** | Private Bank



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Welcome to our Sustainable Portfolio Management Report 2023

As the world faces mounting environmental and social challenges, the need for investment in sustainable solutions is clear. Pressure is mounting to meet the UN's Sustainable Development Goals by 2030, especially in areas where the COVID-19 pandemic has reversed years of progress.

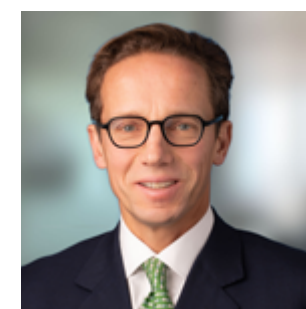
For investors, the importance of managing, and truly understanding, ESG¹ risks is growing – but so are the potential opportunities, as these issues increasingly become a priority for governments and corporates alike. As a result, the global shift from more traditional to sustainable investing is firmly underway, despite the understandable ongoing concerns around greenwashing.

As the report confirms, sustainable investing is about far more than the environment. For that reason, the topics covered are deliberately varied to showcase the breadth of the issues at hand.

Among other things, we focus on how technological advances in healthcare could help eradicate infectious diseases like tuberculosis, as well as the innovative building materials and methods supporting more sustainable cities. We also delve into the challenge of powering the digital revolution and explore the importance of biodiversity in the fight against climate change.

You can find out some of the diverse impacts our investee companies are having, and how well our portfolios are aligned to the goals of the Paris Agreement.

I hope you enjoy reading the report, and I'd like to thank all clients who have invested with us.



Alastair Randall

Head of Multi-Asset Class Discretionary Portfolio Management

¹ ESG refers to a range of environmental, social and governance factors that can influence a company's operations, such as climate change, working conditions and executive pay.

Views from our Lead Portfolio Manager

Michael Topley reflects on the transitions, intentions and interventions currently shaping the global sustainable investing space.

The sustainable investing space faced a testing time in 2022, as increased regulatory scrutiny on greenwashing, and growing dissent from anti-ESG voices¹, were compounded by poor performance for many funds in the category.

Yet despite these challenges, the importance of sustainable investing considerations has, in my mind, never been clearer, with last year's shakeout providing a strong foundation for the years ahead.

THE TRAGEDY OF WAR HIGHLIGHTS THE NEED FOR RESILIENCE

The war in Ukraine has highlighted the fragility of the status quo to which we had grown accustomed. The human tragedy of the conflict has been exacerbated by disruption to energy and food supply chains that will likely see millions suffer as a result.

As soon as bombs began to drop, those critical of sustainable investing were quick to question its underpinnings. Within the first few weeks of the invasion, several journalists asked me whether armaments were now acceptable within our sustainable strategies, given the value of defence to democracy and in turn, human life. While my answer was 'no' for several reasons, it shows the subjective nature of determining whether a company's economic activity is helping to advance sustainability (or not).

In the absence of a Sir David Attenborough equivalent for the investment world, who could issue a sustainability 'seal of approval', there is no easy solution to this. Instead, when deciding which asset managers to entrust with their capital, investors could consider the processes underpinning their approach, the transparency of their rationale, and whether they believe the team managing the strategy shares similar values and intentions.

Ultimately, portfolio management is a people business – just as investors trust a manager's ability to make sound investments from a financial perspective, they also need to judge their ability to select sustainable investments from a values perspective.

Among other things, the war in Ukraine has highlighted the importance of integrating environmental, social and governance (ESG) considerations into investment due diligence as a factor to drive value.

As we have discussed in previous reports, ESG factors² can be an important determinant in understanding the operational quality and resilience of a business. As an example, businesses that have been dependent on Russian gas for their operations have likely faced considerable challenges in sourcing alternative energy sources, highlighting the benefit of having a diversified supply chain, or investing into renewables in order to become self-sufficient.

¹ 'Some GOP States Push Back Against ESG Investing Trend', The Wall Street Journal, 2022
<https://www.wsj.com/articles/esg-backlash-at-odds-with-shift-by-companies-and-investors-11661825320>

CROWDED SUSTAINABLE TRADES HAVE HAD A TOUGH RIDE

For many sustainable funds, 2022 was a tough year of underperformance³. In particular, those with more of a thematic focus had too often concentrated into a small cohort of ESG darlings, which had been lifted by the loose monetary policy responsible for injecting trillions of dollars into the global economy since the pandemic – pushing valuations in these names to unpalatable highs⁴. As this policy was unwound, and interest rates increased rapidly in response to inflationary pressures, the stock price for many of these companies quickly deteriorated⁵.

The benefit of hindsight is of course a wonderful thing, but this does nonetheless highlight why adopting a non-thematic approach may be beneficial – putting the primary focus on understanding the underlying financials of a business, rather than on the specific sustainable objective it is targeting (and finding a good story).

ANTI-ESG LEGISLATION

Anti-ESG voices also grew louder in 2022. In the US, dozens of Republican states, including Texas and Louisiana, introduced laws banning fossil fuel investment restrictions, and divested state funds from managers offering investment solutions which incorporate ESG factors⁶. This was in response to concerns around how ESG considerations could impact their local oil-rich economies, as well as the pervasion of liberal politics into investment decision-making. In these states, investments must now focus solely on financial returns for the beneficiaries of state funds, and not place political or social goals above the duty to enhance financial return.

Asset managers may choose to incorporate investor values into the products they provide. At the same time, they may choose to invest in a responsible way that ensures the long-term sustainability of investments, in the pursuit of greater long-term financial returns. According to the UN Principles for Responsible Investment, this means “acting in such a way as to encourage sustainable economies and markets, and (...) to reduce the economic risk presented by sustainability challenges”⁷.

At present, support for sustainable investing in the US seems to be split along party lines. In the years ahead, however, it is likely to be the red states who will benefit most from the massive government subsidies earmarked for the energy transition. Biden’s Inflation Reduction Act, in particular, will see \$370+bn of clean energy subsidies delivered over the next decade⁸ – with much of this likely going into Republican states, such as Texas and Oklahoma.

A WAVE OF ANTI-GREENWASHING REGULATIONS

Regulators also began to tighten the screws on ESG and sustainable investing, with the roll-out of some significant regulations aimed at reducing greenwashing. These were accompanied by some high-profile raids and significant fines imposed on asset managers who were found to be greenwashing their products. This is clearly an important step for the industry and greenwashing risk is an area we continue to consider internally with our sustainable strategies.

However, these regulations aren’t without their limitations and challenges. For instance, under the EU’s Sustainable Financial Disclosure Regulations, a sustainable investment is one which meets the principle to “do no significant harm”, passes a “good governance” test, and has an economic activity that addresses a sustainable consideration⁹. These criteria do not currently allow for investment in companies that are on a journey of transition, supported by investor stewardship.

Meanwhile, the UK’s Sustainable Disclosure Requirements – currently under industry consultation – are looking to adopt a labelling regime that includes ‘Sustainable Improvers’, which allows for this type of investment¹⁰. This again highlights that sustainable investing is complex and that approaches will vary across managers.

In the coming years, a plethora of new sustainability regimes and standards will launch, with the aim of improving the disclosure and harmonisation of sustainability data, including:

- the IFRS Foundation’s International Sustainability Standards Board, which aims to set a “global baseline” standard for climate disclosures¹¹;
- the EU’s Corporate Sustainability Reporting Directive, which will require companies to report on rigorous, third-party audited emissions data¹²; and
- the long-awaited, and already controversial, SEC climate-related disclosure rules¹³.

All this confirms that top-down policymakers are intervening, in a major way, to drive forward the sustainability agenda and make it clearer what impact businesses are having on the world, as well as what impact the world is having on businesses. Improving transparency for investors, and inspiring their confidence in the sector, can only be a positive step towards a more sustainable future.

As always, I would like to thank all of our investors for continuing to entrust their capital with us. I hope you enjoy reading this year’s report.



Michael Topley
Head of Sustainable
Portfolio Management

² ESG refers to a range of environmental, social and governance factors that can influence a company’s operations, such as climate change, working conditions and executive pay.

³ ‘Sustainable funds hit by another year of underperformance’, Trustnet / FE fundinfo, 2023 <https://www.trustnet.com/news/13355497/sustainable-funds-hit-by-another-year-of-underperformance>

⁴ ibid <https://www.trustnet.com/news/13355497/sustainable-funds-hit-by-another-year-of-underperformance>

⁵ ibid <https://www.trustnet.com/news/13355497/sustainable-funds-hit-by-another-year-of-underperformance>

⁶ ‘Some GOP States Push Back Against ESG Investing Trend’, The Wall Street Journal, 2022 <https://www.wsj.com/articles/esg-backlash-at-odds-with-shift-by-companies-and-investors-11661825320>

⁷ ‘The SDG Investment Case’, Principles for Responsible Investment, 2017 <https://www.unpri.org/download?ac=5909>

⁸ ‘Inflation Reduction Act Guidebook’, The White House, 2022 <https://www.whitehouse.gov/cleanenergy/inflation-reduction-act-guidebook/>

⁹ EU Sustainable Financial Disclosure Regulation, European Parliament and Council of the European Union, 2019 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R2088&from=EN>

¹⁰ ‘CP22/20: Sustainability Disclosure Requirements (SDR) and investment labels’, Financial Conduct Authority, 2022

¹¹ IFRS Foundation, 2023 <https://www.ifrs.org/projects/work-plan/climate-related-disclosures>

¹² Corporate Sustainability Reporting Directive, European Parliament and Council of the European Union, 2022 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022L2464>

¹³ US Securities and Exchange Commission, 2022 <https://www.sec.gov/news/press-release/2022-46>



Our exposure to key ESG factors

A look at the internal operational quality of our investee companies.

Here we provide a snapshot of our sustainable strategies' exposure to key environmental, social and governance (ESG) factors, and how they compare to the wider market¹. ESG data helps us to assess the internal operational quality of a business, and its ability to mitigate risks to future cash flow that may arise from ESG factors. We integrate ESG analysis throughout our investment due diligence, and the data shown here is an output of that process.

For more details on our approach to ESG integration, please see the [Barclays Private Bank Responsible Investing Policy \(Discretionary Portfolio Management\)](#).

Please note that for comparison purposes here, we use the MSCI All Country World Index, which is a stock index designed to represent the wider global equity market. However, this index does not focus specifically on sustainable companies or consider ESG characteristics, and should not be relied upon to compare how well Barclays Private Bank sustainable strategies perform against other sustainable strategies in the market, or even against other traditional/non-sustainable strategies.

Unless otherwise stated, companies referenced in this report were held by our sustainable strategies as of 31 December 2022 and may no longer form part of our portfolios.

¹ Sustainable strategies here refer to the equity portion of the Multi-Asset Class Sustainable Total Return and Sustainable Global Equity discretionary strategies managed by Barclays Private Bank. The data shown does not take into consideration the impact of other financial instruments held in the strategies. The wider market is defined here as the MSCI All Country World Index, which is a stock index designed to represent large- and mid-cap stocks across a number of developed and emerging markets. Please note that this index does not focus specifically on sustainable companies or ESG characteristics.

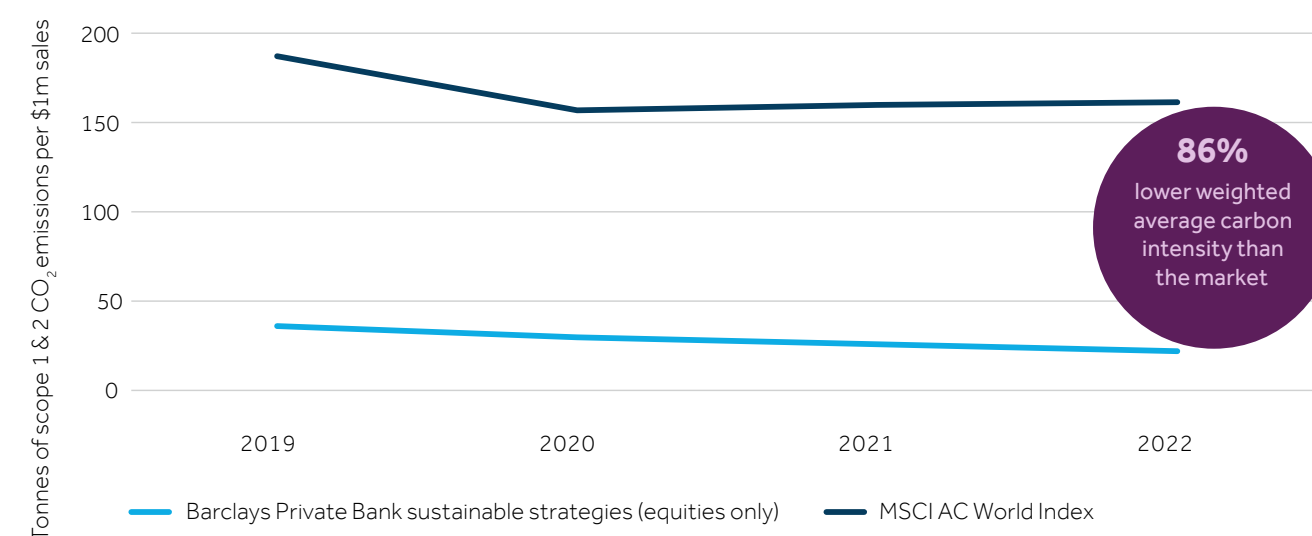
ENVIRONMENTAL RISK

Carbon intensity

Amid the growing climate emergency and heightened geopolitical risk, understanding the emissions profile of a business is increasingly important. Companies with high carbon intensity are more likely to fall under the remit of a carbon pricing mechanism, and are more exposed to fluctuations in global oil and gas prices.

Carbon intensity shows the amount of carbon required to generate revenue. Some businesses are naturally in higher-intensity industries, but their products remain of critical importance to our societies. Analysing a company's opportunities for decarbonisation, and the nature of its emissions, can provide useful insights into the risks it faces.

Weighted average carbon intensity



Source: MSCI ESG Research, as of 31 December 2022²

Weighted average carbon intensity is a measure of a portfolio's exposure to carbon-intensive companies. The figure is the sum of each security's weight multiplied by the security's carbon intensity (tonnes of scope 1 & 2 carbon emissions per \$1 million sales)³. This is a best practice metric across the industry to measure carbon risk.

² See footnote 1

³ Scope 1 carbon emissions are direct emissions that occur from sources that are controlled or owned by an organisation (e.g. emissions associated with fuel combustion in boilers, furnaces, vehicles). Scope 2 carbon emissions are indirect emissions associated with the purchase of electricity, steam, heat, or cooling.

Carbon intensity

(Tonnes of scope 1 & 2 CO₂ emissions per \$1m sales)

Top 5 companies	
Apple	0.2
AIA	0.6
UnitedHealth	0.7
HDFC Bank	1.7
Intuit	1.9
Bottom 5 companies	
Amazon.com	39
EssilorLuxottica	42
Croda	100
American Tower	121
TSMC	198

Source: MSCI ESG Research, as of 31 December 2022

Net-zero alignment

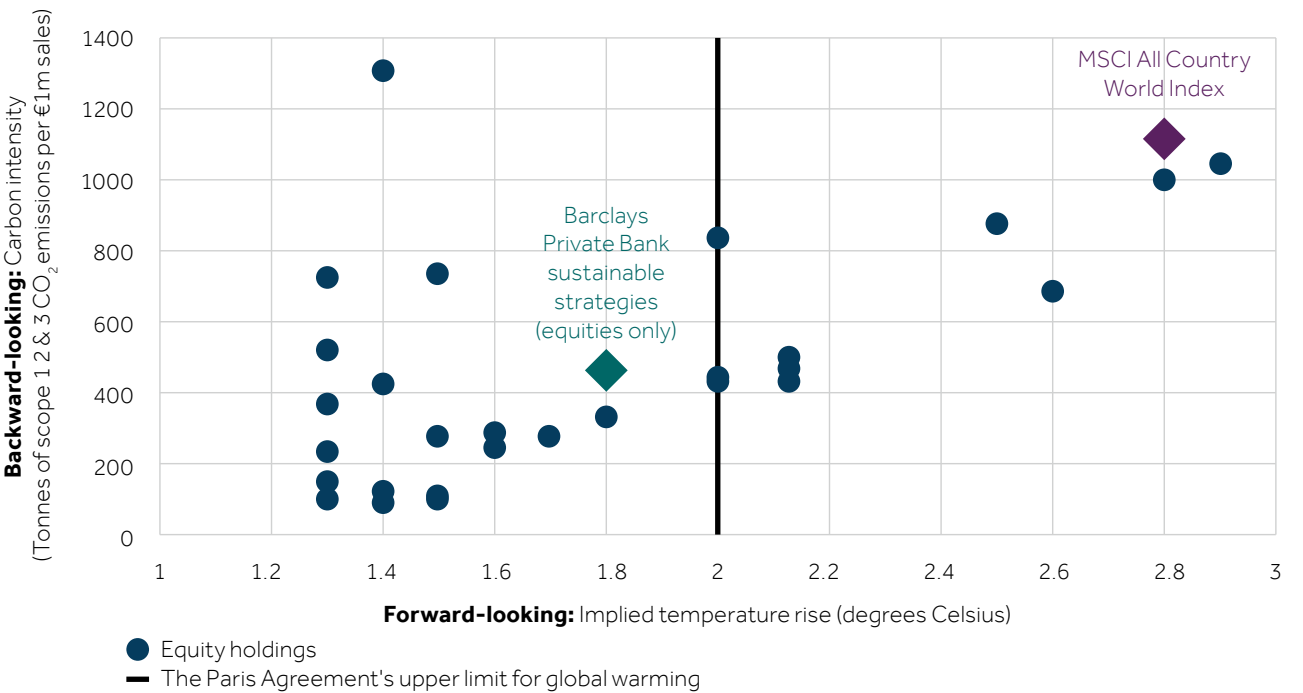
Our sustainable strategies⁴ aim to be aligned with the Paris Agreement goals to limit global warming to well below 2°C above pre-industrial levels – and ideally to below 1.5°C.

When analysing the emissions profile of a company, it's important to consider both backward-looking and forward-looking metrics. Backward-looking metrics, such as carbon intensity, allow us to understand how a company performs relative to peers based on its historical emissions. However, they do not account for any operating changes the company may make to reduce carbon emissions⁵.

A consultation launched by the Task Force on Climate-related Financial Disclosures (TCFD) highlighted the need for forward-looking metrics to estimate how a company's expected future emissions align to the Paris Agreement goals⁶. One example is the Implied Temperature Rise (ITR) metric, which in essence aims to indicate what the level of global warming would be if the world had the same emissions profile as the company. This estimate takes into account the company's historical emissions, its carbon reduction targets, and its allocated share of the remaining global carbon budget⁷.

Each dot in the chart below represents the emissions profile of an investee company, using backward-looking carbon intensity and forward-looking ITR metrics. The chart shows that the majority of our equity holdings have favourable emissions profiles on both measures, especially when compared to the wider equity market, which is represented here by the MSCI All Country World Index. We use this information to steer further due diligence to better understand companies' carbon reduction intentions and initiatives.

Backward-looking vs. forward-looking carbon analysis



Source: MSCI ESG Research, as of 31 December 2022

Implied temperature rise



Source: MSCI ESG Research, as of 31 December 2022⁹

⁴ See footnote 1

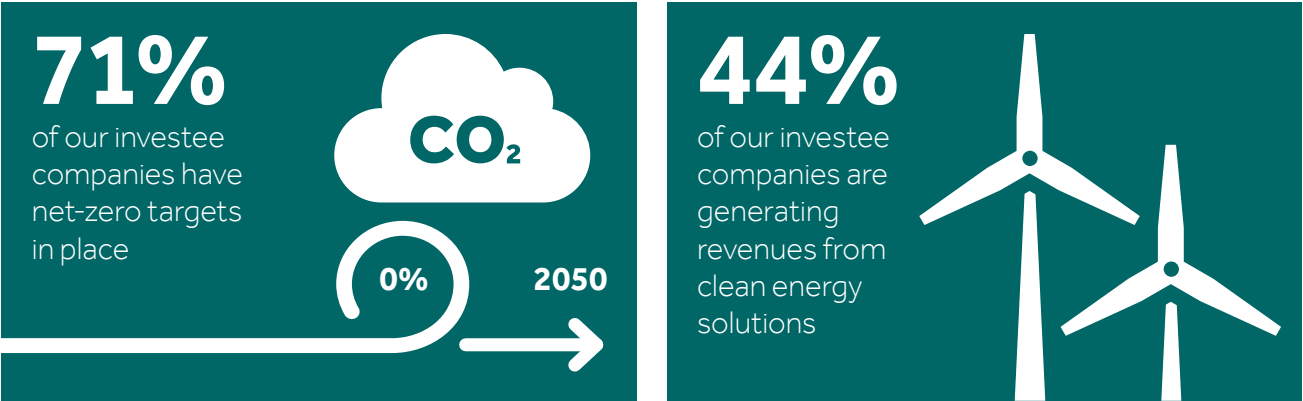
⁵ Past data relating to carbon metrics is not a reliable indicator of the future carbon footprint of our strategies and must not be relied upon as a sole factor when making investment decisions.

⁶ 'Task Force on Climate-related Financial Disclosures Forward-Looking Financial Sector Metrics Consultation' TCFD, October 2020 https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Consultation-Forward-Looking-Financial-Sector-Metrics.pdf

⁷ Forward-looking temperature metrics, such as the MSCI Implied Temperature Rise metric, are based on projections and so are indicative only, may be sensitive to change and based on estimates which may not be accurate or complete. There is no guarantee that each company has set net-zero targets or that a company will be able to achieve its emission reduction targets or that even if such targets are achieved, future warming or emissions levels will be as predicted.

⁸ See footnote 1

⁹ See footnote 1



71% of portfolio companies have net-zero targets in place, over half of which have been independently validated by the Science-Based Targets initiative¹⁰.

As of March 2023, 10 of our 35 investee companies have yet to publish comprehensive net-zero plans or targets. While the majority of these are already doing better than the market average on carbon abatement given their capital-light business models, we are concerned that they do not have formal strategies in place to prove that they are limiting the worst impacts of climate change and future-proofing their business growth.

As we intend to have a net-zero investment strategy, we are actively engaging with these businesses – via EOS at Federated Hermes – to encourage the adoption of science-based targets¹¹.

44% of portfolio companies are working on clean energy solutions across areas such as energy efficiency, pollution prevention and sustainable water management, as defined by MSCI ESG Research.

Source: Science-based Targets initiative, MSCI ESG Research, as of 31 December 2022

Waste

Reducing waste can help cut carbon emissions and protect vital resources. While some companies will naturally produce more than others, understanding how companies manage their waste can offer more nuanced insights into the related risks. For example, Croda is the most waste-intensive company in our sustainable strategies, but is also among the best at recycling and avoiding landfill.

Waste intensity (Tonnes per \$1m sales)	Waste diverted from landfill																								
<table><tr><th>Top 5 companies</th><th></th></tr><tr><td>Visa</td><td>0.0</td></tr><tr><td>Discover Financial Services</td><td>0.0</td></tr><tr><td>Intuit</td><td>0.1</td></tr><tr><td>UnitedHealth</td><td>0.1</td></tr><tr><td>Adobe Systems</td><td>0.1</td></tr></table>	Top 5 companies		Visa	0.0	Discover Financial Services	0.0	Intuit	0.1	UnitedHealth	0.1	Adobe Systems	0.1	<table><tr><th>Top 5 companies</th><th></th></tr><tr><td>TSMC</td><td>100%</td></tr><tr><td>Croda</td><td>97%</td></tr><tr><td>Nike</td><td>97%</td></tr><tr><td>L'Oreal</td><td>97%</td></tr><tr><td>American Tower</td><td>96%</td></tr></table>	Top 5 companies		TSMC	100%	Croda	97%	Nike	97%	L'Oreal	97%	American Tower	96%
Top 5 companies																									
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<table><tr><th>Bottom 5 companies</th><th></th></tr><tr><td>CSL</td><td>5.3</td></tr><tr><td>TSMC</td><td>11.9</td></tr><tr><td>Sika</td><td>15.0</td></tr><tr><td>Sherwin Williams</td><td>17.1</td></tr><tr><td>Croda</td><td>28.3</td></tr></table>	Bottom 5 companies		CSL	5.3	TSMC	11.9	Sika	15.0	Sherwin Williams	17.1	Croda	28.3	<table><tr><th>Bottom 5 companies</th><th></th></tr><tr><td>UnitedHealth</td><td>40%</td></tr><tr><td>Sherwin Williams</td><td>40%</td></tr><tr><td>CSL</td><td>38%</td></tr><tr><td>Sika</td><td>34%</td></tr><tr><td>Halma</td><td>33%</td></tr></table>	Bottom 5 companies		UnitedHealth	40%	Sherwin Williams	40%	CSL	38%	Sika	34%	Halma	33%
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Source: Barclays Private Bank, calculated using data reported by investee companies.

Nine investee companies do not currently disclose waste data and so are excluded from the analysis.

¹⁰ The SBTi defines and promotes best practice in science-based target setting, and independently assesses and approves companies' targets in line with its strict criteria. For more information, visit <https://sciencebasedtargets.org/>

¹¹ Barclays Private Bank has partnered with a leading stewardship provider, EOS at Federated Hermes, to support us with engagement and voting activities. Engagement activity is undertaken for our direct fixed income and equity holdings, while voting activity is only undertaken for our direct equity holdings. Engagement (on select material ESG issues) and voting activities are being exercised in relation to all of our Private Bank DPM investment strategies globally with the exception of services managed in India. Please note engagement and voting activities have been undertaken in the UK since Q2 2021, in Jersey since Q4 2021, and in Ireland, Switzerland and Monaco since Q4 2022. For more information, visit <https://privatebank.barclays.com/what-we-offer/investments/responsible-investing-engagement-and-voting-activities>

Water

As global temperatures rise, water is becoming an increasingly scarce resource in many parts of the world. Different industries will have varying dependencies on water for their continued operations. Digital businesses will likely require much less water than certain industrials or semiconductor manufacturers, for example.

The materiality of a company's water requirements will also depend on where their facilities are based. Operating within the high water-stress regions of California, for example, will likely add greater pressure to businesses

than if their facilities were based in areas with higher rainfall. Understanding the water intensity of a company's operations, along with their geographical footprint, and their water management and conservation initiatives, is key to assessing the operational risks to that business.

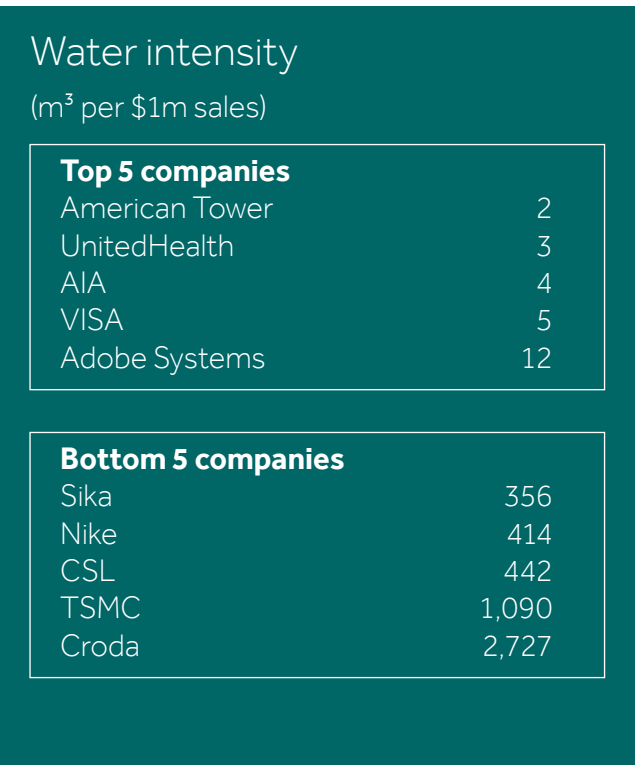
Eight of our investee companies do not currently disclose water usage data.

Water risk		
	Barclays Private Bank sustainable strategies	MSCI AC World Index
Total water intensity (m³ per \$1m sales)	231	107,792
Exposure to high water risk	2.8%	7.3%
Water reduction targets in place	37.1%	33.9%

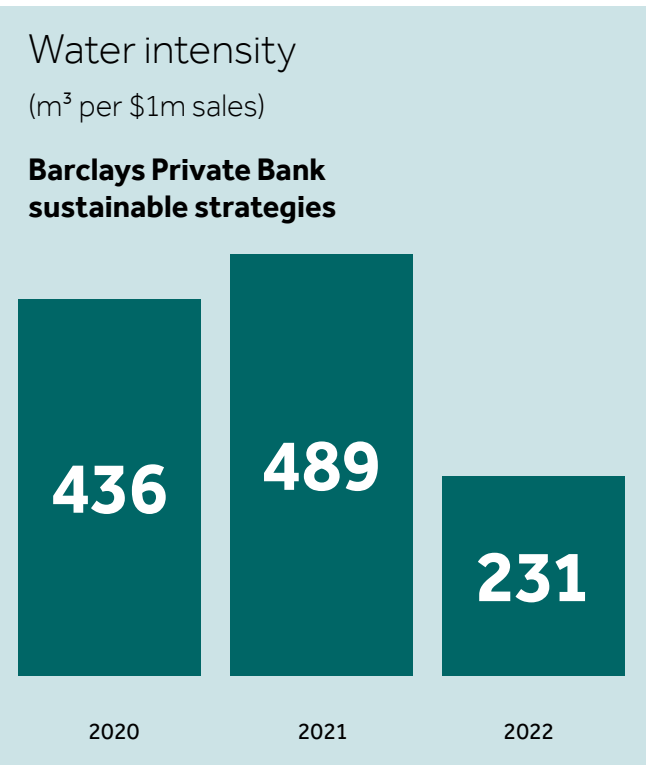
Source: MSCI ESG Research, as of 31 December 2022¹²

Exposure to high water risk: The percentage of portfolio's market value exposed to companies with a Water Stress Exposure Score > 6.6. Scores combine the geographic and business segment components and range from 0 to 10.

Total water intensity: The company's reported water withdrawal (m³) normalised to sales (USD million), which allows for comparisons between companies of different sizes.



Source: MSCI ESG Research, as of 31 December 2022



Source: MSCI ESG Research, as of 31 December 2022¹³

¹² See footnote 1

¹³ See footnote 1

SOCIAL RISK

International norms violations		
	Barclays Private Bank sustainable strategies	MSCI AC World Index
UN Global Compact violations	0.0%	0.7%
Human rights violations	0.0%	0.7%
Labour norms violations	0.0%	0.3%

Source: MSCI ESG Research, as of 31 December 2022¹⁴

Please note that compliance with these principles and norms is determined subjectively by third-party data providers.

UN Global Compact violations: The percentage of portfolio's market value exposed to companies in violation of the UN Global Compact principles.

Labour norms violations: The percentage of portfolio's market value exposed to companies in violation of the International Labour Organisation's broader set of labour standards.

Human rights violations: The percentage of portfolio's market value exposed to companies in violation of the UN's Guiding Principles on Business and Human Rights.

Business involvement		
	Barclays Private Bank sustainable strategies	MSCI AC World Index
Adult Entertainment	0.0%	0.1%
Alcohol	0.0%	3.4%
Armaments	0.0%	4.3%
Gambling	0.0%	0.8%
Tobacco	0.0%	0.9%
Fossil Fuels	0.0%	8.7%

Source: MSCI ESG Research, as of 31 December 2022¹⁵

Please see the notes on page 65 for more details on the data shown in this table.

¹⁴ See footnote 1

¹⁵ See footnote 1

GOVERNANCE RISK

Governance & leadership		
	Barclays Private Bank sustainable strategies	MSCI AC World Index
Lack of independent board majority	1.8%	9.3%
Independent board members	80.9%	63.6%
Companies with no female directors	0.0%	2.1%
Females represent at least 30% of directors	70.0%	63.0%

Source: MSCI ESG Research, as of 31 December 2022¹⁶

Lack of independent board majority:

The percentage of portfolio's market value exposed to companies lacking an independent board majority.

Females represent at least 30% of directors:

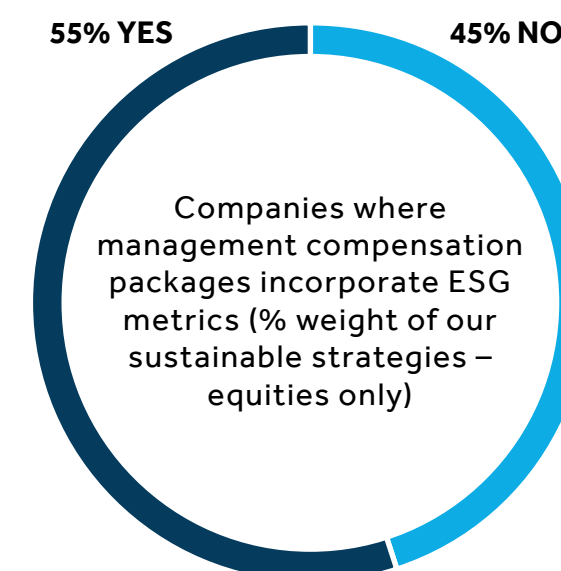
The percentage of portfolio's market value exposed to companies where women comprise at least 30% of the board of directors.

Companies with no female directors: The percentage of portfolio's market value exposed to companies with no female directors.

Female directors (%)	
Top 5 companies	
Halma	50.0%
Schneider Electric	50.0%
Croda	50.0%
London Stock Exchange Group	46.2%
Amazon.com	45.5%
Bottom 5 companies	
Tencent Holdings	22.2%
Oxford Nanopore Technologies	20.0%
HDFC Bank	20.0%
AIA	18.2%
TSMC	10.0%

Source: MSCI ESG Research, as of 31 December 2022

¹⁶ See footnote 1



Source: MSCI ESG Research, as of 31 December 2022

The positive impact our companies are making

Some of the ways our investee companies are supporting the UN's Sustainable Development Goals.

Unless otherwise stated, companies referenced in this article were held by our Multi-Asset Class Sustainable Total Return and Sustainable Global Equity discretionary strategies as of 31 December 2022 and may no longer form part of our portfolios.

Our sustainable strategies invest in companies whose business activities support at least one of the UN's Sustainable Development Goals (SDGs). Here, we highlight some of the ways our investee companies reported the differences they have made to a range of sustainability challenges in their 2021 or 2022 annual sustainability report or a recent interim update.

For each company, the positive impact figure shown reflects one aspect of its business – and the corresponding illustrative allocation to our investment figure is based on the proportion of the company held by our sustainable strategies. Further details on how these figures have been calculated are set out in the notes on page 24.

The impact data and related SDGs shown are highlights only. Certain companies will be having a positive impact across other product lines and/or other SDGs.

There may also be areas where companies could improve their environmental, social and/or governance profile, which are not included here. In these cases, we typically work with them to promote change, in partnership with our stewardship services provider EOS at Federated Hermes (EOS). Through our partnership with EOS, we seek to highlight key ESG issues of concern, that we believe are material to the portfolio companies related to our direct fixed income and equity holdings.

Details of engagement and voting activities undertaken with EOS can be found on page 25. For more information about our approach to stewardship, please see the [Barclays Private Bank Responsible Investing Policy \(Discretionary Portfolio Management\)](#).

POSITIVE IMPACTS REPORTED BY OUR INVESTEE COMPANIES FOR 2021 AND 2022

The following tables set out some of the positive impacts reported by our investee companies for 2021 and 2022 and include some illustrative figures to demonstrate how our investments into these companies might be allocated. Further details on how these metrics should be interpreted and understood are included on page 24.

SDG 13: CLIMATE ACTION

COMPANY IMPACT
2011–OCT 2022:

**>105 bn
kWh energy**

ILLUSTRATIVE ALLOCATION
TO OUR INVESTMENT*:

4.76m kWh energy



ALPHABET

Google's Nest thermostats have, on average, energy savings of 10%–12% for heating and 15% for cooling. As of October 2022, Nest thermostats helped customers cumulatively save more than 105 billion kWh of energy since 2011¹. This is the equivalent to CO₂ emissions from 19.9 coal-fired power plants in one year².

Sources: '[Accelerating Climate Action at Google and Beyond](#)', Google 2022, EPA, June 2023 <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

SDG 16: PEACE, JUSTICE & STRONG INSTITUTIONS



AMAZON

Since the start of the war in Ukraine, Amazon provided humanitarian aid and assistance to the people of Ukraine, including financial and in-kind donations, cloud computing credits, resettlement support, and more. AWS was awarded the Ukraine Peace Prize for the support it has shown the Ukraine government and the Ukrainian people.

Source: [Amazon Sustainability Report 2021](#)

SDG 3: GOOD HEALTH & WELL-BEING

COMPANY IMPACT IN 2021:

55m people

ILLUSTRATIVE ALLOCATION
TO OUR INVESTMENT*:

92,364 people



CRODA

Croda sun protection ingredients helped protect 55 million people from potentially developing skin cancer in 2021.

Source: [Croda Sustainability Report 2021](#)

*Investment refers to both Sustainable Multi-Asset Class and Sustainable Global Equity discretionary strategies managed by Barclays Private Bank

¹ These energy savings are calculated by Google and are based on the typical percentage of heating and cooling savings found in real-world studies of the Nest thermostats (see real-world studies here: <https://storage.googleapis.com/nest-public-downloads/press/documents/energy-savings-white-paper.pdf>). To calculate the total savings, the company applies these savings percentages to the actual heating and cooling hours of all Nest thermostats. Energy savings are an estimate, not a guarantee that any individual user will save energy. Google report live company impact data here: https://store.google.com/us/product/nest_learning_thermostat_3rd_gen?hl=en-US&GoogleNest.

² Calculated using the US Environmental Protection Agency's Greenhouse Gas Equivalencies calculator which uses the AVoided Emissions and geneRation Tool (AVERT) U.S. national weighted average CO₂ marginal emission rate to convert reductions of kilowatt-hours into avoided units of carbon dioxide emissions. Further details are available here: <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>

SDG 7: AFFORDABLE & CLEAN ENERGY

COMPANY IMPACT AS
REPORTED IN 2021³:

10,000+
wind turbines

ILLUSTRATIVE ALLOCATION
TO OUR INVESTMENT*:

12 wind turbines



HALMA

More than 10,000 wind turbines
protected by over 23,000 fire
suppression systems supplied by Halma⁴.

Source: [Halma Sustainability Report 2021](#)

SDG 17: PARTNERSHIPS FOR THE GOALS

COMPANY IMPACT IN 2021:

>£50bn
sustainable finance raised

ILLUSTRATIVE ALLOCATION
TO OUR INVESTMENT*:

**20.9m sustainable
finance raised**



LONDON STOCK EXCHANGE GROUP

Sustainable Bond Market supported
more than 100 debt issuers globally to
raise over £50 billion in sustainable
finance in 2021.

Source: [LSEG Sustainability Report 2021](#)

SDG 3: GOOD HEALTH & WELL-BEING

COMPANY IMPACT IN 2021:

180m
COVID-19 vaccine doses

ILLUSTRATIVE ALLOCATION
TO OUR INVESTMENT*:

**9,726 COVID-19
vaccine doses**



JOHNSON & JOHNSON

180 million doses of COVID-19 vaccine
shipped to the African Union, COVAX
and South Africa through advanced
purchase agreements and country
donations in 2021.

Source: [Johnson & Johnson Health
for Humanity Report 2021](#)

SDG 9: INDUSTRY, INNOVATION & INFRASTRUCTURE

COMPANY IMPACT IN 2021:

34.7bn
identity threats blocked

ILLUSTRATIVE ALLOCATION
TO OUR INVESTMENT*:

**928,977 identity
threats blocked**



MICROSOFT

Blocked 34.7 billion attempts to
compromise its customers'
identity information.

Source: [Microsoft Impact Summary 2022](#)

SDG 13: CLIMATE ACTION

COMPANY IMPACT AS
REPORTED IN 2021⁵:

190m
litres

ILLUSTRATIVE ALLOCATION
TO OUR INVESTMENT*:

103,154 litres



HEXAGON

In the global agriculture market, Hexagon
estimates that its positioning systems
have reduced fuel usage by 190
million litres.

Source: [Hexagon Sustainability Report 2021](#)

SDG 7: AFFORDABLE & CLEAN ENERGY

COMPANY IMPACT
CUMULATED SINCE 2008:

39.7m
people

ILLUSTRATIVE ALLOCATION
TO OUR INVESTMENT*:

8,160 people



SCHNEIDER ELECTRIC

Provided 39.7 million people with access
to green electricity (cumulated
since 2008).

Source: [Schneider Electric Sustainability
Impact Report Q4 2022](#)

*Investment refers to both Sustainable Multi-Asset Class and Sustainable Global Equity discretionary strategies managed by Barclays Private Bank

³ The timeframe relating to this impact is not stated by Halma in its report.

⁴ These metrics are approximate estimates published by Halma, based on best available data and a number of management assumptions about usage of its products. They are updated for significant changes which are not expected to occur on an annual basis. The key assumptions are set out on the website at www.halma.com.

*Investment refers to both Sustainable Multi-Asset Class and Sustainable Global Equity discretionary strategies managed by Barclays Private Bank

⁵ The timeframe relating to this impact is not stated by Hexagon in its report.



EXPLANATORY NOTES ON COMPANY
IMPACT DATA

The company impact metrics shown are taken from the relevant company's 2021 or 2022 annual sustainability report or a recent interim update, and are therefore deemed accurate as of the period stated by the relevant company. Such metrics relate to different time periods for each company and are subject to certain limitations. These metrics have not been independently verified by Barclays.

The company impact metric varies for each company shown and is specific to each company's focus area e.g. kWh energy, gigabytes, vaccine doses (please see the accompanying company text for details). Furthermore, company reporting timelines may not align with each other and/or with the period during which such companies were held in our portfolios. It is therefore not possible to make direct comparisons between the companies shown and/or our portfolio holdings based on this data.

The illustrative allocation to our investment metrics are calculated by multiplying the relevant company impact metric by the proportion of the company held by our sustainable strategies as of 31 December 2022, based on share count. This is an illustrative point-in-time assessment only.

This calculation does not take into account the proportion of the company held by our sustainable strategies based on share count as of the date relating to the company impact metric, and we may no longer hold these companies within our portfolios. Such figures are not an opinion to each company's present or future value or an indication of how our holdings finance the company impact highlighted in the table.

Illustrative allocation to our investment =
Company Impact Metric X (Strategy Nominal
Share Holding ÷ Total Company Share Count).



Engaging and voting
for change

Discover how we've been engaging and voting on behalf of our clients, in partnership with leading stewardship provider EOS at Federated Hermes.

The Private Bank Discretionary Portfolio Management business undertakes engagement and voting for investee companies in partnership with its stewardship services provider, EOS at Federated Hermes (EOS)¹.

We view engagement and voting as an important mechanism through which to hold management to account, and act as a lever to promote change in investee companies on material ESG issues where appropriate. We believe that companies that can better manage material ESG issues could be less prone to severe incidents, such as fraud, litigation or reputational issues. Further details are available on the [Barclays Private Bank Discretionary Portfolio Management website](#).

Here we provide an overview of the engagement and voting activities carried out in partnership with EOS in 2022, on behalf of UK and Jersey clients. Please note that not all reported activity will apply to individual accounts which deviate from our core strategy holdings.

Sustainable strategies refer to the Multi-Asset Class Sustainable Total Return and Sustainable Global Equity discretionary strategies managed by Barclays Private Bank.

¹ Engagement (on select material ESG issues) and voting activities are being exercised in relation to all of our Private Bank Discretionary Portfolio Management (DPM) investment strategies globally with the exception of services managed in India. Engagement activity is undertaken for our direct fixed income and equity holdings, while voting activity is only undertaken for our direct equity holdings. Please note engagement and voting activities have been undertaken in Ireland, Switzerland and Monaco since Q4 2022 and so are not included in this dataset. It is our intention to exercise voting in all markets, although at times our ability to do so may be hindered by regulatory and practical considerations, as well as internal restrictions.

ENGAGEMENT PROCESS

As highlighted on page 20, many of our investee companies are making a difference to a range of sustainability challenges. However, there are areas where these companies could further improve. Through our partnership with EOS, we seek to highlight key ESG issues of concern, that we believe are material to portfolio companies.

Engaging for change is often a long-term process. Some engagements involve one or two meetings over a period of months; others are more complex and entail meetings with different board members over several years. For that reason, EOS sets clear, specific and measurable objectives for each engagement at the outset and uses a four-step milestone approach to monitor progress, as outlined below.



Source: Barclays Private Bank and EOS at Federated Hermes, 2023

EOS's engagement is escalated and intensified with companies over time, depending on the materiality of the risks and issues, and feasibility of achieving change through engagement. EOS uses different methods to escalate and intensify engagement with companies over time, depending on the nature of the challenges faced and the attitude of the board towards dialogue.

EOS is an active participant in a number of collaborative industry bodies and initiatives around the world. Engagements through such collaborations are mechanisms that can increase influence to effect positive change.

Where we believe engagement is not successful, we will look to take further escalation measures, such as voting against management and potentially participating in filing shareholder resolutions in partnership with EOS.

ALIGNING ENGAGEMENT TO THE SDGs

EOS links its engagement issues and objectives to the UN's Sustainable Development Goals (SDGs) where relevant, which helps us better track how our investee companies are progressing. For our sustainable strategies, the most frequently engaged SDGs (as of 31 December 2022) include:

- **SDG #5** – Gender equality (gender diversity, conduct and culture, diversity and inclusion reporting, gender pay gap reporting, human rights)
- **SDG #8** – Decent work and economic growth (human rights, risk management, diversity)
- **SDG #10** – Reduced inequalities (human rights, human capital management, diversity, integrated reporting, and other disclosure)
- **SDG #12** – Responsible consumption and production (sustainability reporting, environmental indicators)
- **SDG #13** – Climate action (climate strategy, forestry and land use).

Engagement example: SDG #16 – Peace, justice, and strong institutions

Following EOS engagement, five of our technology companies have made progress on the protection of digital rights in the virtual world, such as challenges to the right to data privacy, the right to freedom of expression, and protection from unfair biases arising from artificial intelligence. Specifically, one of these companies has improved its responsible supply chain management and made a public commitment to freedom of expression. While these efforts are welcomed, in partnership with EOS, we will continue to push for further improvements in this area.

Engagement example: SDG #13 Climate action

Following EOS engagement, ten of our companies across various sectors have made progress on their respective engagement objectives related to climate change. Among others, these include working towards setting targets in line with the Paris Agreement and a 1.5-degree pathway, improving climate and TCFD reporting, and considering the use of science-based & scope 3 emissions targets².

While we appreciate the progress of these companies, we look forward to further efforts on climate action. The turbulent economic and political environment of 2022 pushed climate change engagement into new territory. Therefore, engagement on this topic is vital to help steward companies through a period of economic transformation. The collaborative engagement initiative Climate Action 100+ has been at the forefront of this activity, and EOS has played an important role within it.

In partnership with EOS, we will continue to push for progress where companies lag best practice, as well as welcome improved approaches and setting of new targets by companies. In respect to climate action, EOS would look to ensure company strategies and actions are aligned with the Paris Agreement goals, and that business models are resilient and can adapt to future climate change. EOS will also continue to focus on further efforts required in areas such as natural resource stewardship (protecting, preserving and restoring natural resources and biodiversity), as well as the move towards a circular economy and the need to control pollution levels to below harmful levels.

² The Taskforce on Climate-related Financial Disclosures (TCFD) reporting framework is based on a set of consistent disclosure recommendations for use by companies as a means of providing transparency about their climate-related risk exposures. Science-based targets show companies and financial institutions how much and how quickly they need to reduce their greenhouse gas (GHG) emissions to prevent the worst effects of climate change. Scope 3 emissions are produced by customers using a company's products or those produced by suppliers making products that a company uses.

OVERVIEW OF ENGAGEMENT ACTIVITIES ACROSS OUR SUSTAINABLE STRATEGIES

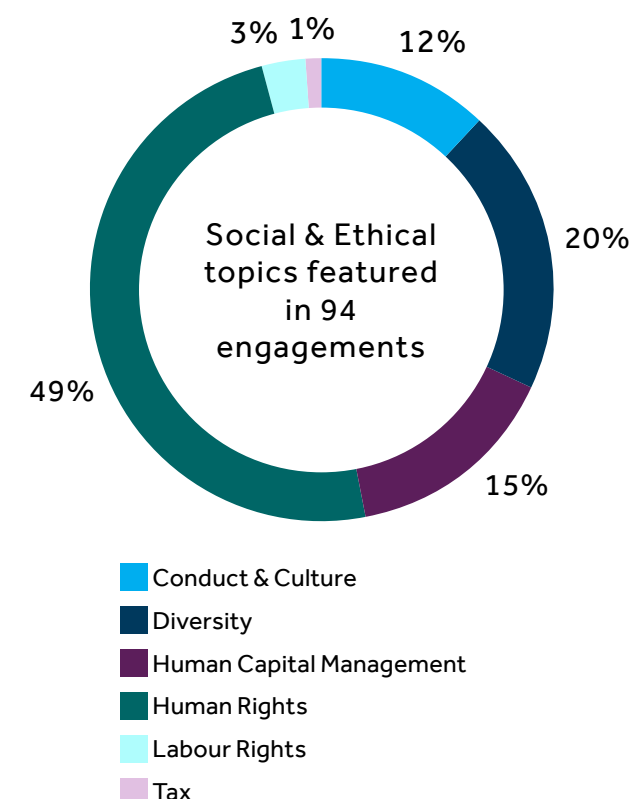
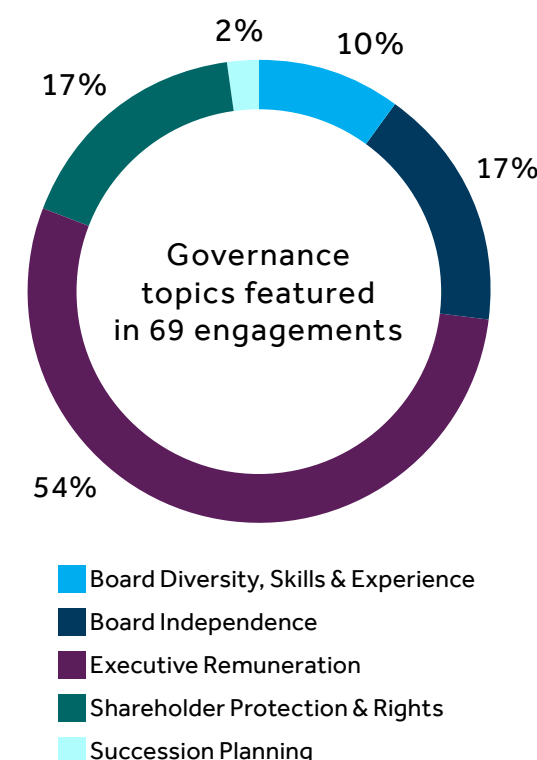
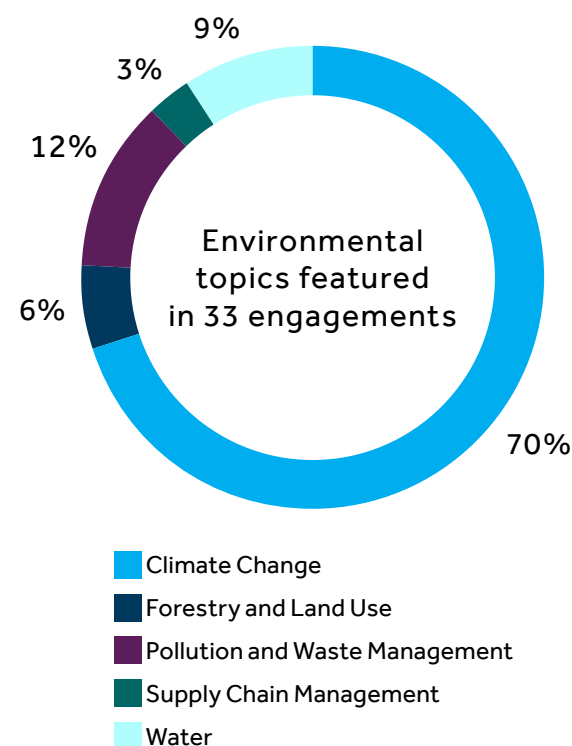
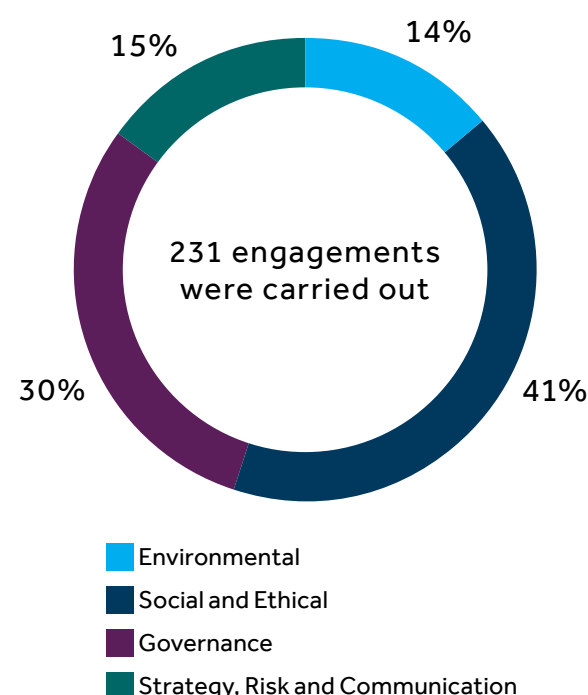
In 2022, 50 milestones³ were reached in relation to holdings in our sustainable strategies, across various engagement objectives. Some examples include:

- A US consumer goods company published its inaugural TCFD-aligned report in 2022 that puts in place the relevant frameworks for the management of climate-related risks and opportunities. While this reporting is much welcomed, further engagement is required to encourage the company to disclose the results of its scenario analysis under different temperature scenarios, as well as provide more information on its strategy for reducing its scope 3 emissions⁴ to net zero by 2050.

We believe that companies improving their climate risk disclosures and aligning these with the TCFD recommendations provide transparency and give investors better visibility of their exposure to climate-related risk and opportunities.

- A US pharmaceutical and healthcare company published a sustainability report based on a standard reporting guideline, such as the Global Reporting Initiative or Sustainability Accounting Standards Board. The company also published detailed workforce diversity statistics, including gender and ethnicity with breakdowns by leadership level.

Going forward, engagement with the company would be welcome to expand pay gap reporting and set public targets for increased diversity across all levels of the organisation, as a means for deriving more meaningful insights to meet the company's goals of equality, diversity and inclusion.



Source for all charts: Barclays Private Bank and EOS at Federated Hermes, for the period 1 January to 31 December 2022.

³ Please see the chart on page 26 for details of EOS's four-step milestone approach

⁴ See footnote 2 for a definition of scope 3 emissions.

Whilst we endeavour to ensure that all the information included here is accurate, correct, up to date and complete, we accept no liability, arising from any information which is not accurate, correct, up to date, complete, or which has been superseded. This information is not intended to constitute advice, and you use it at your own risk.

VOTING PROCESS

Voting forms an integral part of our overall stewardship strategy and is used as a tactical tool to achieve the desired change on ESG issues. Our portfolio managers receive voting recommendations on upcoming annual general/extraordinary meeting resolutions from EOS. These resolutions are analysed by EOS against a range of voting principles and policies⁵, which are based on international best practice and local regional considerations.

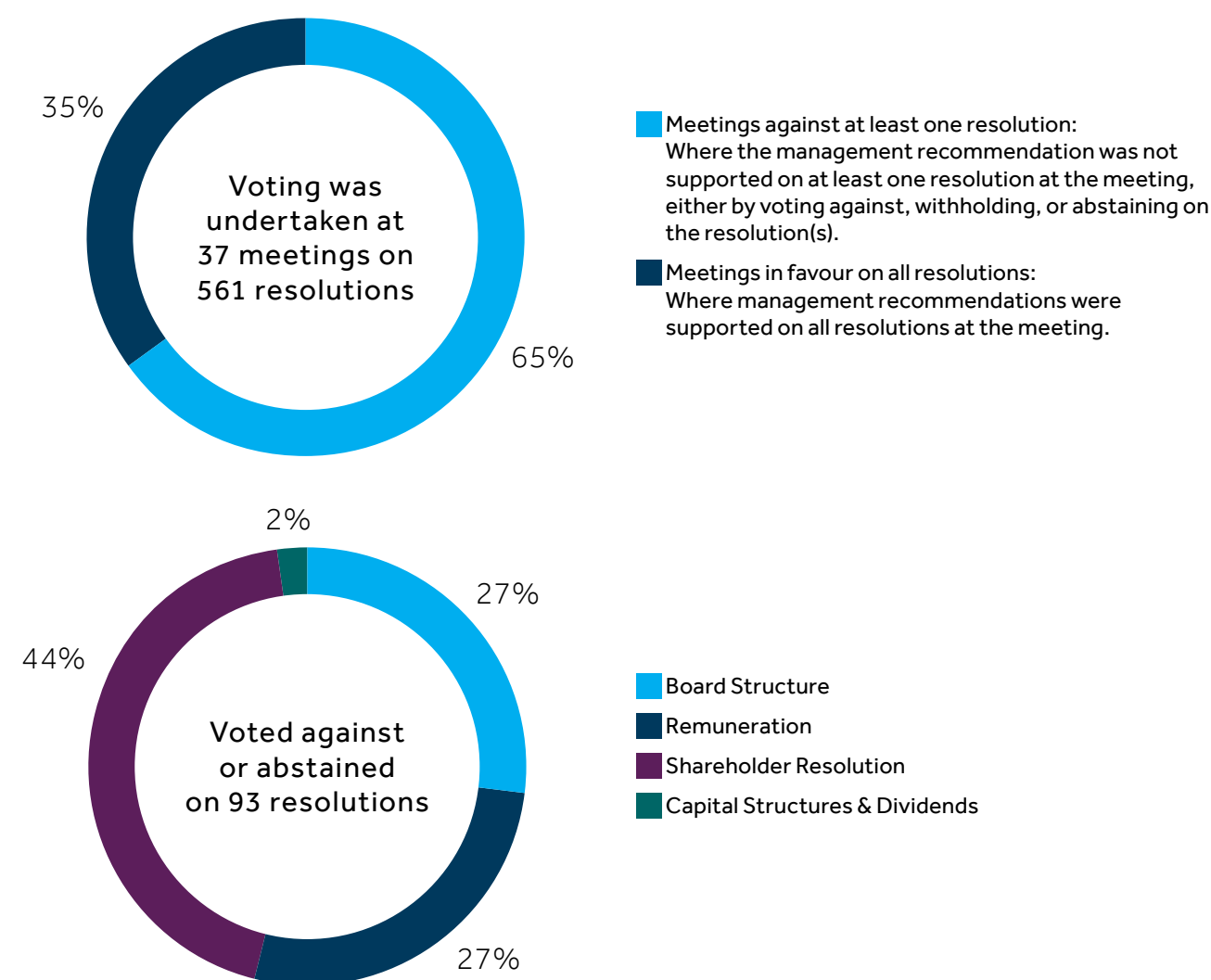
Following receipt of EOS's voting recommendations, our Equity portfolio managers meet to discuss this information for a select number of voting issues and decisions in advance of making the voting decision on behalf of our clients. Voting decisions are made by the lead portfolio managers based on the company's ESG and investment analysis and what the portfolio managers assess to best serve our clients' long-term interests.

Additional governance arrangements will be required to facilitate those occasional instances where a portfolio manager votes differently to the recommendation provided by EOS. It is our intention to exercise voting in all markets. However, our ability to do so may be hindered by regulatory and practical considerations, as well as internal restrictions.

OVERVIEW OF VOTING ACTIVITIES ACROSS OUR SUSTAINABLE STRATEGIES

Some examples of voting activities undertaken in 2022 include:

- At a US tech company, voting supported a shareholder proposal to align the company's retirement plan options with its climate goals, and a proposal for greater transparency in its corporate tax reporting. The latter should help investors to better evaluate potential risks in relation to taxation reforms and if the company is engaged in responsible tax practices. Furthermore, support was given to shareholder proposals which promoted better management of sustainability opportunities and risks, such as challenging the company to report on efforts to reduce plastic use.
- At a US pharmaceutical and healthcare company, voting supported the shareholder proposals which asked the company to report on government financial support and access to COVID-19 vaccines and therapeutics, as well as public health costs of limited sharing of vaccine technology. A proposal to oversee and report a racial equity audit was also supported. We believe these shareholder proposals promoted transparency, or appropriate accountability and incentivisation for the company and its board to improve in these areas.



Source: Barclays Private Bank, for the period 1 January to 31 December 2022.

Definitions for voting decisions

For: A voting decision in line with management's proposal.

Against: A voting decision against management's proposal on a particular resolution.

Withhold: Specific to directorship elections, a withhold vote is used to express dissatisfaction with a candidate where they are the only candidate to have been nominated for the role.

Abstain: A voting decision which declines to vote either for or against a resolution.

⁵ Please refer to 'Global Voting Guidelines' in <https://www.hermes-investment.com/uki/stewardship/eos-library>



Investing in global health: Tackling tuberculosis

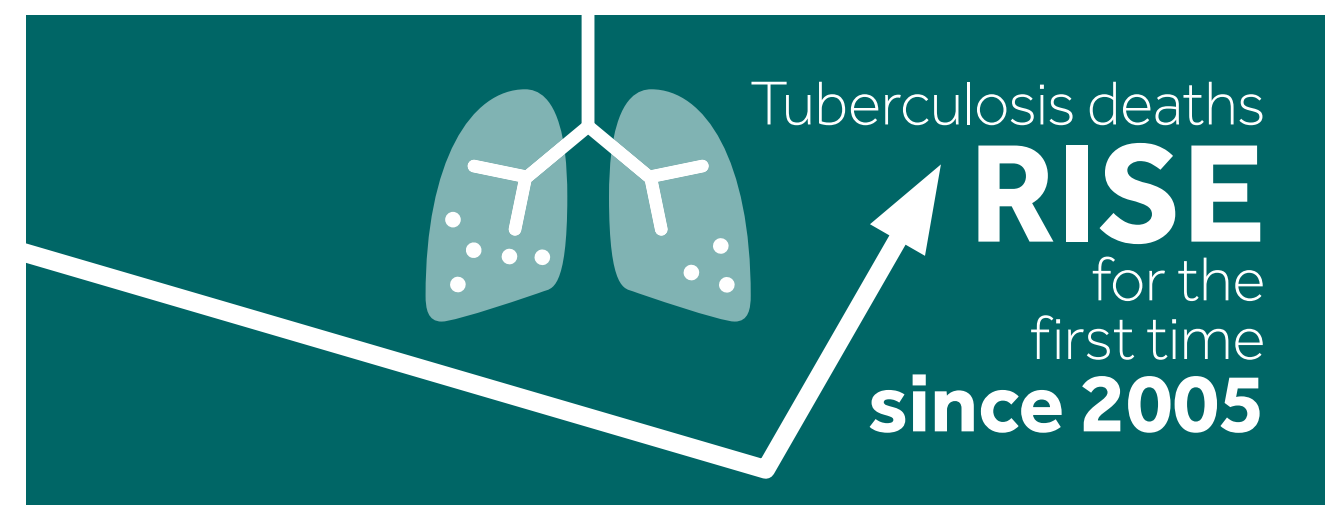
With years of improvements in global health set back by COVID-19, we explore potential solutions for eradicating tuberculosis by 2030.

Deaths from tuberculosis, one of the world's largest infectious killers, are rising after more than a decade of being in decline, as the COVID-19 pandemic reversed years of progress¹. Here we discuss the scale of the challenge, and some of the emerging technologies that could help eradicate this devastating disease (and others).

Tuberculosis (TB) is an infection that multiplies in crowds, spreading through the inhalation of tiny droplets lingering in the air². Outbreaks are difficult to contain, requiring contact tracing, isolation and vaccination programmes. While much of this will sound familiar to us all, having

lived through a global pandemic in recent years, unlike its SARS-CoV-2 cousin, this pernicious pathogen has been a persistent feature of life for centuries³.

Mycobacterium tuberculosis, the bacterium that causes TB, launches its first attack on the lungs. A mild fever is often the first sign, followed by the unwelcome arrival of a painful cough and a shortness of breath. If undefeated by the immune system, it can cause pervasive lung damage – and ultimately spread to the skeletal system, the kidneys and intestines, and then finally the brain⁴.



Source: UN Sustainable Development Goals Report 2022

¹ Globally, the estimated number of deaths from TB increased between 2019 and 2021, reversing years of decline between 2005 and 2019. 'Global Tuberculosis Report 2022', World Health Organisation <https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2022>

² World Health Organisation, 2022 <https://www.who.int/news-room/fact-sheets/detail/tuberculosis>

³ Centers for Disease Control and Prevention, 2016 (last reviewed February 2023) <https://www.cdc.gov/tb/worldtbdays/history.htm#:~:text=TB%20has%20been%20part%20of%20the%20human%20experience%20for%20a%20long%20time.&text=The%20earliest%20written%20mentions%20of,caused%2025%25%20of%20all%20deaths.>

⁴ 'What makes TB the world's most infectious killer?' Melvin Sanicas, TED-Ed video, 2019 https://www.ted.com/talks/melvin_sanicas_what_makes_tb_the_world_s_most_infectious_killer

REVERSING 14 YEARS OF PROGRESS

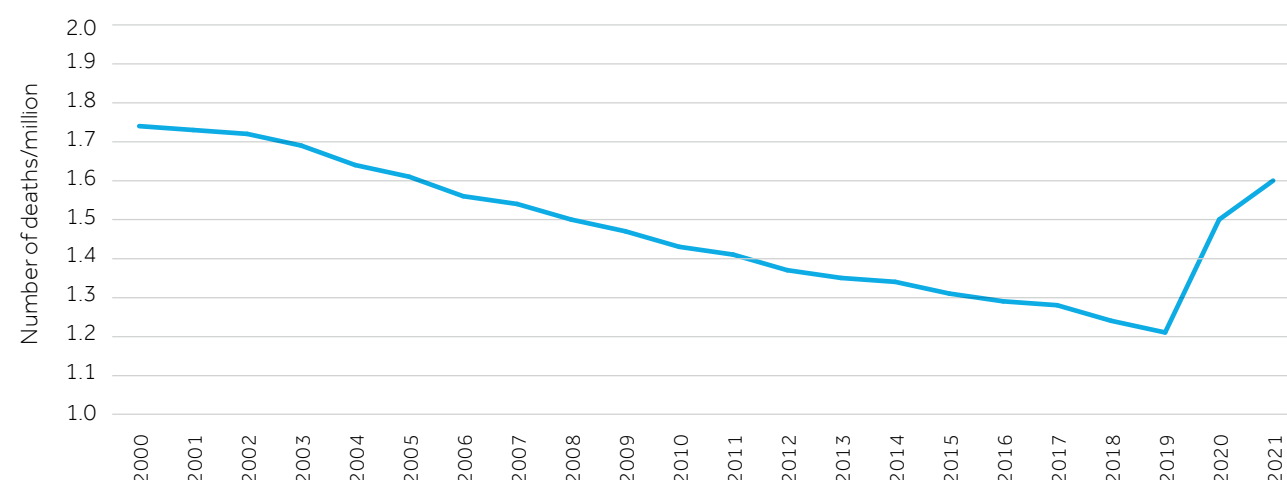
In 2015, the United Nations (UN) set a target to end the tuberculosis epidemic by 2030, as part of the ambitious Sustainable Development Goals (SDG) agenda⁵. We are now halfway through this timeline and yet further away from reaching the goal than when we started. The last decade had seen monumental progress towards the eradication of TB, with 2019 marking an all-time historic low in global TB mortality. However, in 2020, the spread of COVID-19 consumed global health resources, diverted scientific and political attention, and paved the way for TB to make its comeback⁶.

The latest annual TB report published by the World Health Organisation (WHO) estimates that TB killed 1.6 million people in 2021, a death toll last seen in 2005, effectively reversing 14 years

of progress⁷. The 2020 survey results of Global Fund-supported programmes across 106 countries showed that, since the emergence of the COVID-19 pandemic, 80% of TB programmes worldwide reported disruptions in services as a result of lockdowns and supply chain difficulties⁸. A delay in TB diagnosis can lead to an increased severity of the disease, while interruptions to TB treatment can lead to the deadly development of drug-resistant strains – both of which further compound the problem⁹.

While the impact of TB is currently felt most acutely in lower-income countries, which account for 80% of cases, as people migrate and wars displace refugees, strains of TB, in particular the highly drug-resistant variants that are immune to vaccines, are beginning to emerge in the West¹⁰.

The number of deaths caused by tuberculosis



Source: World Health Organisation 2000–2021

⁵ UN Sustainable Development Goals 2015 <https://sdgs.un.org/goals/goal3>

⁶ 'Tuberculosis deaths and disease increase during the COVID-19 pandemic', World Health Organisation, 2022 <https://www.who.int/news/item/27-10-2022-tuberculosis-deaths-and-disease-increase-during-the-covid-19-pandemic>

⁷ 'Global Tuberculosis Report 2022', World Health Organisation <https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2022>

⁸ Global Fund Survey, June 2020 <https://www.theglobalfund.org/en/covid-19/news/2020-06-17-global-fund-survey-majority-of-hiv-tb-and-malaria-programs-face-disruptions-as-a-result-of-covid-19/>

⁹ 'Multidrug-Resistant Tuberculosis (MDR TB) Fact Sheet' Centers for Disease Control and Prevention, 2016 <https://www.cdc.gov/tb/publications/factsheets/drtb/mdrtb.htm>

¹⁰ World Health Organisation, October 2022 <https://www.who.int/news-room/fact-sheets/detail/tuberculosis>

CAN WE SAVE THE SDGs?

The trifecta of the COVID-19 pandemic, a devastating war in Ukraine and a deepening climate emergency has reversed years of global sustainable development across the SDGs more broadly. The UN's Sustainable Development Goals 2022 report revealed that more than four years of progress against poverty have been erased, with millions more people now living in extreme poverty and suffering from increased hunger compared to pre-pandemic levels¹¹.

The report also showed a stark worsening of inequality both within and between nations, with women disproportionately affected by the increased burden of unpaid work. Additionally, we're witnessing the highest number of conflicts concurrently since the creation of the UN, with two billion people estimated to live in conflict-affected regions¹². And all the while, climate change is acting as a "crisis multiplier", further escalating poverty, hunger and inequality¹³.

In our previous [Sustainable Portfolio Management reports](#), we've written about the transformative power of science and technology to develop the solutions humanity so desperately needs. Indeed, we witnessed extraordinary innovation as the world grappled with an unprecedented global health emergency. Despite the typical vaccine production timeline being between 10–15 years, we saw the development of multiple high-quality COVID-19 vaccines in the record-shattering time of less than one year.

While mRNA vaccinology may seem like it came out of the blue, like the emergence of many ground-breaking discoveries of recent years, it really owes its success to decades of foundational research. If the pandemic showed us anything, it's that patient, forward-thinking investment into the world's most innovative companies can work. And that's why this year, against the backdrop of stalled progress, we are doubling down on our investments into the technologies of the future.

¹¹ The Sustainable Development Goals Report 2022, United Nations <https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>

¹² *ibid*

¹³ *ibid*

BUILDING BETTER DIAGNOSTICS

Effectively overcoming the rising number of TB cases starts with better diagnostics. We need to move from a global public health model that relies solely on passive case finding, where those affected are required to self-report when they have symptoms, to a model of both passive and active case finding, where diagnostic capabilities are taken into the community to seek out those infected. This is far more equitable and allows for earlier detection of TB, which in turn allows for earlier treatment and helps to limit the spread of the disease¹⁴.

This kind of community-based active diagnostics has only been made possible in recent years with the breakthrough of portable testing devices. Access to best-in-class molecular diagnostics had previously been limited by the systems needed to run them. However, through the automation of highly complex and time-consuming manual procedures, the most vulnerable populations can now access high-quality, battery-operated devices that can provide accurate and fast diagnosis, even in hard-to-reach areas with limited electrical supply.

Once diagnosed, patients need access to antibiotics capable of fighting the pathogen effectively. This can be difficult, given the prevalence of drug-resistant TB strains that are immune to existing treatments. Typical drug development timelines can also range from between 10–15 years, making it incredibly challenging to respond to the mutating pathogen.

REVOLUTIONISING DRUG DEVELOPMENT

However, the technological progress unfolding in this area is particularly exciting and has the potential to revolutionise the drug development landscape. Cheap gene sequencing, combined with cheap computing, has enabled advances in mRNA technology, synthetic biology, stem-cell therapy and the development of CRISPR gene editing¹⁵. Scientists are able to study the molecular composition of a pathogen and strategically design drugs that target weak points. This expedites the drug discovery process, particularly when using machine learning, and has the potential to be far more effective, and so shortening the time drug regimens are needed.

Vaccines are another area seeing monumental progress. The only licensed vaccine for use against TB today – the BCG vaccine – was first developed over 100 years ago. Although known to provide moderate protection against TB in infants and young children in some countries, it is less effective in areas with high incidence of the disease and it is ineffective in preventing TB in adults¹⁶.

Building on the success seen during the pandemic, we have entered a golden age of vaccine technology. In the year 2000, we had no new TB vaccines in development, but today there are 14 promising vaccine candidates currently in clinical trials, a number of which the WHO expects to be ready in the coming years¹⁷. A new, more effective vaccine that provides immunity to all age groups would be a game-changer for TB eradication, providing the antiviral weaponry we need to contain the spread of multi-drug resistant TB effectively.

IN INNOVATION WE TRUST

With the 2030 SDG agenda as our guiding compass for investing in science and technology for sustainable development, TB eradication is one area that is within reach if capabilities are harnessed. To put the global decline in TB incidence back on track, we need better tools for prevention, diagnosis and treatment. We're investing in companies accelerating efforts in all three areas.

Although government action and global co-operation are undoubtedly critical in the sustainable development toolbox, technological advancement is the workhorse that will deliver the solutions humanity needs at this important juncture. We've said it before, and we'll say it again: in innovation we trust.



Maya Tabaqchali
Sustainable Portfolio Manager

¹⁴ 'Tuberculosis: tackling the troubling uptick', The Naked Scientists podcast, November 2022

¹⁵ CRISPR-Cas9 (commonly shortened to CRISPR) is a unique technology that enables geneticists and medical researchers to edit parts of the genome by removing, adding or altering sections of the DNA sequence. Source: 'What is CRISPR-Cas9?', Your Genome, 2022 <https://www.yourgenome.org/facts/what-is-crispr-cas9/>

¹⁶ 'An investment case for new tuberculosis vaccines', World Health Organisation, 2022 <https://www.who.int/publications/item/9789240064690>

¹⁷ 'An investment case for new tuberculosis vaccines', World Health Organisation, 2022 <https://www.who.int/publications/item/9789240064690>

CASE STUDIES

Here we share the progress some of our investee companies (as of April 2023) have made towards reducing TB.

JOHNSON & JOHNSON

As a result of the over-use and misuse of antibiotics, some of the deadliest pathogens are increasingly becoming immune to the commonly used drugs that were designed to combat them. This is a serious public health issue that currently kills nearly as many people as HIV and malaria combined, and is estimated to be the cause of 10 million deaths annually by 2050¹⁸.

Drug-resistant TB accounts for one-third of all anti-microbial resistant deaths¹⁹ and the large majority of those with drug-resistant TB remain undiagnosed²⁰. As every infected person can go on to infect up to 15 additional people over the course of a year²¹ – and only those who are diagnosed are eligible for treatment – this is a serious challenge to the eradication of TB and needs to be urgently addressed.

Johnson & Johnson (J&J) has been working on the frontlines of the battle against TB for decades. In 2018, J&J launched an updated [10-year roadmap](#) to end TB, which centres around three main objectives:

1. Improving detection of undiagnosed cases

In a cross-country campaign to find the “missing millions”, J&J is leveraging its expertise in behavioural science to educate and inform susceptible population groups in a bid to encourage greater and earlier diagnosis²². The campaign is personalised to each group and country setting to maximise efficacy, and is particularly targeted at those aged between 10–24 years’ old, the group known to have the largest transmission rates and greatest stigma associated with the disease²³. As it stands, four in 10 people with TB go untreated²⁴ and undiagnosed, and this ambitious campaign is working to reduce this number considerably.

2. Broadening access to novel medications

In 2012, the US Food and Drug Administration (FDA) approved the first targeted TB drug with a novel mechanism of action in four decades²⁵. J&J’s Sirturo™ (bedaquiline) is now recommended by the WHO as the backbone of drug-resistant TB treatment²⁶. The oral medication replaces older, more toxic drugs which can cause horrific side-effects such as deafness, and which had to be painfully injected daily – often requiring patients to go to clinics, putting them at further risk of contracting other illnesses²⁷.

J&J is focusing on careful stewardship to protect the drug’s long-term effectiveness in the face of rising anti-microbial resistance, which is key to the drug’s success rate. Another area for consideration is lowering the cost of treatment, so that this critical medication is really affordable and accessible to those who need it most²⁸.

3. Accelerating R&D to discover next-gen TB treatments

Although recent developments are significant, the tools available today will not be enough to permanently end the TB pandemic alone. More effective and better tolerated TB treatments are required, that can be administered in shorter and simpler regimens, making them easier to adhere to. A highly effective preventative vaccine and even more accurate diagnostics are also needed. J&J is continuing its investment in R&D and partnerships with the Europe Union’s Innovative Medicines Initiative, the Bill and Melinda Gates Foundation, the National Institute for Communicable Diseases in South Africa, the London School of Hygiene and Tropical Medicines, and the AMR Action Fund to drive progress to end TB²⁹.

¹⁸ ‘Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis’, The Lancet, 12 February 2022 [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(21\)02724-0/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)02724-0/fulltext)

¹⁹ ‘8 things to know about drug-resistant tuberculosis’, TB Alliance, 2022 <https://www.tballiance.org/news/8-things-know-about-drug-resistant-tuberculosis>

²⁰ World Health Organisation, 2021 <https://www.who.int/activities/tackling-the-drug-resistant-tb-crisis>

²¹ ibid

²² Johnson & Johnson 2018 <https://www.jnj.com/tb>

²³ ‘Empowering Youth to Help Pave the Way to a Tuberculosis-free Generation’ Factsheet, Johnson & Johnson, 2018 <https://www.jnj.com/fact-sheet/empowering-a-generation-of-youth-to-end-tb>

²⁴ ‘It’s time to end drug-resistant tuberculosis’, The Economist Intelligence Unit, 2019 <https://www.eiu.com/graphics/marketing/pdf/its-time-to-end-drug-resistant-tuberculosis-full-report.pdf>

²⁵ ‘After 40 years, new medicine for combating TB’, Mehdi Mirsaeidi, 2013 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4103685/>

²⁶ ‘Advancing the future of TB treatment’ Johnson & Johnson factsheet 2021 <https://www.jnj.com/tb/advancing-the-future-of-tb-treatment-fact-sheet>

²⁷ ‘Johnson & Johnson Announces 10-year Initiative to Help End Tuberculosis, the World’s #1 Infectious Killer’, Johnson & Johnson, 2018 <https://www.jnj.com/johnson-johnson-announces-10-year-initiative-to-help-end-tuberculosis-the-worlds-1-infectious-killer>

²⁸ ‘Protect Antibiotics, Protect Humanity: Safeguarding our medicine for multi-drug resistant tuberculosis treatment’ Johnson & Johnson 2021 <https://www.jnj.com/fact-sheet-safeguarding-bedaquiline-for-drug-resistant-dr-tb-treatment>

²⁹ ibid

CASE STUDIES

CRODA

A recent WHO-commissioned report estimates that, over 25 years, a vaccine that is only 50% effective in preventing TB among adolescents and adults could avert up to 76 million new TB cases, 8.5 million deaths, 42 million courses of antibiotics and \$6.5 billion in costs faced by TB-affected households, especially for the poorest and most vulnerable³⁰.

The report argues that a successful TB vaccine would improve health equity, and contribute substantially towards universal health coverage by narrowing income-based disparities in the health and economic consequences of TB in low- and middle-income countries. In turn, this would help achieve several SDG targets such as eradicating poverty and hunger, promoting decent work and growth, and promoting good health and well-being, according to the report.

This latest guidance from the WHO strongly encourages investment into research and development of novel potential antigenic targets and immunological diversity in vaccine candidates. The WHO is pushing for technological breakthroughs in vaccine development that will dramatically reduce TB incidence.

A specialist in vaccine adjuvants³¹, Croda is investing in innovation to support global efforts to create a successful TB vaccine. Adjuvants are used in vaccines to accelerate, prolong or enhance antigen-specific immune responses, essentially helping vaccines to work better³². Croda is innovating alternatives to traditional aluminium-based adjuvants, which is supporting the quest to develop new TB vaccines. In early research, one of Croda's novel aluminium-free patented adjuvants has been shown to enable TB vaccines to induce strong antibody responses, a significant improvement from current adjuvants that have not resulted in effective vaccines³³.

DANAHER

The benefits to patients, communities and healthcare services of active (vs passive) TB case finding (ACF) have been well-researched and evidenced. For patients, ACF overcomes barriers to access in vulnerable populations, and reduces the total costs of diagnosis and treatment.

For communities, ACF has been shown to reduce disease in adults and infections in children. And finally, for the healthcare service, ACF is cost-effective. As a result, the WHO recommends ACF as a tool to reduce the broader socioeconomic consequences of TB³⁴.

Danaher (through subsidiary company Cepheid) has revolutionised TB diagnostics through its development of the GenXpert MTB/RIF assay. The test can detect both a TB infection and, if present, whether the strain is drug or multi-drug resistant in less than 80 minutes³⁵. This is a momentous improvement

from standard cultures that can take 2–9 weeks to reach a conclusion³⁶. Those infected can start the appropriate treatment in quick succession, thereby dramatically helping to control the spread of the disease within high-risk communities.

The GenXpert test can also save costs, as those who test negative are not prescribed unnecessary precautionary treatment and do not need to isolate in wards³⁷. The test further helps to alleviate some of the load on public health systems as, unlike other tests, it only requires minimal training from medical staff conducting the diagnosis³⁸.

However, the test is currently mainly used in high-income countries and more needs to be done to increase access and affordability³⁹, particularly in low-income countries where scalability remains a challenge⁴⁰.

³⁰ 'An investment case for new tuberculosis vaccines', World Health Organisation, 2022 <https://www.who.int/publications/i/item/9789240064690>

³¹ Croda, 2023 <https://www.crodapharma.com/en-gb/product-effects/adjuvancy>

³² 'Vaccines and Adjuvants', Centers for Disease Control and Prevention, 2022 <https://www.cdc.gov/vaccinesafety/concerns/adjuvants.html#:~:text=What%20is%20an%20adjuvant%20and,adjuvants%20help%20vaccines%20work%20better>

³³ Croda Sustainability Report 2021 <https://www.croda.com/mediaassets/files/corporate/ar-and-sr-files-2021/croda-sustainability-report-2021.pdf?la=en-GB>

³⁴ 'Optimizing active case-finding for tuberculosis', World Health Organisation 2021 <https://www.who.int/publications/i/item/9789290228486>

³⁵ Jones M, et al. Xpert® MTB/RIF Ultra - design and analytical performance of a second generation Xpert® MTB/RIF assay. Poster presented at ECCMID, April 2016 April 9–12, Amsterdam, Netherlands. Referenced by Cepheid at <https://www.cepheid.com/en/tests/Critical-Infectious-Diseases/Xpert-MTB-RIF-Ultra>

³⁶ *ibid*

³⁷ *ibid*

³⁸ *ibid*

³⁹ 'MSF: Cepheid's production delays of critical tuberculosis test will cost lives', Médecins Sans Frontières, September 2022 <https://www.doctorswithoutborders.org/latest/msf-cepheids-production-delays-critical-tuberculosis-test-will-cost-lives>

⁴⁰ *ibid*



Sustainable cities: Building for the future

Faced with rapid urbanisation and population growth, we examine how the construction industry could meet global infrastructure demand in a sustainable way.

By 2050, the cities of the world are expected to be home to more than two-thirds of the world's population¹ and produce 85% of global economic output². Although they occupy around only 2% of total land, cities are responsible for over 60% of energy consumption, 70% of greenhouse gas emissions and 70% of global waste³.

With continued population growth (the UN expects the global population to reach 9.7 billion by the middle of the century⁴) and rapid urbanisation (by one estimate, the planet will add floor space the size of New York City every month until 2060⁵), the resource-intensity of cities is only likely to increase. According to a 2018 report, by 2050, cities are expected to consume 90 billion tons of raw materials, such as sand, gravel, iron ore, coal and wood every year – further depleting finite resources and causing the destruction of natural habitats, green spaces and biodiversity loss⁶.

¹ World Bank, 2022 <https://www.worldbank.org/en/topic/urbandevelopment/overview>

² 'The Future is Now: Science for Achieving Sustainable Development', United Nations Global Sustainable Development Report 2019 https://sdgs.un.org/sites/default/files/2020-07/24797GSDR_report_2019.pdf

³ 'Continuing urbanisation', European Commission, 2023 https://knowledge4policy.ec.europa.eu/continuing-urbanisation_en

⁴ World Population Prospects, United Nations, 2022 <https://population.un.org/wpp/>

⁵ 'The construction industry remains horribly climate-unfriendly', The Economist, 15 June 2022 <https://www.economist.com/finance-and-economics/2022/06/15/the-construction-industry-remains-horribly-climate-unfriendly>

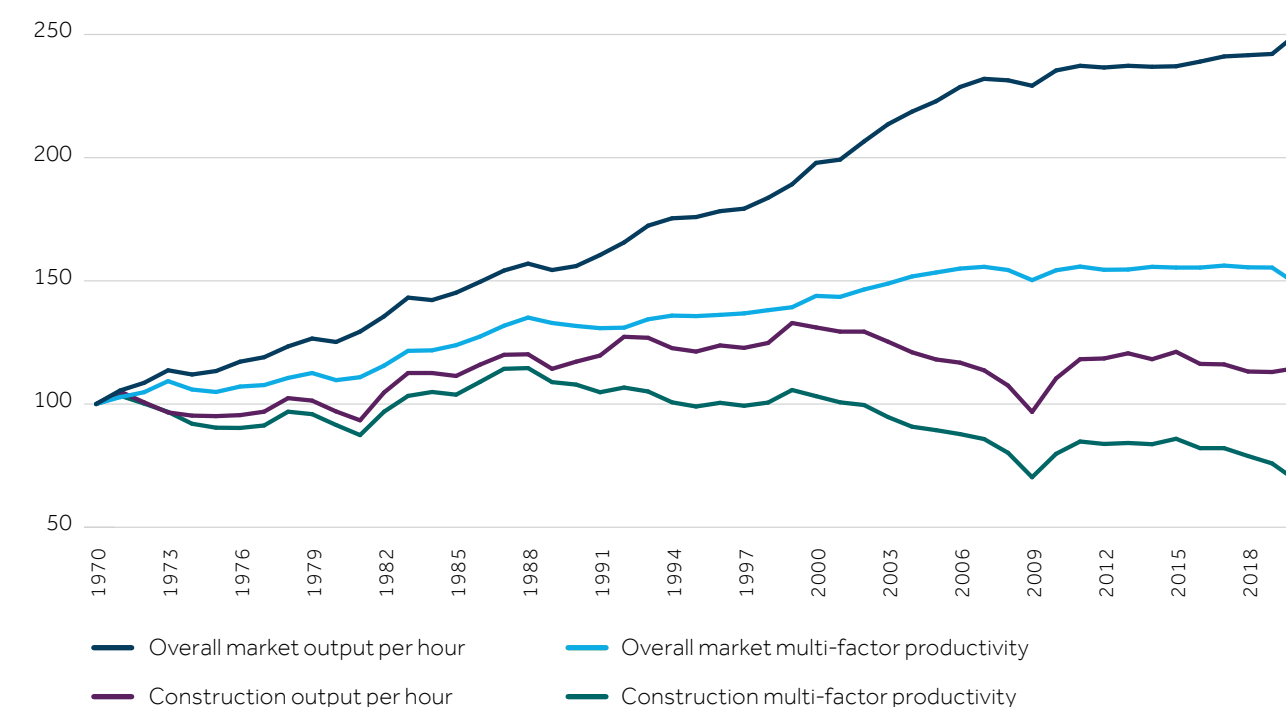
⁶ International Resource Panel, United Nations Environment Programme, 2018

Despite the great need for increased infrastructure, the productivity of the construction industry has consistently lagged other sectors, and has changed very little over the last 50 years⁷. The industry is ripe for a re-imagining – one that places sustainable materials and technologies at its core to build a future that we all want to live in.

Productivity in the UK construction industry has changed little in the past 50 years

Output per hour and multi-factor productivity, 1970-2020

Index 1970 = 100



Source: Office for National Statistics, 2021

Note: Multi-Factor Productivity is the unexplained growth in output after accounting for growth in capital and labour inputs.

⁷ 'Productivity in the construction industry, UK: 2021', Office for National Statistics <https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/articles/productivityintheconstructionindustryuk2021/2021-10-19>

There are two key ways in which the construction industry can start to address these challenges: 1) through using more sustainable building materials, and 2) by harnessing technology to improve efficiencies through the process – as we discuss in more detail below.

REDUCING CONCRETE'S COLOSSAL CARBON FOOTPRINT

More than 4.1 billion tons of cement are produced every year, making it the most produced material on earth⁸. Concrete, derived from cement, is one of the world's most used substances, coming second only to water⁹. Cement is locally available, cheap and an effective composite material when combined with steel and other highly durable materials, making it an ideal building material for urban construction¹⁰.

The majority of the demand for the material comes from emerging economies¹¹, which is a reflection of rising living standards – a positive development. However, this high volume of production comes at an enormous cost to the planet; the global cement industry is one of the largest producers of CO₂, more than tripling its own output since 1992¹². If it were a country, the concrete industry would be the third-highest emitter of CO₂ after China and the US¹³. This trend cannot continue.

Much of these emissions come from the creation of clinker – a key input into conventional cement and concrete, and so recent innovation efforts have focused on this area. Clinker is made by

heating limestone and clay at high temperatures (>1500C) in a rotating kiln¹⁴. The heating process is very energy-intensive and also releases CO₂ embedded in the limestone.

CEMENTING NEW TECHNOLOGIES

However, new techniques for producing cement are being developed. For example, replacing some of the limestone with sustainable additives can reduce the clinker content by 50% and make it possible to use lower temperatures throughout the process¹⁵. This results in a 30% reduction in CO₂ emissions compared to conventional cement – and could save up to 400 million tons of CO₂ per year by 2050¹⁶.

This more sustainably produced cement performs similarly to traditional cement in most respects, but has proven to be even more resistant to chloride and alkali, which helps prevent “concrete cancer”, a form of building corrosion that occurs when the steel inside concrete begins to rust¹⁷. The novel concrete is also 25% cheaper to manufacture than traditional concrete as a result of the lower energy demand¹⁸.

BRINGING CONSTRUCTION INTO THE DIGITAL AGE

The digital revolution that has changed the face of almost every traditional physical industry also needs to be adopted by the construction industry – to help address the dual issues of low productivity and high carbon intensity. Although the sector today remains one of the least digitised industries¹⁹ – with alarming ramifications for the natural environment, contributing to 23% of air pollution, 40% of drinking water pollution and 50% of landfill waste²⁰ – the foundations of a sustainable and circular construction industry are being created using technological innovation.

Digital twin technology is one such tool being suggested by climate experts as an enabler of radical action for stakeholders designing sustainable cities of the future²¹. Simply, a digital twin is a virtual model of a physical object. Using advanced IT tools, including digital identification and automated perception, an actual or planned physical building can be created in the digital space²². This can then be used for holographic simulation, dynamic monitoring, or real-time diagnosis of the state of a real-life physical entity²³.

CUTTING EMISSIONS AND BOOSTING EFFICIENCIES

Digital twin technology can be used across the life cycle of infrastructure projects to help streamline operations, gain insights through artificial intelligence and machine learning, reduce waste, meet sustainability goals and plan for the future using simulations²⁴. It can be used to examine real-time data and provide alerts when an asset is losing energy – through uninsulated roofs for example – and then suggest insights to the asset owner on how to optimise the building and reduce inefficiencies²⁵.

The World Economic Forum estimates that using digital twin technology in the design of a virtual power plant for example, can reduce CO₂ emissions by 630 tons per year²⁶. It also creates a significant opportunity for the construction industry to address its productivity problem. By using data to predict when issues will arise, it may be possible to tackle them before they occur, or when they are still small, thereby potentially preventing downtime and reducing costs²⁷.

⁸ 'Cement production worldwide from 1995 to 2022', Statista, 2022 <https://www.statista.com/statistics/1087115/global-cement-production-volume/>

⁹ Global Cement and Concrete Association, 2023 <https://gccassociation.org/our-story-cement-and-concrete/>

¹⁰ ibid

¹¹ IEA, 2022 <https://www.iea.org/reports/cement>

¹² 'Cement sector CO₂ emissions double in 20 years' Global Cement, 2022 <https://www.globalcement.com/news/item/14286-cement-sector-co2-emissions-double-in-20-years>

¹³ 'How cement may yet help slow global warming', The Economist, 2021 <https://www.economist.com/science-and-technology/how-cement-may-yet-help-slow-global-warming/21806083>

¹⁴ 'Innovative cement-based materials for environmental protection and restoration', Hosam M. Saleh, Samir B. Eskander, in New Materials in Civil Engineering, 2020

¹⁵ 'The Future is Now: Science for Achieving Sustainable Development', United Nations Global Sustainable Development Report, 2019 https://sdgs.un.org/sites/default/files/2020-07/24797GSDR_report_2019.pdf

¹⁶ 'The Future is Now: Science for Achieving Sustainable Development', United Nations Global Sustainable Development Report 2019 https://sdgs.un.org/sites/default/files/2020-07/24797GSDR_report_2019.pdf

¹⁷ ibid

¹⁸ ibid

¹⁹ The importance of digital transformation in the construction industry, BIM Today, 2022 <https://www.pbctoday.co.uk/news/digital-construction/construction-technology-news/the-importance-of-digital-transformation-in-the-construction-industry/117780/#:-text=Very%20few%20construction%20firms%20have,be%20satisfied%20with%20current%20processes>

²⁰ According to research conducted by Bimhow, quoted in: 'How Can We Improve The Negative Impact Construction Has On The Environment?', Procure Partnerships, 2021 <https://procurepartnerships.co.uk/how-can-we-improve-the-negative-impact-construction-has-on-the-environment/>

²¹ 'COP26 & Construction: Are Digital Twins the Answer?' Asite, 2021 <https://www.asite.com/blogs/cop26-construction-are-digital-twins-the-answer>

²² 'ibid

²³ ibid

²⁴ ibid

²⁵ ibid

²⁶ 'Global Digital Twin Cities' World Economic Forum, 2021 <https://initiatives.weforum.org/digital-twin-city/home>

²⁷ 'How will digital twins in construction shape the future?' BIM Today, 2023 <https://www.pbctoday.co.uk/news/digital-construction/digital-twins/challenges-benefits-future-technology-digital-twins-in-construction/121958/>

Using it alongside other emerging technologies, including 3D printing, robotics, modularisation and prefabrication, could offer the industry lower costs, better quality control, less labour intensity and a chance to integrate complex sustainability solutions in building the future²⁸. 3D printing, for example, can be more energy-efficient than conventional manufacturing (although not always)²⁹. It also lends itself well to a reduced waste model, whereby specific parts can be custom-made versus needing to be ordered in bulk (although recyclability does vary depending on the product used in the 3D printing process)³⁰.

That said, there still are challenges to overcome to maximise the potential for digital twin technology. For example, it relies on real-time updates and accurate data to work effectively, and requires supporting infrastructure to integrate it into existing systems and processes. In addition, there are implementation costs and the issue of data security to navigate. And while the growth outlook for virtual twins looks promising – with the market set to grow at a compound annual rate of 36% over the next five years – the current adoption rate is just 10% globally³³.

THE FUTURE OF CONSTRUCTION

Every single construction action – from the materials we choose or the technologies we use, to the way we operate and interact with the built environment – has an impact on the natural environment. If we are to meet the construction challenges of the next century, using sustainable materials and digital adoption within the construction industry will be paramount.

CASE STUDIES

Here are some examples of how our investee companies (as of April 2023) are developing innovative solutions to some of the challenges faced by the construction sector.

SIKA

Swiss-based Sika is a global specialist in sustainable construction material additives. Its products are designed to improve the performance and sustainability credentials of construction materials, whilst aiming to save customers time and money³⁴.

Sika has developed a product that replaces a portion of clinker – the most carbon-intensive element in cement production – with polymer-based additives. This product category alone can reduce global carbon emissions by 65 million tonnes per year, equivalent to the annual carbon emissions of Austria³⁵.

The cement industry is covered by most carbon permit regimes, including the EU's Emissions Trading System³⁶. Over time, the free allocation of permits to the industry decreases, which incentivises producers to find lower-carbon production methods – and the reduction of clinker will be a key aspect of this³⁷.

The majority of Sika's business comes from renovating old buildings and infrastructure. In Europe, reducing the carbon intensity of buildings by repairing – rather than rebuilding – existing infrastructure is a key focus of the EU Green Deal³⁸. The EU already spends close to €700bn per year on building renovation – roughly 1% of building stock per year³⁹. To hit its 2050 carbon neutrality target, the EU would need to lift its building stock renovation rate from 1% to 3% per year⁴⁰. The European Commission aims to at least double the building renovation rate in the coming years as part of its 'Renovation Wave' strategy⁴¹.

²⁸ 'Digital twins: The art of the possible in product development and beyond', McKinsey, 2022 <https://www.mckinsey.com/capabilities/operations/our-insights/digital-twins-the-art-of-the-possible-in-product-development-and-beyond> and 'Accelerating sustainability with digital twins', Accenture, 2021 <https://www.accenture.com/us-en/blogs/industry-digitization/accelerating-sustainability-with-virtual-twins>
²⁹ '3D printing can help the construction industry become carbon-neutral', World Economic Forum, 2022 <https://www.weforum.org/agenda/2022/06/3d-printing-can-help-make-construction-carbon-neutral-heres-how/>
³⁰ 'How Sustainable is Industrial 3D Printing?' Autonomous Manufacturing, 2020 <https://amfg.ai/2020/03/10/how-sustainable-is-industrial-3d-printing/>
³¹ 'How will digital twins in construction shape the future?', BIM Today, March 2023 <https://www.pbctoday.co.uk/news/digital-construction/digital-twins/challenges-benefits-future-technology-digital-twins-in-construction/121958/>
³² ibid
³³ 'Are virtual twins key to achieving the world's sustainability goals?' World Economic Forum, 2021 <https://www.weforum.org/agenda/2021/01/virtual-twin-technology-sustainability-goals/#:~:text=But%20the%20current%20adoption%20rate%20of%20virtual%20twins,the%20World%20Economic%20Forum%20doing%20about%20climate%20change%3F>

³⁴ Sika Group, 2023 <https://www.sika.com/en/construction/cement.html>
³⁵ Sika Group annual report 2020 <https://www.sika.com/content/dam/dms/corporate/media/glo-annual-report-2020-magazine.pdf>
³⁶ European Commission, 2021 https://climate.ec.europa.eu/system/files/2021-10/policy_ets_allowances_bm_curve_factsheets_en.pdf
³⁷ ibid
³⁸ 'Delivering the Green New Deal', European Commission, 2019 https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en#renovating-buildings-for-greener-lifestyles
³⁹ 'Time to create a Renovation Fund for All Europeans', Renovate Europe, 2020 https://www.renovate-europe.eu/wp-content/uploads/2018/09/REC_Let_VDL_Com_Econ_Recovery_April_2020_Final.pdf
⁴⁰ ibid
⁴¹ 'A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives', European Commission, 2020 https://eur-lex.europa.eu/resource.html?uri=cellar:0638aa1d-0f02-11eb-bc07-01aa75ed71a1.0003.02/DOC_1&format=PDF

SCHNEIDER ELECTRIC

Schneider Electric provides energy and automation in homes, buildings, data centres and across infrastructure, with a focus on providing efficient and sustainable solutions. Schneider's scalable energy efficiency solutions aim to address the pressing urgency of climate change whilst also supporting the megatrends of mass digitisation and the increasing role of natively connected digital products and software.

In order to meet global net-zero targets, the world will need to use energy more efficiently. This will likely require leveraging the benefits of connected devices provided by the Internet of Things (IoT), whilst using data

analytics to optimise how energy flows around. Schneider Electric's artificial intelligence-enabled EcoStruxure platform is an open IoT platform that leverages advancements in mobility, sensing, cloud and big data analytics to improve efficiency and lower the energy footprint of a building by up to 50%⁴².

Since 2018, the EcoStruxure platform has helped its customers save and avoid 440 million tonnes of CO₂ emissions, with the target of saving 800 million tonnes by 2025⁴³. For context, these average annual savings are equivalent to the carbon footprint of 55 million people in the EU⁴⁴.

HEXAGON

It is estimated that, globally, 13,000 buildings (excluding single family homes) will need to be completed every day until 2050 to meet the demands from a growing population and increasing urbanisation⁴⁵. However, this has to be done through the constraints of a shortage of skilled labour and the need for sustainable construction practices.

Hexagon specialises in digital reality and autonomous solutions, combining an extensive portfolio of sensors, software and autonomous technologies with the power of data to help improve productivity, reduce waste, and enable more complex building designs⁴⁶.

Its solutions are used at every stage of the building life cycle – planning, surveying, construction and validation – with the aim of enabling faster construction, better performance and lower environmental impact at a lower cost. For instance, it

provides professional-grade imagery and surveying data tools to enable accurate 3D modelling and cloud collaboration during the design phase. It also offers multiphysics simulations to help designers understand how a building would respond to particular weather events, allowing them to optimise and/or validate their plans⁴⁷.

Hexagon's SmartBuild platform allows contractors to capture and visualise their work, and compare it to design data within a digital twin. This can help improve accuracy and reduce unexpected downtime. As a project progresses, Hexagon's 3D laser-scanning technologies, through their Leica brand, autonomously replicate the physical world and turn it into a digital twin with high survey-grade accuracy to ensure the building matches the design specifications⁴⁸. Products include the Leica BLK2FLY, an autonomous flying laser scanner that captures building exteriors through 3D point clouds from the air⁴⁹.

⁴² Schneider Electric, 2023 <https://www.se.com/uk/en/work/campaign/innovation/overview.jsp>

⁴³ Schneider Electric Sustainability Impact Report Q4 2022 <https://www.se.com/ww/en/assets/564/document/378893/schneider-sustainability-impact-q4-2022-results.pdf>

⁴⁴ Based on calculations in Schneider Electric's 2021 Sustainable Development Report, which cited that the average annual savings from the 347 million tonnes of CO₂ saved (2018–2021) was equivalent to the carbon footprint of 55 million <https://www.se.com/ww/en/assets/564/document/322964/sustainability-report-2021.pdf>

⁴⁵ Hexagon, 2023 <https://hexagon.com/solutions/buildings-ecosystem?tabId=tab-BAF03A70BA8347A19072F6F10975FB6A-4-3>

⁴⁶ Hexagon, 2023 <https://hexagon.com/>

⁴⁷ Hexagon, 2023 <https://hexagon.com/solutions/multiphysics-simulation>

⁴⁸ Leica Geosystems, 2023 <https://leica-geosystems.com/en-gb/products/laser-scanners>

⁴⁹ Leica Geosystems, 2023 <https://leica-geosystems.com/en-gb/products/laser-scanners/autonomous-reality-capture/blk2fly>



Greening the cloud: Digital infrastructure for a net-zero world

Technological innovation is key to fighting climate change, but how can we power the digital revolution without adding to the problem?

The exponential leap in digital adoption following the pandemic has escalated concerns about the environmental footprint of information and communications technology (ICT) infrastructure. How can we meet growing digital demand while improving sustainability?

Data centres are the infrastructure behind everything we consume online. These groups of networked computers range from 1000sq metre boxes – often found in remote corners of the world and which ‘ground’ the cloud – to highly customised units built into other complexes.

Whatever their design, they respond to almost everything we choose to do on the internet and store, distribute and process most information dear to us. However, their power intensity attracts scrutiny from environmentalists and policy makers alike, and is bringing into question their role in a low-carbon future.

The International Energy Agency (IEA) estimated that data centre electricity use in 2021 was around 1% of global electricity demand¹. The electricity used to meet these power demands still largely relies on fossil fuels and creates significant pressures on local energy grids. There is also the issue of keeping them cool: servers running within data centres generate high levels of heat and the cooling can make up to 40% of the energy bill². Temperatures are often brought down by evaporating millions of gallons of water, which can significantly strain local resources.

The IT industry is moving fast with solutions, such as harnessing excess heat for use in other buildings, or improving airflow management, whereby fan speeds are adapted to create ideal circulation channels. However, as of 2021, Nature Research has estimated that a medium-sized data centre uses as much water as three average hospitals³.

¹ Excluding energy used for cryptocurrency mining. ‘Data Centres and Data Transmission Networks’, International Energy Agency, 2022 <https://www.iea.org/reports/data-centres-and-data-transmission-networks>

² ‘Cooler data centres help take the heat off electric’, Horizon: The EU Research & Innovation Magazine, August 2021 bills <https://ec.europa.eu/research-and-innovation/en/horizon-magazine/cooler-data-centres-help-take-heat-electric-bills>

³ ‘Data centre water consumption’, npj Clean Water (Nature Research), 2021 <https://www.nature.com/articles/s41545-021-00101-w>

CUTTING EMISSIONS THROUGH SCALE

Much of the technological progress helping to further a better understanding of the world, and contributing to the fight against climate change, is sustained through infrastructure at the scale of large data centres. For example, machine learning is powered by a series of algorithms (some of them aptly called neural networks) that mimic the way the human brain operates. The workloads involved are often so immense that up until the last decade, it was impractical to run them on traditional computers. Some of the biggest breakthroughs of the past decade have come from this leap in computing capacity. For example, big data and AI are helping to map out malaria outbreaks, deploy renewable energy grids, and explore protein folding at a depth and range unprecedented a decade ago.

In the coming decades, artificial intelligence applications will likely support better climate change modelling and research, design more energy-efficient buildings and improve our understanding of battery systems and storage capacities, amongst other things. For example, the US National Oceanic and Atmospheric Administration is already using AI to enhance its use of satellites and environmental data to improve extreme weather forecasting⁴.

Most importantly, large-scale data centres embody the fundamentals of digital innovation: the potential for economies of scale. Since 2010, the shift away from small, inefficient, on-premise servers to efficient, hyper-scale data centres has seen the supply of digital services outpace the growth of their carbon footprint⁵. So much so that between 2015–2019, while the global energy use for data centres remained flat, internet traffic tripled⁶.

Another indicator of improving efficiency is the trend in Power Usage Effectiveness, or PUE, in recent years. This standard industry metric measures the energy efficiency of data centres, where the lower the value, the less energy is being used. While in the past three years we've seen a slight stalling of this metric, over the last decade, we've seen the average annual PUE for large data centres come down from 2.5 to 1.55 – with some even reaching 1.2 PUE. By staying ahead of the innovation curve, hyper-scalers are estimated to dominate 61% of all installed data centre servers⁷.

At these scales, marginal efficiency improvements in their design can lead to disproportionate emissions savings per user. Instead of hundreds of hardware systems that would typically characterise an individual enterprise, large providers are able to run a very small number of configurations that make it easier to address bottlenecks.

For example, the energy efficiency of any data centre is largely a function of the intensity of their computational and cooling sub-systems. Optimisations in both have been largely achieved by making the transition away from monolithic, customised data centres accommodating individual demands, to more industrial, prefabricated modular buildings that have allowed companies to connect built-in factory models designed for better 'behaviour'.

CONNECTED NETWORKS

Technology sourcing policies are also being revisited, with the goal of better aligning the number of servers with the demand. Ensuring reliability is a primary concern for data centre operators, which leads to the procurement of "just in case" equipment to back up the primary servers in case of failure. Now, however, resilience is starting to be provided at an application level rather than facility level, by making use of connected networks, where a number of independent sites use a shared internet connection or VPN. For example, if a given server experiences downtime, the application running in it will work its way around other connected servers.

The industry is even venturing into the idea of 'green coding'. While still largely in the realm of the academic world, this is all about designing software that minimises the energy requirements of the hardware running it⁸. Hyper-scale operators are also unlocking large-scale purchases of renewable power, which would be impossible in a highly distributed system. The promise of consistency and volume from these operators often makes otherwise unviable renewable projects possible. And in cases where the original anchor customer relocates or falls through, standardisation of contracts is becoming more common to de-risk long-term agreements.

REASON FOR OPTIMISM

The global data load is expected to rise to a staggering 221 zettabytes by 2026⁹. The radical reduction in resource intensity and procurement of green energy therefore have implications for the design and operation of data centres at all stages of their life cycle. In this way, the industry's big players are demonstrating that it is possible to future-proof the industry.

By debunking the assumption that doing or producing less is the only way to reduce environmental impacts, we are seeing economies of scale deliver on the demands of the digital age without straying from a solid path towards sustainability. More work is required, but there is reason for optimism.



Anne Benitez Canelles
Analyst

⁴ 'AI agreement to enhance environmental monitoring, weather prediction', National Oceanic and Atmospheric Administration, 2020 <https://www.noaa.gov/media-release/ai-agreement-to-enhance-environmental-monitoring-weather-prediction>

⁵ International Energy Agency, 2022 <https://www.iea.org/reports/data-centres-and-data-transmission-networks>. Note as well that while the growth has been moderate at a global level, there are disparities when looking at smaller countries.

⁶ International Energy Agency, 2019 <https://www.iea.org/commentaries/data-centres-and-energy-from-global-headlines-to-local-headaches>

⁷ Uptime Institute Global Data Centre Survey 2022, https://uptimeinstitute.com/uptime_assets/6768eca6a75d792c8eeede827d76de0d0380dee6b5ced20fde45787dd3688bfe-2022-data-center-industry-survey-en.pdf

⁸ Harvard Business Review, 2020, <https://hbr.org/2020/09/how-green-is-your-software>

⁹ 'High Data Growth and Modern Applications Drive New Storage Requirements in Digitally Transformed Enterprises', IDC White Paper, sponsored by Dell Technologies and NVIDIA, July 2022 <https://www.delltechnologies.com/asset/en-us/products/storage/industry-market/h19267-wp-idc-storage-reqs-digital-enterprise.pdf>

CASE STUDIES

Here we highlight how some of our investee companies (as of April 2023) have been reducing the carbon footprint of data centres.

DEEPMIND BRINGING DOWN GOOGLE’S ENERGY INTENSITY

In 2016, Alphabet’s DeepMind developed an AI framework that monitored existing cooling systems in Google’s data centres through a myriad of physical sensors. These would then feed into deep neural networks, which would propose ideal actions to better predict future temperatures and cooling requirements. All in all, according to Deepmind, Google’s cooling bills were reduced by 40%¹⁰.

The potential impact of this is significant, given that Google’s data centres are the engine through which they provide their services (think of every Google internet search and YouTube video you’ve watched). For scale, and while never publicly disclosed by the company itself, in 2016 Gartner estimated Google to hold around 2.5 million

physical servers worldwide, a number which likely has risen rapidly along with Google’s infrastructure expansion. At these scales, minor energy improvements go a long way in decreasing energy consumption for services provided¹¹. As of 2022, the company is estimated to account for 93% of global internet traffic¹².

However, it is important not to lose track of the big picture by focusing on one-off improvements. In the long term, the difference will be made by companies with adequate control systems and ongoing efforts to lower their energy efficiency. In this light, we’ve seen Google set some ambitious goals: to operate its data centres on carbon-free energy, 24 hours a day, 7 days a week, 365 days a year by 2030¹³.

SCHNEIDER ELECTRIC’S PREFABRICATED DATA CENTRES

According to Schneider Electric, it has produced 40% of Italy’s renewable energy through its green energy procurement systems, and aims to provide 50 million people with access to green electricity by 2025¹⁴.

The company is also participating in the data centre environmental race by providing companies with prefabricated modular data centres. This offers large environmental advantages versus designing them as part of the building infrastructure.

For one, it significantly cuts back on concrete use, as the modular data centre is built on steel and directly shipped to site. Second, the integration from design to assembly, where 90% of components are produced in-house, means there is little-to-no waste¹⁵. Finally, the company is much better positioned to provide end-of-life solutions when servers need a refresh. In that sense, Schneider Electric could be seen as playing a role in addressing the issue of e-waste.

MICROSOFT’S SUSTAINABLE MATERIALS FOR A LOW-CARBON CLOUD

Aside from operational carbon, cloud providers are aiming to reduce the embodied carbon of their data centres, or the ‘baked in’ carbon at the end of the construction process. Microsoft estimates it will build 50–100 data centres annually due to growing demand¹⁶, and is taking firm steps towards carbon-positive architectural practices.

The group has started experimenting with construction materials that would allow the facilities’ walls to store carbon by developing “living bricks” grown from algae, mycelium (mushroom) structural tubes, and agricultural waste panels, amongst others¹⁷. However, many of these concepts are not yet a reality. We are yet to see the technological limitations of deploying these new construction materials at the scale and speed needed to support demand.

Ending on a positive note, Microsoft has also created first-of-their-kind Microsoft Circular Centres to help extend the life cycle of servers, and is on track to achieve 90% reuse¹⁸. And by revising its approach to energy procurement, the company has signed new power purchase agreements for approximately 5.8 gigawatts of renewable energy across 10 countries, making it the second-largest corporate purchaser of renewables globally¹⁹.

¹⁰ DeepMind, 2016 <https://www.deepmind.com/blog/deepmind-ai-reduces-google-data-centre-cooling-bill-by-40>
¹¹ Gartner, July 2016 <https://www.datacenterknowledge.com/archives/2017/03/16/google-data-center-faq>
¹² ‘Top Website Statistics For 2023’, Forbes, 2023 https://www.forbes.com/advisor/business/software/website-statistics/#sources_section
¹³ Google, 2023 <https://sustainability.google/commitments/carbon/>
¹⁴ Schneider Electric, 2022 <https://www.se.com/uk/en/work/campaign/life-is-on/case-study/enel.jsp>
¹⁵ Schneider Electric, 2022 <https://blog.se.com/datacenter/2022/06/24/addressing-data-center-growth-sustainable-prefabricated-modular-data-center-solutions/>
¹⁶ Microsoft, 2021 <https://news.microsoft.com/source/features/innovation/microsofts-virtual-datacenter-grounds-the-cloud-in-reality/>
¹⁷ Microsoft, 2021 <https://blogs.microsoft.com/blog/2021/10/27/supporting-our-customers-on-the-path-to-net-zero-the-microsoft-cloud-and-decarbonization/>
¹⁸ ‘Learn how Microsoft Circular Centers are scaling cloud supply chain sustainability’, Microsoft 2022 <https://azure.microsoft.com/en-us/blog/learn-how-microsoft-circular-centers-are-scaling-cloud-supply-chain-sustainability/>
¹⁹ Microsoft, 2021 <https://blogs.microsoft.com/blog/2021/10/27/supporting-our-customers-on-the-path-to-net-zero-the-microsoft-cloud-and-decarbonization/>

Biodiversity & climate change: A joint challenge

Joseph Pigott, Climate Change Specialist within our Responsible Investing team, explains why protecting nature is key to preventing global warming.

THE EMERGENCE OF NATURE AND BIODIVERSITY

The case for tackling climate change has become increasingly clear to investors in recent years. Governments have stepped up efforts to mitigate and manage the devastating impacts of a warming world, with the Paris Agreement and, more recently, the Glasgow Climate Pact laying the groundwork for the action needed.

The role of the financial industry in combatting climate change is also fast evolving. The raft of net-zero pledges made under the Glasgow Financial Alliance for Net Zero (GFANZ)¹ demonstrates a real progression in how the financial industry is addressing this challenge. This is perhaps no surprise given the risks involved – as Christiana Figueres, former Executive Secretary of the UN Framework Convention on Climate Change once said, “Climate change increasingly poses one of the biggest long-term threats to investments”².

There is, however, another important topic emerging from the shadow of climate change and rapidly rising up the investor community’s agenda – that of nature and biodiversity. Climate change and biodiversity loss have typically been seen as separate issues, with the former dominating the discourse at both a governmental and private sector level. However, it’s becoming clearer that they may be twin crises on “two sides of the same coin”³.

¹ For more information, visit <https://www.gfanzero.com/>

² Christiana Figueres, former Executive Secretary of the UN Framework Convention on Climate Change, quoted in ‘20 Climate Change Quotes by Inspirational Leaders to Ignite Transformation’, The Education Magazine <https://www.theeducationmagazine.com/word-art/climate-change-quotes-transformation>

³ ‘Nature and climate crisis: two sides of the same coin’, European Commission, 2021 <https://ec.europa.eu/research-and-innovation/en/horizon-magazine/nature-and-climate-crises-two-sides-same-coin>

UNDERSTANDING THE INTERPLAY BETWEEN NATURE AND CLIMATE CHANGE

One way to consider nature and biodiversity is through the benefits and value they provide to businesses and wider society, referred to as 'ecosystem services'.

The Millennium Ecosystem Assessment has classified ecosystem services into four major categories⁴:

1. provisioning services, such as food and water;
2. regulating services, such as flood and disease control;
3. cultural services, such as recreational and cultural benefits; and
4. supporting services, such as nutrient cycling, that maintain the conditions for life on Earth.

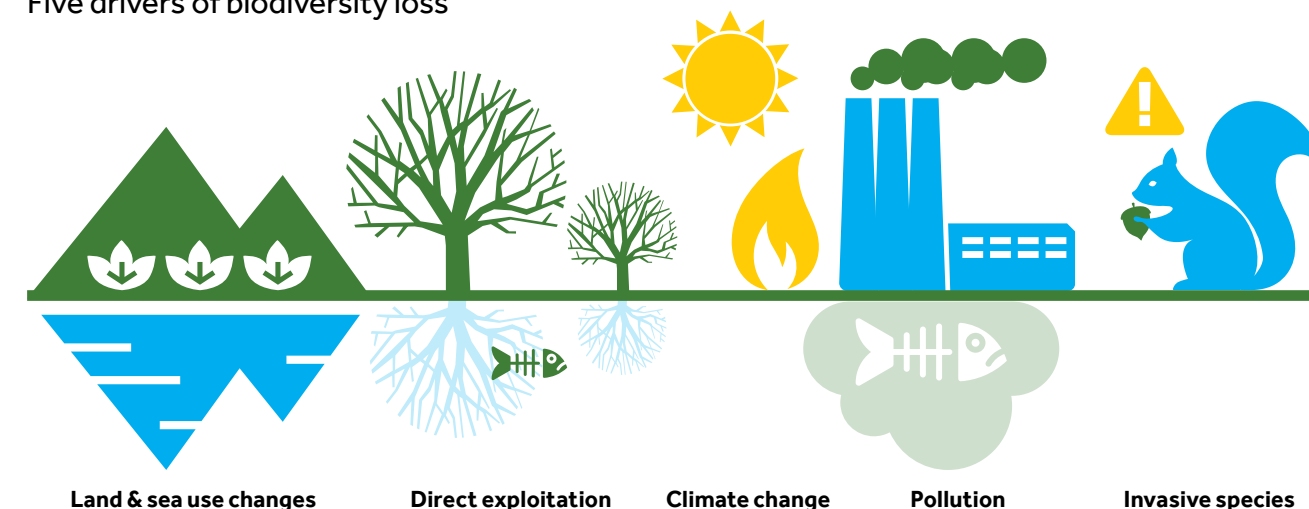
These ecosystem services flow from the stock of natural capital, which is underpinned by biodiversity i.e. the diversity within and between species⁵.

These ecosystem services that are so critical to our way of life – from food security to green spaces that aid mental health – are not priced into our current economic measures⁶. It is estimated that \$44 trillion of economic value generation – over half the world's total GDP – is moderately or highly dependent on nature and its services⁷, but nature is largely considered a free and limitless externality.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is a leading voice in advising policymakers on the state of nature and biodiversity globally. IPBES has identified and categorised five direct drivers of nature and biodiversity loss:

1. land and sea use changes
2. direct exploitation of organisms (such as overfishing and deforestation)
3. climate change
4. pollution
5. invasive species.¹²

Five drivers of biodiversity loss



Source: IPBES 2019

Of these drivers, land and sea use changes, as well as exploitation, have the largest impact on nature and biodiversity loss currently. However, if we don't limit the scale of warming, then climate change is likely to become the dominant cause of biodiversity loss and the degradation of ecosystem services in the coming decades¹³. Here lies the unique challenge between biodiversity loss and climate change – that they are highly interdependent of each other. The temperature rises and increased intensity of weather events associated with climate change are expected to lead to biodiversity loss by making habitats less hospitable. At the same time, this loss of biodiversity and nature means we lose some of our best defences against climate change¹⁴.

To put that into context, the ocean absorbs around 25–30% of annual CO₂ emissions¹⁵, whilst forests worldwide have absorbed about 18% of all human-caused carbon emissions¹⁶. As temperatures increase, however, the ability of the oceans to dissolve CO₂ decreases¹⁷, whilst the rate of deforestation – currently equivalent to losing an area about the size of Portugal annually¹⁸ – means we are reducing the volume of CO₂ absorbed each year. Nature also helps to reduce the impact of extreme events, such as flooding, by dissipating wave and tidal energy¹⁹. This interconnection between biodiversity loss and climate change means that it may not be possible to solve one without solving the other²⁰.

⁴ 'Ecosystems and Human Well-being: A Framework for Assessment', Millennium Ecosystem Assessment, 2005 <https://www.millenniumassessment.org/documents/document.300.aspx.pdf>

⁵ 'The global assessment report on biodiversity and ecosystem services: Summary for policymakers', IPBES, 2019 <https://ipbes.net/global-assessment>

⁶ Elliott Harris, UN Chief Economist, 2021 <https://www.un.org/en/climatechange/elliott-harris-measure-value-nature>

⁷ 'Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy', World Economic Forum, 2020 https://www3.weforum.org/docs/WEF_New_Nature_Economy_Report_2020.pdf

⁸ 'Global Biodiversity Outlook 5', UN Convention on Biological Diversity (CBD), 2020 <https://www.cbd.int/gbo/gbo5/publication/gbo-5-en.pdf>

⁹ 'Living Planet Report 2022', WWF <https://livingplanet.panda.org/en-GB/>

¹⁰ 'Forests and Deforestation', Hannah Ritchie and Max Roser, 2021. Published online at OurWorldInData.org. Retrieved from <https://ourworldindata.org/forests-and-deforestation>

¹¹ 'Changes in the global value of ecosystem services', Global Environmental Change Volume 26, Professor Robert Constanza et al, 2014 <https://www.sciencedirect.com/science/article/abs/pii/S0959378014000685>

¹² 'The global assessment report on biodiversity and ecosystem services: Summary for policymakers', IPBES, 2019 <https://ipbes.net/global-assessment>
https://ipbes.net/sites/default/files/inline/files/ipbes_global_assessment_report_summary_for_policymakers.pdf

¹³ 'Living Planet Report 2022', WWF <https://livingplanet.panda.org/en-GB/>

¹⁴ 'Nature and climate crisis: two sides of the same coin', European Commission, 2021 <https://ec.europa.eu/research-and-innovation/en/horizon-magazine/nature-and-climate-crises-two-sides-same-coin>

¹⁵ 'What does the ocean do for us', Blue Marine Foundation, 2022 <https://www.bluemarinefoundation.com/2022/06/06/what-does-the-ocean-do-for-us/>

¹⁶ 'Living Planet Report 2022', WWF <https://livingplanet.panda.org/en-GB/>

¹⁷ 'The ocean cannot absorb much more CO₂', Robert U. Ayres, INSEAD Emeritus Professor of Economics, Political Science and Technology Management, 2016 <https://knowledge.insead.edu/economics-finance/ocean-cannot-absorb-much-more-co2>

¹⁸ 'Living Planet Report 2022', WWF <https://livingplanet.panda.org/en-GB/>

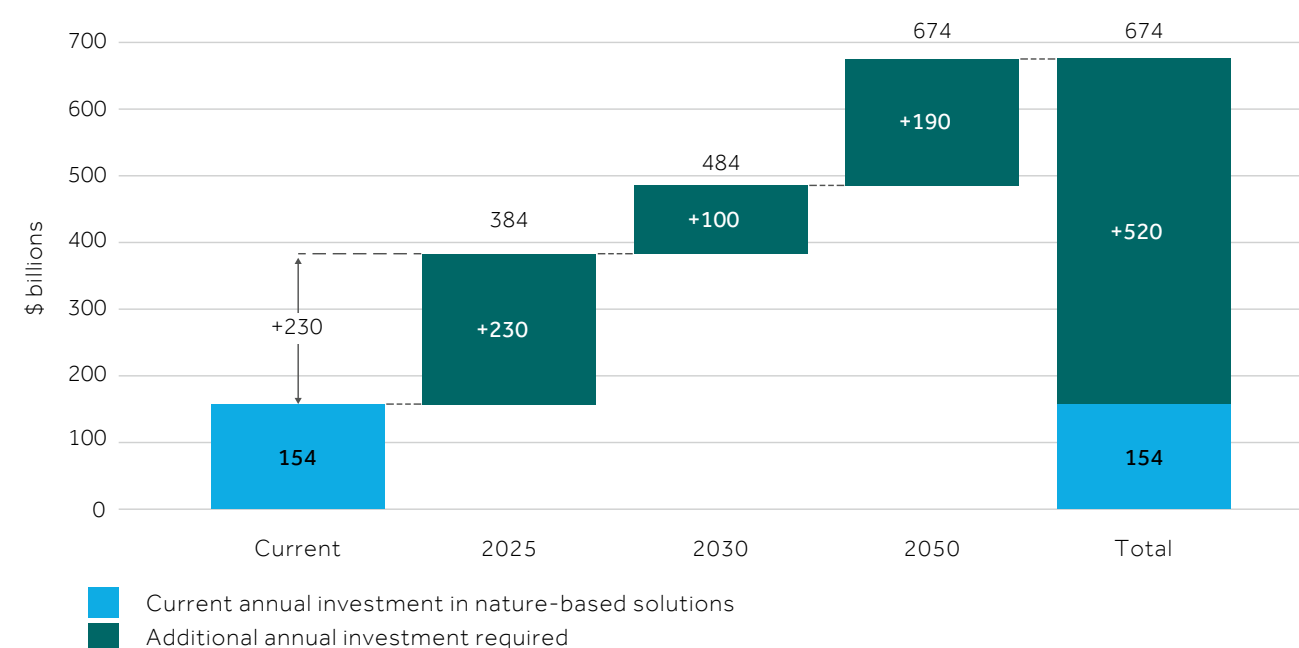
¹⁹ Natural Resources Wales, 2022 <https://naturalresources.wales/flooding/managing-flood-risk/nature-based-solutions-for-coastal-management/?lang=en>

²⁰ 'Nature and climate crisis: two sides of the same coin', European Commission, 2021 <https://ec.europa.eu/research-and-innovation/en/horizon-magazine/nature-and-climate-crises-two-sides-same-coin>

HOW PRIVATE FINANCE CAN LEVERAGE CLIMATE ACTION TO HALT BIODIVERSITY LOSS

In its 2022 report on the 'State of Finance for Nature', the UN identified a need to double investment by 2025 and eliminate nature-negative finance flows²¹. The financing gap is substantial and, as the chart below shows, a doubling of investment by 2025 is just the start. By 2050, \$674 billion is required each year, four times current investment levels. According to the report, if this level of finance were to be achieved, we could halt biodiversity loss, significantly reduce emissions and restore close to one billion hectares of degraded land.

The trajectory of annual nature-based solutions investment needed to limit climate change to below 1.5°C, halt biodiversity loss and achieve land degradation neutrality



Source: UN Environment Programme, 2022

There are several challenges with mobilising this level of finance for nature and biodiversity, particularly as to reach this level of scale, private finance is going to be critical alongside that of public finance. Investors will need strong policy signals, robust data and investable projects. Investment in nature and biodiversity is currently in its infancy, often taking place via smaller, localised initiatives that would need to be significantly upscaled.

At a national level, the UN Biodiversity Conference (COP15) held in Montreal in December 2022 resulted in a positive signal that governments are committed to halting and reversing biodiversity loss. Most notable was the agreement of the Kunming-Montreal Global Biodiversity Framework (GBF) which had, amongst other things, a target to conserve and manage 30% of land and the oceans by 2030²².

Strong policy signals are a key element for mobilising private capital. Whilst the COP15 GBF is not legally binding like the Agreement made for climate at COP21, some have referred to it as biodiversity's 'Paris' moment. Time will tell if it will drive significant action from companies as further commitments will likely be required, but it can be viewed as a positive step from the global community.

INTENTION ALONE ISN'T ENOUGH

Investors need more than intent, however; they also need decision-useful information from companies to guide their capital allocation decisions. The Task Force on Nature-related Financial Disclosures (TNFD) aims to deliver that by providing a consistent framework for companies and financial institutions to disclose the nature-related impacts, dependencies, risks and opportunities they are exposed to. The TNFD is following the same structure as its climate counterpart – the Task Force on Climate-related Financial Disclosures (TCFD) – and is aiming for similar, if not accelerated levels of support and uptake when it releases the final version in September 2023.

Investors can also use engagement with companies as a lever to enact change. Building on the success of Climate Action 100+, an investor-led initiative ensuring the world's largest Greenhouse Gas (GHG) emitters take action on climate change, Nature Action 100 will be officially launched in spring 2023, driving corporate action to reduce nature and biodiversity loss²³.

If private sector investment in nature is to increase by several orders of magnitude in the coming years, then 2023 will be critical in determining its success. There are high expectations that the same approaches and tools that have mobilised investors in the fight against climate change, will encourage them to act on nature and biodiversity.



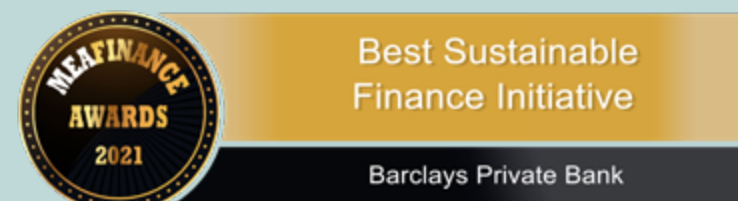
Joseph Pigott
Climate Change Specialist

²¹ 'State of Finance for Nature', United Nations Environment Programme, 2022 https://wedocs.unep.org/bitstream/handle/20.500.11822/41333/state_finance_nature.pdf?sequence=3

²² Kunming-Montreal Global Biodiversity Framework, Convention on Biological Diversity, 2022 <https://www.cbd.int/article/cop15-final-text-kunming-montreal-gbf-221222>

²³ Nature Action 100, 2022 <https://www.natureaction100.org/>

Your sustainable portfolio management team



Notes

ADDITIONAL DETAILS ON THE BUSINESS INVOLVEMENT DATA SHOWN ON PAGE 18.

Adult entertainment involvement:

The percentage of portfolio's market value exposed to companies deriving 5% or more revenue from the production of adult entertainment materials, or those deriving 15% or more aggregate revenue from the production, distribution and retail of adult entertainment.

Alcohol involvement: The percentage of portfolio's market value exposed to companies deriving 5% or more revenue from the production of alcohol-related products, or those deriving 15% or more aggregate revenue from the production, distribution, retail and supply of alcohol-related products.

Armaments involvement: The percentage of portfolio's market value exposed to any of the following:

- companies deriving 5% or more from the production of conventional weapons, or those that derive 15% or more aggregate revenue from weapons systems, components, and support systems and services
- companies that manufacture nuclear warheads or missiles, components, or delivery platforms for use in nuclear weapons
- companies with any ties to controversial weapons, including companies involved in the manufacture and production of cluster munitions, landmines, depleted uranium, biological and chemical
- companies classified as a "Producer", or those that derive 5% or more revenue from the distribution of civilian firearms.

Fossil fuels involvement: The percentage of portfolio's market value exposed to companies that have proven and probable coal reserves and/or oil and natural gas reserves used for energy purposes. Reserves are considered to be used for energy purposes in the case of companies with the following Global Industry Classification Standard (GICS) classification: (a) Oil, Gas and Consumable Fuels Industry (b) Energy Equipment and Services Industry (c) Utilities Sector (d) Diversified Metals and Mining Sub-Industry.

Gambling involvement: The percentage of portfolio's market value exposed to companies deriving 5% or more revenue from ownership of operation of gambling-related business activities, or those deriving 15% or more aggregate revenue from gambling-related business activities.

Tobacco involvement: The percentage of portfolio's market value exposed to companies classified as a "Producer", or those that derive 5% or more aggregate revenue from the production, distribution, retail and supply of tobacco-related products.

Our investment selection process for sustainable strategies¹

Barclays Private Bank's Discretionary Portfolio Management (DPM) strategies are underpinned by the objective of maximising risk-adjusted return while integrating Environmental, Social and Governance (ESG) considerations in the investment process.

There is currently no market consensus, universally accepted framework (legal, regulatory or otherwise), criteria or purely objective way to select investments for sustainable strategies. We undertake multiple screening processes and analyse a number of factors in our investment selection process that we consider relevant in accordance with our internally defined criteria. A high level overview of our investment selection process is set out in the [Barclays Private Bank Responsible Investing Policy \(Discretionary Portfolio Management\)](#), which is available on our website.

Our investment selection process includes subjective elements which require us to consider whether, on balance, we consider a particular investment appropriate for inclusion in a sustainable strategy based on our criteria, available information (including ESG data) and professional judgement. This means there may be companies and investments that, on balance, we deem appropriate to include in a sustainable strategy, but a specific company or investment may still have certain areas where it could improve its ESG profile (including in relation to any adverse sustainability-related impacts of such companies and investments) or where ESG controversies exist.

While we seek to screen for adverse sustainability-related impacts and ESG controversies against our internally defined criteria as part of our investment selection process, this process includes subjective judgements and investors should review our Responsible Investing Policy and disclosures relevant to any sustainability strategy, to understand our approach and determine whether this aligns with their ESG expectations for their investments.

Further, ESG considerations are rapidly evolving and may vary by sector/industry, market trends, current science or academic thought, and the macro environment. Therefore, any information herein should not be relied upon as being an exhaustive or complete view of the ESG profile or characteristics of any particular company or investment. No assurance can be given that a sustainable strategy will meet any or all client expectations regarding 'ESG', 'sustainable', 'responsible', or other similarly labelled objectives or that no adverse environmental, social, and/or other impacts will occur.

Our sustainable strategies rely on ESG data. There is currently no universally accepted way of reporting, rating or categorising ESG data and so, where we rely on third-party data, such data may be subject to certain limitations (including in relation to the quality, timeliness, completeness and availability of such ESG data).

Importantly, ESG data may not be audited or otherwise reviewed by an independent third party and while Barclays will use sources it believes to be reliable, we do not guarantee the information is accurate, complete, and up-to-date. The ESG data, models and methodologies used, and the judgements, estimates or assumptions made, are rapidly evolving and this may directly or indirectly affect the metrics and data contained herein.

¹ Excluding India. We do not offer sustainable strategies in India.

Key investment risks

ESG interpretation risk: The Private Bank's DPM business incorporates Environmental, Social and Governance (ESG) considerations and certain exclusions across all of its strategies. These considerations and exclusions are applied to varying degrees depending on the type of strategy, including but not limited to whether the strategy is internally categorised as a 'traditional strategy' or a 'sustainable strategy'. As a result, a strategy will perform differently from a strategy or reporting benchmark that uses a different methodology to identify and/or incorporate environmental and/or social impact criteria or relies solely or primarily on financial metrics.

There is currently no globally accepted framework or definition (legal, regulatory or otherwise) of, nor market consensus as to what constitutes, an 'ESG', 'green', 'sustainable', 'climate-friendly' or an equivalent company, investment, strategy or consideration or what precise attributes are required to be eligible to be categorised by such terms. This means there are different ways to evaluate a company or an investment and so different values may be placed on certain ESG credentials as well as adverse ESG-related impacts of companies and ESG controversies.

The evolving nature of ESG considerations, models and methodologies means it can be challenging to definitively and universally classify a company or investment under an ESG label and there may be areas where such companies and investments could improve or where adverse ESG-related impacts or ESG controversies exist.

The evolving nature of sustainable finance related regulations and the development of jurisdiction-specific regulatory criteria also means that there is likely to be a degree of divergence as to the interpretation of such terms in the market. We expect industry guidance, market practice, and regulations in this field to continue to evolve.

Any references to 'sustainable strategy', 'sustainable investment', 'ESG considerations', 'ESG factors', 'ESG issues' or other similar terms or related exclusions in this document are as used in our internal framework and as explained in our Responsible Investing Policy and not to any jurisdiction-specific regulatory definition or other interpretation of these terms unless specified otherwise. Further details are set out in this document and in the [Barclays Private Bank Responsible Investing Policy \(Discretionary Portfolio Management\)](#), which is available on our website.

Investors with specific sustainability preferences or sustainability-related objectives should review and consider our Responsible Investing Policy and disclosures relevant to any sustainability strategy in detail to ensure the sustainability profile of the sustainable strategy (including the approach we take to evaluating and screening adverse ESG-related impacts or ESG controversies) reflects such preferences or objectives.

There can be no guarantee that the aims or characteristics of any sustainability strategy will be achieved, or any adverse ESG-related impact or controversy avoided. Any decision to invest in a sustainable strategy should take into account both the financial and non-financial characteristics of the strategy.

The approach taken by the Private Bank DPM business may differ from decisions made by other Barclays entities and lines of business.

ESG analysis risk: In respect of Fixed Income strategies only, each fixed income investment undergoes fundamental quantitative Environmental, Social and Governance (ESG) analysis where data is available. For a minority of issuers, such as where the quantitative data is not deemed appropriate by the investment team and/or the data is not available, additional qualitative investigation is undertaken.

In respect of all other strategies, as part of our investment due diligence process, ESG factors are analysed to gain insight into the operational quality of a business and its resilience to ESG risks. For those that are eligible, each investment undergoes fundamental quantitative ESG analysis, which highlights areas where we then undertake further qualitative investigation.

In all cases, there is no guarantee that the assessment undertaken is exhaustive in nature or that this will influence our investment decisions. Certain asset classes, such as cash or hedging derivatives, are ineligible for ESG analysis.

Where we use ESG data, models and methodologies, we consider such data, models and methodologies to be appropriate and suitable for these purposes as at the date on which they were deployed based on our knowledge at the time. However, these data, models and methodologies are subject to future risks and uncertainties and may change over time.

These data, models and methodologies are also still evolving and therefore not as developed as historical standards for financial information, nor subject to the same or equivalent disclosure standards, historical reference points, benchmarks or globally accepted accounting principles. Therefore, historical data may no longer be a strong indicator of future trajectories. Outputs of models, processed data and methodologies will also be affected by underlying data quality which can be hard to assess or challenges in accessing data on a timely basis.

The data, models and methodologies used, and the judgements, estimates or assumptions made, are rapidly evolving and this may directly or indirectly affect the metrics, data points and targets we use. We will continue to review and develop our approach to data, models and methodologies in line with market principles and standards as this subject area matures on a reasonable endeavours basis.

Third-party risks in respect of ESG data (including research): There are differences in approach, coverage and methodology applied by third parties in compiling ESG data across the market (including but not limited to assignment of ESG ratings), that may lead to divergent views and opinions as to ESG credentials and considerations (including but not limited to the ESG rating applicable, if any).

Where we rely on third-party data (including research), we will consider the credibility of the source, however, we note that underlying data quality can be challenging to verify and assess due to certain limitations. We expect industry guidance, market practice, and regulations in this field to continue to change and we will review and develop our approach as appropriate.

Any use of third-party data including as part of the investment due diligence process may therefore be subject to limitations. As such, Barclays Private Bank and its affiliates shall have no liability for any errors or omissions in connection with any third-party data which they consider to be credible.

Sustainable strategy risk: Our sustainable strategies look to identify businesses that are helping to address either an environmental or social consideration through the products and services that they sell. The disparate nature of global businesses means that this analysis is subjective, using a combination of qualitative and quantitative inputs. Such strategies may not succeed in generating a positive environmental and/or social impact.

The incorporation of environmental and/or social impact criteria into an investment process may cause a sustainable strategy to select, screen or require the disposal of investments for reasons other than financial performance. As a result, a sustainable strategy will perform differently from a strategy that uses a different methodology to identify and/or incorporate environmental and/or social impact criteria or relies solely or primarily on financial metrics. There is no assurance that an investment objective will be achieved. For further information, see the section entitled "Our investment selection process for sustainable strategies" further above.

Investors with specific sustainability preferences or sustainability-related objectives should review and consider our Responsible Investing Policy and the relevant disclosures relevant to any sustainability strategy in detail to ensure the sustainability profile of the sustainable strategy reflects such preferences or objectives.

Any decision to invest in a sustainable strategy should take into account both the financial and non-financial characteristics of the strategy.

Market risk: The possibility for an investor to experience losses due to factors that affect the overall performance of the financial markets. Market risk, also called "systematic risk", cannot be eliminated through diversification, though it can be hedged against. Sources of market risk include major natural disasters, recessions, political turmoil and geopolitical tension.

Liquidity risk: The risk stemming from the lack of marketability of an investment that cannot be bought or sold quickly enough to prevent or minimise a loss.

Derivatives exposure: The use of these instruments can, under certain circumstances, increase the volatility and risk profile of the strategy beyond that expected of a strategy that only invests in equities. The strategy may also be exposed to the risk that the company issuing the derivative may not honour their obligations which could lead to losses arising.

Currency risk: An investor will be exposed to currency fluctuations between their domestic currency, a fund's holding currency, and the local currency of an investment.

Interest rate risk: An investor will be exposed to interest rate risk. Changes in interest rates will impact the performance and/or value of instruments. Interest rates tend to change suddenly and unpredictably.

Inflation: Inflation will reduce the real value of your investments in the future.

Taxation and tax relief: Levels of taxation and tax relief are subject to change.

Returns are not guaranteed: Past performance is not an indication of future performance. The value of investments, and any income, can fall as well as rise, so you could get back less than you invested. Neither capital nor income is guaranteed.

Purpose of information: Any information contained or referred to herein, in relation to any actual or potential ESG objective, issue or consideration is not intended to be relied upon for EU Sustainable Finance Disclosures Regulation classification purposes, EU Taxonomy Regulation classification purposes, or equivalent classification regimes.

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