Investing Beyond Returns

Advancing Environmental, Social and Governance (ESG) with Google Cloud in the Financial Services Industry

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Executive summary

The science is clear. **The world must act now** if we're going to avert the worst consequences of climate change.

High on the agenda of most companies is the need to integrate sustainability into their governance, risk assessment, decision-making, and disclosures.

Capital markets, as a consequence, are coming to grips with the fact that they need to assess the intrinsic value of a company, not just by its financial performance, but by its sustainability performance, too.

ESG issues differ in how they are measured and may vary depending on industry and geography, making it challenging to normalize the data.

With the help of artificial intelligence (AI), machine learning (ML) and high-performance computing (HPC), it is possible to put a large number of signals to work on structured and unstructured data, in order to analyse a portfolio and its supply chain under various climate change scenarios.

Since 2016, Google has been applying ML to increase the energy efficiency of its own business. Our data centers, powering products such as Search, Workspace and YouTube for billions of people around the world, have seen a 30% improvement[1] in cooling system efficiency through the use of autonomous AI to control the cooling systems. These same signals can be factored into climate risk models in the financial world.

Technology is critical to assessing the impact of climate change and facilitating the required pivot to a lower carbon economy. What this technical paper intends to do is clarify the problem, and engage our clients in the financial services industry to work towards a solution together.

[1] Evans, Richard and Pete Gao. DeepMind AI Reduces Google Data Centre Cooling Bill by 40%. 2016.

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Background

The Bank of England requires all UK banks and insurers to develop climate risk management capabilities, including scenario analysis, and even though The Task Force on Climate-Related Financial Disclosures (TCFD) is voluntary, the Bank of England has made it mandatory for all UK banks and insurers beginning in 2025.

TCFD recommends that signatories disclose how they incorporate climate change into the following four factors (including the application of scenario analysis in each of these factors and reporting the actual results of scenario analysis in their disclosures):

Governance	Strategy
Risk Management	Metrics & targets

In June 2020 the Bank of England published its own climate-related financial disclosure. It sets out the Bank's approach to managing the risks from climate change across its entire operation, and explains what it's doing to improve its understanding of these risks.

The European Union is also taking measures to mobilize capital via the financial services sector. Through the joint consultation paper on ESG disclosures, published by the European Supervisory Authorities (ESAs) in April 2020, financial market participants will be required to disclose specific information on their approaches to the integration of sustainability risks, and the consideration of adverse sustainability impacts on their investments across all financial products.[2]

Regulation Timeline

Figure 1: According to McKinsey, ESG regulation is evolving at high speed.[3]

Task Force on Climate-Related Financial Disclosures (TCFD)

Recommendations for disclosures in climate-risk-management approach and risk exposures

European Banking Authority

Guidance planned on the following topics:

• Regulatory expectations for management of environmental, social, and governance (ESG) risks
• Standards for ESG disclosures in Pillar 3 reporting
• Methodology for EU-wide climate stress-testing program and guidance for banks' own testing
• Guidelines on inclusion of ESG risks into supervisory framework

2017 — 2018 — 2019 — 2020 — 2021 — 2022 — 2023 — 2024 — 2025

Bank of England

• Supervisory statement on embedding climate risks into risk-management framework
• Draft methodology for comprehensive climate stress-testing program

European Commission

Disclosure recommendations on climate risks, building on TCFD framework

Bundesanstalt für Finanzdienstleistungsaufsicht

Expectations for integrating sustainability risks within risk-management framework

UK Government

[2] European Securities and Markets Authority. Joint Consultation Paper: ESG Disclosures, 2020.

[3] Poppensieker, Thomas et al. McKinsey on Risk: New risk challenges and enduring themes for the return. 2020.

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Sizing up climate risk

Climate change may lead to physical risks to world populations. Concerns like water levels rising, and natural catastrophes like wildfires, are causing investors to rethink the consequences of how and where their money is invested.

A few concrete examples

According to the Cambridge Institute for Sustainability Leadership,[4] just under 10% of the value of mortgage exposures in England is tied to properties in flood risk zones.

According to the Bank of England's discussion paper,[5] loan exposures to fossil fuel producers, energy utilities and emission-intensive sectors amount to around 70% of the largest banks' common equity Tier 1 (CET1) capital; and for UK insurers, around 12% of equity and 8% of corporate bond portfolio exposures are in high carbon technologies.

While corporate-level resilience to physical and transition risk varies greatly within and across sectors, S&P Global Trucost data show that heatwaves, wildfires, water stress, and hurricanes linked to increasing average global temperatures, represent the biggest physical risks for companies in the S&P 500.[6]

60%

of the companies in the S&P 500 index (with a market capitalization of $18 trillion) are exposed to at least one type of physical climate-change risk, according to S&P Global Trucost.[6]
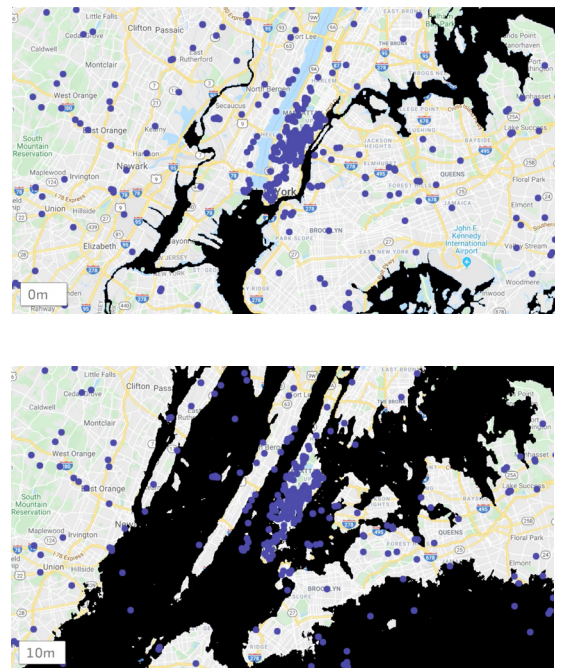

Figure 3: New York area real estate assets overlaid with sea-level rise (multi-century)[6]

[4] Cambridge Institute for Sustainability Leadership. Physical risk framework: Understanding the impact of climate change on real estate lending and investment portfolios. 2019.

[5] Bank of England. The 2021 biennial exploratory scenario on the financial risks from climate change. 2019.

[6] Mattison, Richard et al. S&P Global. The Big Picture on Climate Risk. 2020.

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As firms proceed, it is important to note that the location of assets is often the key factor in determining the extent of the risks—more so than the industry or sector in which a company operates.

The graphic below represents a heatmap for potential wildfire risks between 2030 and 2050 (see Figure 4), based on historic temperature and precipitation data projected forward. S&P 500 utilities companies with revenues of $184 billion and market capitalization of $515 billion own at least one asset at high risk of wildfire located on this map. Using this data, these companies can make informed planning decisions to avoid physical damage to assets and legal liabilities where electricity-transmission infrastructure may be located in a vulnerable area.
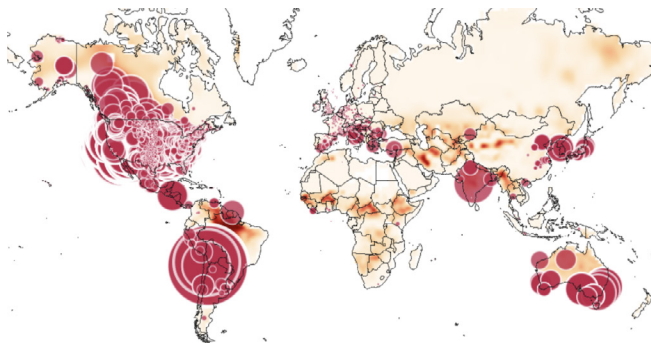
New fire-tracking tools in Google Maps and Search provide near real-time tracking of wildfires, aiding firefighters across the western U.S.[8]

Figure 4: S&P 500 utilities sector assets overlaid with wildfire risk (2030-2050)[7] Source: S&P Global Trucost, 2019

For risk managers to inject climate risk considerations into their risk management processes, they need to examine the company's business model in terms of transition risk, including greenhouse gas (GHG) emissions and reliance on fossil fuels.

A qualitative assessment of these factors may then suggest the company's climate risk management policies to protect physical assets and adopt a more sustainable business model.

[7] Mattison, Richard et al. S&P Global. The Big Picture on Climate Risk. 2020.
[8] Goode, Lauren and Boone Ashworth, Wired. Google Expands Its Fire-Tracking Tools—and Just in Time. 2020.

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The challenge: Getting the right data and tools

A lack of quality data and the prevalence of unreliable scores has meant that there is an increase in demand for raw data to develop proprietary ESG models.

Another concern in assessing climate risk is the shortage of available climate data, climate-related corporate information, and climate modeling.

The solution lies in working with publicly available data, augmented with climate hazard and unstructured data, and developing new tools to address these risks.

With the help of artificial intelligence (AI), machine learning (ML) and high-performance computing (HPC), it is possible to put a large number of signals to work on structured and unstructured data to deliver predictions that can save on cost and reduce reliance on fossil fuel energy.

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Where Google can help

1

Alternative data sets

Here are some examples of alternative datasets, powered by Google Cloud capabilities. Portfolio and risk managers can access them to make decisions regarding climate risk, while also keeping a careful eye on their firm's reputation and bottom line.

Google Earth Engine datasets*

Google Earth Engine, powered by Google Cloud's infrastructure, combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities to detect changes, map trends and quantify differences on the Earth's surface. The data catalog is paired with scalable compute power, backed by Google data centers; flexible APIs enable users to seamlessly implement existing geospatial workflows.

Earth Engine has partnered with Global Forest Watch, a network organized by the World Resources Institute to create a living map of forest loss.

Additionally, Earth Engine has partnered with Global Fishing Watch to track global fishing activity across the global ocean.

In 2016, the European Commission's Joint Research Centre (JRC) and Google released the Global Surface Water Explorer in tandem with a publication in "Nature." It allows measuring and monitoring when and where water is changing, including statistics for every country's annual surface water (i.e., lakes and rivers).

In 2019, Google partnered with the United Nations Environment to launch a new app, powered by Earth Engine, to map and monitor the world's freshwater supply. Measuring their changes is a prerequisite for their protection and restoration, which is why in 2015 the United Nations set a Sustainable Development Goal target, 6.6, to protect and restore water-related ecosystems.

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More public datasets

Environmental Insights Explorer (EIE), launched in partnership with the **Global Covenant of Mayors for Climate & Energy**, analyzes Google Maps data to provide rich insights into cities, including building emissions, rooftop solar panels, transportation estimates and other information. These insights can be used to create carbon baselines and accelerate climate action plans.

Project Air View makes the invisible visible by mapping air quality everywhere to compile heat maps using hyper-local air quality information, collected by Google Street View cars equipped with air quality sensors.

Project Sunroof mapped more than 107 million rooftops to help estimate rooftop solar energy potential and savings across 21,500 cities in the U.S. and Germany.[9] More than 2 million users have accessed the tool to make informed decisions about solar panel installation.

You can use **Dataset Search** to find more datasets or get started right away by adding the **public weather and climate datasets** to your workflows.

40+ years

of historical imagery and scientific datasets, updated and expanded daily.[10]

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Where Google can help

2

Smart analytics to assess climate risk

Historically, fund managers have performed fundamental analysis of company financials. Under ESG, new criteria has entered the picture.

In addition to identifying the right alternative data sources, managers will need massive computing power to process this data, and AI capabilities to understand it and effectively separate the good investments from the bad.

One approach might be to custom build a data platform and self-manage it. However, the time and money spent building and maintaining such a platform, along with the applications needed to acquire the data and clean it for analysis, could be prohibitive.

Cloud technology brings scalable analytics, powered by AI and ML, that can help frame actionable insights in ESG.

Here is one example of how Google Cloud could help: satellite data may be clarified using semantic data, such as business locations, to build context for input. Then, using AI and other inputs, like weather or tidal information, a time-lapse model may be constructed to reveal potential changes in the survey area. As these results are stored in the common data lake, users may access the data for analysis at any time and modify forecasts when setting policies or making decisions.

The components of any analytics framework must accommodate the operating models of the organization for the purpose of ESG planning. Google has already invested much in assembling these components with ESG in mind. How they come into play depends on the organization's specific business goals and approach to ESG.

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Tools for analysing ESG:

Natural language processing

NLP is one of the more important functions for investment firms looking to derive insights from news articles, unstructured documents, and other visual and vocal inputs that have an impact on investment decisions. Google tools enable NLP through a host of useful tools, ranging from speech-to-text and AutoML Translate, to AutoML NLP entity extraction and document AI.

Use case: AutoML NLP for entity extraction and sentiment analysis on news data such as GDELT can be used to build an ESG score for public companies, which can feed into the downstream investment process. GDELT provides regional news data from across the globe and is available via BigQuery.

NLP can also be used to extract keywords linked to a company's culture from data sources such as earnings calls, company transcripts, news articles, etc.

High-performance computing

Modeling in an ESG context can be compute-intensive, especially if using Monte Carlo methods to run what-if scenarios against parallel systems exhibiting non-linear dynamics.[11]

A use case of this would be to evaluate the risk to a coastal real estate portfolio from potentially rising sea-levels.

Google's high-performance computing can be used to optimize the cost of running these simulations to help you understand investment outcomes under conditions of varying uncertainty. An array of custom virtual machine types, preemptible Virtual Machines (VMs), batch scheduling, and graphic processing units combine to provide high-performance virtualization for scaling on demand.

BigQuery data warehouse

BigQuery is Google's serverless, fully managed, highly scalable, and cost-effective data warehouse. It offers real-time insights from streaming data and has a high-speed, in-memory business intelligence engine for faster reporting and analysis. BigQuery also provides functionality for geospatial analysis which is becoming ever more important for ESG analysis.

Use case: Researchers can leverage the geography data type and geospatial functions in BigQuery to map the operations centers of firms they are analyzing and understand how they are affected by natural and anthropogenic disasters, catastrophes and global pandemics. Public datasets available in BigQuery, such as COVID-19, NASA and NOAA, can serve as useful datasets for these types of exercises.

AI Platform Notebooks

AI Platform Notebooks is a managed service that offers an integrated and secure JupyterLab environment for data scientists and ML developers to experiment, develop and deploy models into production. It provides faster ramp-up on new projects, a highly responsive computing environment, increased security and better collaboration among data scientists.

Use case: Researchers in the ESG space will lean heavily on Python and SQL for their analysis, which can all be run from an AI Notebook with access to structured data in BigQuery and unstructured data on GCS. The BigQuery Python client has native support for pandas which makes the process of moving between pandas dataframes and BigQuery datasets seamless. Leverage GPUs and TPUs from your Notebook for computationally heavy NLP and ML tasks.

With these four powerful tools, you have the compute processing power necessary to interpret and understand the myriad alternative data sources that ESG decisions and reporting will require, leading to reduced regulatory exposure and increased alpha generation.

[11] Baez, John C., and David Tweed, Math Horizons. Monte Carlo methods in climate science. 2013.

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Real world examples

WWF Sweden

Google is partnering with WWF Sweden, using Stella McCartney as the pilot fashion brand, to help create a new data-enriched, decision-making platform that will help drive responsible sourcing decisions in the fashion industry.

According to the UN, the fashion industry accounts for 20% of wastewater worldwide.[12] On average, it takes 20,000 liters of water to produce just one kilogram of cotton, equivalent to a single T-shirt and a pair of jeans.[13]

Much of this impact occurs at the raw materials stage in the production process, where supply chains can be highly fragmented, and gathering and assessing data at scale is a challenge.

Collaboration with Stella McCartney to use Google Cloud technology will provide a more comprehensive view into raw materials of clothing manufacturers' supply chains.[14] At the same time, Google and WWF Sweden will collaborate on an updated platform leveraging all of these data types, aiming to further increase the accuracy and relevance of raw materials assessments.

20% waste

the fashion industry accounts for 20% of wastewater worldwide.[12]

20K liters

of water are needed to produce just 1 kilogram of cotton.[15]

[12] Ellen Macarthur Foundation. A New Textiles Economy: Redesigning Fashion's Future. 2017.

[13] World Wildlife Fund. Sustainable Agriculture: Cotton.

[14] Martin, Nick. Google Cloud Blog. Google's new pilot aiming to measure the environmental impact of the fashion industry. 2019.

[15] World Wildlife Fund. Sustainable Agriculture: Cotton.

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Shipping

UPS

UPS delivers 21 million packages in more than 220 countries worldwide every day. During the all-important holiday season, the number of packages delivered per day spikes. The drivers who make that possible perform 120 pickup and drop off stops daily.[16] Sifting through more than 1 billion data points daily to select the single best, most efficient and cost-effective route is a perfect challenge for Google Cloud.

UPS used Google Cloud's **BigQuery** to significantly reduce the time it takes to identify optimal routes, helping delivery drivers determine exactly where to go, every step of the way. The routing software saves the company up to $400 million a year and reduces fuel consumption by 10 million gallons annually, significantly contributing to UPS' journey towards more sustainable operations.

10M

gallons of fuel was saved by optimizing delivery routing.[16]

Cosmetics

Lush

By 2050, it's estimated there will be more plastic in the ocean than fish.[17] Lush, a brand centered around sustainability, aims to use as little packaging as possible. It has created **virtual packaging** for their beauty products with the help of Google Lens technology. By taking a picture of a beauty product in store and analyzing it with Google Lens, consumers can rapidly pull detailed product information on their mobile phones.

[16] Kurian, Thomas. UPS uses Google Cloud to build the global smart logistics network of the future. 2019.

[17] Wearden, Graeme. The Guardian. More plastic than fish in the sea by 2050, says Ellen MacArthur. 2016.

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Appendix: Google's sustainability approach

At Google we strive to build sustainability into everything we do. We are raising the bar in making smart use of the Earth's resources throughout our supply chain and creating products with people and the planet in mind.

Neutralizing our carbon legacy: Google has eliminated its entire carbon legacy (covering all our operational emissions before we became carbon neutral in 2007) through the purchase of high-quality carbon offsets. This means that Google's lifetime net carbon footprint is now zero.[18]

Largest sustainability bond offering: Recently, as part of a $10 billion debt offering, Alphabet issued $5.75 billion in sustainability bonds, the largest sustainability or green bond by any company in history.[19] Although a number of companies have issued green bonds (directed solely to environmental uses), sustainability bonds differ in that their proceeds support investment in both environmental and social initiatives.

Renewable energy: Google is the world's largest corporate purchaser of renewable energy.

Google has signed more than 50 wind and solar agreements to purchase a total of more than 5 GW of renewable power that is new to the grid.[20]

Google's agreements will also spur the construction of more than $2 billion in new energy infrastructure, including millions of solar panels and hundreds of wind turbines spread across three continents. In all, Google's renewable energy fleet now stands at 52 projects, driving more than $7 billion in new construction and thousands of related jobs.[21]

$7B

Google's renewable energy agreements have resulted in ~$7B in investment worldwide.[21]

[18] Pichai, Sundar. Google Blog. Our third decade of climate action: Realizing a carbon-free future. 2020

[19] Porat, Ruth. Google Blog. Alphabet issues sustainability bonds to support environmental and social initiatives. 2020.

[20] Google Data Centers. https://www.google.com/about/datacenters/renewable/. 2020.

[21] Pichai, Sundar. Google Blog. Our biggest renewable energy purchase ever. 2019.

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Data centers: Our data centers are the heart of our company, powering products such as Search, Gmail, and YouTube for billions of people around the world, 24/7, and are committed to zero landfill waste.

Our data center cooling systems are AI-powered for optimal efficiency, resulting in a 30% reduction in the electricity required for cooling servers.[22]

Clean energy: To date, we have committed approximately $4 billion to purchase clean energy from more than 50 wind and solar projects globally through 2034.[23] and aim to source carbon-free energy for our operations 24 hours-a-day, seven days-a-week by 2030.

Green buildings: Since the beginning, we've focused on the impact of our workplaces, from how we build our offices, to preventing food waste in our cafes. Today, more than 13 million square feet of Google offices are LEED-certified.[24]

Clean transportation: We're working to mitigate carbon emissions and take cars off the road by promoting the use of electronic vehicles and bicycles. By using Google shuttles in the Bay Area, we've saved 40,000+ metric tons of CO2 emissions— equivalent to taking 8,760 cars off the road every work day.[24]

Circular economy and design: We are committed to maximizing the reuse of finite resources across our operations, products and supply chains, and strive to enable others to do the same. To date, we've shipped millions of devices made with post-consumer recycled plastic, and 100% of Nest products launched in 2019 include recycled plastics.[25]

$4B
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of Google offices are LEED-certified.[24]

Google saved 40K+ metric tons
of CO2 emissions by using shuttles for Google employees in the Bay Area— equivalent to taking 8,760 cars off the road every work day.[24]

[22] Gamble, Chris and Jim Gao. Safety-first AI for autonomous data centre cooling and industrial control. 2018.

[23] Porat, Ruth. Alphabet Industry Relations. Alphabet Issues Sustainability Bonds To Support Environmental And Social Initiatives. 2020.

[24] Google Environmental Report. https://services.google.com/fh/files/misc/google_2019-environmental-report.pdf. 2019.

[25] Google Sustainability. Partnering with suppliers to create better recycled plastic. 2019.

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Affordable housing: We strive to be a good neighbor in the places we call home. To address the lack of affordable housing in the Bay Area in San Francisco, we've made a $1 billion commitment to invest in housing and expect to help build 20,000 residential units, of which at least 5,000 will be affordable.[26]

Commitment to racial equity: Because racial equity is inextricably linked to economic opportunity, we will continue to support Black businesses. Recent efforts include a $175+ million economic opportunity initiative[27], including financing for small businesses in Black communities, and a $100 million YouTube fund[28] to amplify the voices of Black creators and artists.

Get in touch with your account executive or Google representative for a discussion on how we can work together.

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Click here for more information about Google Cloud for Financial Services.

[26] Pichai, Sundar. Google Blog. $1 billion for 20,000 Bay Area homes. 2019.

[27] Pichai, Sundar. Our commitments to racial equity. 2020.

[28] Wojcicki, Susan. YouTube Blog. Susan Wojcicki: My mid-year update to the YouTube community. 2020.

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