

THEMATIC RESEARCH

# AN ESG LENS ON BLOCKCHAIN AND PUBLIC EQUITIES

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# Executive Summary

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The investment risks and opportunities associated with blockchain go beyond the volatile cryptocurrency market, with applications ranging from enhanced payment platforms and contract execution to supply chain management and carbon tracking systems. This report aims to help investors assess environmental, social and governance (ESG) issues related to applications of blockchain in the public equities market. We survey multiple industries in search of companies developing blockchain tools to improve the efficiency of their operations, the resilience of supply chains and product governance.

We assess ESG issues facing the constituents of a selection of blockchain-themed exchange-traded funds (ETFs) and expand our company sample by scanning the corporate filings of companies in Sustainalytics' ESG Risk Ratings universe. While our findings suggest that blockchain initiatives are still at an early stage of development across most sectors, we identify companies that are well positioned to integrate this technology into their ESG strategies. Our analysis covers diverse responsible investing topics, such as cybersecurity, the growing demand for specialized developers and the crypto market's impacts on climate change. Our industry analysis focuses on companies in the blockchain ecosystem and compares peers on Material ESG Issues (MEIs) and metrics.

## Key insights

*We built a model fund of funds (FOF) based on 10 blockchain-themed ETFs*

- Compared to the Morningstar Global Markets Large-Mid Cap index, the weighted MEI risk scores of the FOF are 17% higher on Human Capital and 71% higher on Data Privacy and Security. These MEIs serve as potential focal points for portfolio strategies and engagements with firms in this space.

*Our industry analysis reveals several ESG issues facing companies in this space*

- Nearly half (41%) of the financial companies sampled from our blockchain FOF have experienced significant to severe business ethics controversies, suggesting that many firms are unprepared for tightening crypto regulations.
- Seven of the metal mining companies in our sample are using blockchain to improve systems for tracking carbon emissions and sourcing materials.
- Blockchain in food retail aims to reduce recall costs, estimated at USD 10-100 mn per recall, and food fraud, which costs more than USD 50 bn per year.
- A small number of household and personal products firms use blockchain in managing supply chain issues, such as human rights and deforestation.

*The framework that we develop identifies potential ESG opportunities and risks*

- Despite a recent surge in capital invested in the blockchain and crypto vertical, over half (15 of 29) of the software and services firms in the model blockchain FOF are trading below Morningstar's fair price estimates.
- Over 11% (1,560 of 13,530) of the firms covered by our comprehensive ESG Risk Ratings use "blockchain," "crypto" or related terms in their public filings.
- We identify 10 firms leading in blockchain development and related ESG risk management across key markets, including North America, Europe and Asia.

Issues on the horizon	Many themes are currently trending in the responsible investing industry. The year has started with volatile financial markets, the continuing toll of the pandemic, and geopolitical tensions. Deforestation, pollution and climate change are among the mounting environmental crises that are top of mind. <sup>1</sup> While facing such challenges and uncertainties, we are also in an era of unprecedented levels of interconnectivity, innovation and potential for international co-operation.
A breakthrough technology	In 2022, we see blockchain as a breakthrough technology that will play an increasingly important role in how companies can work to achieve ESG-related objectives. This study presents a framework for identifying firms that are well positioned to leverage blockchain, seize ESG opportunities and mitigate risks.
Commercial applications of blockchain	Launched in the aftermath of the 2007-2008 financial crisis, Bitcoin was the first implementation of blockchain, created to have one application: a decentralized peer-to-peer electronic cash system. Other blockchains have since emerged to support various functions, such as general-purpose platforms that enable alternative crypto tokens, decentralized apps, and enterprise data management systems. <sup>2</sup> Transparency, speed and efficiency are among the features of blockchain that lend it to commercial applications. <sup>3</sup> The 10 companies identified in this report are at the forefront of innovating with blockchain, and have strong management programmes in place to mitigate relevant ESG risks (Exhibit 1.1).

### Exhibit 1.1: Examples of companies applying blockchain technology to advance business activities

Company	Domicile	Subindustry	Example
DBS Group	Singapore	Banks	DBS Group expects to grow its blockchain Digital Exchange user base by 20% to 30% over the next three years. The exchange supports fund raising with asset tokenization and digital asset trading.
Ping An Insurance Group	China	Insurance	With a total 1,215 of blockchain patent families filed since 2016, Ping An ranked the second in global blockchain patent race as of November 2021.
Visa Inc	US	Data Processing	In 2021, Visa partnered with BlockFi (a crypto fintech company), Deserve (a tech and program management firm) and Evolve Bank to release a credit card that rewards in Bitcoin to US residents.
SAP SE	Germany	Enterprise and Infrastructure Software	SAP's blockchain platforms support data management for multiple industries. In 2016, SAP and its partners used blockchain to shorten international payment time from up to six days to 20 seconds.
Qualcomm Inc	US	Semiconductor design and manufacturing	Qualcomm is deploying 5G technology, which combined with smart technology, IoT and blockchain, it estimates will have the potential to contribute a ~6% reduction in annual US emissions by 2025.
Norsk Hydro	Norway	Diversified Metals Mining	Norsk Hydro is using blockchain to produce sustainable aluminium certifications by tracking minimum 75% recycled aluminium and lowering carbon emissions in the metal's value chain journey.
Carrefour SA	France	Food Retail	In partnership with the IBM Food Trust, Carrefour uses blockchain to share safety information to customers. The firm aims to extend the technology to over 100 product lines in France in 2022.
Unilever PLC	UK	Personal Products	Unilever is using satellite data, geolocation, blockchain and AI to improve the monitoring and traceability of raw materials with the aim of eliminating deforestation from its supply chain by 2023.
Verbund AG	Austria	Electric Utilities	Verbund has teamed with Salzburg to develop a blockchain based peer-to-peer energy trading and wholesale electricity distribution. This new digital infrastructure reduces consumer bills by ~40%.
Siemens AG	Germany	Industrial Conglomerates	Siemens has developed a decentralized software platform called Estainium using blockchain technology to optimize CO2 emissions tracking throughout its global supply chains.

Source: Sustainalytics

## Structure

Three main sections	This report has three main parts. The background section provides a primer on blockchain and an overview of key ESG issues associated with the crypto market. Then, we create a model FOF based on 10 blockchain-themed ETFs and compare its ESG risk profile with that of a global equities index. Finally, we survey a selection of industries that are developing blockchain systems that may contribute to companies' abilities to advance their ESG objectives. We compare
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industry peers in terms of how they manage risks related to their applications of blockchain. This section features tear sheets for 10 companies that appear well positioned on blockchain and relevant ESG criteria (Exhibit 1.2).

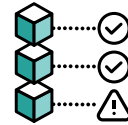
**Exhibit 1.2: Structure of this report – three parts**



Background on blockchain, crypto and ESG issues



An ESG snapshot of blockchain-themed ETFs



Assessing companies on ESG criteria

Source: Sustainalytics

## Data-driven analysis

Sustainalytics research

Our analysis draws on data points from Sustainalytics’ ESG Risk Ratings framework, including company Material ESG Issue (MEI) risk scores, MEI management scores, controversies research, climate solutions and impact metrics (Exhibit 1.3). We also draw on Morningstar equity research, Pitchbook, and public sources of third-party data.

Caveat

Although the data and analysis covered in this report provide reference points for investors to consider when assessing the ESG positioning of firms developing blockchain tools, the data and analysis are not measures of specific blockchain capabilities. Rather, our analysis addresses broader issues, such as companies’ overall approach to data security, product governance and supply chain management. By comparing company disclosures on related MEIs and metrics, our analysis offers investors a snapshot of how firms developing blockchain address any relevant ESG issues that may materialize. While the data used in our analysis examine more general issues, these results may be indicative of how prepared firms are to manage blockchain-related issues. We apply this broader lens due to limitations in available disclosures focused on ESG issues related to blockchain and the nascent stage of many blockchain applications.

**Ex. 1.3 Sustainalytics’ data points used in this report**



MEI Risk Scores



MEI Management Scores



Controversies Research



Climate Solutions



Impact Metrics

Source: Sustainalytics

## Crypto and ESG issues

Concerns about crypto

The surge in crypto prices in 2021 has attracted investor attention, but the precipitous downturn in the crypto market in early 2022 highlights the volatility and risks of this market. The price of Bitcoin fell from its November 2021 highs of nearly USD 70,000 to around USD 33,000 in January 2022.<sup>4</sup> Cryptos also face tightening regulations. As of November 2021, 51 countries have placed implicit or explicit bans on specific crypto-related activities, up from 23 in 2018.<sup>5</sup> The



environmental impact of crypto mining is another major concern, due to its large energy and e-waste footprints.

Responsible crypto investing?

However, some aspects of crypto may be supportive of an ESG investment thesis. The shift from proof-of-work (PoW) to a proof-of-stake (PoS) consensus mechanism among popular blockchain protocols is expected to reduce the energy demands by as much as 99%.<sup>6</sup> Instead of securing a blockchain network with energy intensive PoW crypto mining, PoS involves securing networks by rewarding users who stake their crypto to verify transactions.<sup>7</sup> Early research on PoS suggests that advances in crypto energy use could even eventually undercut the energy intensity of traditional central payments systems.<sup>8</sup> Other potential benefits of crypto and decentralized finance (DeFi) include reducing the costs of remittances and supporting other Sustainable Development Goals (SDGs).<sup>9</sup>

## ETF analysis

Blockchain and financial markets

Discussions about ESG issues linked to blockchain have tended to focus on crypto, but other aspects of this technology present different risks and opportunities. To identify ESG issues related to blockchain applications in the public equities market, our analysis starts by looking at 10 blockchain-themed ETFs. One indication of the growing interest in blockchain-themed investment strategies is that four of these ETFs launched just last year (Exhibit 1.4).

**Exhibit 1.4: An overview of blockchain-themed ETFs covered in this report**

Name	Ticker	Inception Date	Domicile	# Holdings (Long) 2021-12	Fund Size USD mn	Total Ret 1 Yr	Total Ret Annlzd 2 Yr	Total Ret Annlzd 3 Yr	Morningstar Rating Overall	Morningstar Sustainability Rating
Amplify Transformational Data Shrg ETF	BLOK	2018-01-16	US	52	917	0	44	36	***	⊕⊕
Siren Nasdaq NexGen Economy ETF	BLCN	2018-01-16	US	64	216	-5	22	25	**	⊕⊕⊕
First Trust Indxx Invtv Tnsctn&Prct ETF	LEGR	2018-01-25	US	104	150	14	17	19	*	⊕⊕⊕⊕
Capital Link Global Fintech Leaders ETF	KOIN	2018-01-29	US	43	26	11	20	23	**	⊕⊕⊕⊕⊕
Blockchain Technologies ETF	HBLK	2018-02-02	Canada	56	34	4	67	46	N/A	⊕⊕⊕⊕
Invesco CoinShares Global Blockchain ETF	BCHN	2019-03-08	Ireland	60	763	7	47	N/A	N/A	⊕⊕
Bitwise Crypto Industry Innovators ETF	BITQ	2021-04-27	US	33	92	N/A	N/A	N/A	N/A	N/A
Global X Blockchain ETF	BKCH	2021-07-12	US	26	87	N/A	N/A	N/A	N/A	N/A
Viridi Cleaner Engy Crypto Mng & Sem ETF	RIGZ	2021-07-19	US	18	11	N/A	N/A	N/A	N/A	N/A
Invesco Alerian Galaxy Crypto Eco ETF	SATO	2021-10-07	US	48	7	N/A	N/A	N/A	N/A	N/A

\*Total returns (daily) base currency. Data as of 19 January 2022.

Source: Morningstar

Overall ESG risk

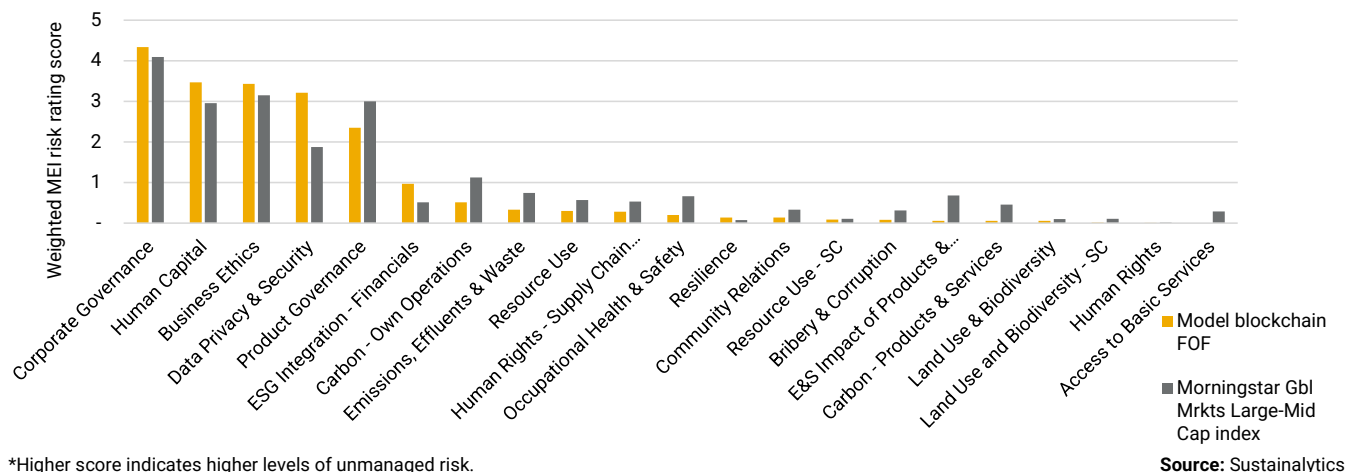
We combine 144 constituents of these ETFs that are covered by our comprehensive ESG Risk Ratings into a model FOF and assess its ESG characteristics relative to the Morningstar Global Markets (Gbl Mrkts) Large-Mid index. Our analysis suggests that investors in the blockchain market face slightly less overall ESG risk than investors in the broader global equities market. The model FOF has an overall weighted ESG risk score of 19.9, compared to 21.6 for our global equities index. Furthermore, only 10.4% of the FOF's market value falls into the high or severe ESG risk categories, compared to 13.8% for the index. This

finding suggests that blockchain ETF investors may avoid some of the material ESG risks facing global equity investors. However, the FOF exhibits much less sector diversity than the global index, suggesting that the potential benefits of application use cases in other sectors may be untapped by investors. We outline potential portfolio and investment strategies based on this analysis.

MEI analysis

From an MEI perspective, we find that our model FOF faces higher levels of unmanaged risk in areas that are critical for companies developing blockchain applications (Exhibit 1.5). Compared to the index, the weighted risk scores of the model FOF are 9% higher on Business Ethics, 17% higher Human Capital and 71% higher on Data Privacy and Security. We attribute the outsized unmanaged risk of the FOF on these issues to its high concentration of companies in the Information Technology and Financials sectors, which face high levels of exposure to the issues. These MEIs may constitute an area of interest for investors in this space to assess and engage with companies.

**Exhibit 1.5: Material ESG Issue risks, blockchain model FOF vs Morningstar Global Markets Large-Mid Cap index\***



## Industry analysis

Text mining corporate reports

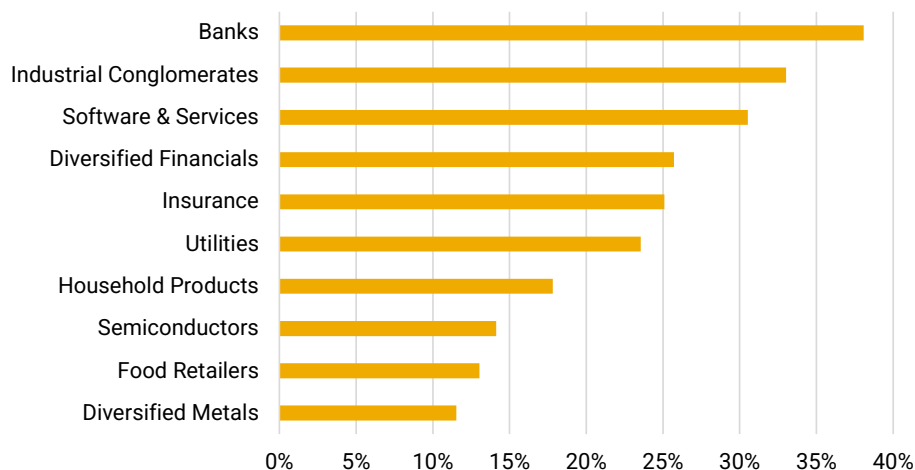
Moving from funds to an industry level of analysis, we expand the sample of companies contained in the FOF by text mining a digital library of company documents, including annual reports, corporate social responsibility reports, and integrated reports. Overall, we find that about 11% (1,560 of 13,530) of the companies in Sustainalytics' ESG Risk Ratings universe mentioned relevant key terms, such as "blockchain," "cryptocurrency" or "bitcoin" in their most recent public filings. Although blockchain has only been noted in the filings of a minority of companies, the 1,560 companies in this sample provide a starting point for additional research into the context of each company's use of these terms. This research increases the size and diversity of our sample from the model FOF.



Text mining to expand sample

We draw on this expanded sample to improve our study’s coverage of industries that are underrepresented in the model FOF, including Diversified Metals, Food Retailers, Household Products and Utilities. Exhibit 1.6 shows the percentage of companies that make at least one mention of a blockchain related key term within the selection of industries covered in this report.

**Exhibit 1. 6: Portion of industries that use blockchain terms in company reports\***



\*Select industries shown. Full sample: 13,530 firms. Search terms include blockchain, crypto and select tokens.<sup>10</sup>  
**Source:** Sustainalytics

### Prevalent ESG issues

Four central themes

Our survey of blockchain applications in different sectors identifies four key areas of ESG research that investors in this space can integrate into their portfolio, engagement and financing strategies: 1) product governance and business ethics, 2) cybersecurity and the growing demand for skilled developers, 3) environmental risk management and 4) supply chain management (Exhibit 1.7).

Product Governance, Business Ethics

1) Financials companies sampled from our model blockchain FOF tend to face high levels of unmanaged risk on two MEIs: Product Governance and Business Ethics. Applications of this technology among Financials companies include blockchain platforms that enhance security and efficiency features of payment systems, transaction clearing/settlements, contract execution and the processing of customer data. Financials companies are also increasingly treating cryptos as an asset. Yet only 22% (10 of 46) of the financials companies in our FOF sample fall into the low-risk category of Product Governance and Business Ethics. Companies facing less risk on these MEIs may be better positioned to align their blockchain initiatives with their existing management initiatives. Two of the sector’s top performers on these issues are DBS Group and Ping An Insurance Group. DBS Group, a Singapore-based banking group, operates DBS Digital Exchange, which uses blockchain technology to support fund-raising through asset tokenization and secondary trading of digital assets.

Ping An Insurance Group is a China-based insurer that is one of the global leaders of blockchain-related patents filed.<sup>11</sup>

Cybersecurity and skilled developers

2) Human Capital and Data Privacy and Security are critical MEIs for companies that are developing blockchain tools to support business activities across multiple sectors. In the context of blockchain implementation, these MEIs are related because skilled developers contribute to the security of data platforms. Companies in the Conglomerates and Software and Services industries are highly exposed to these issues because they face growing demand for blockchain developers and heightened cybersecurity risks related to data breaches and hacks. Among the firms in the data processing subindustry, Visa Inc. stands out for having launched multiple blockchain and crypto-related partnerships, products and services, while also achieving best-in-class performance on these two MEIs in focus. SAP SA, an enterprise and infrastructure software company, is similarly well positioned on these MEIs and works across various industries to develop enterprise blockchain data systems. Siemens AG leads the Conglomerates on these MEIs, with its robust cybersecurity management systems and human capital initiatives, which may support its early adoption of blockchain in tracking carbon emissions.

**Exhibit 1.7: Four prevalent ESG issues related to blockchain applications**



Product Governance and Business Ethics



Cybersecurity and Skilled Developers



Environmental Risk Management



Quality and Supply Chain Management

Source: Sustainalytics

Environmental risk management

3) Resource-intensive industries are developing blockchain applications to address environmental risks. Companies in the Utilities, Mining and Semiconductor industries are at early stages of developing blockchain tools to address risks related to Resource Use.

Utilities

Applications of blockchain in the Utilities industry support digital energy markets, renewable energy certifications, microgrid management, decentralized power generation and other innovations that can help mitigate carbon risks. The six Utilities companies in our sample generate most of their energy using renewable sources, namely solar, wind and hydro. Among the European Utilities firms in our sample, Verbund AG has the highest level of exposure to renewables, with 95% of electricity coming from renewable sources – mainly hydro and wind power.

Semiconductors

While much of the concern about the environmental impacts of cryptocurrency have focused on the energy intensity of proof-of-work crypto mining, the environmental impacts of producing the chips required for crypto mining is also a material issue.<sup>12</sup> Semiconductor fabrication requires a large supply of resources, including water and electricity. Chip manufacturing uses up to 30-50 megawatts of peak electrical capacity, enough to power a small city.<sup>13</sup> The Semiconductor industry also has a significant carbon and hazardous waste

footprint. While few of our sampled Semiconductor companies produce products used for crypto mining, several are involved in blockchain application, communication, consumer electronics and automobiles. Qualcomm has the lowest carbon emissions and water intensity among the sampled fabless firms. The company's application of blockchain focuses on scaling and securing its 5G network, which the company reports can contribute to reducing its emissions, as 5G networks offer improved energy efficiencies. Compared to its industry peers, Qualcomm has minimal direct exposure to carbon and water risks and offers potential carbon solutions related to its blockchain initiatives.

#### Diversified Metals

Metal miners are involved in the blockchain ecosystem through e-data storage and smart contracts – solution paths that expand the ability of mining companies to trace materials in their supply chains and track emissions in their operations. While blockchain projects in the mining industry tend to be in a preliminary phase, this technology offers the prospect of enhanced transparency on these issues. Comparing six metal mining peers that have such blockchain initiatives, Norsk Hydro has the lowest carbon intensity of the firms in this sample. Although its relatively low carbon intensity is mainly driven from the type of metal it produces (aluminum), Norsk's use of durable and recyclable materials, renewables and blockchain technologies can enable further reductions in its energy intensity. The company has launched a blockchain-supported pilot project aiming to measure and report on its use of post-consumer aluminium scrap.

#### Quality and supply chain management

4) Early blockchain adopters in the Consumer Goods sector are integrating blockchain into data management systems with the aim of improving issues related to supply chain management.

#### Household and personal products

Companies in the Household and Personal Products (HPP) industry are using blockchain systems to address supply chain management issues and secure payment processing. Blockchain can enable companies to encrypt records of transactions, verify the origin of commodities, and authenticate criteria related to sustainability and regulatory compliance. Unilever is relatively well positioned to manage environmental risks related to land use and biodiversity. Its recent commitment to be deforestation-free using blockchain could help the company tackle this critical supply chain concern.

#### Food retail

Major Food Retail companies have been experimenting with blockchain to improve supply chain transparency and traceability for selected food products. These initiatives aim to mitigate risks related to product recalls, food fraud, and child, slave and forced labour. Important commodities linked to these risks include cacao, sugar, tomatoes, seafood and cotton. We regard Carrefour as well positioned on these issues; its supply chain management programme applies to its tier 2 suppliers and is complemented by detailed policy commitments in its social supplier standards. The firm aims to deploy blockchain systems to track all its own brand quality line products in France by 2022.

# Background

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Cryptocurrencies (cryptos) include coins, which are native assets of blockchains, and tokens, which are representations of an asset that are built on an existing blockchain.<sup>14</sup> While blockchain enables most cryptos, in exceptional cases cryptos can function without a blockchain.<sup>15</sup> Crypto coins and tokens act as a form of digital money that is used as a medium of exchange and storer of value.

Blockchain

Although cryptos and blockchain are related, they are distinct concepts. A blockchain is a database that is distributed in a computer network using a cryptographic consensus mechanism to ensure the authenticity of proposed changes, while maintaining an immutable record of transaction history. Any proposed change to the blockchain database is broadcast to the network, which determines whether the alteration is permitted, based on a set of rules designed to minimize risks of unauthorized manipulations or hacks.

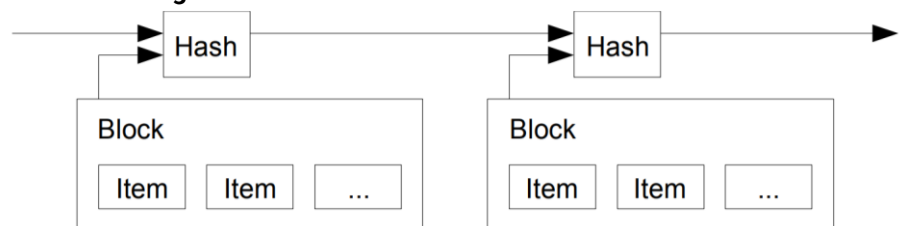
Building blocks

The rapid adaptation of the internet in the early 1990s for commercial use led to a revival of the study of cryptology, an offshoot of which led to the development of blockchain. In a 1991 article published in the Journal of Cryptology, two scientists at Bell Communications Research (Bellcore), Stuart Haber and W. Scott Stornetta, proposed a computational procedure for creating an immutable digital record.<sup>16</sup> The process involved calculating a hash value (a fixed-length result) from digital documents of different lengths and saving it on a network with a timestamp. A hash changes in response to any change to the original document. Private keys sign submitted data and a distributed consensus mechanism certifies links between hashes.<sup>17</sup>

Satoshi Nakamoto

In 2008, an unidentified individual or group by the pen name Satoshi Nakamoto published a whitepaper explaining how such a system could be adapted to support a new form of digital money. The paper described how a distributed network can apply a proof-of-work (PoW) consensus mechanism that draws on pools of computer power to secure payments and prevent double-spending without the use of an intermediary or centralized authority. “[T]he network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work” (Exhibit 1.2).<sup>18</sup>

**Exhibit 2.1: Diagram of hashes linked in a blockchain\***



\*Each timestamp includes the previous timestamp in its hash, forming a chain, with each additional timestamp reinforcing the ones before it. **Source:** Satoshi Nakamoto (2008)<sup>19</sup>

The launch of Bitcoin

On 3 January 2009, Satoshi Nakamoto implemented this idea with the launch of Bitcoin – an open source, electronic, peer-to-peer cash system. This innovation promised to reduce transaction costs and improve transparency and accountability in financial systems.<sup>20</sup> Unlike government-issued currencies, Bitcoin was intentionally designed to operate independently of a centralized authority that would otherwise be trusted to mint cash and validate transactions.

Proliferation of technology

Since the launch of Bitcoin, other blockchains and cryptos have launched, many of which support different functions and make use of alternative consensus mechanisms. While some the most popular blockchains and cryptos are decentralized, public and open source, others are centralized and private.

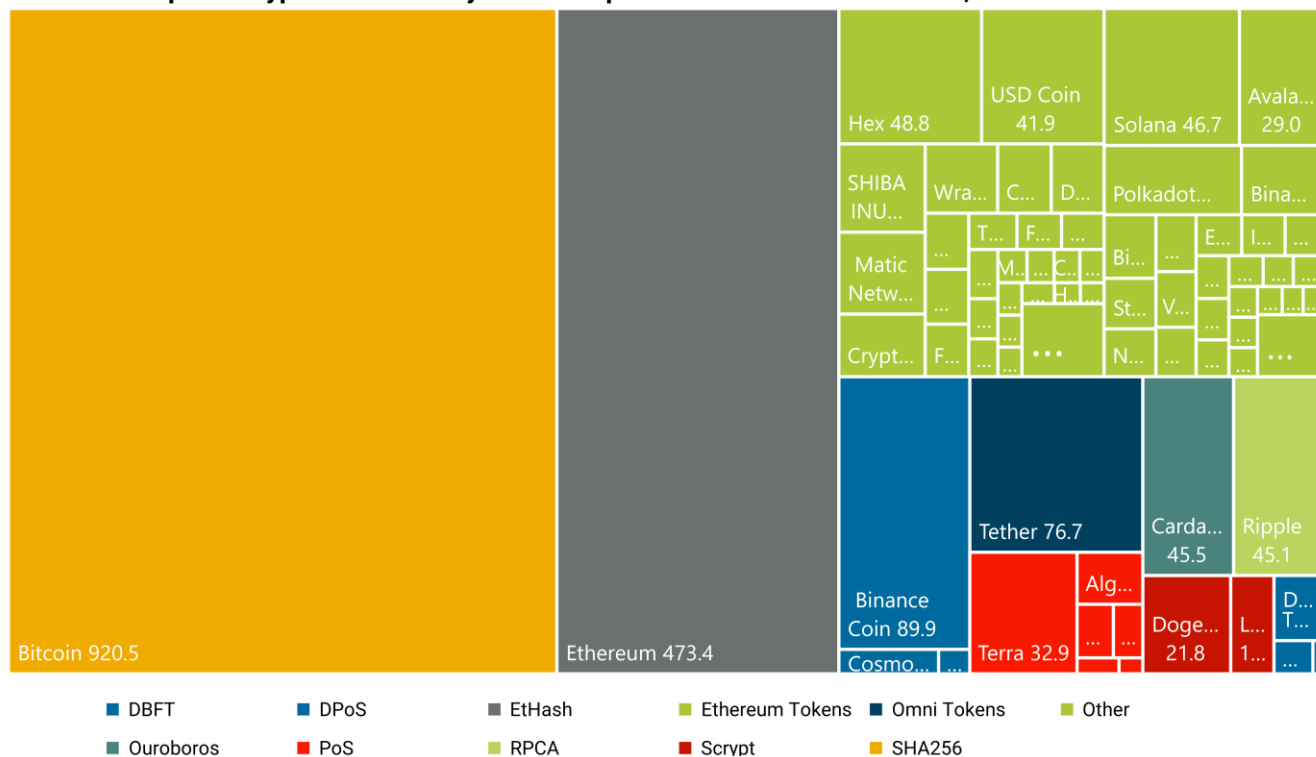
Unboxing general purpose blockchains

In 2013, Vitalik Buterin, a Russian-Canadian programmer and writer, published the Ethereum whitepaper, proposing a next-generation blockchain that enables smart contracts. Smart contracts are “cryptographic ‘boxes’ that contain value and only unlock it if certain conditions are met.”<sup>21</sup> This innovation allows users to create digital assets, such as decentralized apps (dApps) and non-fungible tokens (NFTs), which are secured by blockchain. Such innovations can support trade clearing, health insurance, voting, product tracking and other services.<sup>22</sup>

Growth of crypto assets

A variety of other general and specific purpose blockchains underpin the crypto market. Exhibit 1.3 shows the top 100 cryptocurrencies by market capitalization grouped by their consensus mechanism, operating principles and functions.<sup>23</sup> The total capitalization of this market grew 189% in 2021, from USD 759 bn in January 2021 to USD 2.1 tn in December 2021. Since then, the size of the market has fallen to USD 1.7 tn, as of 31 January 2022.<sup>24</sup>

**Exhibit 2.2: Top 100 cryptocurrencies by market capitalization at the end of 2021, USD bn\***



\*Market cap as of 30 December 2021, grouped by consensus mechanism, operating principles and functions.

Source: Coin360<sup>25</sup>

## ESG considerations related to crypto

### Mainstream crypto investing

A growing number of investment funds have been focusing on cryptos, crypto futures and other derivatives. Allied Markets Research projects that the size of the global crypto asset management market will reach USD 9.36 bn by 2030, up from USD 0.67 bn in 2020.<sup>26</sup> Although this space has gained popularity, it presents significant ESG risks. Crypto prices are highly volatile, and the crypto market faces risks related to tightening regulations and environmental issues.

### Volatility

In a single day in May 2021, the price of Bitcoin dropped 30% after regulators in China banned domestic financial institutions from supporting Bitcoin-related activities and shut down crypto mining operations.<sup>27</sup> The following day, Bitcoin recovered 12%.<sup>28</sup> The price of a Bitcoin reached a record high in November 2021 about of USD 70,000 but fell below USD 33,000 in January 2022.

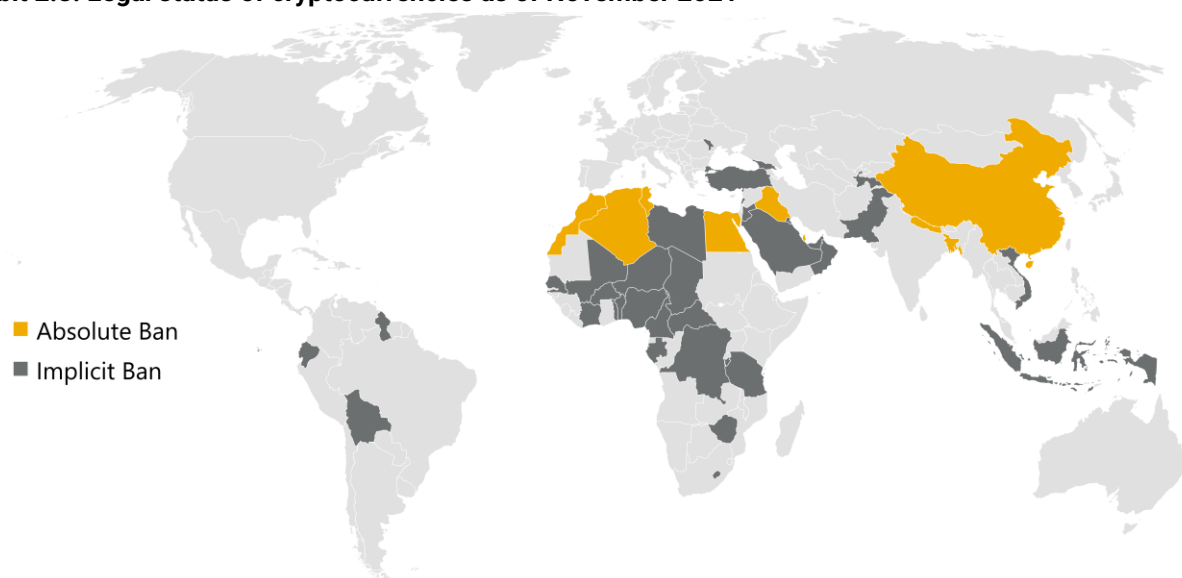
### Compliance

Regulatory environments are evolving in response to the emerging issues within the crypto market. In June 2021, El Salvador became the first country to accept Bitcoin as legal tender.<sup>29</sup> Many other countries allow Bitcoin and other cryptos to be used in transactions and permit financial institutions to provide crypto-related products and services.<sup>30</sup> Across different regions, crypto is regulated by a variety of tax, anti-money laundering, and counter-financing of terrorism laws.<sup>31</sup> As of January 2022, 80 countries are pursuing central bank digital currency (CBDC), which is a digital token of a country's official currency.<sup>32</sup>

### Tightening regulations

According to the Global Legal Research Directorate of the Law Library of Congress, 51 countries have placed implicit or explicit bans on specific crypto related activities, up from 23 in 2018. As of November 2021, nine jurisdictions had “absolute” bans, which make cryptocurrencies illegal. Another 42 had implicit bans, which target crypto exchanges or prevent financial intuitions from dealing with crypto or offering related products and services (Exhibit 1.4).<sup>33</sup>

**Exhibit 2.3: Legal status of cryptocurrencies as of November 2021**



Source: Global Legal Research Directorate of the Law Library of Congress<sup>34</sup>



Energy and carbon

One of the most controversial environmental aspects of Bitcoin and other proof-of-work (PoW) based cryptos is the energy intensity associated with crypto mining. According to the University of Cambridge’s online tracker, Bitcoin uses 126.5 terawatt-hours (TWh) of electricity per year, which represents 0.65% of global electricity consumption, more than the energy use of many countries, such as Finland and Switzerland (Exhibit 2.4).<sup>35</sup> In some countries, such as Kazakhstan – which generates nearly 70% of its electricity by burning coal – mining crypto can have a significant carbon footprint.<sup>36</sup>

Mitigating measures

While crypto mining is energy intensive, some operations are strategically located in places with access to low-carbon energy sources, such as hydro. The Crypto Climate Accord, an alliance of major crypto organizations, recently announced its goal to power all the world’s blockchains with 100% renewables by 2025.<sup>37</sup> In colder climates, energy used in mining can be upcycled to heat buildings, potentially recovering as much as 96% of the energy used in mining.<sup>38</sup>

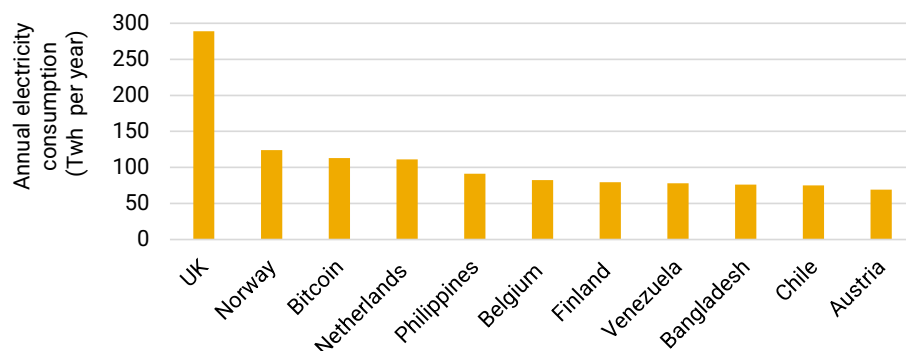
Proof-of-stake consensus

Advances in blockchain that involve a transition from energy intensive PoW to alternative consensus mechanisms, particularly proof-of-stake (PoS), can reduce the energy intensity of the crypto industry. A transition from PoW to PoS in the Ethereum blockchain is expected in 2022. By eliminating the need for mining Ether, its transaction token, this change to PoS promises to increase transaction speeds and reduce its energy intensity by 99%.<sup>39</sup> A 2021 paper published by the Centre for Blockchain Technologies at University College London found that PoS-distributed ledgers could eventually become less energy intensive than traditional central payment systems, potentially mitigating climate risks.<sup>40</sup>

E-waste, value leakage and pollution

Another environmental concern about crypto mining is its contribution to e-waste pollution. A 2021 article published in the Journal of Resources, Conservation & Recycling estimates that the amount of e-waste generated by Bitcoin miners grew from 1 metric kiloton (kt) of mining devices in 2014 to over 30 kt in 2021. This increase coincides with the proliferation of equipment and computational power used to secure Bitcoin transactions.<sup>41</sup> Industries that produce materials that become e-waste may be experiencing value leakages when valuable materials, such as precious metals and rare earth elements, are wasted. Firms exposed to e-waste may face compliance and reputational risks as e-waste damages the environment and contaminates other waste streams.<sup>42</sup>

**Exhibit 2.4: Annual electricity consumption of Bitcoin versus select countries**



Source: Cambridge Bitcoin Electricity Consumption Index<sup>43</sup>

Potential social benefits

From another perspective, blockchain, crypto and the decentralized finance (DeFi) industry may help promote more inclusive financial systems by servicing underbanked individuals, including people in developing economies.<sup>44</sup> Cryptos and blockchain services can expedite remittances by removing high-cost intermediaries. In this respect, some applications of blockchain may be aligned with a sustainable investment thesis. For example, Sustainable Development Goal (SDG) 10 (c) aims to reduce to less than 3% the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5%.<sup>45</sup>

A focus on the underlying technology

We expect that use cases for blockchain will continue to be of growing relevance to the responsible investing community in 2022 and beyond. This technology is on course to play an increasingly important role in multiple sectors. It also forms an integral part of other innovations, such as the metaverse – a network of virtual worlds – and Web3 – the next generation of the internet in which individual ownership of digital assets, including personal data, will be commonplace.<sup>46</sup>

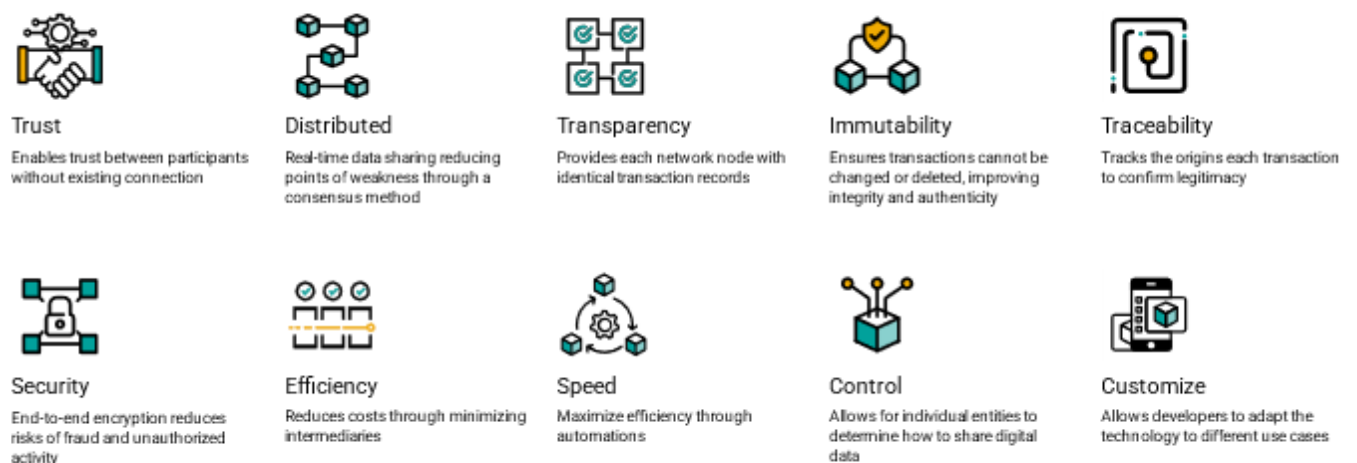
Key features

Exhibit 2.5 summarizes several features of blockchain that may be conducive to commercial applications. Throughout the rest of this report, we assess how these features, and different applications of blockchain, can offer strategic advantages to businesses across a range of industries. While we highlight how blockchain can be supportive of different ESG initiatives, we also identify material risks facing companies in this space.

Next steps

In the following section, we identify prevalent ESG issues related to the blockchain ETF market. Material ESG issues (MEIs) that we highlight include Data Privacy and Security, Human Capital and Business Ethics: we find that the Financials and Technology sectors are highly exposed to these issues. Then, we survey key industries that are developing blockchain tools for different applications, starting with sectors that are overweighted in the model FOF. Additional ESG topics that surface in our industry analysis include supply chain management in the Food Retail and Personal Products industries, and approaches to carbon risk management among companies in Utilities, Semiconductor and Diversified Metals.

**Exhibit 2.5: Potential features of blockchain that may support use cases across multiple industries**



Source: Sustainalytics<sup>47</sup>

# Blockchain fund analysis

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Over the course of 2021, interest in blockchain-themed investing gained momentum with new products coming to the market, including four of the 10 blockchain exchange-traded funds (ETFs) in our study sample. These ETFs invest in companies developing, researching, innovating and using blockchain, or in companies that support the crypto industry, such as crypto miners, equipment suppliers and service providers. The total market value of our ETF sample grew from USD 1.7 bn in January 2021 to a high of USD 3.7 bn in mid-November 2021. However, by the first month of 2022, concerns about inflation, interest rates, political conflicts and COVID-19 have contributed to market volatility. As of 26 January 2022, the total size of the ETFs had fallen to USD 2.3 bn (Exhibit 3.1).

**Exhibit 3.1: Sample of 10 blockchain ETFs**

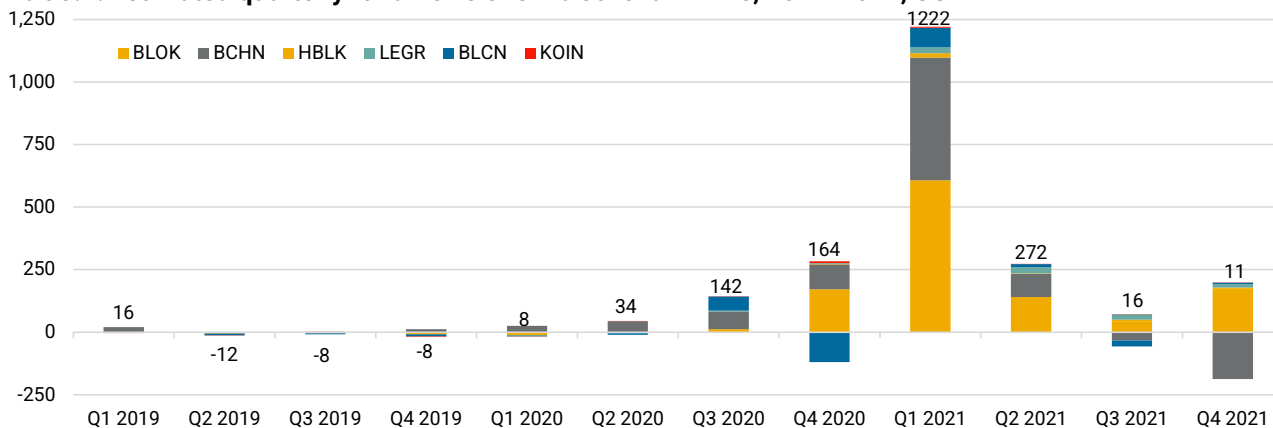
Name	Ticker	Inception Date	Size, USD mn
Amplify Transformational Data Shrg ETF	BLOK	2018-01-16	917
Siren Nasdaq NexGen Economy ETF	BLCN	2018-01-16	216
First Trust Indxx Invtv Tnsctn&Prs ETF	LEGR	2018-01-25	150
Capital Link Global Fintech Leaders ETF	KOIN	2018-01-29	26
Blockchain Technologies ETF	HBLK	2018-02-02	34
Invesco CoinShares Global Blockchain ETF	BCHN	2019-03-08	763
Bitwise Crypto Industry Innovators ETF	BITQ	2021-04-27	92
Global X Blockchain ETF	BKCH	2021-07-12	87
Viridi Cleaner Engy Crypto Mng & Sem ETF	RIGZ	2021-07-19	11
Invesco Alerian Galaxy Crypto Eco ETF	SATO	2021-10-07	7

Source: Morningstar

**Fund flows**

A potential signal of investor optimism about the blockchain ETF space is the direction of capital flows into this market. For six of the sampled ETFs that have inception dating back at least to 2019, the net inflows into this market were positive for eight of the past 12 quarters. Q1 2021 was a record quarter, with net inflows of USD 1.2 bn, driven mostly by BLOK and BCHN (Exhibit 3.2). The record inflows of Q1 2021 corresponded to an 80% increase in the price of Bitcoin, while the decline in Q2 2021 coincided with a crypto market downswing.<sup>48</sup>

**Exhibit 3.2: Estimated quarterly fund flows of six blockchain ETFs, 2019-2021, USD mn\***



\*Net inflows and outflows indicated above and below the bars, respectively.

Source: Morningstar

## An ESG snapshot of the blockchain ETF market

### Fund of funds ESG analysis

In this section, we assess the ESG risk profile of the blockchain ETF market by building a model fund of funds (FOF) that pools the investments of the 10 ETFs. We compare the model blockchain FOF with the Morningstar Global Markets Large-Mid (Gbl Mrkts) Cap index to identify sources of ESG risk facing blockchain ETF investors. Comparing the model FOF with the Morningstar Global Markets Large-Mid allows us to assess ESG issues across multiple sectors and identify industries that may be underrepresented in the ETF sample.

### ESG coverage

Sustainalytics’ comprehensive ESG Risk Ratings universe covers 144 of the 180 unique entities included in the full sample of companies from the 10 ETFs. The analyzed entities in the FOF account for 56% of the market value of the 10 ETFs. The gap in entity coverage is due to the inclusion of assets in the ETF that are outside the comprehensive ESG Risk Ratings universe, such as derivatives, cash positions, private equity and others. Our comprehensive coverage of the index includes 3,362 of the 4,663 entities listed on the index, accounting for 97% of its market capitalization.

### Rebalancing

We normalized the weights of the researched securities to equal 100% of the weights of the FOF and the index by proportionally redistributing the weights of securities that are outside our comprehensive ESG Risk Ratings universe.

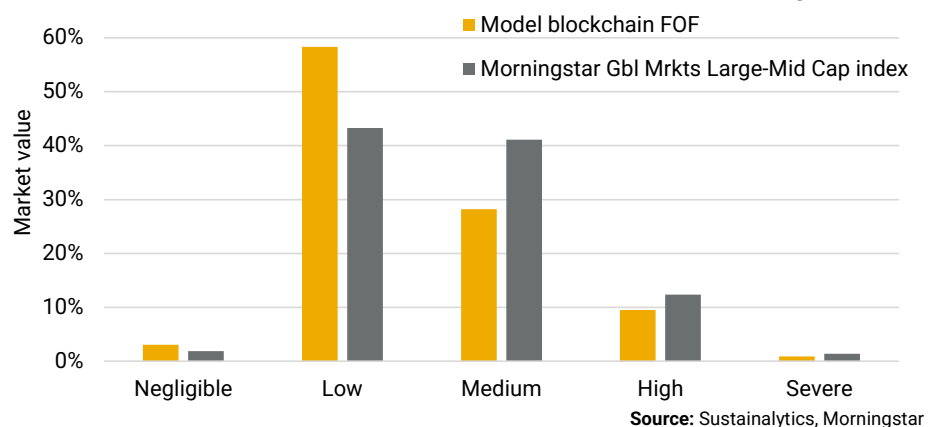
### Weighted ESG risk scores

The model FOF has an overall weighted ESG risk score of 19.98, compared to 21.65 for the Morningstar Global Markets Large-Mid Cap index.<sup>49</sup> This difference suggests that a typical global equity investor is exposed to more unmanaged ESG risk than a typical blockchain ETF investor. In addition, only 10.4% of the FOF’s market value falls into the high to severe ESG risk categories, compared to 13.8% of the Morningstar Global Markets Large-Mid (Exhibit 3.3).

### ESG risk attribution

To assess the sources of ESG risk in the FOF compared to the index, we adapt the Brinson Fachler attribution model, which is typically used to discern the source of a portfolio’s total returns performance in terms of sector allocation and stock selection investment decisions. Instead of focusing on total returns, we compare the weighted ESG risk scores of the FOF with those of the index.

**Exhibit 3.3: Distribution of FOF and index value across ESG risk categories**



**Sector allocation and stock selection** The FOF's lower ESG risk score is largely the result of sector allocation and stock selection effects, which account for -1.84 and -1.43 units of weighted ESG risk, respectively (Exhibit 3.4). The allocation effect of the Information Technology sector represents 59% of the total allocation effect. The FOF has largely over weighted this sector, which is less risky than most other sectors in the global equity index. In addition, the FOF's exclusion of Healthcare and Real Estate contributes to its reduced risk attributed to stock selection decisions.

**Potential applications** A potential use case for this type of analysis could be to expand sector coverage by including other industries in the FOF and tilting its sector allocation towards securities with lower ESG risk.<sup>50</sup> The ESG risk profile of the FOF could be further reduced by excluding or underweighting high ESG risk stocks and overweighting low ESG risk stocks. For example, a portfolio could redirect capital from Aluminum Corporation of China, which has the most severe ESG risk score (53.65) among the FOF constituents, and increase the weight of positions like Norsk Hydro ASA, a Norwegian aluminum producer with a medium ESG risk score (20.59). Looking across all sectors, Accenture PLC and SAP SE are two Software and Services companies in the FOF that have the lowest ESG risk scores of the sample; 9.45 and 9.69, respectively.

**Material ESG issues** Shifting from an overall ESG risk perspective to an analysis of Material ESG Issues (MEIs), we find that the weighted MEI risk scores of the model FOF are higher than those of the index on only six of 22 issues. The unmanaged risk scores of the model FOF are higher than those of the index on Corporate Governance, Human Capital, Business Ethics, Data Privacy and Security, ESG Integration and Resilience (Exhibit 1.3).

### Exhibit 3.4: Weighted ESG risk score attribution

Sector	Sector Weight		Active Weight Δ	Sector Weighted ESG Risk Score		ESG Risk Score Attribution			
	FOF	Equity Index		FOF	Equity Index	Sector Allocation Effect	Stock Selection Effect	Interaction Effect	Total Effect
Consumer Discretionary	2.36%	12.52%	-10.16%	27.12	21.07	0.06	0.76	-0.62	0.20
Consumer Staples	0.51%	6.61%	-6.10%	26.06	23.74	-0.13	0.15	-0.14	-0.12
Energy	0.25%	3.46%	-3.21%	36.60	33.70	-0.39	0.10	-0.09	-0.38
Financials	30.74%	14.00%	16.75%	22.47	22.07	0.07	0.06	0.07	0.19
Healthcare	0.00%	11.53%	-11.53%	0.00	23.01	-0.16	-2.65	2.65	-0.16
Industrials	1.14%	9.98%	-8.84%	29.97	24.44	-0.25	0.55	-0.49	-0.18
Information Technology	58.16%	29.05%	29.11%	17.29	17.90	-1.09	-0.18	-0.18	-1.45
Materials	3.10%	4.86%	-1.76%	32.12	26.30	-0.08	0.28	-0.10	0.10
Real Estate	0.00%	3.12%	-3.12%	0.00	13.61	0.25	-0.43	0.43	0.25
Telecommunication Services	3.43%	2.14%	1.29%	21.52	21.40	0.00	0.00	0.00	0.00
Utilities	0.31%	2.72%	-2.41%	23.94	26.94	-0.13	-0.08	0.07	-0.14
<b>Total</b>	<b>100.00%</b>	<b>100.00%</b>	<b>0.00%</b>	<b>19.98</b>	<b>21.65</b>	<b>-1.84</b>	<b>-1.43</b>	<b>1.60</b>	<b>-1.67</b>

Source: Sustainalytics<sup>51</sup>

**ESG risk differentials** The largest difference between the weighted MEI scores of the FOF and the index are on Data Privacy and Security and Human Capital. The MEI risk scores of the FOF are 71% and 17% higher than the index, respectively, on these issues. These

differences are in part driven by the model FOF’s concentration of Information Technology and Financials companies, which are highly exposed to these MEIs.

ESG topics for investing strategies

Data Privacy and Security and Human Capital constitute a reasonable starting point for investors in the blockchain global equity market to consider in their portfolio and engagement strategies, especially for companies that fall into the high or severe MEI risk categories. As detailed in our industry analysis below, these MEIs are relevant to companies in the blockchain ecosystem because blockchain developers are in high demand and blockchain-related cyberattacks have resulted in significant financial losses, estimated at around USD 3.78 bn in 2020 alone.<sup>52</sup> Investors engaging with issuers can demand more clarity in disclosures about cybersecurity, their programmes to adapt to technological change and their plans for attracting and retaining specialized developers and data security experts.

### Lessons and next steps

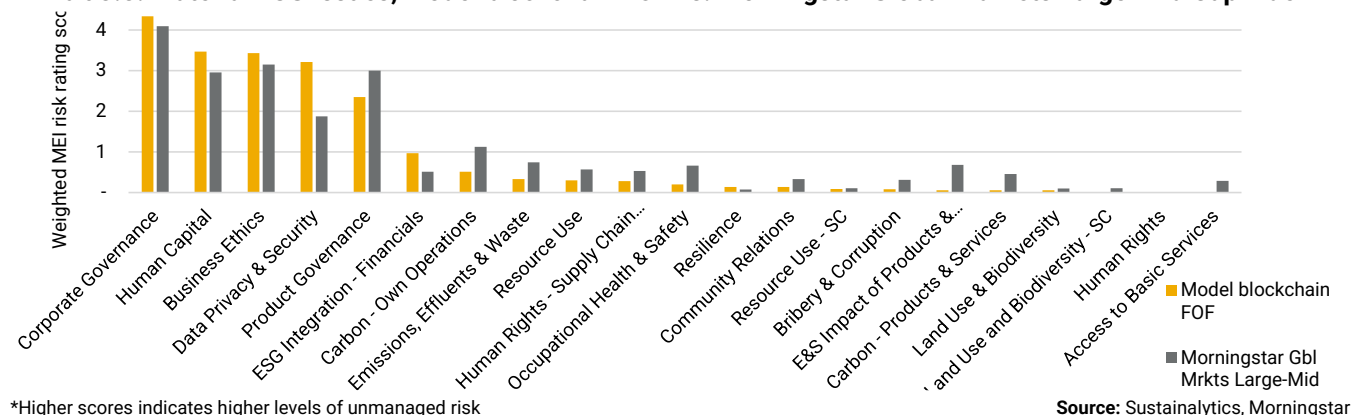
Summary

This analysis of the blockchain ETF market has identified several topics that investors can investigate and consider in their portfolio and engagement strategies. Our analysis suggests that blockchain ETFs tend to be at less overall ESG risk than the global equity market, which we attribute to the ETF’s large allocation in Information Technology and exclusion of Healthcare and Real Estate companies. However, the blockchain ETF market also faces elevated risk on a several MEIs, including Data Privacy and Security and Human Capital.

Going deeper

To mitigate exposure to ESG risk in the blockchain equity market, investors may consider tilting the weights of sectors and companies based in part on their ESG performance. They can also engage with companies’ management teams on select MEIs. In the next section, we explore how ESG issues related to blockchain applications can materialize in industries that are driving innovation in the global equity market, starting with the industries that contain the largest number of sampled companies. Our analysis includes company case studies that investors can reference as examples of best-in-class performers.

**Exhibit 3.3: Material ESG Issues, model blockchain FOF vs. Morningstar Global Markets Large-Mid Cap index**





# Blockchain and Financials

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Companies in the Financials sector have developed blockchain applications to enhance payment systems, transaction clearing and settlements, contract execution and the processing of customer identity. The technology is also the backbone of cryptocurrencies, which are increasingly treated as an asset class and are being included in crypto-themed trusts, exchange-traded notes (ETNs) and funds (ETFs).

The distributed nature of blockchain systems offers key benefits to the sector, especially in terms of Data Privacy and Security. Blockchain systems are resilient to failure, less vulnerable to attacks and more difficult to manipulate than conventional data systems. They can also make processing faster, cheaper and more efficient. These blockchain features may support more robust financial products, stronger defences, and improved compliance practices.

Product governance is critical

However, companies that apply blockchain face risks, as the technology is complex and still relatively nascent. Disclosures on product features and risks are, therefore, critical for ensuring client awareness and protection.

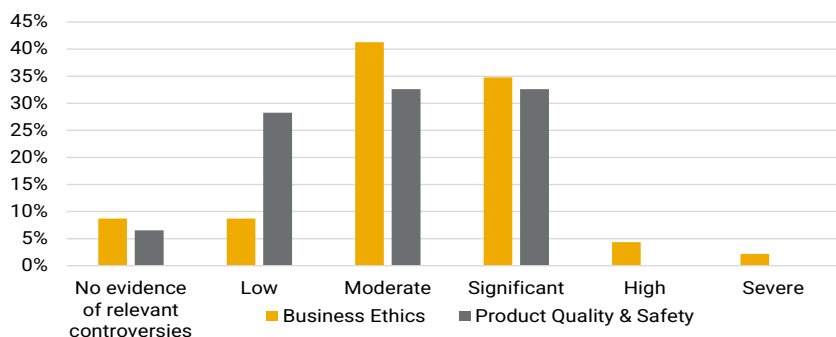
Compliance risks

Non-uniform and dynamic regulatory environments can expose firms in this sector to compliance and ethical risks, especially for those with crypto offerings. Managing these risks is important because the safety nets that govern traditional banking and investment service providers do not typically apply to cryptos. In key markets, such as the US, it is still unclear how regulations may evolve.

Sample of 46 companies

Using a sample of 46 firms in the Financials sector within blockchain the ETFs, discussed in the introduction, we find that a significant proportion are already exposed to the above-mentioned issues.<sup>53</sup> Nearly half (41%) of the companies have experienced significant to severe business ethics controversies, while a third (33%) have faced significant product quality and safety events (Exhibit 4.1). Though not related to blockchain, the volume and severity of these issues illustrate that lapses in product quality and compliance can lead to investigations, lawsuits, fines and penalties. While blockchain may help mitigate some risks, companies in the Financials sector, especially those dealing with crypto assets, may need to bolster defences to handle tightening regulations and public scrutiny.

**Exhibit 4.1: Distribution of controversies among sampled Financials firms\***



\* N = 46 companies with blockchain-themed ETFs

Source: Sustainalytics

### Assessing the Financials blockchain-crypto vertical

Material ESG Issue risk analysis

Within Sustainalytics' ESG Risk Ratings framework, we assess both the exposure to and management of these issues using two Material ESG Issue (MEI) risk scores: Product Governance and Business Ethics. Product Governance gauges how companies manage their responsibilities towards clients in terms of their product offering. Business Ethics assesses the management of risks and opportunities surrounding their ethical conduct of business. For the Financials companies in our blockchain ETF sample, strong management of Product Governance and Business Ethics risks is important because it can act as a hedge against actual or perceived product misconduct, given the recency of blockchain usage and relatively low awareness among clients. Addressing these MEIs may also help mitigate the risk noncompliance of strengthening regulations.

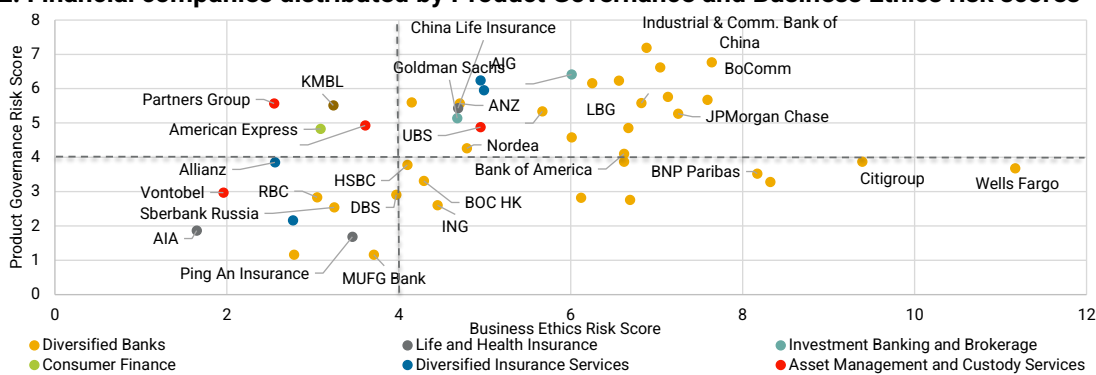
Broader issues may signal gaps

As shown in Exhibit 4.2, nearly half (22 of 46) of this sample have relatively high unmanaged risk scores on these MEIs (upper right quadrant), reflecting issues related to their business operations and potential gaps in their preparedness to deal with the risks related to blockchain and crypto. With several large banks, such as JP Morgan Chase,<sup>54</sup> HSBC<sup>55</sup> and Wells Fargo,<sup>56</sup> increasingly getting involved in blockchain, their improved product and compliance practices may help these firms mitigate risks and boost readiness in their blockchain product and service offerings.

Low-risk players

On the positive side, 22% (10 of 46) of the sample falls in the lowest risk quadrant (lower left). Compared to their peers, these firms display superior management of their Product Governance and Business Ethics risks, with stronger programmes and policies governing ethical practices, compliance and product quality. Among these players, Ping An Insurance Group and DBS Group Holdings stand<sup>57</sup> out. Ping An Insurance, a China-based insurer, is among the global leaders in holding blockchain patents filed.<sup>58</sup> DBS Group (DBS), a Singapore-based banking group, operates DBS Digital Exchange,<sup>59</sup> which uses blockchain technology to provide an ecosystem for fundraising through asset tokenization and secondary trading of digital assets. In addition to strong programmes and policies, we have not found any evidence of these companies being directly involved in significant controversies related to Business Ethics or product Quality and Safety.

**Exhibit 4.2: Financial companies distributed by Product Governance and Business Ethics risk scores\***



\*N=46 financial companies included among 10 blockchain-themed ETFs; higher scores indicate higher levels of unmanaged

Source: Sustainalytics

# DBS Group Holdings Ltd. Inc.

## Bullish on blockchain

Domicile: Singapore  
 Industry: Banks  
 Subindustry: Diversified Banks  
 Ticker: SES:D05  
 Mkt cap: USD 67.44 bn\*  
 \* as of 26 January 2022

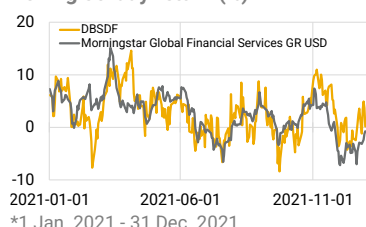
### Key insights

- Offering Asia's first direct crypto offering (May 2021) to clients, DBS is actively pursuing blockchain to offer innovative solutions and drive efficiencies.
- Among DBS's several blockchain-related platforms are Digital Exchange and Partior, an open industry blockchain platform.
- DBS expects to double the number of members on its Digital Exchange to 1,000 by the end of 2021, and to grow that number 20-30% over three years.

### Overview

Based in Singapore, DBS Group (DBS) provides consumer banking, wealth management and institutional banking services. The firm has been actively pursuing blockchain to drive innovation as well as efficiency. Apart from the Digital Exchange<sup>60</sup> mentioned above, DBS has developed a blockchain platform to digitize commodity transaction processes, which can expedite processing and enhance traceability in the supply chain, potentially allowing goods to be shipped earlier and delivering cost benefits to participants.<sup>61</sup> The company has also entered a joint venture with Temasek and JP Morgan Chase to launch an open industry platform, called Partior, to accelerate value movements for payments, and trade and foreign exchange settlement.<sup>62</sup>

Rolling 30-day return (%)\*



\*1 Jan. 2021 - 31 Dec. 2021

Source: Morningstar

### Strong performance and partnerships

Considering the evolving risks of financial crime, DBS has partnered with Exiger, a specialist in tech-enabled financial crime, risk and compliance solutions, to implement artificial intelligence (AI) that powers due diligence solutions to strengthen the bank's screening processes.<sup>63</sup> The company also plans to hire 150 developers and engineers, skilled in AI and blockchain, through its Hack2Hire programme.<sup>64</sup> DBS has developed a blockchain platform, in conjunction with Agrocorp, to allow more seamless transactions and digitize the entire process for commodities transactions.<sup>65</sup> DBS reports that it seeks to develop three stages of sustainable digital transformation, involving blockchain in all stages: sensing and instrumentation; structuring and integration; and sculpting and inspiration.<sup>66</sup> The firm's awareness of the potential risks due to increasing blockchain usage, along with strong risk management practices, makes it well positioned to navigate potential challenges that may come as it scales its blockchain-based solutions.

### Exhibit 4.3: DBS Group Holdings, select data points\*

Data point	Category	Value	Event Rating
Overall Unmanaged ESG Risk	Low Risk	19.9	
Subindustry Rank	11th Percentile	44 of 415	
Product Governance	Low Risk	2.9	Category 1
Business Ethics	Low Risk	4	Category 2

\*As of 25 January 2022

Source: Sustainalytics, Morningstar

# Ping An Insurance (Group) Co. of China Ltd

## One of the world’s biggest blockchain patentee

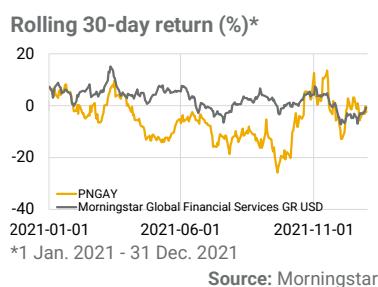
Domicile: China  
 Industry: Insurance  
 Subindustry: Life and Health Insurance  
 Ticker: HKG:2318  
 Mkt cap: USD 148.97 bn\*  
 \* as of 26 January 2022

### Key insights

- Having filed a total of 1,215 blockchain patent families since 2016, Ping An Group ranks second in the global blockchain patent race (November 2021).
- Ping An has achieved more than USD 140 bn in responsible investment, spanning from clean energy to affordable healthcare.
- The company reports that it is committed to help China achieve its CO<sub>2</sub> emissions peak by 2030, before becoming carbon-neutral by 2060.

### Overview

Headquartered in Shenzhen, Ping An Insurance (Group), (Ping An), is a leading Chinese insurer. It is the first Chinese asset owner to join Climate Action 100+ and the United Nations Principle of Responsible Investment (UNPRI).<sup>67</sup> Ping An has achieved more than USD 140 bn in responsible investment, covering clean energy to affordable healthcare. It has extended green credit lines of more than USD 8.5 bn.<sup>68</sup> The company released its green financing activities plan, stating that the endeavours are part of its efforts towards China’s goal of achieving carbon neutrality by 2060, combatting global climate change and promoting sustainable social development.<sup>69</sup>



Blockchain to address ESG issues

Considering the challenges in privacy protection, system performance and interoperability in the development of blockchain, Ping An has developed FiMAX S3C, a fully encrypted blockchain architecture. Within this architecture exists FiMAX Cathaya, a data encryption and privacy protection module, which reportedly has effectively resolved the conflicts between information sharing, data privacy and data ownership rights.<sup>70</sup> Ping An also leverages blockchain to resolve issues in other industries. To address the problem of quality assurance for agricultural products, Ping An has created a new model of “blockchain production and sales traceability, traceability insurance and food safety liability insurance” through traceability insurance and blockchain technology. Ping An also uses blockchain technology in its contribution to integration activities in the Greater Bay Area (GBA, Guangdong-Hong Kong-Macau Greater Bay Area) in terms of port logistics and trade facilitation. The GBA is the first connected, shared blockchain network to involve the whole trading process of ports, customs, logistics, business and finance.<sup>71</sup>

**Exhibit 4.4: Ping An Insurance (Group) Co. of China Ltd, select data points\***

Data point	Category	Value	Event Rating
Overall Unmanaged ESG Risk	Low Risk	19.1	
Subindustry Rank	23rd Percentile	22 of 94	
Product Governance	Negligible Risk	1.7	Category 1
Business Ethics	Low Risk	3.5	Category 2

\*As of 25 January 2022

Source: Sustainalytics, Morningstar

# Software, security and skills

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Companies in the Software and Services industry play a key role in the blockchain ecosystem. Some of these firms provide services or develop technology related to the exchange, storage, or mining of crypto. Others develop blockchain business applications such as smart contracts, crowdfunding, supply chain auditing, identity management, intellectual property, and file storage.

Over the past year, the amount of capital invested in the software blockchain and crypto vertical, including private equity, mergers, and acquisitions (M&A), venture capital (VC), and public liquidity increased by 1,275%, from USD 4.5 bn in 2020 to USD 62.2 bn in 2021, according to Pitchbook data (Exhibit 4.5).<sup>72</sup> The listing of Coinbase on the Nasdaq in 2021 alone raised an estimated USD 37.7 bn in April 2021, earning a valuation of over USD 80 bn.<sup>73</sup>

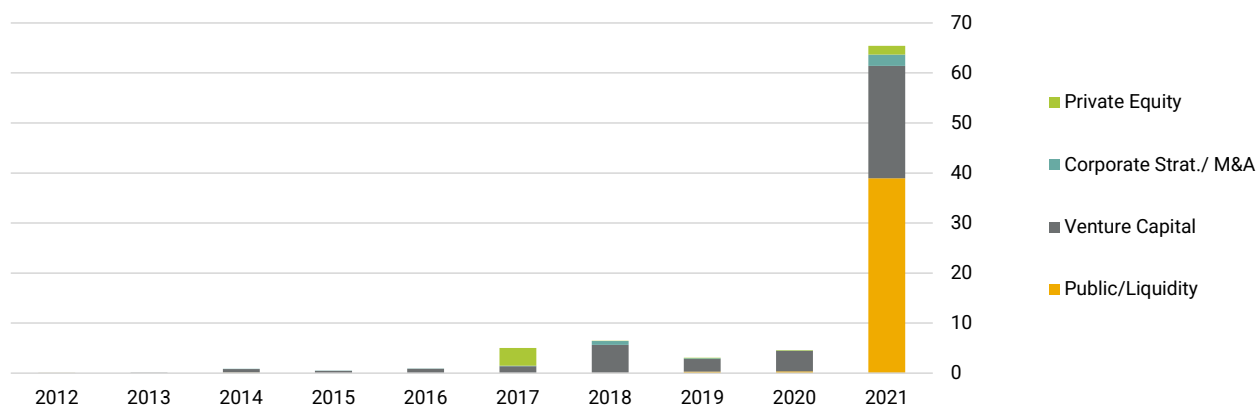
Data privacy and security

While the software and services blockchain/crypto segment continues to grow, companies in this space face material data security risks. On the one hand, the transmission of information through distributed, immutable ledgers can improve data privacy and security.<sup>74</sup> On the other, blockchain has unique vulnerabilities, which have been targeted and exploited by hackers. Atlas VPN, a digital security company, estimates that through more than 122 attacks, blockchain hackers stole nearly USD 3.78 bn in 2020, with most of the losses reported from crypto wallets. While most of these attacks targeted crypto exchange, wallets and apps, others targeted blockchains themselves, with 12 such cases resulting in a total loss of USD 5.9 mn.<sup>75</sup> In May 2021, hackers targeted users of crypto exchange platform Coinbase and stole assets from more than 6,000 accounts.<sup>76</sup>

Human capital

Another concern for firms in this space is attracting and retaining developers. During the “Great Resignation” of 2021, the US tech sector saw a 4.5% increase in employee turnover,<sup>77</sup> reportedly driven by pandemic burnout and backlash against larger tech firms.<sup>78</sup> Meanwhile, demand for talent has surged; LinkedIn reported that US job postings referencing crypto or blockchain grew 615% in August 2021 compared to August 2020.<sup>79</sup> Upwork, a marketplace for freelancers, included blockchain developers in its top 30 most in-demand job skills for 2021.<sup>80</sup>

**Exhibit 4.5: Capital invested in the software and services blockchain/crypto vertical by year (USD bn) \***



\*Data extracted 24 November 2021.

Source: Pitchbook, Sustainalytics, Morningstar<sup>81</sup>

### Value, human capital, data privacy and security

Valuations

Exhibit 4.6 compares the 29 Software and Services firms sampled from the 10 blockchain ETFs discussed in the introduction of this report.<sup>82</sup> To gauge whether the market is pricing companies in the blockchain/crypto space at a premium, we plotted the Morningstar Price to Fair Value ratio of these 29 companies (Exhibit 4.6). Based on this measure, about half (15 of 29) of the companies in this sample are undervalued. Block Inc. (previously Square Inc.), which developed the first peer-to-peer bitcoin payment platform, is among the overvalued firms, with shares priced 29% above our fair value estimate.<sup>83</sup>

MEI scores

The vertical axis shows the sum of each firm’s score on two MEIs: Human Capital, which assesses factors such as gender diversity and labour relations; and Data Privacy and Security, which covers issues such as cybersecurity and client and user data privacy. The large spread in these composite MEI risk scores (3.9 to 13.6) reflects differing levels of risk exposure and management approaches across the five subindustries in the Software and Services industry.

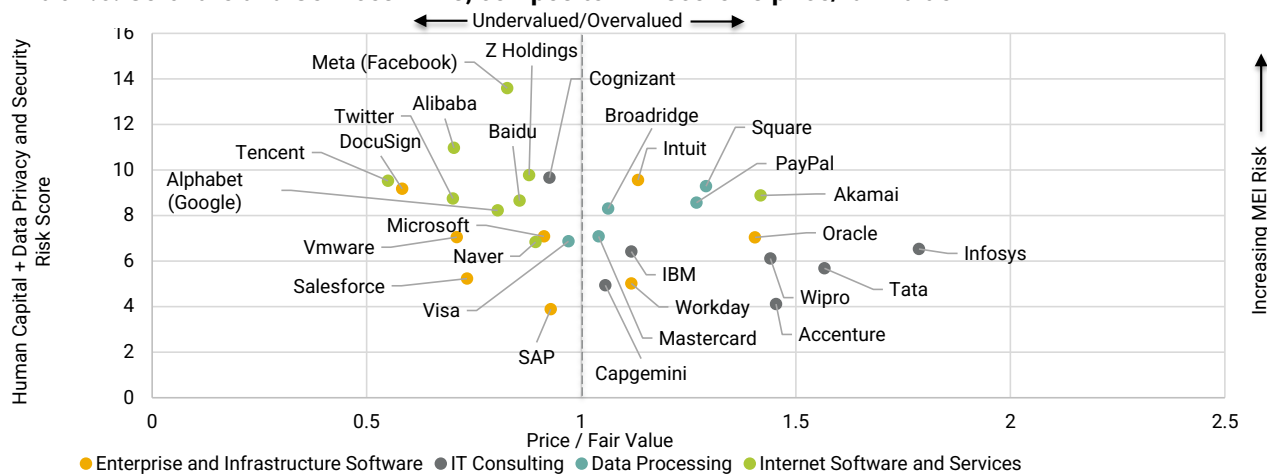
Meta concerns

Meta Platforms (previously Facebook) has the highest composite risk score (13.6), driven by its exposure to Data Privacy and Security issues. Meta’s business model relies on monetizing user data from its social media platforms. The firm was fined USD 5 bn in 2019 for harvesting its users’ data in the Cambridge Analytica scandal. The personal data of 533 million users were leaked in 2021.<sup>84</sup> As Meta has been developing blockchain projects, i.e., Diem, a blockchain payment system; and Novi, a crypto wallet, investors can engage with the firm to ensure data security concerns are well managed in these ventures.<sup>85</sup>

SAP managing cybersecurity

In contrast, SAP SA, an enterprise and infrastructure software company, has the lowest composite MEI risk score (3.9) within this sample. The firm aims to attract and retain diverse talent for growth areas, such as cloud technology, AI and blockchain. Among the data processing firms, Visa has the lowest score on this composite measure (6.8). The following two pages highlight key aspects of these two companies’ human capital, cybersecurity and blockchain initiatives.

**Exhibit 4.6: Software and Services firms, composite MEI score vs price/fair value\***



\*MEI and fair value data as of 11 January 2022.

Source: Sustainalytics, Morningstar



# Visa Inc.

## Scaling blockchain and crypto products and services

Domicile: United States  
 Sector: Software & Services  
 Subindustry: Data processing  
 Ticker: NYS: V  
 Mkt cap: USD 447.52 bn\*  
 \* as of 26 January 2022

### Key insights

- Visa’s blockchain-based business-to-business payments service aims to streamline payments for financial institutions and their clients.
- Visa aims to bridge digital currencies and its network of 61 million merchants by partnering with licensed and regulated digital currency platforms.<sup>86</sup>
- Visa’s research team is exploring the science of blockchain, focusing on mechanisms to improve scalability and enable offline digital transactions.

### Overview

With more than 60 years of experience in global data network management, Visa is the largest payment processor in the world. In FY2020, it processed almost USD 9 tn in purchase transactions. Visa operates in over 200 countries and processes transactions in over 160 currencies. Its systems are capable of processing over 65,000 transactions per second. The company is exposed to data privacy and security risks, including cybersecurity threats, based on its size and the sensitive nature of the data it processes. It is also subject to complex and evolving global regulations.

Rolling 30-day return (%)\*



\*1 Jan. 2021 - 31 Dec. 2021

Source: Morningstar

Embedded in blockchain and crypto

Visa has worked with industry partners to develop several blockchain and crypto services and products. Visa has rolled out its blockchain-based business-to-business payments service, B2B Connect, which is designed to streamline business payments for financial institutions and their business customers.<sup>87</sup> Other related projects include its crypto consulting<sup>88</sup> and partnerships with major crypto exchanges. Visa has services linked to more than 25 digital wallets.<sup>89</sup> In 2021, Visa partnered with BlockFi, a crypto fintech company, and Evolve Bank and Deserve to release a credit card that rewards in bitcoin to US residents.<sup>90</sup> Visa seeks to minimize fraud, including crypto-related fraud, through its Cybersource Decision Manager.<sup>91</sup> It also works with companies and public sector partners to address concerns about digital currencies.<sup>92</sup> The firm has collaborated with the World Economic Forum to create policy recommendations for the use of Central Bank Digital Currency.<sup>93</sup> Visa Research studies the technologies behind digital currencies and explores the science of blockchain, focusing on mechanisms to scale and enable offline digital transactions.<sup>94</sup>

### Exhibit 4.7: Visa Inc., select data points

Data point	Category	Score/Ratio
Overall ESG Risk Rating	Low Risk	16.1
Human Capital	Negligible Risk	1.8
Data Privacy and Security	Medium Risk	5.1
Price/Fair Value	Fair Value	0.97
Star Rating	★★★	-
Moat Rating	Wide	-

\*As of 11 January 2022

Source: Sustainalytics, Morningstar

# SAP SE

## Building blockchain platforms for diverse industry applications

Domicile: Germany  
 Sector: Information Technology  
 Industry: Software and Services  
 Subindustry: Enterprise and Infrastructure Software  
 Ticker: SAP  
 Mkt cap: USD 165.32 bn\*  
 \* as of 11 January 2022

### Key insights

- SAP offers blockchain solutions in a range of industries, including finance, utilities, food production, retailing and pharmaceuticals.
- In 2016, SAP worked with collaborators to send an international blockchain payment, shortening the process from up to six days to 20 seconds.
- The company reports that 77% of all global transactions interact with an SAP system.

### Overview

Founded in 1972 by former IBM employees, SAP provides database technology and enterprise resource planning software to enterprises around the world. Across more than 180 countries, it serves 440,000 customers, approximately 80% of which are small to medium-sized enterprises. The firm maintains that 77% of all global transactions interact with an SAP system.

SAP’s blockchain-as-a-service platform lets users build, test, deploy and scale blockchain applications that can process 1,000 transactions per second.<sup>95</sup> It enables the connection of enterprise blockchain platforms to SAP’s HANA database.<sup>96</sup> These products and services can help developers leverage the power of blockchain for various use cases.

Rolling 30-day return (%)\*



Source: Morningstar

Blockchain applications

SAP has developed blockchain solutions in the public and private sectors, partnering with governments and companies across multiple industries. In 2016, SAP worked with ATB Financial, Ripple Labs and ReiseBank AG to send a blockchain payment from Canada to Germany, reducing processing time from up to six business days to 20 seconds.<sup>97</sup> SAP also provides blockchain solutions for supply chain management in a range of industries, such as finance, utilities, food production, retailing and pharmaceuticals. These solutions improve tracking and traceability along complex supply chains, proving authenticity and origin, and optimizing transportation and logistics management, supported by Internet of Things applications.<sup>98</sup>

Information security management

SAP has enhanced its security policies and data protection management, which includes obtaining external certification (ISO 27001) for its info security systems and integrating risk assessments into its software development life cycle.

### Exhibit 4.8: SAP SE, overview of select data points\*

Data point	Category	Value
Overall ESG Risk Rating	Negligible Risk	9.7
Human Capital	Negligible Risk	1.8
Data privacy and security	Low Risk	2.1
Price/Fair Value	Fair Value	0.92
Star Rating	★★★	-
Moat Rating	Narrow	-

\*As of 11 January 2022

Source: Sustainalytics, Morningstar

# Chips, crypto and blockchain

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Despite the recent volatility in the cryptocurrency market, the surge in crypto mining last year contributed to the current shortage of semiconductor chips and the increase in their price.<sup>99</sup> According to data from World Semiconductor Trade Statistics (WSTS), strong consumer demand, especially from communications, computers and automobiles, as well as crypto and blockchain users are driving semiconductor revenue growth, estimated to have increased by 25.6% in 2021 from 2020 (Exhibit 4.9).<sup>100</sup> The Semiconductor industry is addressing the growing demand through record levels of investment in manufacturing, adding new fab capacity and capital expenditure, with forecasts of capex reaching over USD 150 bn in 2022.<sup>101</sup>

Chip production leading to emissions

While much of the concern about the environmental impacts of cryptocurrency have focused on the energy intensity of proof-of-work crypto mining, the environmental impact of chip production required for crypto mining is also a material issue.<sup>102</sup> Chip fabrication requires a large supply of resources, including water and electricity. The industry also has a significant carbon and hazardous waste footprint.

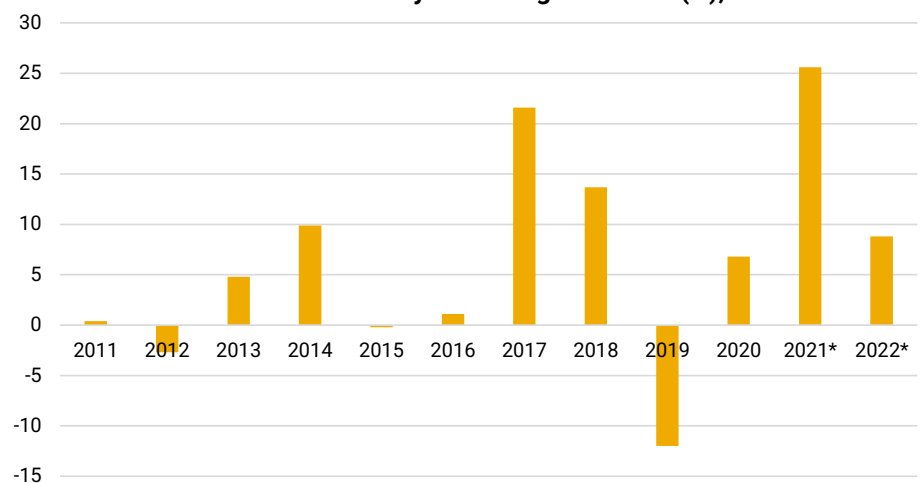
Water demand

Creating one integrated circuit board can require approximately 2,200 gallons of water. Semiconductor chips need to be rinsed with ultrapure water (UPW) to remove debris from the manufacturing processes and prevent contamination. It can take about 1,400-1,600 gallons of tap water to make 1,000 gallons of UPW.<sup>103</sup>

Energy use in chip production

Chip fabricators are also energy intensive, using up to 30-50 megawatts of peak electrical capacity, enough to power a small city.<sup>104</sup> Their manufacturing processes result in emissions that can pose significant risks, especially in jurisdictions that are strengthening regulations related to carbon.<sup>105</sup> While investors in the semiconductor market may benefit from the demands of crypto mining and the accelerated shift to the digital economy, they face intensifying risks related to the industry’s carbon emissions and water consumption.

**Exhibit 4.9: Semiconductor industry revenue growth rate (%), 2011-2022\***



\*2021 and 2022 forecasts; baseline year 2020. Source: World Semiconductor Trade Statistics (WSTS), Statista

### Comparing fab and fabless on carbon and water metrics

Assessing carbon and water metrics

Among the Semiconductor companies contained in the blockchain ETFs discussed in the introduction of this report, only a few of these companies (e.g., TSMC) make products used for crypto mining, while others are involved in blockchain application, communication, consumer electronics and automobiles.<sup>106</sup> Exhibit 2 compares eight firms<sup>107</sup> in this sample for which we have carbon and water withdrawal intensity data, illustrating that high water intensity and carbon intensity tend to go hand in hand with chip fabrication (Exhibit 4.10).<sup>108</sup>

Fab: water usage

Fabrication companies (fabs), Micron Technology and Taiwan Semiconductor Manufacturing Company (TSMC), report relatively high-water withdrawal intensity compared to their peers. TSMC, the biggest chip producers in the world, reported an increase in total water consumption of 70% from 2015 to 2019.<sup>109</sup> As companies with more diverse product offerings, Samsung Electronics and Intel report a relatively low water intensity compared to their fab peers. They also have water conservation and recycling programmes.<sup>110</sup>

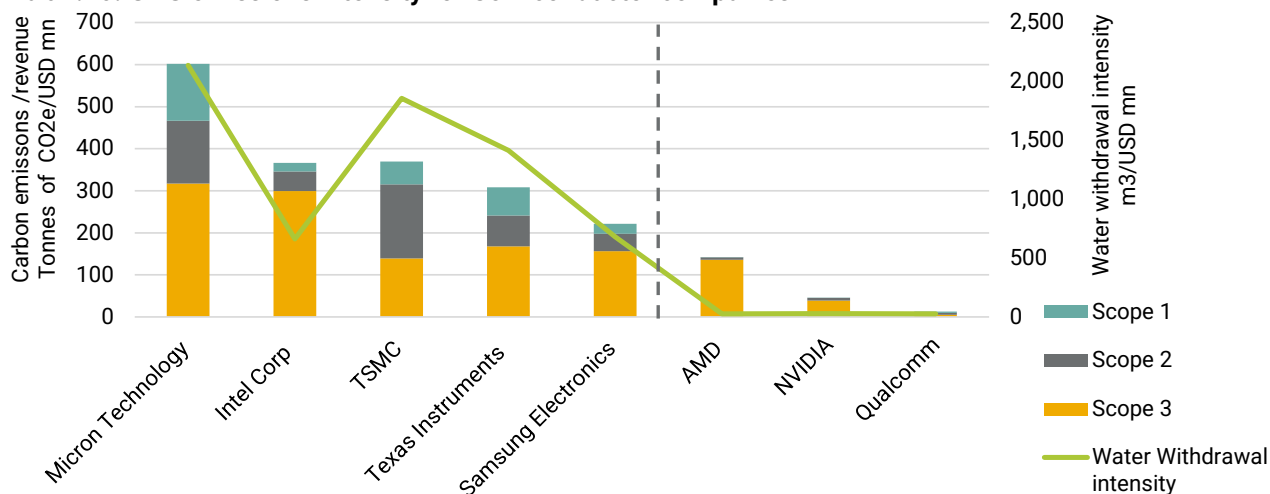
Fabless: better energy usage

Fabless facilities – AMD, NVIDIA, and Qualcomm – have considerably lower carbon emissions and water withdrawal intensity, given that they outsource their chip production to fab companies. Additionally, these fabless chip producers have taken several measures to reduce emissions. For example, AMD has traced over 250 environmental, health and safety data points to reduce its carbon footprint in 39 facilities, aiming for a 50% reduction of emissions by 2030.<sup>111</sup>

Qualcomm: winner of the pack

Qualcomm reports the lowest carbon emissions and water intensity among the sampled fabless companies. Qualcomm reports decarbonization measures, water conservation programmes, and technology improvements as a part of its plan to achieve net zero emissions by 2040.<sup>112</sup> The company’s application of blockchain focuses on scaling and securing its 5G network, which may help reduce GHG emissions, as 5G networks can offer improved energy efficiencies.<sup>113</sup>

**Exhibit 4.10: GHG emissions intensity for Semiconductor companies\***



\* Fabs- left of the grey dotted line; Fabless- right of the grey dotted line.

Source: Sustainalytics, Impact Metrics and Carbon Solutions<sup>114</sup>

# Qualcomm Inc.

## 5G, IoT and blockchain: keys to a more sustainable economy

Domicile: United States  
 Industry: Semiconductors  
 Subindustry: Semiconductor Design and Manufacturing  
 Ticker: NASDAQ: QCOM  
 Mkt cap: USD 187.89 bn\*  
 \* As of 26 January 2022,

### Key insights

- Qualcomm aims to achieve net zero emissions by 2040 and has committed to the Science Based Targets initiative’s (SBTi) business ambition of 1.5°C.
- The company reports that the successful implementation of 5G could bring a reduction of about 6% annual emissions in the US by 2025.
- Qualcomm currently employs energy efficiency and water conservation measures to reduce its carbon emissions.

Rolling 30-day return (%)\*



Source: Morningstar

Union of technologies: green future

### Overview

Headquartered in California, Qualcomm produces semiconductors for wireless technology and is a leader in 5G network technology.<sup>115</sup> Qualcomm is developing solutions to meet its net zero target, including technology improvements, such as its Snapdragon chipsets that are reported to reduce power consumption, enabling longer battery life and increase renewable purchases.<sup>116</sup> It is also cutting waste from its operations, minimizing energy consumption and e-waste through regular on-site events and optimized data centres.<sup>117</sup> The company’s direct emissions are lower than its indirect emissions, owing to outsourced manufacturing and assembly. Qualcomm has been a leading force behind 5G technology, which is expected to reduce per bit energy use.<sup>118</sup>

While it is still at the early phase of implementation, 5G has received positive feedback as a potential sustainability enabler.<sup>119</sup> For example, 5G will enable the connectivity needs of Internet of Things (IoT) devices, which Qualcomm<sup>120</sup> expects to number over 43 billion by 2023. The adoption of blockchain is integral to the success of 5G-enabled IoT, as it can address issues such as data security and scalability.<sup>121</sup> Qualcomm’s deployment of 5G technology lays the pathway for a union of blockchain and Internet of Things (IoT) – a combination that can improve security, scalability issues and fast track transactions.<sup>122</sup> Qualcomm has been encouraging accelerated adoption of 5G to support the transition towards a more sustainable economy.<sup>123</sup>

Exhibit 4.11: Qualcomm Inc, select data points\*

Data point	Category	Value
Overall Unmanaged ESG Risk	Low Risk	18.0
Subindustry Rank	6th Percentile	11 of 206
Resource Use	Negligible	1.7
Scope 1 carbon emissions	Tonnes of CO2e	75,290
Scope 2 carbon emissions	Tonnes of CO2e	114,060
Scope 3 carbon emissions	Tonnes of CO2e	112,252
Water Withdrawal Intensity	m3/USD mn	26.7

\*As of 25 January 2022

Source: Sustainalytics, Morningstar

# Tracking carbon in mining

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Metal Mining companies are involved in the blockchain ecosystem through e-data storage and smart contracts – solution paths that expand the ability of companies to trace materials in their supply chains and track emissions in their operations.<sup>124</sup>

While most blockchain projects in the industry are in a preliminary phase, this technology offers the prospect of enhanced supply chain transparency. Once it has mined its raw material, for example, a mining company can upload data in a blockchain platform, enabling business partners and contractors to independently verify the product’s source. Such applications help secure transfers and reduce documentation costs. Blockchain technology also helps miners to track the provenance of metals, human rights abuses, and finances.<sup>125</sup>

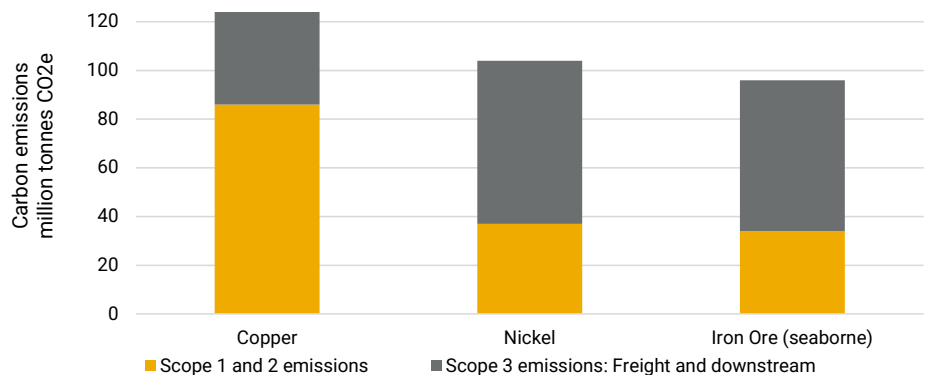
Tracking carbon footprint

Blockchain can aid metal mining companies in tracking carbon data more precisely and consistently, supporting security features of tools used to measure and manage emissions. In 2020, the World Economic Forum’s Mining and Metals Blockchain Initiative (MMI) released a unique proof of concept to trace carbon emissions across the value chain using distributed ledger technology. While the project is at an early stage of development, major players, including Anglo American and Glencore, are supporting the MMI and developing systems to resolve issues such as emissions and responsible sourcing in the industry.<sup>126</sup>

Emission curves: copper, nickel, iron.

Investors, governments and the public are putting pressure on the industry to reduce emissions, as 4% to 7% of global emissions come from mining.<sup>127</sup> An initial step in addressing portfolio exposure to carbon risks in the mining sector allows investors to compare the carbon emissions of miners that produce different metals. As shown in Exhibit 4.12, Scope 1 and 2 emissions represent direct and indirect emissions from mines, and scope 3 encompasses all indirect emissions in the value chain. While copper mining displays high scope 1 and 2 emissions (86 MT CO<sub>2</sub>e), nickel and iron show significantly higher freight and downstream<sup>128</sup> emissions (67 and 62 MTCO<sub>2</sub>e, respectively). To assess carbon risks, investors can consider the range of approaches that firms take to mitigate emissions. Blockchain systems are among the many technological solutions.<sup>129</sup>

**Exhibit 4.12: Emissions per tonne of metal equivalent in finished product**



Source: Skarn Associates, 2018 & 2019 carbon emissions data, N=293.<sup>130</sup>



## Tracking emissions with blockchain

Addressing carbon emissions

Scanning the 10 blockchain-themed ETFs and text-mining analysis<sup>131</sup> discussed in the introduction of this report, we identified six metal mining companies that are responding to tightening carbon regulations via distributed ledger technology. While blockchain can help these companies address data integrity and analysis, achieving actual emissions reductions will require the companies to make more significant changes to improve their energy efficiency and increased adoption of renewable energy.

Investors interested

Exhibit 4.13 shows carbon intensity: the annual carbon emissions of the mining companies (tonnes of CO<sub>2</sub>e) per million dollars of revenue.<sup>132</sup> Investors can consider this metric when comparing the carbon intensity of companies across the mining industry. Overall, mining companies show significantly higher scope 3 emissions, associated with supply chain logistics and the use of metals in making intermediate and end products.<sup>133</sup> According to research by Sustainalytics' Material Risk Engagement team, investors' interest in carbon emissions reduction is especially pronounced during investor engagements with North American-based companies, as it plays an important role in meeting their net zero commitments.<sup>134</sup> Investors looking to engage with mining companies on this topic may focus on the roles of individual emissions and assess the different tools that companies are developing to mitigate their carbon footprint.

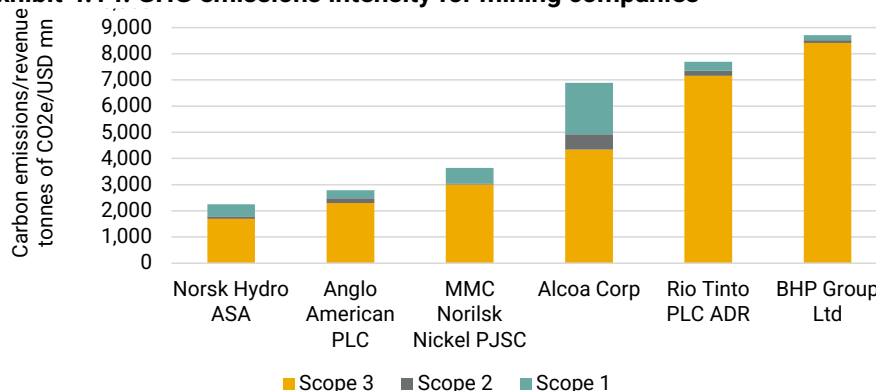
Diversified players' performance

Diversified players BHP and Rio Tinto exhibit relatively higher carbon intensity than their peers in the sample, reporting between 6,000 and 14,000 tonnes of CO<sub>2</sub>e emitted per USD 1 mn in revenue in 2019. BHP, Rio Tinto, Anglo American and Norilsk Nickel are engaged in blockchain-based emissions tracking systems, as well as product tracing and responsible sourcing.<sup>135</sup>

Norsk Hydro leading

Norsk Hydro has the lowest carbon intensity of the firms in this sample. The company has launched a blockchain-aided pilot project, aiming to measure and report its use of post-consumer aluminium scrap with significantly reduced energy use. However, its relatively low carbon intensity is mainly due to the type of metal it produces and its use of durable and recyclable materials. The company currently produces lightweight aluminium, with clean hydropower fuelling more than 70% of Norsk Hydro's primary metal production.<sup>136</sup>

**Exhibit 4.14: GHG emissions intensity for mining companies\***



\*Based on 2020 company reports and estimates

Source: Sustainalytics, Climate Solutions<sup>137</sup>

# Norsk Hydro ASA

## Building low carbon aluminium

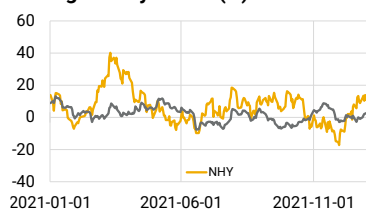
Domicile: Norway  
 Industry: Diversified Metals  
 Subindustry: Aluminium  
 Ticker: OSL: NHY  
 Mkt cap: USD 16.27 bn\*  
 \* as of 2 February 2022

### Key insights

- Norsk Hydro has a goal to reduce its carbon emissions by 10% in 2025 and by 30% in 2030, from a 2018 baseline.
- The company is collaborating with DNV GL, a certification provider for energy management, on blockchain based certifications for low-carbon aluminium.
- Norsk Hydro is working on research and development for greener sourcing and production, supporting the Aerospace and Automotive industries.

### Overview

Rolling 30-day return (%)\*



\*1 Jan. 2021 - 31 Dec. 2021

Source: Morningstar

Headquartered in Oslo, Norway, Norsk Hydro is a primary aluminium and renewable energy company and has operations globally. The IMF and World Bank forecast that aluminium demand will grow by 5% per year until 2025.<sup>138</sup> Clean hydropower charges more than 70% of Norsk Hydro’s primary metal production, permitting the company to make low-carbon brands, distinguishing its products from competitors. Norsk Hydro’s Karmøy Technology Pilot project (2020) has successfully verified its production of primary aluminium with 15% lower energy consumption and GHG emissions compared to the world average.<sup>139</sup> In 2021, responding to customer feedback to check data on its product’s environmental profile,<sup>140</sup> Norsk Hydro undertook an initiative to trace its product’s journey, giving flexibility to customers to choose products with lower emissions and higher recycled metal content.

Blockchain based product labels

In 2021, Norsk Hydro teamed up with DNV GL, an internationally accredited registrar and classification company, to form a blockchain technology aided project for low-carbon aluminium labels. This blockchain-supported pilot project aims to measure and report the minimum 75% recycled, post-consumer aluminium scrap, manufactured through a significant reduction in energy use.<sup>141</sup> Tracking emissions in the metals value chain can facilitate sustainable aluminium certifications, helping customers make informed purchasing decisions.<sup>142</sup> Norsk Hydro targets its first near-zero-carbon aluminium in 2022, through recycled metal, carbon capture and storage and technology.

Exhibit 4.15: Norsk Hydro ASA, select data points\*

Data point	Category	Value
Overall Unmanaged ESG Risk	Medium Risk	20.6
Subindustry Rank	4th Percentile	2 of 33
Resource Use	Low	2.9
Scope 1 carbon emissions	Tonnes of CO2e	7,340,000
Scope 2 carbon emissions	Tonnes of CO2e	1,600,000
Scope 3 carbon emissions	Tonnes of CO2e	27,266,885
Emissions, Effluents & Waste	Low	3.2

\*As of 11 January 2022

Source: Sustainalytics, Morningstar

# Utilities, blockchain and carbon

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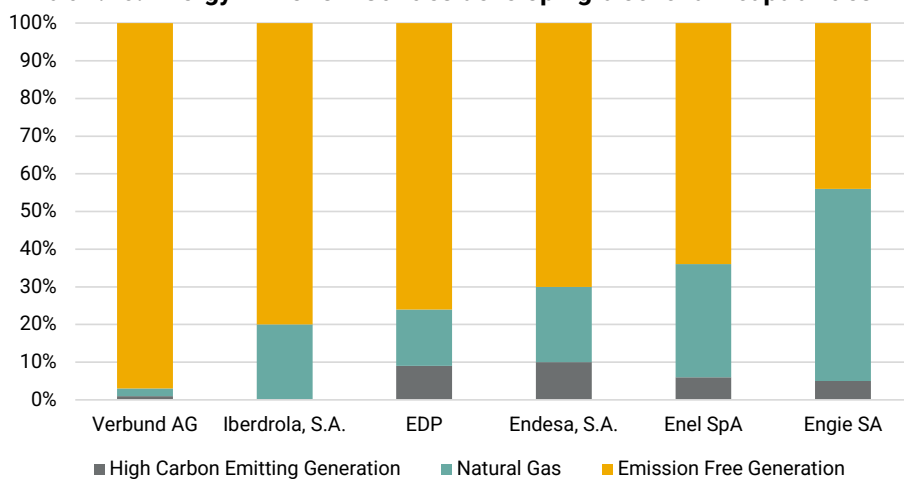
Through leveraging blockchain as a distributed database, utilities companies are developing decentralized peer-to-peer networks that are causing disruptive changes. Applications of blockchain in this industry support digital energy markets, renewable energy certifications, microgrid management, decentralized power generation, optimized EV charging stations, and the Internet of Things.<sup>143</sup> With their wealth of transmission, power infrastructure and skilled employee base, utilities companies are in a strong position to take advantage of this growing market by investing in blockchain research and development.

The COVID-19 pandemic-induced supply disruptions that have permeated globally highlight the need for increased efficiency and a seamless connection between the digital and physical economy. According to MarketWatch, the global market size of blockchain in energy grew at a 56% CAGR from USD 11.85 mn in 2016 to USD 110.17 mn in 2021. This market is projected to reach USD 2.1 bn by 2026.<sup>144</sup>

Increasing renewable proportion

While transitioning to renewable energy production has a significant impact on the infrastructure and processes of electricity companies, utilities can support the growing demand for green energy with help of a range of technologies, blockchain being one of them. Drawing on the ETF and text-mining analysis discussed in the introduction, we identified six utilities that are leveraging blockchain in different areas of their business.<sup>145</sup> As shown in Exhibit 4.16, most of these companies have relatively little exposure to high-carbon emitting generation (3% to 56%). Our research indicates that of this sample, the Utilities companies with high carbon emitting energy generation (EDP, Endesa, Enel and Engie) have decreased their reliance on these resources as a percentage of their total generation portfolio over the past three years. Overall, these six companies generate most of their energy mix using renewable sources, namely solar and wind.<sup>146</sup> Of the companies in this sample, Enel, Iberdrola and EDF are among 10 of the world’s largest electric Utilities companies as of April 2021.<sup>147</sup>

**Exhibit 4.16: Energy mix of six Utilities developing blockchain capabilities\***



\*Based on 2020 reports and estimates

Source: Sustainalytics

## Blockchain: helping in transition to renewables

Energy crisis in Europe

The energy crisis that Europe has faced over the last several months<sup>148</sup> highlights the apparent risks to energy security in transitioning to a carbon-free generation source too quickly without properly synchronizing renewable generation to electric load. That is to say, the transition to a carbon-free world is a journey and not a sprint, and some traditional sources of generation (namely natural gas) must be considered as transitional fuel until long-term solutions are developed. All of these companies have allocated a portion of their generation portfolio to natural gas to facilitate a gradual transition.

Blockchain solutions for renewables

Most of these companies are vertically integrated and share a competitive advantage by using blockchain, to varying degrees, in their different operations and business segments. Blockchain presents a unique solution that introduces a way of efficiently managing intermittent renewable output, battery storage and demand response minute by minute, employing sophisticated data analytics and robust computing systems. The companies in the sample are leaders in this space and are making significant progress towards solutions.<sup>149</sup>

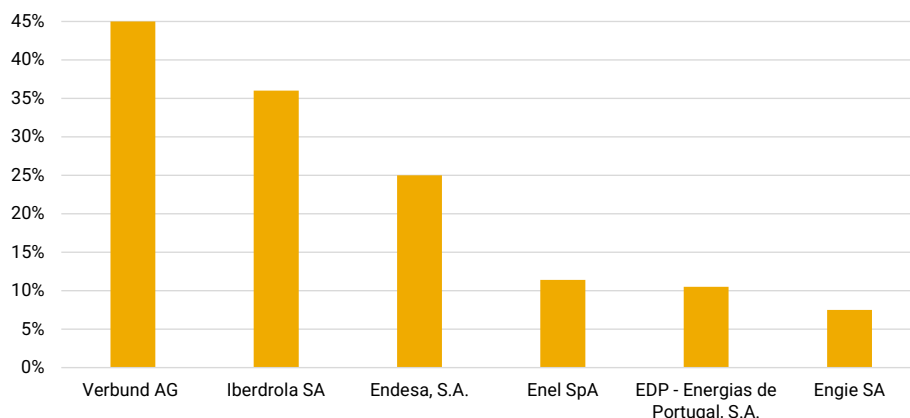
Impact solutions metrics

Another way to assess the capabilities of Utilities firms to mitigate carbon risks and benefit from the growing demand for renewables is to compare their renewable generation portfolio as a percentage of their overall revenue.<sup>150</sup> Renewable energy as a percentage of overall revenue is the sum of the revenues derived from power generation and from developing products or services that support power generation from renewable energy. This metric can help investors gauge Utilities companies' exposure to the growing demand for renewables. For our sample, the spread in renewable energy as a percentage of overall revenue ranges from 7.5% to 45%, as shown in Exhibit 4.17.

Verbund: winner of the pack

The company reporting the highest renewable generation portfolio as a percentage of overall revenue is Verbund. It is the top performer among the firms in the sample, with 45% of its overall revenue stemming from renewables. The company applies blockchain to help wholesale customers trade electricity via self-operated android-blockchain applications.

**Exhibit 4.17: Renewable energy as percentage of overall revenue for utility firms**



Source: Sustainalytics Impact Solutions, 2020<sup>151</sup>

# Verbund AG

## Using blockchain for energy transition

Domicile: Austria  
 Industry: Utilities  
 Subindustry: Electric Utilities  
 Ticker: VIE: VER  
 Mkt cap: USD 48.13 bn\*  
 \* As of 26 January 2022.

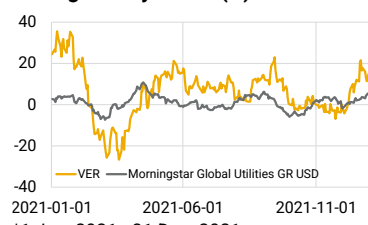
### Key insights

- Verbund aims to achieve net zero by 2040, aligned with the Austrian Government Programme 2020-2024.
- The company is collaborating with Salzburg AG on blockchain pilot projects of peer-to-peer trading and development of new electricity models.
- Verbund is expanding on newly installed renewable energy production and transformer capacity through advanced technology and planned financing.

### Overview

Headquartered in Vienna, Austria, Verbund is Austria’s largest electricity provider, with 95% of electricity coming from renewable sources – mainly hydropower and wind power. The remaining 5% comes from thermal power plants. The company is particularly focused on its 2030 strategy, modelled on SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action). The strategy is organized across five key pillars: hydropower generation; expansion of power from renewable sources such as wind and solar; sustainable expansion and safe operation of Austria’s high-voltage grid, use of the flexible power plants to maintain security of supply, and customer-centric solutions in the energy sector.<sup>152</sup> In 2021, Verbund released an EU taxonomy-aligned green and sustainability-linked bond, aimed at funding projects in Verbund’s Green Financing Framework.<sup>153</sup> Blockchain technology is one of the tools it is using to achieve these objectives.

Rolling 30-day return (%)\*



Source: Morningstar

Blockchain helps to achieve net zero

Verbund has teamed up with Salzburg AG to develop peer-to-peer proof of concept, enabling tenants to trade electricity with each other via self-operated Android blockchain applications. Blockchain infrastructure improves consumption within multi-residential buildings, increasing the overall efficiency of buildings’ consumption. The technology also tracks output from renewable facilities and permits trading companies to circumvent intermediaries. The process induces savings due to lower transaction costs and grid charges.<sup>154</sup> The distributed ledger application is one of the primary tools Verbund uses to achieve its customer-focused solutions and secure decentralized grid operations at reduced costs, supporting its 2030 strategy.

Exhibit 4.18: Verbund AG, select data points\*

Data point	Category	Value
Overall Unmanaged ESG Risk	Low Risk	18.9
Subindustry Rank	6th Percentile	15 of 298
Resource Use	Low	2.7
Scope 1 carbon emissions	Tonnes of CO2e	653,000
Scope 2 carbon emissions	Tonnes of CO2e	406,000
Scope 3 carbon emissions	Tonnes of CO2e	335,000
Emissions, Effluents & Waste	Negligible Risk	1.2

\*As of 11 January 2022

Source: Sustainalytics, Morningstar

# Blockchain and commodities

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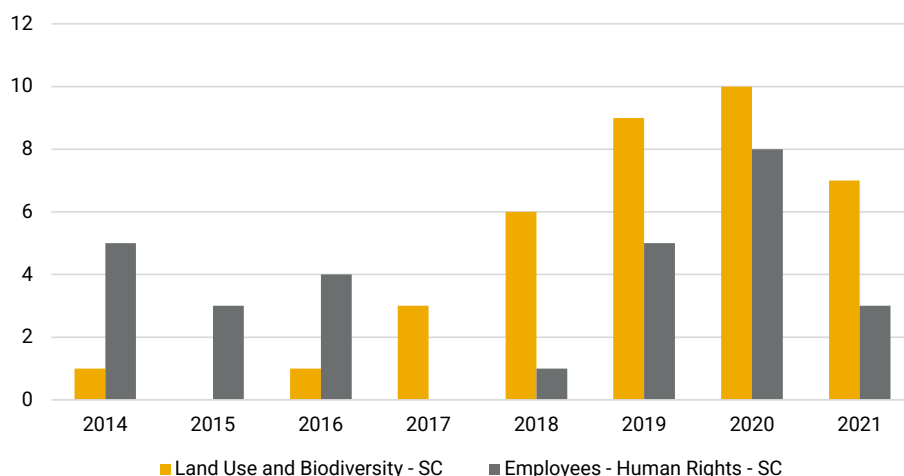
Companies in the Household and Personal Products (HPP) industry face increased scrutiny as regulators, financial institutions, NGOs, and consumers are calling for more transparency with respect to final, consumer-ready goods, upstream supply chain mapping and the traceability of raw materials.

The value chains of raw materials used in the HPP industry are diverse, long and complex due to the many changes of hands along the way, often taking place in unregulated and unmonitored domains. Sustainalytics’ controversy research suggests that the HPP industry has experienced an increase in controversies occurring within companies’ supply chains related to Land Use and Biodiversity and Employees – Human Rights. As shown in Exhibit 4.19, the number of HPP firms involved in these types of incidents has grown substantially since 2014. We observe recurring allegations of various labour abuses, including child labour and inadequate working conditions, as well as deforestation and environmental damage at palm oil plantations. Such events pose the risk of reputational damage, which can lead to consumer boycotts, as well as financial, compliance, regulatory and operational risks stemming from tightening regulations.

HPP supply chain controversies

To address these issues and mitigate environmental and social risks, blockchain solutions have become a tool for responsible sourcing. Blockchain can enable companies to encrypt records of transactions, verify the origin of commodities and authenticate criteria related to sustainability and regulatory compliance. In this regard, blockchain applications may help companies address environmental concerns and protect workers’ human rights, health and safety throughout their supply chains. HPP’s blockchain applications focus on palm oil and mica sourcing, which are often linked to labour and land use incidents. Blockchain enhances visibility on the identity of farmers, the origin and location of trees and harvested fruits, extraction processes and in the transfer of goods from farms to oil mills and producers. The technology can improve management of such risks.

**Exhibit 4.19: No. of HPP companies involved in supply chain incidents by year\***



\*N= 17 companies involved in 361 initial incidents.

Source: Sustainalytics



### MEIs, gaps and blockchain

Only 21% of HPP mention blockchain

To identify HPP companies developing blockchain solutions, we applied a text miner to their corporate reporting over last three years (as outlined in the introduction to this report). Only nine of 42 companies in this sample (21%) make any mention of blockchain. Among the nine companies that mention blockchain, five refer to supply chain management, whereas the remaining four discuss other blockchain solutions, such as applications to secure payment processing.

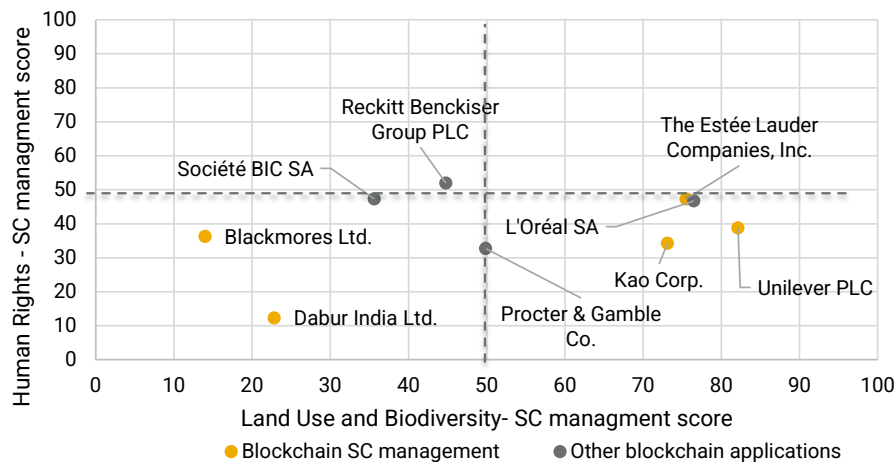
Broader supply chain management

Exhibit 4.20 shows our assessment of the broader management capabilities of these nine companies on two Material ESG Issues: Land Use and Biodiversity – Supply Chain and Human Rights – Supply Chain. These measures account for companies’ overall preparedness to address related risks through best practices for supply chain management, such as external verification of suppliers’ social certifications and environmental management systems and commitments to combat deforestation. Most HPP firms in Sustainalytics’ research coverage, including this sample, are still behind on these issues. The four entities grouped in the low quadrant – Blackmores, Dabur, P&C and Société BIC – would benefit from stronger safeguards in their supply chains.

Can blockchain improve the industry?

None of our sampled companies scores highly on both MEIs. Blockchain solutions to supply chain management may help some of these companies improve their current practices. For example, Estée Lauder, together with its Aveda brand, has announced a blockchain platform for managing its vanilla supply chain in Madagascar, beginning with 450 smallholder farms. This solution may help support the protection of human rights in the company’s supply chain. Unilever is relatively well positioned to manage some environmental risks related to land use and biodiversity; its recent commitment to be deforestation-free through the use of blockchain could help the company tackle labour issues in the supply chain. These two companies are among the early adopters of blockchain that set higher standards for the HPP industry in 2022.

**Exhibit 4.20: HPP companies, management scores on supply chain (SC) MEIs**



\*Scores of 0-25 indicate weak management; 25-50 is average; 50-100 is strong level. Source: Sustainalytics

# Unilever PLC

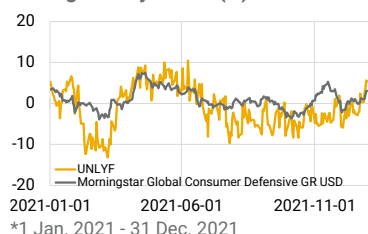
## Eliminating deforestation with blockchain

Domicile United Kingdom  
 Industry: Household Products  
 Subindustry: Personal Products  
 Ticker: LON:ULVR  
 Mkt cap: USD 132.78 bn  
 \* as of 26 January 2022

### Key insights

- Unilever has set a goal to have a deforestation-free supply chain by 2023 through the use of innovative digital solutions such as blockchain and AI.
- The company, which purchased 1% of global palm oil production in 2020, is a co-founding member of the Roundtable on Sustainable Palm Oil.
- In 2020, it sustainably sourced 92% of its 12 key commodities, such as sugar, palm oil, soya, cocoa, paper and board, and tea.

Rolling 30-day return (%)\*



Source: Morningstar

### Digital technologies and deforestation

### Overview

Unilever’s diverse product portfolio, which includes 400 brands ranging from disinfectants and deodorants to meat substitutes and food supplements, shapes its significant footprint. As one of the biggest palm oil users in the industry (810,437 metric tonnes purchased in 2020, or 1.1% of global production), Unilever is highly exposed to the environmental, social, reputational, and regulatory risks linked to unsustainable palm oil, which have the potential to materially influence its operations and performance. On the other hand, it can capitalize on opportunities related to sustainable commodities in areas such as resilience, brand value and market competitiveness.

### Areas for improvement

At its 2021 AGM, the company presented its climate transition action plan that included a 50% reduction in the average footprint of its products by 2030. To achieve this plan, Unilever aims to eliminate deforestation from its supply chain using several digital technologies, including blockchain, satellite data and geographical tracking. Its partnership with Global Forest Watch and Earth Equalizer supports the EU’s proposal to curb the import of commodities linked to deforestation.

By year-end 2020, Unilever reported on 99.6% of its core volumes of palm oil and palm kernel oil as being sustainably sourced, with 94.3% coming from physically certified sources, and 83% of its procurement spending was through suppliers meeting the Responsible Sourcing Policy’s social requirements. Despite these measures, Unilever’s suppliers in Indonesia, Malaysia, Malawi, and Sri Lanka have been implicated in labour and human rights violations in recent years. While the company includes SA 8000 certification in the Integrated Social Sustainability audit checklist, it does not disclose on the scope of externally certified suppliers.

### Exhibit 4.21: Unilever PLC, select data points\*

Data point	Category	Value
Overall Unmanaged ESG Risk	Medium Risk	21.6
Subindustry Rank	6th Percentile	5 of 79
Land Use & Biodiversity - Supply Chain	Negligible Risk	1.3
Human Rights - Supply Chain	Low Risk	3.7

\*As of 11 January 2022

Source: Sustainalytics, Morningstar

# Food retailers and blockchain

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Controversy research

Use cases for blockchain

ESG themes, risks and opportunities

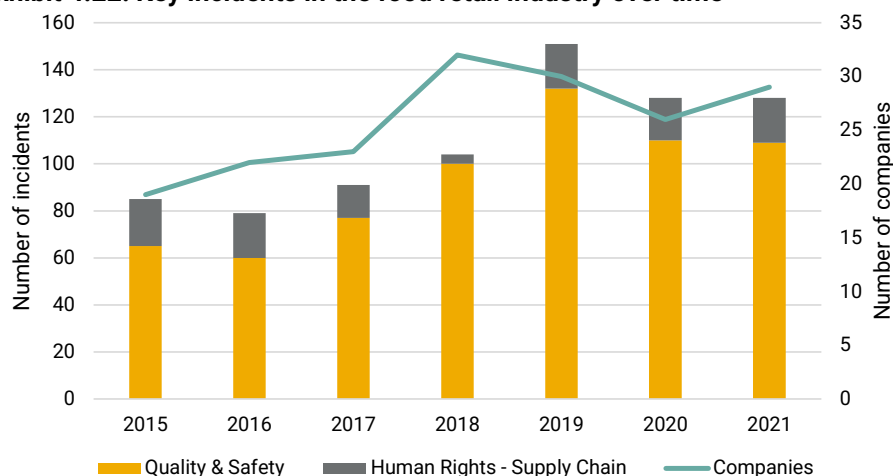
Controversies in the Food Retail industry have resulted in a loss of consumer trust and brand damage for companies involved in high profile incidents. A 2018 study, for example, published by the Center for Food Integrity, found that only 33% of US consumers were confident that the food they purchase and eat is safe.<sup>155</sup> Food companies and retailers alike bear the financial costs of product recalls, direct costs of which range from USD 10-100 mn per recall.<sup>156</sup> Food fraud, a practice that is estimated to cost more than USD 50 bn per year,<sup>157</sup> continues to be a challenge for the industry. Moreover, recurring issues of child, slave and forced labour in the value chain for commodities such as cacao, sugar, tomatoes, seafood, and cotton pose reputational, regulatory and litigation risks.

As shown in Exhibit 4.22, Sustainalytics controversy research suggests that companies in the Food Retail industry have faced mounting exposure to incidents related to Quality and Safety and Human Rights in their supply chains. Quality and Safety incidents among food retailers have almost doubled since 2015, while involvement in Human Rights issues persist. Overall, the number of companies involved in these issues has increased by 53%, from 19 in 2015 to 29 in 2021.

Rising consumer demand for transparency and reassurance on product safety have created use cases for blockchain. In the last five years, major Food Retailer companies have been experimenting with this technology to improve supply chain transparency and traceability for selected food products. In the EU and the US, stricter regulations against food fraud, economically motivated adulteration (EMA)<sup>158</sup> and the importation of products made using slave or forced labour further drive compliance risks among companies in the Food Retail industry.

Consumers can scan QR codes on food labels with their smartphones to gain quick access to information sorted on blockchain, such as the location where food was grown, date of harvest and packing, and safety tests conducted on the products. Blockchain can help prevent record tampering, improving the credibility of supply-chain tracing. The technology can also improve the speed of accessing data, which is crucial for timely recalls of contaminated products from stores.

**Exhibit 4.22: Key incidents in the food retail industry over time**



Source: Sustainalytics

### Material ESG Issues (MEIs), events and solutions

29% of industry mention blockchain

Applying a text miner to 52 Food Retailers in Sustainalytics’ comprehensive research universe, we find that only nine of these companies mention blockchain more than twice, which suggests that only a few industry players are leveraging the potential benefits of this technology.

Assessing key issues

Exhibit 4.23 compares these nine retailers on their overall management of two ESG issues: Product Governance management scores include product and service safety programmes, while Human Rights - Supply Chain scores measure supply chain management programmes and supplier standards. Blockchain applications among Food Retailers are often deployed to complement product safety and supply chain programmes through improved traceability. However, many still opt for certification schemes such as ISO 22000 or FSC 22000.

Walmex and product governance

A notable example is Wal-Mart de Mexico (Walmex) and its application of blockchain to its distribution centres.<sup>159</sup> Its strong Product Governance management score, however, is driven by its broader programme on product and service safety and the notable absence of related controversies. Walmex has a regular product safety assessment to identify potential critical areas, overseen by its VP for Ethics and Compliance Committee, which oversees food safety.

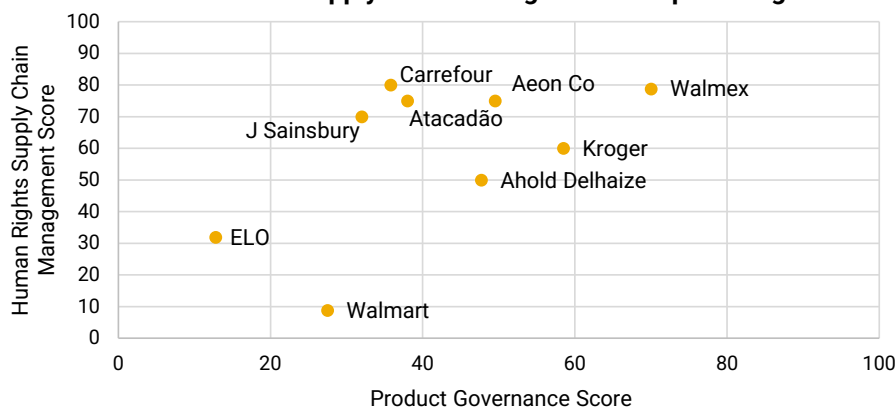
Areas where blockchain might help

Despite a robust supply chain management programme, Walmart’s (Walmex’s parent company) low management score on this MEI is mainly driven by its involvement in high impact events, notably on Employees - Human Rights – Supply Chain (Category 4) and Labour Relations – Supply Chain (Category 3). Given its focus on sustainably sourcing key commodities often linked to supply chain issues such as palm oil, beef and seafood, blockchain may help to boost transparency and consumer trust in the products’ provenance.

Carrefour’s supply chain management

Walmex and Carrefour both stand out for their strong management of Human Rights – Supply Chain. Carrefour’s supply chain management programme notably applies to its tier 2 suppliers and is complemented by detailed policy commitments in its social supplier standards. As outlined in its profile below, Carrefour’s blockchain solutions are especially ambitious. The company aims at deploying the technology to track all of its quality line products in France by 2022.

**Exhibit 4.23: Food Retail – supply chain management and product governance**



Source: Sustainalytics

# Carrefour SA

## Blockchain and product traceability

Domicile: France  
 Industry: Food Retailers  
 Subindustry: Food Retail  
 Ticker: PAR:CA  
 Mkt cap: USD 14.83 bn\*  
 \* As of 2 February 2022

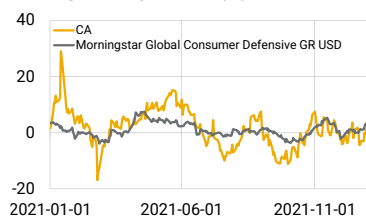
### Key insights

- Through its 2022 plan, the company aims to lead the food transition by promoting quality food and organic food production as a key focus area.
- Carrefour’s partnership with the IBM Food Trust aims to use blockchain in sharing crucial product safety information to customers.
- Through its Act for Food programme launched in September 2018, the company aims to help customers and employees eat better.<sup>160</sup>

### Overview

Carrefour is a multiformat retailer that operates in more than 30 countries and has over 13,000 stores worldwide. The company has been slowly diversifying away from its original large hypermarket format, which still accounts for the majority of its sales in France. Through its Carrefour 2022 business strategy launched in January 2018,<sup>161</sup> the company aims to lead the food transition by committing to provide customers with accessible and affordable organic products, to ensure food safety, and to reduce food waste and opt for more sustainable product packaging. Carrefour has rolled out blockchain technology to improve product traceability, allowing customers access to product information such as harvest and packing date, location where it was grown and the transport duration, all by scanning a QR code. In 2020, blockchain was applied to 34 Carrefour Quality Line products and the company aims to extend the technology to more than 100 Quality Line products in 2022.

Rolling 30-day return (%)\*



\*1 Jan. 2021- 31 Dec. 2021

Source: Morningstar

#### Product Traceability and Transparency

Carrefour launched its Act for Food programme<sup>162</sup> in September 2018 with the aim of helping customers and employees “eat better at affordable prices.” The programme, based on nine commitments to be implemented first in France and then internationally, commits to using blockchain technology to guarantee transparency in the traceability of its products. Carrefour collaborates with the IBM Food Trust in utilizing blockchain technology to provide crucial product safety information to customers.

#### Plans for 2022 and beyond

In its FY2020 annual report, Carrefour states that six new products were added to its blockchain to provide customers more information on these products’ life cycle. The company has also been developing organic food production in France that is overseen from farm to table, and as of 2020, its entire chicken supply chain was on blockchain technology.

#### Exhibit 4.24: Carrefour SA, select data points\*

Data point	Category	Value	Event Rating
ESG Risk	Medium Risk	20.4	
Subindustry Rank	17th Percentile	22 of 132	
Product Governance	Low Risk	2.3	Category 3
Chain	Low Risk	2.0	Category 2

\*As of 11 January 2022

Source: Sustainalytics, Morningstar

# Blockchain in Conglomerates

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The COVID-19 pandemic has accelerated companies' adoption of digital technologies and tools to stay competitive and ensure business continuity. According to a study by Huawei and Oxford Economics, digitalization will grow to account for 24% (USD 23 tn) of global GDP by 2025.<sup>163</sup> Among the emerging digital tools available, blockchain offers a secure and transparent structure to manage and store data. The Conglomerates industry, which operates across diverse business segments, is uniquely positioned to leverage blockchain.

According to technology and research firm, Gartner, the blockchain solutions market will be worth around USD 3.1 tn by 2030.<sup>164</sup> Within the Conglomerates industry, companies are implementing blockchain technologies for a range of applications, such as platforms for optimizing CO<sub>2</sub> emissions tracking in supply chains and developing a blockchain-based e-commerce marketplace for aircraft parts. The benefits of this technology include increased traceability, reduced costs and a decentralized structure that enables real-time data sharing.

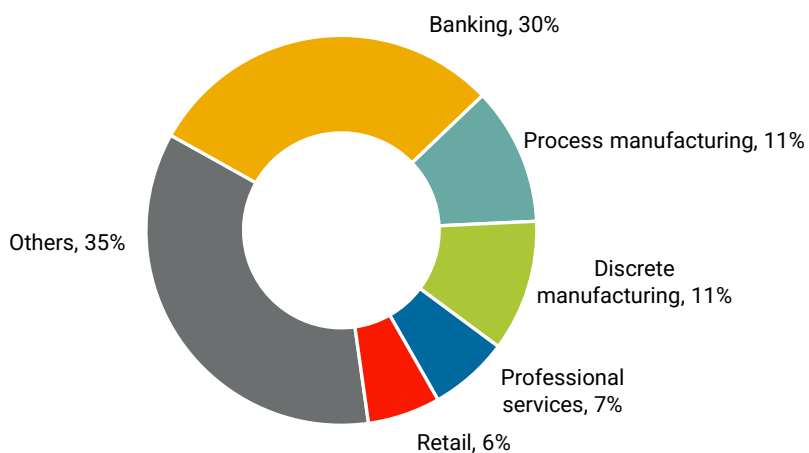
Data management and transparency

Companies in the Conglomerates industry operate in multiple businesses across the globe and have resources to scale this technology for different cases. Exhibit 4.25 shows the sector distribution of the blockchain market share in 2020. As Conglomerates operate across all these sectors, they are at an advantage to further accelerate blockchain adoption. However, key risks that Conglomerates face include expanding a skilled workforce while demand for blockchain talent is on the rise, and prioritizing cybersecurity during technology transitions.

Most in-demand technical skill in 2020

Blockchain systems are also vulnerable to cyberattacks and can cause significant financial losses to firms. In 2020, hackers stole an estimated USD 3.8 bn in 2020 through attacks aimed at blockchain projects and cryptocurrencies.<sup>165</sup> Blockchain developers are also in high demand as companies have begun scaling this technology. According to a LinkedIn report, blockchain was among the most in-demand hard skills in 2020.<sup>166</sup>

**Exhibit 4.25: Sector distribution of blockchain market value worldwide in 2020\***



\*Global market value estimated at USD 3 bn

Source: Statista<sup>167</sup>



### ESG risk factors to consider

14% of industry mentions blockchain

Applying a text-mining tool to the public filings of 51 Conglomerates in Sustainalytics' comprehensive research universe, we find that only seven (14%) firms in this space make any mention of blockchain in their reports. This finding suggests that the advantages of blockchain may be overlooked by many players in the industry. To assess how well these seven firms are positioned to manage the integration of blockchain into their business models from an ESG lens, we compare their approaches in the management of two material ESG issues (MEIs): Data Privacy and Security, and Human Capital.

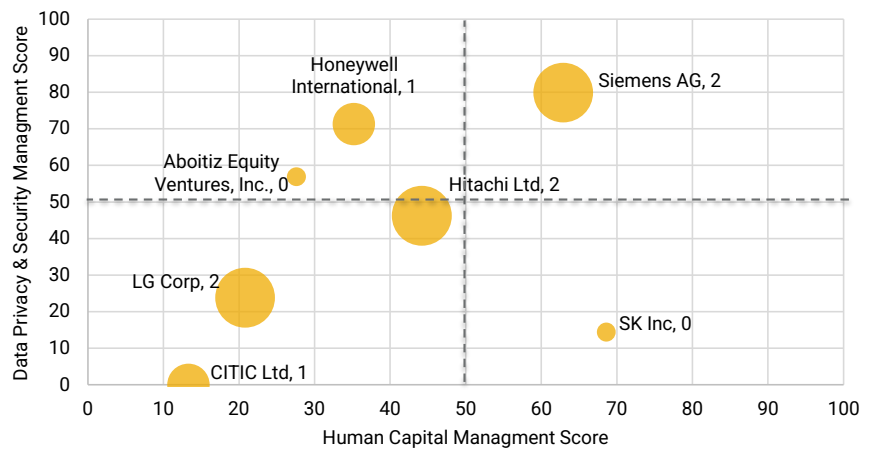
Assessing data security measures

As shown in Exhibit 4.26, the controversy ratings for this sample are low (Category 2 or lower). However, comparing the companies' MEI management scores, we see substantial differences in their management of these issues. CITIC, LG Corp and Hitachi (bottom left quadrant), for example, do not disclose whether they conduct external cybersecurity audits and vulnerability assessments or have employee recruitment initiatives to attract skilled professionals. This management gap could pose challenges in scaling up the blockchain applications that they have been developing to support payments and enable digital authentication.<sup>168</sup> Honeywell and Aboitiz (top left) report that they conduct regular privacy risk assessments and have governance structures for cybersecurity management. These actions could benefit them in the long term, as their blockchain applications are used for product tracing and digitizing financial offerings.

Talent management

SK Inc. and Siemens have been applying blockchain technology to develop digital real estate beneficiary platforms<sup>169</sup> and to track carbon emissions in supply chains,<sup>170</sup> respectively. As they have strong Human Capital management and disclose talent development initiatives to upskill existing employees, they are better equipped to scale up blockchain adoption quickly. Although Siemens is involved in relatively minor incidents related to cyberattacks, it is better positioned than its peers in this sample to manage blockchain integration due to its strong management of Data Privacy and Security and Human Capital.

**Exhibit 4.26: Comparing conglomerates on MEI management\***



\*Highest event category on Data Privacy & Security and Human Capital indicated by bubble size and enumerated beside company name. **Source:** Sustainalytics

# Siemens AG

## Harnessing blockchain to improve transparency and traceability

Domicile: Germany  
 Industry: Conglomerates  
 Subindustry: Conglomerates  
 Ticker: DE:SIE  
 Mkt cap: USD 128.09 bn\*  
 \*as of 26 January 2022.

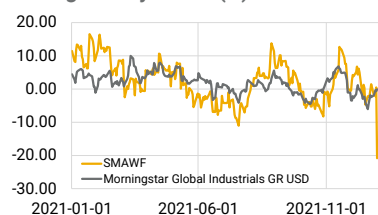
### Key insights

- Siemens has pivoted its growth strategy towards digitalization and aims to be climate neutral by 2030.
- It has developed a decentralized software platform, called Estainium, using blockchain technology to optimize CO<sub>2</sub> emissions tracking in supply chains.
- The company discloses robust cybersecurity management systems and human capital initiatives to support its blockchain technology adoption.

### Overview

Based in Germany, Siemens is an industrial conglomerate, with businesses selling components for factory automation, railway equipment, electrical distribution equipment and medical equipment. Following the spin-off of Siemens Energy in 2020, the company disclosed a new growth strategy that is focused on digitalization, automation and sustainability.<sup>171</sup> Integrating blockchain technologies is a key enabler for this transition. In FY2021, Siemens spent EUR 4.9 bn on R&D (7.8% of FY2021 revenue), which included autonomous robotics, cybersecurity and blockchain applications.<sup>172</sup>

Rolling 30-day return (%)\*



\*1 Jan. 2021 - 31 Dec. 2021  
 Source: Morningstar

#### Digitalization at the forefront

Siemens has been actively using blockchain technology to design applications across its businesses. The company is applying blockchain on its cloud-based IoT (Internet of things) operating system, MindSphere, to enable complete product traceability in the food and beverage industry.<sup>173</sup> More recently, in November 2021, it launched a decentralized blockchain-based software platform, called Estainium, that makes tracking carbon emissions in global supply chains transparent.

#### Looking beyond 2022

To support these developments, Siemens has invested in a future fund that helps employees gain exposure to emerging technologies and trends. Data Privacy and Security concerns are overseen by the company's global chief cybersecurity officer. Siemens also has around 1,000 cybersecurity experts working internally to ensure that its systems are protected against cyberattacks. To further reduce potential financial risks caused by cyber incidents, Siemens has cyber insurance that covers financial losses of up to EUR 200 mn.<sup>174</sup> As shown in Exhibit 4.27, Siemens is a top performer within the subindustry and is well positioned to rapidly scale up blockchain adoption in the coming years, due to its strong management of risks related to Data Privacy and Security, and Human Capital.

**Exhibit 4.27: Siemens AG, select data points\***

Data point	Category	Value
Overall Unmanaged ESG Risk	Medium Risk	28.0
Subindustry Rank	6th Percentile	7 of 115
Data Privacy & Security	Negligible Risk	1.5
Human Capital	Low Risk	2.0

\*As of 11 January 2022

Source: Sustainalytics, Morningstar

## Conclusion

### Innovating across sectors

This report surveyed ESG issues related to applications of blockchain in the public equity market and assessed how this breakthrough technology is playing an increasingly important role in company initiatives to improve aspects of their operations, supply chains, products and services. The framework that we developed aims to help investors assess material risks and opportunities related to blockchain and to identify companies that are well positioned to seize ESG opportunities and mitigate ESG risks.

### Concerns about crypto

Our overview of the crypto market highlighted several issues for investors to consider when evaluating this market. Risks related to tightening regulations and the potential environmental impacts of crypto mining are critical issues. However, crypto mining can also draw on renewables and some cryptos function without having to rely on proof-of-work mining, which is energy intensive. Such innovations may help make this market more sustainable.

### The blockchain ETF landscape

The model fund of fund (FOF) that we built from 10 blockchain-themed ETFs has lower levels of ESG risk than the Morningstar Global Markets Large-Mid Cap index. However, Human Capital and Data Privacy and Security pose elevated risks in the blockchain ETF market due to the central role of the Financials and Information Technology sectors, which are highly exposed to these issues. Investors can mitigate such risks by developing portfolio strategies, such as sector tilts or stock exclusions targeting high risk companies. They may also consider thematic engagement programmes focused on these issues.

### Industry analysis

Our industry analysis identified four central themes for equity investors to consider when assessing companies in the blockchain ecosystem:

1. Financials companies sampled from our model blockchain FOF tend to face high levels of unmanaged risk on two MEIs: Product Governance and Business Ethics.
2. Human Capital and Data Privacy and Security are critical MEIs for Conglomerates and Software and Services companies that are developing blockchain tools to support business activities across multiple sectors.
3. Resource-intensive companies, including those in the Utilities, Mining and Semiconductor industries are developing blockchain applications to address environmental risks related to carbon emissions and water withdrawal.
4. Early blockchain adopters in the Consumer Goods sector are integrating blockchain into data systems with the aim of improving their approaches to supply chain management and mitigating risks related to human rights and deforestation.

### Blockchain supported solutions

By comparing peers within a selection of industries, we identified 10 companies leading in blockchain tool development and ESG risk management. The companies featured in this report span key markets, including North America, Europe and Asia. These firms may serve as case studies for investors to use as a point of reference in their own ESG analysis of the blockchain equity market.

# Endnotes

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  - The iron ore carbon intensity curve: covers almost all global seaborne supply. The assets covered account for over 34 million tonnes (Mt CO<sub>2</sub>e) of Scope 1 and 2 CO<sub>2</sub> equivalent emissions, plus an additional 62Mt CO<sub>2</sub>e associated with land and sea freight to importing country port.
  - The nickel carbon intensity curve: covers Scope 1 and 2 emissions from mine sites, plus freight and downstream processing to the first saleable nickel product (Class 1 Nickel for concentrate producers, and intermediate compounds for others). The assets covered account for over 37Mt CO<sub>2</sub>e of Scope 1 and 2 emissions, plus an additional 67Mt CO<sub>2</sub>e associated with freight to importing country port and downstream processing.
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