A new frontier: the financial materiality of water risks

This paper will inform discussions at the ninth meeting of the Roundtable on Financing Water (Geneva, 7-9 February 2023), particularly session 5 on "Changing finance for water: driving the behaviour of corporates and financiers".

The background note builds on existing literature and OECD's experience. It may not reflect the opinion of the OECD, UN Water or their Member Countries.

Introduction

Water is often considered a plentiful renewable resource, yet there is increasing stress on supply. Growing population and economic activity in emerging and developing economies, as well as rising expectations around standards of living in developed economies, are increasing water demand from households, agriculture, industry, and energy production. This creates competition for existing resources whilst also contributing to increased pollution. With the global water cycle being the main channel through which climate impacts manifest, climate-induced impacts on water security have further consequences on food security, energy production, biodiversity, human health and livelihood.

There is a growing body of research on physical climate risks and environmental risks, not least by the Intergovernmental Panel on Climate Change (IPCC), which already identifies with high confidence, widespread, pervasive impacts to ecosystems, people, settlements, and infrastructure triggered by climate and weather extremes, including heavy precipitation and drought, amongst others (IPCC, 2022[1]). There is significant evidence related to the cost that water-related risks can pose on economies and societies today and in the future. These risks are already affecting businesses across sectors, and particularly those in sectors that heavily rely on water, such as agriculture, energy production, and mining and materials (CDP, 2022[2]). A number of industries are also exposed: floods in Bangkok or droughts in Chinese Taipei affect the chip industry and global value chains in car manufacturing or telecoms.

The financial sector evaluates risks through the concept of financial materiality. Originally developed as an accounting principle, an event is financially material when its impact would affect the judgement of an investor. Accounting standards in most advanced economies require financially-material events to be publicly disclosed in financial reporting, including risks which might materialise in the future and affect the financial performance of the reporting entity, whether it is a non-financial or financial entity. Yet, from a review of current practices, it appears that the financial materiality of water-related risks is not yet fully understood or measured by the financial sector (OECD, 2021[3]).

This paper aims to support dialogue in the context of the Roundtable on Financing Water between the water community and the financial community, by considering recent development and emerging topics on the financial materiality of water-related risks.

Understanding financial materiality

Financial materiality as a critical driver of financial decision making

Financial materiality refers to the importance of certain financial information being disclosed in a company's financial statements because it could impact the decisions of users of those statements. Under accounting principles, a factor is material if it will positively or negatively affect a company's cash flow or revenue growth. Yet, materiality is subjective and is a matter of judgement and assessment depending on specific circumstances rather than clear-cut rules involving pre-established quantitative thresholds. Generally, it is the threshold at which the inclusion or exclusion of financial information in financial statements would alter the overall understanding or opinion of those statements (IFAC, 2015[4]).

Identifying the financial materiality of risk should be a strong motivator for taking action to mitigate the potential financial impact of the risk. When risks, such as water-related risks, are considered financially material, action to minimise their financial impact should ensue (ECB, 2020[5]).

It is important to differentiate between financial materiality and impact materiality concepts. Reporting on financial materiality focuses on information on economic value creation or loss at the level of the reporting company. Impact materiality is more broadly of interest to multiple stakeholders, such as investors, employees, customers, suppliers and local communities, and refers to the company's impact on the economy, environment, and people. For example, industry can contribute to water stress through groundwater depletion, metal contamination, plastic pollution, and water diversion amongst other harmful practices (CERES, 2022[6]). Financial materiality and impact materiality together are referred to under the umbrella of 'double materiality' (GRI, 2022[7]). The concept of double materiality highlights the interconnectivity of the two types of materiality, where impact materiality can lead to increased exposure to financial material risks. In addition, the broader concept of double materiality can have greater transformational potential, as it considers longer-term implications in terms of both financial performance and sustainable development (Adams et al., 2021[8]).

The water community has been advocating for more financing for investments that contribute to water security and sustainable growth, including through climate adaptation and resilience. While the consequences of the water-related risks becoming financially material for the financial system could be various, this could help trigger action by financial actors to contribute to the mitigation of these risks. Identification of risks could lead to engagement with companies to influence corporate behaviour to mitigate the impacts of risks. Strikingly a recent study by CDP found that the cost of water risks to businesses could be more than five times the cost of taking action to address those risks (CDP, 2021[9]).

However, there are numerous channels through which the financial system can mitigate water-related risks. For example, risks can be eliminated by cutting off finance flows to certain sectors or regions through divestment, by transferring the risk to a third party via insurance, or by taking measures to reduce the likelihood or severity of the risk. Financial resources could also be put aside to cover potential future losses. Other risk management strategies can include diversification, hedging, or the creation of financial instruments to transfer risk (OECD, 2021[3]).

A typology of financially material risks

Climate change and environmental degradation, including water-related risks, can lead to structural change that affects economic activity and, in turn, the financial system. These risks can be transmitted to the financial system through both macroeconomic and microeconomic impacts on corporates, households, sovereigns, and other financial institutions.

Water-related risks, in the form of too much or too little water, can create physical risks to the financial system. The impact of this risk is determined by the physical hazards themselves and the entities' exposures, vulnerabilities, and risk mitigation measures in place, including insurance coverage. For example, water-related risks can affect an entity through the destruction of physical capital, disruption of production and supply chains, adaptation costs, and deterioration of macroeconomic conditions.

An entity can also be impacted by changes in public sector policies, legislation and regulation, changes in technology and changes in market and customer sentiment, referred to as transition risks. These risks are where adjustment towards a lower-carbon and more environmentally sustainable economy can result directly or indirectly in an institution's financial loss (ECB, 2020[5]) (ECB, 2021[10]). For example, in 2022, prolonged droughts and falling groundwater levels in Germany resulted in changes in policy that have the potential to delay or even stop Tesla's USD 5.7 billion Brandenburg manufacturing project, with implications for the project's investors and lenders (Bloomberg, 2022[11]).

The European Central Bank (ECB) suggests the following typology of climate-related and environmental risk drivers in its supervisory guidance (ECB, 2021[10]).

Table 1 ECB examples of climate-related and environmental risk drivers

Physical		Transition	
Climate-related	***Environmental***	***Climate-related***	***Environmental***
Extreme weather events	Water stress	Policy and regulation	Policy and regulation
Chronic weather patterns	Resource scarcity	Technology	Technology
	Biodiversity loss	Market sentiment	Market sentiment
	Pollution		
	Other		

Source: (ECB, 2021[10])

Determining financial materiality

Determining financial materiality, as noted earlier, is a matter of judgment and assessment.

Data is a critical first step to assessing a financial system's exposures to physical risk drivers. This requires granular information on the geospatial characteristics of financial institutions' exposures, combined with data on physical risk drivers (ECB, 2021[10]) For transition risks, financial system actors need to assess multiple industries and consider how their situations will evolve under a transition to a zero-carbon and more environmentally sustainable economy.

The financial materiality of risk will depend on the likelihood of the risk materialising and generating financial impacts at some point in the future. Insurance can mitigate the impacts of risks by transferring the risk to a third party. This means that financial materiality assessments will only look at the residual financial impact remaining for the assessing entity. Materiality also depends on the relative impact on the bearing entity of a given risk, given the financial resources it has at the time of impact to cover for it. For instance, the loss of a house to a flood may be financially material to a household if the house was a large part of their net worth and the damages are not covered by insurance. But the same loss of the same house may not be financially material for the bank that owns the mortgage, as this represents a small loss in terms of the bank's resources, and the risk was insured or hedged (OECD, 2021[3]).

In addition, the evaluation of financial materiality is dependent on the present value attributed to a risk which materialised in the future. For future risks, this will depend on the discount rate used by the assessor to estimate the net present value of impacts. Changes in discount rates will modify the materiality of future risks assessed at the present time, even when the evaluation of the future impact is unchanged. The higher the discount rate, the smaller the impact when considered at its present value.

In light of rapid and unprecedented climate change, assessing the financial materiality of water-related risks is not a static exercise but a dynamic one. Estimations of risks based on past patterns will likely underestimate future risks. Therefore, impacts of water-related events which do not meet the financial materiality threshold today could very well do so in the future if they increase in frequency and intensity (SASB, 2020[12]).

Financial markets are not fully aware of their exposure to water-related risks at present.

Water-related risks, which refer to risks associated with "too much, too little, or polluted water," can transmit to the financial system through various channels, both at the micro level, affecting individual financial actors, or at the macro level to a sector as a whole. Yet, emerging evidence from central banks and financial institutions indicates that water-related risks are not being fully captured in current approaches to assessing risk.

Water risks are material in the economy.

Many parts of the world face concern over deteriorating water security. For example, more than 80% of India's population lives in districts that are highly vulnerable to extreme hydro-meteorological disasters. Over the past decades, weather events have become more extreme, with storms intensifying into cyclones, droughts affecting more than half of the country, and floods of unprecedented scale (Mohanty and Wadhawan, 2021[13]). Over the last few decades, Pakistan has transitioned from abundant water supply to a water-stressed country; now 'over 80% of the total population in the country faces severe water scarcity for at least one month of the year' (PIDE, 2022[14]). Brazil, known for its abundant water resources and home to the amazon river, faced in 2021 its worst droughts in over a century, impacting hydroelectric dams and reservoirs, notably along the Parana river basin, as well as the production of crops such as coffee, corn, sugarcane, and oranges (NASA, 2021[15]).

This is not exclusive to emerging economies. Water stress has been characterised as the largest medium-term climate risk for Europe's biggest economies. Greece, Italy, Spain and Belgium stand out as the most exposed. This is of concern for heavy water users, such as the agriculture industry, manufacturing, and energy, as well as other activities, such as data centres of technology and telecom companies, which require high volumes of water directly for cooling purposes (Mytton, 2021[16]). Water stress is also causing disruption to supply chains. For example, in recent years, cargo barges on the Rhine River in Germany have faced loading and transportation issues because of critically low water levels (Naik, 2021[17]).

The impact of water-related events comes with a high increase in the economy. In the United States alone, since 1980, there have been 338 weather and climate disasters where overall damages were greater than USD 1 billion, which combined exceed USD 2.295 trillion. Over a quarter of these events took place in just the last five years, with the rate of events increasing from 3 per year in the 1980s to nearly 18 per year in the last five years. The costs of recorded drought and flood events in 2022 already amounted to USD 10.2 billion by September (NCEI, 2022[18]).

Research on exposure of sovereign borrowers to climate risks, including water-related risks, estimated that roughly USD 78 trillion, equivalent to about 57% of the world's current GDP (PPP), is situated along flood-prone coastlines, riverways, and low-lying deltas (427, 2020[19]).

The 2020 CDP survey on water security found that the financial value of water-related detrimental business impacts of over 2 900 corporates amounted to USD 16.7 billion. Currently identified water-related risks could have impacts on the business value of up to USD 336.3 billion in the future. However, today, corporate water-related risk disclosure remains limited. Of the 5 500 companies asked to provide data via the CDP water security questionnaire by their investors or business customers, just over half of them did (CDP, 2022[2]).

Water risk factors are already stranding assets. A report released by CDP. and Planet Tracker highlighted how global companies in key industries are already losing billions because of the global water crisis. While large firms are often able to absorb the financial implications of water-stranding events, this is much more challenging for smaller companies that make up most of the market in these sectors and the financial institutions investing in them. Throughout the coal, electric utilities, metals and mining, and oil and gas sectors, they found that USD 13.5 billion in assets are already stranded and a further USD 2 billion at risk due to water issues (CDP, 2022[2]).

Physical risks are not adequately understood in banking system

The banking sectors is exposed to water-related risk through numerous channels. A large part of bank lending in advanced economies is for mortgages, which may be affected by water-related events as they could impact the market value of the property and the solvency of borrowers. Financial derivative products are another substantial part of banks' holdings, which are held by banks to hedge the risk of their clients or as trading instruments for the banks. The materialisation of water-related risks could impact a wide range of prices: water itself, agricultural or industrial commodities dependent on water availability, such as irrigated crops, livestock, steel, mining, blue chip, and hydropower, among others. Credit default swaps, which are insurance provided by banks against the default of a corporate or sovereign issuer, could also be affected by water-related losses for corporates and sovereign issuers, whose credit quality may be affected by water-related risks and pose losses on banks (OECD, 2021[3]).

In 2021, a study by the ECB together with the European Systemic Risk Board (ESRB), found that physical risks did not appear to be priced in the Eurozone banking system. The study considered corporate exposures to several climate-related risks, including river and coast floods and droughts. It found only modest pricing of financial sector exposure to these risks, which likely represents only the lower bound for climate-related losses in the financial system. For instance, of bank credit exposures to non-financial corporations in the Eurozone, only 10.6% were subject to high or increasing flood risk, 1.4% to coastal floods/sea level rise, 12.2% to water stress. Out of the banks surveyed, only two-fifths had performed a mapping of climate and environment risk exposures (ECB, 2021[20]).

In 2022, a follow-on review of 186 banks with total combined assets of USD 25 trillion led to a broad acknowledgement within the banking sector of the materiality of physical and transition risks within the current business planning horizon. The review found that more than 80% of institutions perceive that risks from climate change and environmental degradation would have a material impact on their risk profile and strategy, with 70% seeing material risk within their business planning horizon of three to five years (ECB, 2022[21]). Since the 2021 review, over 85% of survey institutions had performed an initial mapping of their risk exposures, allocated responsibilities within the organisation, set initial key performance and risk indicators, and developed a qualitative mitigation strategy for at least part of their risk exposures. However, approaches taken vary across institutions and the ECB highlighted a need for more methodological sophistication and use of more granular data on risk profiles. In addition, while credit risk receives the most focus, less analysis is being undertaken on market and operational risks (ECB, 2022[21]).

In a country example, evidence from a stress test by the Netherlands Central bank found the banking sector sufficiently capitalised to withstand floods in unprotected areas where there is relatively little real estate. However, capital depletions would increase quickly if more severe floods were to hit the densely populated western part of the Netherlands. These findings have possible implications for various policy areas, including macroprudential policy (Coloia and Jansen, 2021[22]).

At the bank level, HSBC performed a stress scenario to assess the potential impact on the credit risk of water stress in heavy industry companies in an East Asian country. This test highlighted how water-related risks could have a significant impact on the credit risk of HSBC banks' lending books. In the stress scenario when water services were disrupted for three months by non-climate drivers such as increasing exploitation of water or upstream land use change, which are amplified during periods of extreme weather variability. The study found that risks are not currently considered in banks' credit risk management methodologies, which creates a potential risk to banks' financial stability. This study pointed towards a need for an industry-wide framework and relevant tools to assess nature-related financial risks and embed them into banks' risk management practices (CISL and HSBC, 2022[23]).

Insurance and reinsurance have an essential role in mitigating water-related risks.

Insurance plays a major role in estimating and mitigating water-related risks. As underwriters of natural catastrophe risks, the insurance and reinsurance ((re)insurance) sector is at the frontline of climate change and environmental degradation. The long maturities of (re)insurance company portfolios, which span over several decades in advanced economies, will bear the longer-term water-related risks.

For instance, floods have been highlighted as a cause of regular and sometimes devastating damage. In 2021 alone, flooding accounted for USD 90 billion in losses, USD 20 billion of which were insured. The July 2021 flooding in Central Europe was the costliest natural catastrophe in modern European history and the costliest flood event globally to date, with estimated overall losses of USD 54 billion (MunichRe, 2020[24]).

In Europe, a common practice from insurers is to not include climate change-related risks in their pricing methodology for non-life insurance contracts, as most contracts will have a short duration, which allows them to reprice annually. In practice, actuarial analysis is one input to pricing decisions, and reinsurers' pricing is also influenced by the appetite of global capital providers and the reinsurance pricing cycles associated with the occurrence of extreme events (EIOPA, 2021[25]).

However, past events have already shown that it will not always be possible to adjust premiums gradually over time, with large, unexpected events occurring with unexpected frequency. For example, Berenberg insurance estimated

that European floods in 2021 will cost the German reinsurance industry between USD 2 billion and USD 3 billion. The scale of the floods and how close on the heels it came to other floods were both unexpected by Berenberg insurance (Naik, 2021[26]).

Another reinsurer, Swiss Re, makes a distinction between "primary" and "secondary" perils, where “primary perils” refers to large-scale catastrophes, notably tropical cyclones, earthquakes and European winter storms. “Secondary perils” is an umbrella term for natural catastrophes that typically generate losses of low to medium magnitudes, such as thunderstorms, hail and tornadoes, drought, wildfire, snow, flash floods and landslides. Secondary peril events are not yet fully monitored nor modelled, which is problematic given the rise of their associated losses. Secondary perils need to be better understood for the purpose of a more complete and accurate risk assessment. (SwissRE, 2021[27]).

With levels of uncertainty and potentially large impacts, water risks are a major emerging risk for the (re)insurance industry and for a global society, which should spur insurers to explore a new set of solutions. This includes accurate risk assessments based on precise geographic zones to measure insurance coverage. Yet, simply pricing water-related risks with increased premiums could adversely affect insurance coverage and lead to an increase in the protection gap over time. Insurance companies have an important role in promoting long-term planning, new technologies to reduce water consumption or preventive measures to avoid flooding that can minimise the overall financial burden. For example, new considerations in underwriting could be directed to favour businesses with efficient water security strategies.

In certain jurisdictions, the exposure of insurance companies to certain water-related risk is shared by the State (such as France with the “catastrophes naturelles” legislation). Alternatively, some State agencies may offer coverage where private insurance is not available (such as the Federal Emergency Management Agency in the US) (OECD, 2021[3]). The UK has developed Flood Re, a joint initiative between the Government and insurers. Its aim is to make the flood cover part of household insurance policies more affordable. Insurer can choose to pass the flood risk element of your policy to Flood RE for a fixed price and be reimbursed on flood related claims. This helps keeps premiums down for the customer (RE, 2023[28]).

Other estimates of water-related risks in the financial system find mixed results

Asset owners are typically holding corporate securities (equity and debt) and government bonds. Asset owners specialising in infrastructure may be proportionately more exposed to water-related issues than other types of asset owners, such as pension funds. Corporate securities valuation may suffer from water-related events, particularly in agribusinesses and industries highly dependent on water availability or quality. Central banks have become the largest asset owners of advanced economies since the Great Financial Crisis in 2008; therefore, they are exposed to the same risks as asset owners. Asset managers are also exposed to the consequences of higher perceived or real risks in their portfolios by their clients. When water-related risks materialise, clients may ask to sell off related assets, which may lead to a performance decrease (OECD, 2021[3]).

The impacts of climate change are increasingly being seen, leading to increasing physical and transition risks to global businesses. Financial market participants appear to have started to pay attention to this as a potential source of financial vulnerability, yet until now only a very small proportion of global stocks are held by sustainable funds, which pay greater attention to climate risk and typically have a long-term view. Despite the rapid growth in recent years, sustainable funds still account for only about 4% of the global fund market (UNCTAD, 2022[28]).

Under the risk of stranded assets, one could assume that investors should demand a premium for holding assets exposed to physical risks, such as water-related risks, which will increase over time under climate scenarios. Following this logic, these assets would have a lower price compared with assets with similar characteristics but not exposed to this change in physical risk. The IMF's 2020 Global Financial Stability report studied aggregate stock market data for 68 economies to assess whether markets were pricing climate risk. The report found that climate change physical risk does not appear to be reflected in global equity valuations. This works suggests that there is no clear evidence that investors are paying attention to climate change risks, and there is a need for greater stress testing and climate risk disclosure to better assess physical risk (IMF, 2020[29]).

However, the report also found that the impact of large climatic disasters on equity prices has also been modest, particularly where there are higher rates of insurance penetration and greater sovereign financial strength, which mitigate the impact of a large disaster on equity returns (IMF, 2020[29]).

There is mixed evidence for the pricing of climate change physical risk in other asset classes. In the United States, counties projected to be adversely affected by rising sea levels faced higher costs for underwriting fees and initial yields when issuing long-term municipal bonds, in comparison with other long-term municipal bonds from counties unlikely to be affected by climate change and short-term municipal bonds. This implies that the market is pricing climate change risks for long-term securities (Painter, 2020[30]).

Conversely, BlackRock observed two municipal bonds with similar characteristics: the first, Jupiter, Florida, USA, is exposed to climate risks through its location and its numerous waterways, which make the city especially vulnerable to tropical storms and hurricanes; and the second, Neptune, New Jersey is relatively insulated against severe storms. The comparison of a Jupiter water revenue bond against a Neptune bond with similar characteristics found identical yields after adjusting for credit quality. Similar results were found on other spot checks of bonds in areas of relatively high and low climate and water-related risk (BlackRock, 2019, p. 11[31]).

Water-related risks are financially material at macro-level

At the macro level, water-related risks can impact the economy of a given country. It is important to note that a large share of losses linked to extreme weather and climate-related events are not insured and are therefore borne by the entity that suffers the loss or by the state. In Europe, it was estimated that in 2019 only 35% of the total losses caused by extreme weather and climate-related events were insured, leaving an insurance protection gap of 65% (EIOPA, 2021[25]).

In this context, major water-related events can negatively affect sovereign bond markets by deteriorating the solvency of sovereign borrowers. This can occur through the need to finance immediate investment needs following a water-related event, decreased tax revenues, and increased social spending. More research is need on sovereign borrowers' exposure to water-related risks, which has not been fully priced in by financial markets (ECB, 2021[20]).

Where major events have taken place, the (re)insurance sector has tended to react by significantly increasing the premiums, adding policy exclusions or refusing to renew cover, which ultimately leaves the policyholder with no coverage or with difficulties paying for such coverage. This could lead to decreasing insurance coverage, and the protection gap may correspondingly increase over time (EIOPA, 2021[25]). Reinsurer Munich Re notes that flooding accounts for some 40% of all loss-related natural catastrophes since 1980, with losses worldwide totalling more than USD 1 trillion. However, only 12% of these losses were insured, which means that the direct impact on the insurance sector is much smaller than the total losses and property owners and governments bear the uninsured risk (MunichRe, 2020[24]).

In turn, financial institutions may be impacted by water-related risks through widescale losses on loans and investments, increased default risk, and reduced access to funding.

Overall, it is important for financial institutions to consider water-related risks and implement strategies for managing and mitigating them, as these risks can have significant impacts on the financial system through their effects on individual financial actors and the economy as a whole.

Financial market regulation, a baseline for assessing water risks

Relevant financial sector institutions could be loosely categorised under banks, (re)insurance companies, asset owners such as pension funds, asset managers, and central banks (OECD, 2021[3]). Because of their crucial role in economies and societies, global financial systems are strongly regulated, both at the global and national levels. It is important to consider how water-related risks are considered (or not) by the regulatory frameworks that govern the financial systems, as these provisions will establish the baseline for how financial system define and assess risks.

Insurance provider and banks are governed by prudential regulation, which aim to ensure that entities that it regulates can meet their financial commitments. Financial markets are also governed by investors regulations, for example on securities and pensions. These aim to ensure that the market functions in an orderly, fair, and transparent manner, to protect investors, maintain market integrity and promote overall economic stability. Finally, reporting and disclosure standards for non-financial corporates determine the type of information that will be made available to the rest of the financial system.

Prudential regulation of the banking sector does not currently include climate and environmental risks.

Across advanced economies, Basel III prudential regulation of banks, under the supervision of the Bank for International Settlements, aims at strengthening the solvency of individual banks to avoid a systemic banking crisis. Amended, after the Great Financial Crisis in 2008, Basel III provides a comprehensive set of measures to improve the banking sector's ability to absorb financial and economic shocks, improve risk management and governance, and strengthen banks' transparency and disclosures. This is complemented by regulation at the national level, but as banks are strongly connected between themselves via interbank lending, and Basel prudential regulation, aims to forestall the default of a given bank that may trigger the default of the entire banking system (BIS, 2021[32]).

Amongst other updates, Basel III notably increases minimum capital requirements for market risk. In determining capital requirements, the regulation requires banks to publish a solvency ratio, which compares the equity capital that the bank holds to the risks it bears. Risks that require mandatory reporting by banks under prudential regulation are listed in Table 2.The regulation requires that the prudential solvency ratio does not get below 4.5%. In case it would, the regulator could take regulatory action against the bank, asking it to increase its equity capital, or restricting its licence to operate. To make this calculation banks will look at credit risks, which are risks on the lending activities of banks. They will also look at market risks, on the trading activities of banks, and operational risk, stemming from the technical operations of a bank, such as cyber risk, fraud, litigation, and liability fines.

Table 2 Definition of risks in banks' prudential regulation

Type of risk	Definition
Credit risk	Internal assessment based on the probability of default and loss given default to account for guarantees or other recoverable amounts such as the value of mortgages.
Market risk	Computed on financial products that banks hold for trading purposes. The risk is evaluated on the basis of internal risk models based on the past observed probabilities of default (VAR calculation).
Operational risk	Technical risks such as fraud, cyber risk, and failure to operate following, for instance, fire, flooding or litigation.

Source: Authors.
Notes: Value at Risk (VAR)

It is important to note that prudential regulation does not currently mandate reporting on climate, and environmental risks, which would be an important means of ensuring the banking sector reported on water-related risks and acted in accordance with its exposure. Central banks have started giving supervisory guidance on how to amend their risk models to account for climate and environmental risks (ECB, 2021[33]) (Table 3). This guidance is not mandatory and the uptake of this advice by banks in the Eurozone is still in the early stages. This points a clear gap in risk assessments, as banks that systematically assess climate and environmental risks are already reporting on their material impacts (ECB, 2021[33]).

However, the evaluation of these risks comes with new data requirement, much of which is not readily available, as it concerns information on private households or businesses, which is often not publicly available or only disclosed under differing reporting methodologies. Moreover, banks can no longer base their assessments on historic data, given the rapid changes in climate and regularity of water related events (Blijlevens and Wiersma, 2022[34]).

Yet the ECB emphasises the "need for banks to take intermediate steps when data or methodological gaps exist. They should use qualitative metrics, develop proxies with the data sources that are available and adjust their strategies accordingly to enhance their resilience against climate and environmental risks. However, some of the supervisory expectations do not have considerable data needs, so banks should meet these expectations more quickly" (ECB, 2021[20]).

Table 3 ECB examples of environmental risks drivers in prudential regulation

Risks affected	Physical risks	Transition risks
	(Of which water stress)	(of which policy, regulation, technology and market sentiment)
Credit risk	The probabilities of default (P.D.) and loss given default (L.G.D.) of exposures within sectors or geographies vulnerable to physical risk may be impacted, for example, through lower collateral valuations in real estate portfolios as a result of increased flood risk.	Energy efficiency standards may trigger substantial adaptation costs and lower corporate profitability, which may lead to a higher P.D. as well as lower collateral values.
Market risk	Severe physical events may lead to shifts in market expectations and could result in sudden repricing, higher volatility and losses in asset values in some markets.	Transition risk drivers may generate an abrupt repricing of securities and derivatives, for example, for products associated with industries affected by asset stranding.
Operational risks	The bank's operations may be disrupted due to physical damage to its property, branches and data centres as a result of extreme weather events.	Changing consumer sentiment regarding climate issues can lead to reputation and liability risks for the bank as a result of scandals caused by the financing of environmentally controversial activities.
Other types of risks (liquidity, business model)	Liquidity risk may be affected in the event of clients withdrawing money from their accounts in order to finance damage repairs.	Transition risk drivers may affect the viability of some business lines and lead to strategic risk for specific business models if the necessary adaptation or diversification is not implemented. An abrupt repricing of securities, for instance, due to asset stranding, may reduce the value of banks' high-quality liquid assets, thereby affecting liquidity buffers.

Source : (ECB, 2021, p. 12[33]).

Prudential regimes for insurance and reinsurance undertakings are evolving to include sustainability risks.

Water-related risks, such as floods, droughts, and water scarcity, can have a significant impact on the insurance industry, as well as the companies and individuals they insure. As a result, insurance regulators and supervisory authorities around the world have begun to consider these risks in their prudential regulation of the industry.

Prudential regulation in the insurance sector aims to ensure that insurance companies are financially stable and able to meet their obligations to policyholders. This is typically done through standards including capital adequacy requirements, risk-based solvency, investment regulations and supervisory tools like stress testing and early warning systems.

However, the insurance sector is less internationally integrated than the banking sector, and insurance regulations will vary across countries and regions. For example, in the United States, prudential regulation is conducted by state-level insurance departments and the National Association of Insurance Commissioners (NAIC), which develops and implements common standards and best practices. In Australia, the Australian Prudential Regulation Authority (APRA) is responsible for the prudential regulation of the insurance industry. In the UK, it is conducted by the Prudential Regulation Authority (PRA), part of the Bank of England. In the EU, EIOPA coordinates the work of national regulators

and provides guidelines for the sector. In other parts of the world, the responsibility for regulating the insurance industry may fall on central banks or financial supervisory authorities or ministries of finance or similar government departments.

While industry reports have highlighted the importance of water risks to the re/insurance industry, there is currently no global approach by the insurance sector for water-related risks. Some countries or regions set specific actions or guidelines regarding water risks, such as standards for insurers to assess and manage water-related risks in their underwriting and investment activities. Other measures include stress tests and scenario analysis to evaluate the potential impact of water-related risks on insurers' financial stability. Regulators can also encourage insurers to develop and utilise catastrophe models that consider water-related risks.

For example, in Australia, APRA has issued guidance for insurers on how to identify, assess, and manage climate risks, which include water risks; and in the EU, the European Insurance and Occupational Pensions Authority (EIOPA) has also launched a discussion paper on the integration of climate change and environmental risks in the insurance sector to better address physical risk including river and coastal flood risks. (APRA, 2022[35]) (EIOPA, 2022[36]). It is worth noting that water risks are still a relatively new area of focus for insurance regulators and supervisory authorities, and the specifics of how they are considered and addressed may differ depending on the country or region.

Solvency II, under the EU provides an international set of standards for the assessment and management of risks, which can be applied to environmental risks such as water stress. Insurance companies are required to conduct their own risk and solvency assessment (ORSA) that considers the full range of risks to which they are exposed. In 2021, regulation was amended to require the integration of sustainability risks in the risk management and governance of (re)insurance undertakings. This means that sustainability risks need to be reflected in the investment and underwriting strategies of insurers. As part of the prudent person principle, insurers will also need to consider the potential long-term impact of their investment strategy and decisions on sustainability factors (EIOPA, 2022[37])..

Further steps towards integrating sustainability and climate into the framework need to be taken, to identify and assess the potential impact of environmental risks on businesses. An opinion published by EIOPA in 2021, proposed to include climate scenario analysis in the ORSA to assess climate risks both in the short term, and also in the long-term. Risk management framework can then be designed to address the risks identified in the ORSA, which can include measures to mitigate and manage water stress risks, such as reducing water consumption, increasing water efficiency, or investing in water-saving technologies. This would allow regulators to better understand how insurers are addressing water stress risks and to act if they believe insurers are not adequately managing these risks (EIOPA, 2022[37]).

The European Commission, as part of the review of the Solvency II Directive, has provided two additional mandates on sustainability risks. Under the first mandate, EIOPA should explore the potential for risk differentials related to assets or activities associated with environmental and social objectives. Given the expected increase in physical risk exposures due to climate change, EIOPA will also explore the potential for a dedicated prudential treatment of insurers' underwriting exposures related to climate change adaptation. The second proposed mandate requires EIOPA to regularly re-assess the appropriateness of parameters for natural catastrophe risk and, if necessary, provide an opinion on potential changes to the prudential framework (EIOPA, 2022[37]).

Investment regulation takes a light-touch approach to climate and environmental risk management

Laws and government agencies that oversee operations in the financial markets aim to ensure that markets function in an orderly, fair and transparent manner to protect investors, maintain market integrity and promote overall economic stability. For example, financial market regulations can include securities laws, banking regulations and derivatives regulations. For example, in the US regulatory agencies include the Securities Exchange Commission (SEC) and the Commodity Future Trading Commission (CFTC). In the EU, the European Securities and Markets Authority (ESMA) is responsible for securities and markets, the European Banking Authorities oversees responsible banking regulation, and the European Insurance and Occupational Pensions Authority oversees insurance and pension funds regulation.

The notion of financial materiality is part of investment regulations in the financial market. However, investor regulation focuses on ensuring the fair and transparent functioning of the market, rather than prescriptive investment guidance.

While there are no specific regulations in place to address water-related risks, there is an increasing perception that climate and environmental risks fall under the broader mandate of protecting investors and promoting overall economic stability

For example, the SEC requires public companies to disclose certain types of risks in their financial statements, which can be applied to environmental issues such as water scarcity. In 2022, the SEC proposed rules to enhance the disclosure of climate-related risks and metrics by companies in their registration statements and periodic reports. These would provide investors with greater insight into the potential material impact of climate risks on a registrant's business, results of operations, or financial condition. Companies would also be required to disclose the impact of climate-related events, such as severe weather conditions, on their financial statements (SEC, 2022[38]).

In the UK, the government has announced new Sustainability Disclosure Requirements (SDR) whereby pension schemes and other asset owners would be required to disclose their sustainability-related risks, opportunities and impacts in a way that enables clear communication with savers.

Another example in the US, at least demonstrates that there is resistance to new regulation negatively impacting on ESG considerations. The US. Department of Labour (DoL) issued a regulation under the Employee Retirement Income Security Act of 1974 (ERISA) that governs investments made by private pension and health schemes in the US. A rule on "Financial Factors in Selecting Plan Investments," included amendments to the "Investment Duties" regulation under ERISA, which would require pension plan fiduciaries to make investment decisions based solely on financial considerations and their impact on the returns of the investors. However, enforcement of this rule was suspended in 2021 while the DoL conducted further stakeholder outreach to determine how to incorporate ESG factors into investment evaluations while also maintaining the fiduciary responsibilities of these plan's investment managers **(DoL, 2021[39])**.

Corporate disclosure on financial materiality

In recent years, against the backdrop of increased awareness of the importance of environmental risks, new reporting standards ask companies to report on both financial and non-financial information, and the ESG risks to which they are exposed.

In 2016 the establishment of the Task Force on Climate-related Financial Disclosures (TCFD)[1] by the Financial Stability Board (FSB) was a key milestone for climate disclosure. The next year TCFD published recommendations to the financial sector for more and better disclosures of financially material, or potentially material, climate-related risks. The objective of these recommendation was to promote more informed investment, credit, and insurance underwriting decisions and, in turn, enabling stakeholders to understand better the concentrations of carbon-related assets in the financial sector and the financial system's exposures to climate-related risks.

Advances in disclosure notably include integrated reporting, which is an approach that uses a combination of financial and non-financial data to provide a more comprehensive evaluation of a company's performance. This can be a useful approach for evaluating water risks and opportunities, as it can provide a more complete and holistic understanding of these risks and opportunities and how they might affect a company's financial performance over time.

The International Integrated Reporting[2] framework provides a structure for companies to report on their responses to the external environment in communication about an organisation's strategy, governance, performance and prospects. This type of reporting can help investors assess the financial materiality of water risks, by looking at how the risk and opportunities relate to an entities business model, strategy, governance performance and prospects, as part of broader sustainability and financial performance evaluation.

[1] More information: https://www.fsb-tcfd.org/

[2] More information: https://www.ifrs.org/issued-standards/ir-framework/

The Sustainability Standards Board (SASB) also publishes standards to guide the disclosure of financially material sustainability information by companies to their investors across 77 industries with a subset of ESG issues most relevant to financial performance in each industry.

Other metrics include The World Economic Forum's International Business Council (WEF IBC) stakeholder capitalism metrics[3], which propose a set of universal and material ESG metrics identified by the big four consultancy firms, to be used in mainstream annual reports of companies on a consistent basis.

The formation of the International Sustainability Standards Board (ISSB) in 2022, under the International Financial Reporting Standards (IFRS) Foundation, consolidates many of these initiatives (TCFD, SASB, Integrated Reporting and WEF IBC metrics) to provide standards for the Disclosure of Sustainability-related Financial Information and Climate-related Disclosures, with a focus on financial materiality for an investor audience.

In parallel, the European Parliament and Council approved the Corporate Sustainability Reporting Directive (CSRD) to make businesses more publicly accountable for their societal and environmental impacts. CSRD introduces more detailed reporting requirements and ensures that large companies and listed SMEs are required to report on sustainability matters such as environmental rights, social rights, human rights and governance factors. This will come into force in four stages between 2025 and 2029 (Consilium Europa, 2022[40]).

The European Financial Reporting Advisory Group (EFRAG) has proposed European Sustainability Reporting Standards (ESRS) to the European Commission for adoption. This guidance is for a multi-stakeholder audience (which includes investors) and is based on the concept of double materiality, expanding a company's reporting boundary to its entire value chain. ESRS would have a significant impact on the scope, volume and granularity of sustainability-related information to be collected and disclosed by companies (Jubels, 2022[41]).

While recent initiatives such, as the ISSB aims to converge disclosure and reporting frameworks towards more standardised approaches, this is still very much in early stages, and water-related risk are just one small part of these reporting frameworks. Lack of standardisation in how climate and environmental risks, including water-related risks, are assessed, reported, and integrated into investment and lending decisions remains a significant barrier (Jones and Jessop, 2021[42]).

Various initiatives are trying to bridge this gap. For example, CDP environmental disclosure, includes a strong focus on water disclosure[4], summarised in Box 3, which encourages companies to report on their water management practices and risks. These programmes aim to improve companies' understanding by reporting on water-related risks as well as water usage, water stewardship and water efficiency.

A recent programme, known as the Valuing Water Finance Initiative, aims to develop and implement a new set of water-related disclosure frameworks for financial institutions beyond the existing TCFD recommendations. This initiative aims to provide a standardised approach to disclosing exposure to water-related risks to ensure investment, insurance, lending, rating and underwriting practices are well aligned, and to enable scoring and benchmarking. This initiative is summarised in (Valuing Water Initiative, 2021[43]).

Box 1. CDP Environmental Disclosure

CDP is a non-profit organisation, which provides a global environmental disclosure system aligned with TCFD recommendations. CDP's standards for corporate environmental reporting aim to help companies make their environmental impact transparent to stakeholders and provide a better understanding of how to reduce these impacts.

Through its disclosure system, CDP has a comprehensive set of environmental data available, including data on water-related risks, to capital markets to inform investment decisions, reduce investment risk, reward high-performing companies, and drive

[3]More information: https://assets.kpmg/content/dam/kpmg/xx/pdf/2021/03/wef-ibc-common-metrics-measuring-stakeholder-capitalism.pdf

[4]More information: https://www.cdp.net/en/water

action towards environmental and climate objectives. At the same time, more disclosure helps accelerate the development of standard water impact metrics and performance benchmarks. This enables individual firms to benchmark their performance whilst also supporting tracking on global progress towards meeting environmental objectives, including sustainable use of water resources.

CDP's focus on water security is driven by corporate awareness of the need for better understand water-related information to inform decision-making and drive effective action. With increasing water stress, pressure is growing for companies to build long-term resilience to water challenges into their businesses. As an illustration, in 2021, through CDP disclosure, companies reported potential financial impacts of USD 301 billion from water risks.

To disclose on water related risks, companies complete annual Water Security questionnaire, which helps them to better understand water risks and opportunities, facilitating informed decision making and improving long-term resilience. In addition, disclosure through CDP increases the transparency of water security and pollution reduction measures to shareholders and customers, helping companies improve their reputation. As mandatory disclosure gains momentum, voluntary disclosing through CDP also enables companies to develop internal reporting procedures and best practice, ahead of regulation.

Source: (CDP, 2022[43]) Disclosing through CDP; (CDP, 2023[44]) Water

Box 2. Valuing Water Finance Initiative

The Valuing Water Finance Initiative is a new global investor-led effort to engage companies with a high water footprint to value and act on water as a financial risk and drive the necessary large-scale change to better protect water systems. The initiative calls on companies to meet Corporate Expectations for Valuing Water that align with the United Nations' 2030 Sustainable Development Goal for Water (SDG6) and the actions laid out in the Ceres Roadmap 2030.

This programme was launched by the Government of Netherlands leader of the Valuing Water Initiative, in partnership Ceres, a non-profit organisation working with capital market actors on sustainability issues, working in collaboration with a network of investors, companies and non-profits.

The Valuing Water Initiative works collaboratively with stakeholders, both inside and outside the water sector, to encourage governments, industries and civil society to bring about the systemic change required to understand, value and manage water resources, through the application of the UN Valuing Water Principles in different water value chains and sectors.

Building on this work, in 2022 Ceres' Valuing Water Finance Initiative was launched as a new global investor-led effort to engage 72 companies with a high water footprint to value and act on water as a financial risk and drive the necessary large-scale change to better protect water systems. These companies, while at different stages of their water journeys, all have the potential to better steward and protect freshwater resources within their business operations and global supply chains to drive meaningful, global change. The initiative launched with a group of 64 signatories representing USD 9.8 trillion in assets under management.

Using new research and analysis as the foundation, the Valuing Water Finance Task Force, alongside investor and NGO partners, developed the Corporate Expectations for Valuing Water. This set of six, science-based, actionable expectations provide investors with a framework to engage with companies to strategically address water risk. These include:

- Actions to ensure current practices don't impact water quality and water availability
- Integration of water management into business processes, including board oversight and policy engagement
- Efforts to ensure access to the essentials – water and sanitation – across company value chains

- Protection of ecosystems is critical to the freshwater supplies that their businesses depend on

Source: (Government of Netherlands, 2023[43]) The Valuing Water Initiative (Ceres, 2023[44]) Valuing Water Finance Initiative

Scenario analysis

Amongst key recommendations of the TCFD in 2017, was the use of scenario analysis as an important and useful tool for understanding the potential implications of climate change on organisations (TCFD, 2017[44]). This type of scenario analysis can help investors, banks and insurance companies assess the potential financial impacts of different water related risks on company operations and financial performance. A number of organisation provide different types of scenarios. For instance, WWF Water Risk Filter provide assessments on water risk exposure to the financial impacts of severe droughts, flooding building on climate and socio-economic scenarios (WWF, 2020[48]). In another example, the Inevitable Policy Response (IPR) by UN-PRI looks more specifically at how policy trajectories in the short and long term (transition risks) across all major countries/regions will impact investors (PRI, 2022[45]). Yet, scenario can often show only a partial picture. The relationship between climate change and potential second-order effects is highly complex and so difficult to estimate." Research points out that some water-related variables are more sensitive to measurement errors and modelling assumptions, notable changing patterns of precipitation and extreme events (Stocker, 2013[46]) (Tankov, 2019[47]).

The Network for Green the Financial Sector (NGFS) aims to bring a global perspective on how the financial sector can manage the financial risk of climate and environmental factors. In particular, the NGFS works inform central banks and supervisors, as well as other financial sector participants on the integration of climate-related risk. Under the NGFS, an expert group of climate scientists and economists designed a set of hypothetical scenarios to provide a common point for understanding how physical risk and transition risk could evolve under different contexts. The scenarios provide a range of higher and lower-risk outcomes to help central banks and supervisors explore the possible impacts on the economy and the financial system. This includes estimates of GDP losses from chronic risks that now more comprehensively account for model uncertainty and indicative illustrations of the way that acute physical risks could materialise over the course of the six scenarios. Acute physical risks were included via the integration of stochastic shocks calibrated based on historical data and "multipliers" to derive future trends (NGFS, 2021[48]).

Currently, work is underway to better reflect nature, including biodiversity and water, in future work, given the potentially significant macroeconomic implications, and that failure to account for, mitigate, and adapt to these implications is a source of risks relevant to financial stability (NGFS, 2022[49]).

New data and tools are emerging to assess the financial materiality of water-related risks

Water-related risk is a complex and multi-faceted issue for companies and investors. To understand the financial materiality of water risks, it is important to consider the implications of water scarcity and flooding on company assets and operations and supply chains (physical risks) as well as the impact of changing regulations, consumer demand, and market shifts (transition risks). The assessment of water-related risks to actors in the financial system is therefore largely dependent on the quality and granularity of data and tools available.

Ensuring the granularity and consistency of data is a challenge

Lack of standardization and consistency in the data and metrics used to evaluate water risks can make it difficult for financial actors to compare companies and sectors and identify the most significant water-related risks and opportunities. Concerns in relation to the lack of granular data are expressed in different parts of the financial system. For instance, the Norwegian Ministry of Finance, asset manager Norges Bank Investment Management (NBIM) notes that "Access to relevant, high-quality data is limited. Unlike assessments of other types of risk, we can make limited use of historical data. There is also considerable uncertainty about the possible financial consequences of climate

change and about the likelihood and timing of specific developments". This relates to climate and environmental risks, including water-related risks (NBIM, 2021, p. 3[51]).

Data on physical and transition risks comes from a variety of sources, including government agencies, research institutions, and companies themselves. The Global Risk Report 2021 by the World Economic Forum highlights that "Water-related risks are complex and can have cascading impacts on multiple sectors and regions" (WEF, 2021[50]). A wide range of information is needed to understand risks across a company's value chains, including geospatial data on water resources, water stress, as well as water-related laws, regulations, and policies. It is important to note that while there is a growing amount of data available on water-related risks, it is still a relatively new area of focus, which can often be overshadowed by the wealth of analysis on climate change risk and carbon disclosure.

As discussed above, corporate non-financial information on water usage, wastewater management, and water stewardship initiatives are typically provided through financial statements, sustainability reports, and other disclosures. Recent initiatives, such as the ISSB, aim to converge disclosure and reporting frameworks towards increasingly standardised approaches to financial and non-financial sustainability disclosure. However, water-related risk is only one small part of this framework. Additionally, there is still large variation in the depth and breadth of corporates disclose across assets and supply chain. Development of water specific disclosure frameworks, such as that announced by the Valuing Water initiative, can support greater granularity and standardised reporting on water-related risks and opportunities, but this is still very much in early stages (Valuing Water Initiative, 2021[43]).

In addition, public disclosure frameworks increase the amount of data on water-related risks available in the public realm to develop metrics and performance benchmarks., whereas much of the analysis on climate and environment risks can be produced and owned by private actors. This can create asymmetries of information for governments and regulators. For example, Four Twenty Seven (427), a key climate research and data provider, which produces physical risk guidance to the financial sector was acquired by Moody's, one of the largest credit rating agencies.

Certainly, Given the multifaceted nature of water-related risk, assessments of water-related risks require significant amounts of resources and expertise to conduct a comprehensive analysis. Investors including institutional investors and asset managers will often of make use of existing tools to evaluate the financial materiality of water-related risks when making investment decisions. There are an increasing number of research firms, consulting firms, and other organisations that produce reports and research specifically targeted to look at water-related risks and opportunities, and dedicated water risks tools are also emerging to support investor decision making.

Beyond ESG, water specific investors tools are being developed

Better understanding of water risks is needed at investors level but also corporate level, where business decisions have a direct impact on exacerbating or mitigating water related risks.

As an often-inexpensive resource, risks linked to water can often be overlooked until an event leads to a situation of water stress. This has led to increasing demand for industry tools to help businesses assess water-related risks and understand the gap between what is being paid for water, its value for operations and the potential costs of water risks. For example, ECO Lab enhanced Smart Water Navigator, provides a Water Risk Monetizer tool to evaluate the potential costs of water. This is also combined with a Water Action Assessment tool to provide guidance on proportionate action at local level to mitigate risks (EcoLab, 2022[52]). This type of tool can help corporates gain a better understanding of the materiality of water-related risks and the corresponding value or cost of implementing mitigations measures. In turn this helps investors understand the types of risks that corporates are facing at the asset level.

Other tools are more specifically targeted towards investors, including institutional investors and asset managers, to equip them with information and resources to assess how water-related risk can materially affects corporations and how to integrate water risk into investment decisions. For example, as summarised in S the Ceres Investor Water Toolkit, was developed in collaboration with institutional investors, and provides learning material, databases, case studies and other tools to inform investment decisions (Ceres, 2023[53])

Dedicated tools which increase both corporate and investors understanding of water risks can have an important role engaging and stimulating collective action from investors and corporates to mitigate water-related risks and develop strategies at local level.

Box 3. Ceres – Investor Water Toolkit

Ceres is a non-profit organisation working with capital market actors on sustainability issues, working in collaboration with a network of investors, companies and non-profits. Ceres provides market-based and policy solutions across a range of sustainability topics, including water. This includes interactive tools and research to educate and encourage companies and investors across sectors of the economy to take sustainability action. For example, Ceres has recently published analysis contributing to the body of research on the financial materiality of water-related risks in the meat and apparel sectors.

The Investor Water Toolkit is designed to help investors manage these risks. Developed in collaboration with more than 40 institutional investors from the Ceres Investor Water Hub, a working group of Ceres Investor Network, it is the ultimate investor resource on water risk integration in portfolio management. The guides are designed to help investors to evaluate water risks across all asset classes and design strategies for mitigating water risks in their investment portfolios. The Toolkit is designed to:

- Help investors comprehensively understand water risk drivers;
- Create a one-stop platform that allows institutional investors to integrate water across the decision-making value chain, from asset class analysis to portfolio characterization, to buy/sell decision making;
- Provide stand-alone guides, resource lists and databases on specific topics or asset classes, including equities, municipal bonds and private equity;
- Provide case studies written by investors that showcase real life water risk integration practices;
- Evolve and capture new ideas through on the dedicated webpage (www.ceres.org/investorwatertoolkit).

Source: (Ceres, 2018[54]) Investor Water Toolkit; (Ceres, 2021[55]) Financial Implications of Addressing Water-Related Externalities in the Apparel Sector; (Ceres, 2021[56]) Financial Implications of Addressing Water-Related Externalities in the Meat Sector | Ceres

ESG and climate risk scoring can provide a high-level picture of water risk

A number of providers, such as Moody's[5], S&P[6], MSCI[7] provide ESG and climate scoring tools, which consider water stress as well as certain aspects of the company's management for water resources.

ESG factors are a set of non-financial metrics that are used to evaluate the sustainability and societal impact of a company or investment. Evaluating water risk is one component of the environmental aspect of ESG analysis. This can include assessing a company's exposure to water-related risks, such as water scarcity, flooding, and pollution,

[5] More information: https://esg.moodys.io/climate-solutions?

[6] More information: https://press.spglobal.com/2022-09-15-S-P-Global-Sustainable1-Launches-Physical-Risk-Exposure-Scores-and-Financial-Impact

[7] More information: https://www.msci.com/documents/1296102/16985724/MSCI-ClimateVaR-Introduction-Feb2020.pdf/f0ff1d77-3278-e409-7a2a-bf1da9d53f30#:~:text=Climate%20Value%2Dat%2DRisk%20(,change%20could%20affect%20company%20valuations

and analysing a company's water usage, its operations in areas prone to water-related risks, and its water management policies and practices.

ESG analysis has become increasingly granular in recent years, with the emergence of new data providers and analytical tools that allow for more detailed and comprehensive assessments of companies' environmental, social, and governance performance. However, ESG data is often self-reported by the companies and may not be independently verified, which can weaken its reliability. Variation between ESG reporting can also lead to inconsistencies. Both are critical barrier to the integration of ESG risks and opportunities into investment processes (Jonsdottir et al., 2022[57]). This means that the assessment of water-related risk is likely to partial and with coverage varying across providers.

Climate risk scoring is a method used by investors to assess the financial risks and opportunities associated with climate change. These can provide a present and forward-looking view of an asset's exposure to a range of physical climate risks, including floods, heat stress, hurricanes and typhoons, sea level rise, water stress, and wildfires. It typically involves the use of a climate risk score, which represents the climate hazard exposure of a portfolio of assets, as well as its management of those risk. This enables investors to look at specific risk drivers and identify companies that are more vulnerable to the impacts of climate change, such as those in sectors exposed to water scarcity or flooding, as well as transition risks like those related to changing regulations, shifting consumer demand, or stranded assets. For example, a company in water-stressed regions, with water-intensive operations, or poor water governance and management, would be exposed to higher physical risks of water scarcity and flooding.

Climate Risk scoring is also increasingly used by regulatory bodies and financial institutions and companies to report their risk exposures, to have a clear picture of the climate change risk on their portfolio and future growth projections. Yet climate risk scoring relies on various data sources, including company disclosures, external data providers, and sector-specific research and it is important to note that different companies and investors may use different methodologies to develop climate risk scores, which can lead to different results.

Credit scoring can capture water-related risk exposure

Credit scoring is a method used to evaluate the creditworthiness of individuals or businesses. It typically involves the use of a credit score, which is a numerical value that represents an individual or business's credit worthiness. Credit scores are based on a variety of factors, such as credit history, income, and debt levels. Water risks can have a significant impact on an individual or business's ability to repay debt, and credit scoring can be used to help evaluate these risks. For example, a business located in an area prone to flooding or drought may be considered to have a higher risk of defaulting on a loan. Similarly, an individual with a history of late payments or defaults on water bills may be considered to have a higher risk of defaulting on other types of debt. But it is important to note that Credit rating agencies (CRAs) rate the credit risk of a given issuer, not economic risk, unless it is directly impacting on credit risk (The World Bank Group, 2016[58]) (Sadoff, et al., 2015[59]).

CRAs such as Moody's and S&P Global influence the pricing of an issue. It can also enable the fast distribution of newly issued paper on capital markets without borrowers having to carry out their own credit risk assessment. By assessing a company's ability to manage various risks, this can in turn can help investors determine whether a water-related risk could be financial material. However, water-related risk is just one of many considerations for organisations working on credit scoring.

While credit scoring is a useful tool for evaluating the creditworthiness of individuals and businesses, it is not specifically designed to evaluate water-related risks. There can therefore be gaps in its ability to identify companies that depend heavily on access to water in locations that are exposed to water stress and to quantify the potential impact of water scarcity on the company's creditworthiness.

Resources to inform water-related risks in credit scoring are starting to emerge. For example, the 'Corporate Bonds Water Credit Risk Tool" enables users to integrate financial risk exposure to water scarcity into standard financial models used to assess the credit strengths of corporates across water-intensive sectors including power utilities, beverages and mining. The tool supports financial analysts in quantifying quantify corporate exposure to water stress

and its potential impact on a company's credit ratios. It does this by drawing on data on corporate water usage in various production locations combined with site-specific data on water supply and demand conditions (Ridley and Bolan, 2016[64]).

Areas for further research

The topic of financial materiality of water related risks has evolved rapidly in the last few years. The apparent disconnect between the economic and financial materiality of water-related risks is an important consideration for policymakers. Of relevance to financial regulators, this indicates that material financial risks may be invisible to analytical approaches currently used in the financial system. This would mean that if and when risks materialise, the financial sector may not be equipped to deal with them.

While finance supervisors have started to provide guidance on the integration of water-related risks in global financial system risk assessments, regulation does not yet mandate thorough analysis of exposure to water-related risks. Recommendations from TCFD, NGFS and central banks take a step in the right direction to push the financial sector towards analysing financial materiality. Yet the financial system appears to be slow in its uptake of the assessment of those risks, and many institutions continue to rely to on historical rather than forward-looking data, despite evidence that risks are present and increasing. Those that have made assessments, however, are drawing light to substantial exposure to water-related risks.

There may be a role for the water community to engage with finance supervisors to bridge the data and methodological gaps that may prevent a quick uptake of risk assessment by the financial system. However, the trigger for such collaboration must come from a willingness of the financial system to rapidly change its practices.

The general approach to risk assessment in the financial system is a granular, individual asset risk level approach. Lack of data is a limitation to properly assess water-related risks, as well as, more generally, environmental and climate-related risks. This is increasingly recognised as an issue for the financial sector. There is a need for better data and better risk assessment methods to better understand and manage the risks associated with water scarcity. In particular,

- Improving **disclosure standards** for water-related risk is critical to improving investors understanding of risks and enabling relevant data to consistently be included in risk assessments. The next phase of the TCFD should bring a strong focus to water in its guidance to central banks, insurers and investors.
- There are a growing number of data sources and tools that aim to guide corporates and investors in their understanding of the materiality of water-related risk. A comprehensive overview of resources that are already available would be of benefit to the water community. This includes a review of **current limitations and next steps for risk assessment tools** in seeking to translate water-related risk into financial risks.
- The use of risk assessment tools and to data to spur **on collective action and engagement between corporate and investors** on water-related risks is critical. These risks are not static the importance of engagement with stakeholders to identify and mitigate risks at local level should not be understated.
- Research points to the importance of the **insurance sector**, which plays a critical role in determining the financial materiality of water-related risks. Insurance regulation, however, has a less cohesive international framework than the banking sector. Nationally different regulation will govern companies and inform how water-related risks are assessed and priced. There is a danger that simply reflecting rising water-related risks through higher insurance premiums could lead to a growing coverage gap and increased exposure to risks. There may be an important role here for identifying best practices in assessing water risks, as well as approaches to managing and mitigating water-related risks, alongside insurance. This includes the role of government in risk-sharing as seen with the Water RE programme in the UK.
- Previous OECD research points at gaps in the assessment of the potential impact of water-related risks on **bank premises**, including data centres and offices, and including the risk assessment in the prudential reporting, which as per ECB guidance would seem a relatively quick win. It could also contribute to enhancing

the water-related risks culture within banks, opening the way for a larger update of risk assessment tools beyond the operational risk (OECD, 2021[3]).

- In addition, sovereign borrowers are a large part of banks' credit exposures. Research highlights that there are reason to believe that **sovereign borrowers**, or some of them, may be highly exposed to water-related risks, and that this exposure has not been fully priced in by financial markets (OECD, 2021[3]).
- Research points at gaps in the assessment of the financial materiality of water-related risks for **sovereign and municipal issuers**, which together form a substantial part of new issuance and stocks of debt on capital markets. The water community could be instrumental in bridging this gap by considering not only the economic implications of policy action but also its potential financial impacts. While this role has been traditionally devoted to financial analysts such as those employed in CRAs, water-related risks are a new area of investigation for the financial sector. Enhanced dialogue between the water and the financial community on financial impacts could help bridge the existing materiality gap. It could also increase the information channels of the water community on which type of policy action is considered as a mitigant by the financial sector from the point of view of financial impacts (strong regional planning, robust storage and conservation efforts in the above example), which could help prioritise investment (OECD, 2021[3]).
- On a more general level, water policies, regulations and management practices directly impact the water security of municipalities, regions and countries. Physical, economic and financial water-related risks are also driven by policies in other sectors (agriculture, urban development and housing, land use, and energy, among others). In this respect, the water community also needs to **engage with other communities** to mitigate water-related risks. Therefore, these actions directly affect the financial impacts of water-related risks on sovereigns and municipal issuers. Investments to improve water security can be a key factor in mitigating financial risk (notably in the short-term credit risk of states and local water utilities) (OECD, 2021[3]).

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