Green and Sustainable
Finance Cluster
Germany

TCFD Think Tank

Physical climate-related risks

A perspective for banks and asset managers

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Abbreviations

AR5	5th Assessment Report
CRR	Capital Requirements Regulation
EBRD	European Bank for Reconstruction and Development
IPCC	Intergovernmental Panel on Climate Change
NGFS	Network for Greening the Financial System
TCFD	Task Force on Climate-related Financial Disclosures

Foreword Green and Sustainable Finance Cluster Germany

Transparency is fundamental to evaluating risks and allocating capital efficiently. For this purpose, the consistent disclosure of financial results, the handling of opportunities and risks, the presentation of the situation and the making of forecasts are indispensable. This also applies to understanding the effects of the climate crisis.

The analysis of climate-related risks is challenging, as neither the exact path to a world compatible with the Paris Agreement nor the exact timing and extent of the physical effects of the climate crisis can be predicted. Many actors are only slowly recognising the significance of the climate crisis for their future economic success. In fact, changes due to the climate crisis affect all parts of the global economic system. The associated changes not only represent a considerable risk, but also open up new business opportunities for companies that are strategically consider the climate crisis. Risk/return profiles in the lending business and in asset management will change considerably as a result of the climate crisis. They are a result of the physical effects of climate change, climate policy and regulation, changing demand structures and new emerging technologies. Avoiding climate-related risks will prove difficult in certain asset classes or sectors, which may lead to a revaluation of such activities.

The Financial Stability Board has set up an industry-led Task Force on Climate-related Financial Disclosures (TCFD) to assess information relevant to climate-related risk. The TCFD has issued recommendations for the voluntary and consistent disclosure of climate-related financial information. These are intended to help investors, lenders and insurance companies understand significant climate-related risks and opportunities. Globally, the TCFD recommendations are now understood as a guideline and numerous companies have committed themselves to their implementation.

The Green and Sustainable Finance Cluster Germany e.V. (Cluster) showed in its Baseline Report published in August 2018 that the TCFD recommendations seem too abstract for German financial institutions. There is little understanding of practical implementation approaches of the TCFD recommendations. The cluster has therefore established a think tank for practical implementation issues in cooperation with experienced financial market practitioners. This is supported by the concentrated knowledge of the Frankfurt School of Finance & Management, PwC Deutschland, d-fine and right. based on science.

Within the framework of the TCFD Think Tank, four workshops were held with selected financial market practitioners. In the course of this process, a deeper understanding of the TCFD recommendations was built up. The findings are now made available to the interested public, in particular financial institutions, in the form of handouts. They are tailored to the needs of practitioners in order to independently advance the implementation of the TCFD recommendations.

1 WHAT ARE PHYSICAL CLIMATE RISKS AND HOW CAN THEY BE EVALUATED?

According to the TCFD, physical risks resulting from climate change are one of the two central sources of climate-related risk that companies and financial institutions should consider in their strategy, risk management and reporting. A distinction is made between an increasing accumulation and intensity of acute extreme weather events (e.g. heat waves, storms, floods) and longer-term chronic changes in mean values and ranges of fluctuation of various climate variables (e.g. temperature, precipitation, sea levels). For financial institutions, these physical risks can be felt in the real economy, in particular through their impact on investments and business counterparts / customers.

Definition

chronic and climatic hazards

Temperature pattern

Droughts

Rainfall

Sea-level rise

Wind velocities

Extreme weather events (heat waves, forest fires, overheating landslides, storms)

In addition to the expected probability and magnitude of the hazard (hazard: generalised intensity, depending on the type of event, region, time horizon, climate model), the exposure of the economic unit under consideration (exposure: proportion of the ensemble exposed to the hazard due to its location) and its vulnerability (e.g. expected costs per event due to the exposure) must also be determined for the risk analysis.

Definition

Physical climate risk

= Hazard  Trend or event with unfavourable potential and probability as well as extent of the event

x Exposure  Exposure of the system under consideration to an environment,, which could be adversely affected by the climate event

x Vulnerability  inclination or predisposition of the system under consideration to suffer damage due to exposure

(Sensitivity - Adaptive Capacity)

Degree to which the system under consideration is affected by a change

Potential of the system to adapt to climatic hazards or to react adequately to them

The direct operational exposure of the economic unit under consideration (e.g. the operating facilities of an enterprise) is generally only part of the hazard potential at risk. Climate-related consequences can also result from impairments of the entire value chain (suppliers, resources and inputs, logistics, consumers) as well as indirect effects on the socio-economic environment. From the interaction of these factors it is finally possible to estimate the extent of the possible damage and the resulting financial effects on sales, operating expenses, capital expenditure and the procurement of capital.

Key Message

Value chain of the customer	Mögliche finanzielle Auswirkungen
Supply chain • Change in quantity and price of resources required **Logistics** • Faults & interruptions **Operational operation** • Interruptions and productivity losses • Damage to plant and equipment **Markets** • Changes in demand for products & services	**Balance sheet** • Value adjustment on property, plant and equipment and intangible assets • Impact on investments • Difficult capital procurement • Higher financing costs **Income statement** • Decreased sales due to declining unit numbers and prices • Increased operating expenses
Socio-economic environment	

The assessment of physical climate risks therefore requires a forward-looking analysis of climate-change-related hazards and socio-economic aspects on short to long-term time scales. The effects of physical climate risks can already be observed today and will continue due to the inertia of the climate system due to the anthropogenic emissions that have already occurred; they will increase further in the next 10 - 20 years. For longer-term time horizons, scenario analyses of socio-economic development and mitigation and adaptation to climate change impacts must therefore also be included in the risk assessment.

Further reading:

Final Report: *Recommendations of the Task Force on Climate-related Financial Disclosures* (TCFD, Juni 2017)

Getting started on physical climate risk analysis in finance - available approaches and the way forward (Institute for Climate Economics, Dezember 2018)

Shades of Climate Risk: Categorizing climate risk for investors (CICERO, February 2017)

https://www.physicalclimaterisk.com/knowledge-hub/

2 WHY IS THE CONSIDERATION OF PHYSICAL RISKS RELEVANT FOR FINANCIAL INSTITUTIONS?

Physical risks can spread to the financial sector via the value chains of their business partners. If the possible financial effects are insured, this has a direct impact on the business model and risk management of the insurers. If this is not (completely) the case the losses have to be borne by households, companies and governments, which in turn can have consequences for the valuation of financial institutions' positions - e.g. in the form of mortgages, corporate loans, project financing, bonds or shares. The risk of companies, credit institutions, banks and other investors depends in particular on the context and nature of their business activity (sector and region) and the composition of the portfolio (concentration of high-risk sectors/regions). Physical climate risks also mean growing investment opportunities in improved adaptability to climatic changes.

Examples of investment opportunities in relation to ...

- the management of existing or emerging climate risks
- Technologies for predicting availability and improving the efficiency in the use of natural resources such as water
- Consulting services for the selection of production locations and for the construction of infrastructure resistant to extreme weather conditions

- the development of new products and services due to changes in the needs of customers
- Demand-driven services to optimize energy consumption due to temperature fluctuations

Main reasons for addressing physical climate risks and adaptability to changing climatic conditions:

1. Financial impacts (credit/market/operational/strategic/reputation/capital market risk)
2. Regulatory developments and requirements (TCFD, non-binding guidance on non-financial reporting, CRR II, recommendations of the NGFS)
3. Rising expectations and pressure from key stakeholders
4. Fiduciary obligations
5. Additional investment opportunities

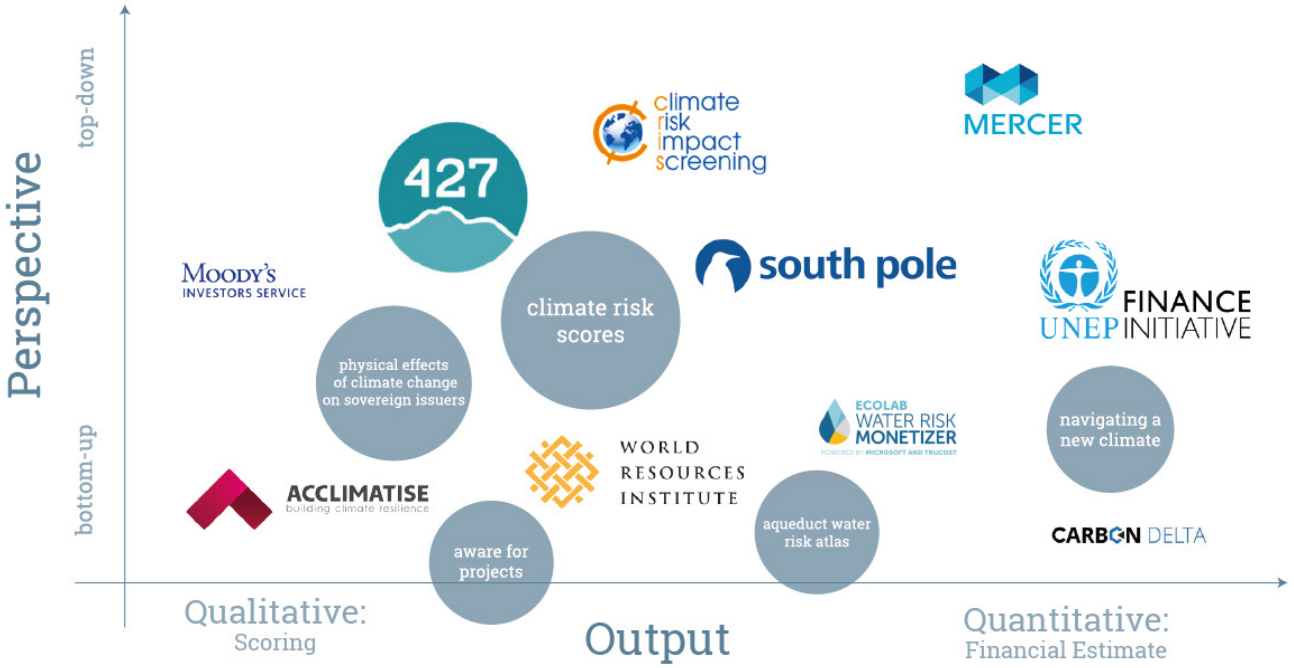
Further reading:
An Investor Guide to Physical Climate Risks & Resilience: An Introduction (Global Adaptation & Resilience Investment Working Group, Dezember 2017) Advancing TCFD guidance on physical climate risk and opportunities (EBRD and Global Centre of Excellence on Climate Adaptation, Mai 2018) Navigating A New Climate
(UNEP Finance Initiative - Acclimatise, July 2018)

3 APPROACHES AND CHALLENGES

Available model approaches tailored to financial institutions for the analysis of physical climate risks are still relatively limited in number and in most cases developed by specialised service providers. As a rule, these are subject to a fee, aim at different applications and users for different institutes and try to answer the question to what extent climate change can potentially influence counterparties such as projects, companies or governments. Depending on the approach, only certain counterparties and aspects of possible impacts are considered.

Applications range from the preliminary assessment of projects (e.g. for development banks), the extension of existing risk methods (e.g. to enrich credit assessments), the assessment of exposure and susceptibility to a specific climate hazard (e.g. water shortage), to the analysis of the climate risk for large portfolios (exposure to hazards and possible effects on counterparties). Even if the models tackle the same kind of questions, the comparability of their results is limited due to the broad spectrum of possi-

bilities, different methodological assumptions, limited transparency with regard to the data bases used and differing levels of detail of information provided to the user. Existing approaches provide either a qualitative risk assessment (usually as scoring) or quantitative financial estimates (impact on costs or assets). The results obtained may also differ in the degree of detail (sector, region, asset class, counterparty, element of the value chain), the type of climate hazards considered, time horizon and the possible consideration of climate scenarios.



A central challenge is the - in contrast to climate data - still significantly limited availability of company data. While the exposure of operational processes and the downstream added value is considered on a company-specific basis (investment capital, sales markets), the supply chain is always analysed on the basis of sector data and the socio-economic environment is only rarely explicitly addressed. Similarly, the susceptibility to damage has so far been assessed at sectoral level and the effects of adaptive capacities of companies have not yet been incorporated.

Further food for thought and career opportunities

AR5 Climate Change 2014: Impacts, Adaptation, and Vulnerability
https://www.ipcc.ch/report/ar5/wg2/ (IPCC Working Group II Contribution, 2014)

Climate Change Knowledge Portal
https://climateknowledgeportal.worldbank.org/ (World Bank Group)

> Notre Dame Global Adaptation Initiative (ND-GAIN)
> https://gain.nd.edu/
>
> The International Disaster Database (EM-DAT)
> https://www.emdat.be/

In order to enable financial institutions to carry out their own analyses for the evaluation of the physical climate-related risk of portfolios - with an initial focus on the risk of extreme losses - it is necessary for companies in the real economy to provide consistent and detailed information on the geographical location (at least by country) of their production sites, sales markets and key suppliers. This would also make it possible to identify geographical concentration risks arising from the composition of the portfolio and the underlying assets. Effects should at least take into account the expected average life of the investments and loans and the likely duration of customer relationships.
Furthermore, companies should provide more detailed information on historical effects of extreme weather events/fluctuations (e.g. impaired businesses, revenue losses, repair costs, insurance benefits) as these can provide an important starting point to gain a better understanding of the very demanding projection of future events.
So where could financial institutions start a first thematic approach? The first step is focusing on an „interesting" portfolio in order to make a first qualitative inventory of potential climatic hazards and identify the main risk drivers, initially at the level of the industrial sector and region and on the basis of publicly available data (e.g. the aforementioned ND-GAIN or CICERO) and studies (e.g. UBA Vulnerability Analysis 2015). For the hot spots identified in this way, a needs-based and more detailed analysis can then be carried out in a next step (e.g. overview analysis of data availability and data quality along the value creation chain, consideration of available loss functions and impact models for risk quantification, estimation of trends for key drivers and indicators under established climate change scenarios). The focus should be on the development of a systematic approach and transparency regarding methodological simplifications and uncertainties, since in this way the foundation for future consideration of new findings and further developments can be laid.

4 CONCLUSION

Many of the effects of climate change that scientists originally expected to happen in decades from now are already being observed today and will continue to increase in the near future, even if greenhouse gas emissions are significantly reduced. For financial institutions, these physical risks can be felt in particular through their consequences along the entire value chain for their equity holdings and business counterparties/customers. In addition to potential financial effects, anticipated regulatory requirements, growing pressure from important interest groups, fiduciary obligations, but also the identification of new investment opportunities and customer needs are important reasons for the increasing relevance of this topic. Model approaches for physical climate-related risk analysis are still relatively limited in number and are often used by companies only for exploratory purposes. In any case, the development towards a comprehensive and meaningful integration of (physical) climate risk analysis into the decision-making processes of financial institutions has only just begun.

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