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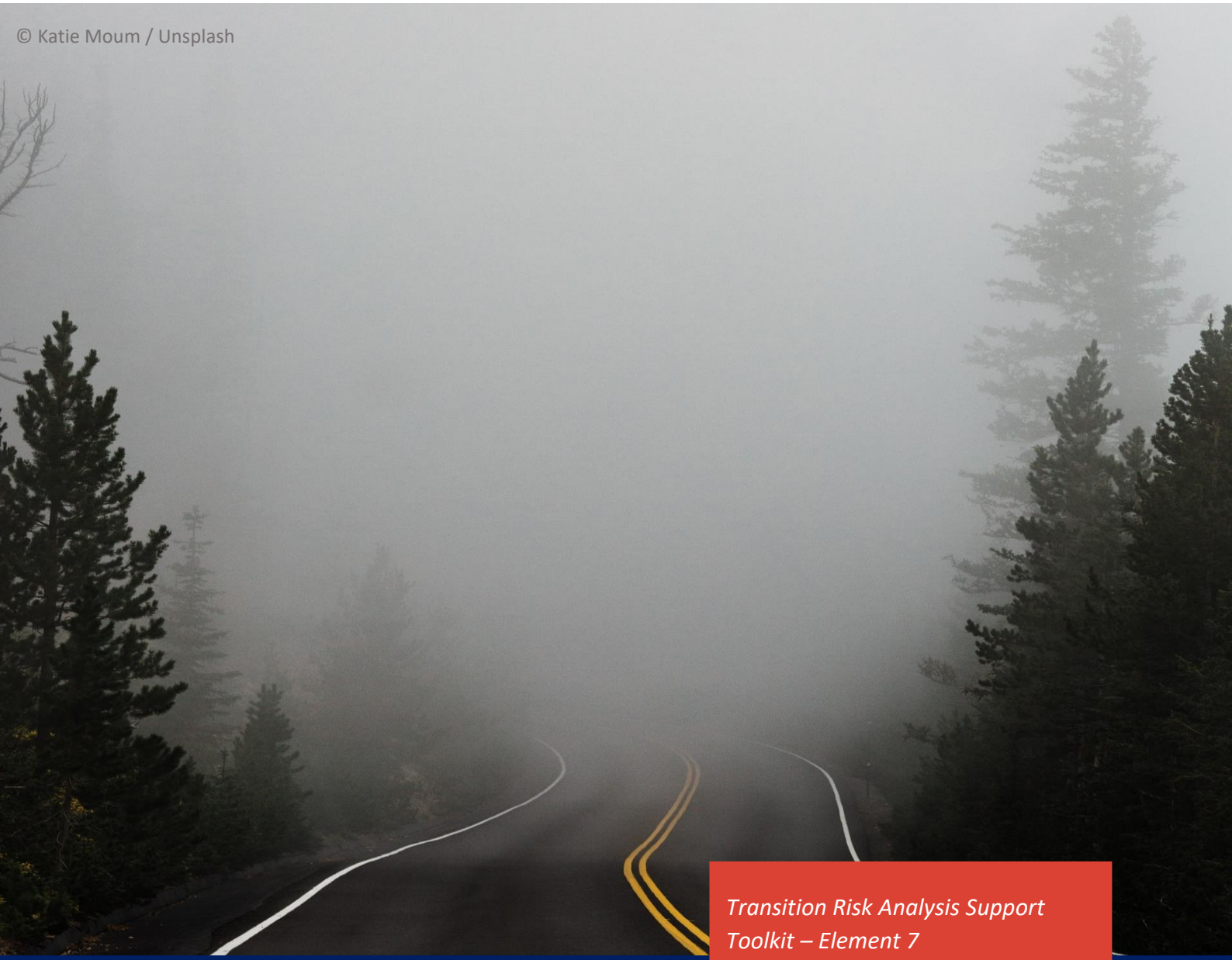

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Transition Risk Analysis Support Toolkit – Element 7

Using scenarios to understand transition risk

DNA Economics

21/12/2021

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1. Introduction

Some level of climate change is inevitable and will have significant environmental, economic and social impacts. The 2018 IPCC special report *Global Warming of 1.5°C* warns that the level at which climate change needs to be contained by 2100 to avoid catastrophic impacts is lower than previously believed. If the impacts of climate change are to remain manageable, net carbon dioxide (CO2) emissions from human activities must be zero by 2050 (IPCC, 2018).

The impact that climate change will have on organisations will depend on the speed of the response to contain climate change, the level of climate change that materialises, and efforts to adapt to climate change. All three of these factors present risks that organisations and investors need to consider carefully (TCFD, 2017).Identifying and quantifying expected impacts are complicated by the uncertain nature of climate risks (see Section 2). Internationally, organisations have started using scenario analysis to overcome this barrier and inform decision-making. In South Africa this practice is relatively new, although useful examples are starting to emerge.

This document motivates for the use of scenario analysis in climate-related financial disclosure among South African-based financial institutions. It introduces the use of scenario analysis in climate-related financial impact analysis and is intended to illustrate the value of this technique in financial disclosures. It provides elementary tools that organisations can adopt contains useful resources that organisations can access to better understand scenario analysis. It is hoped that this will encourage institutions to start engaging with scenario analysis to understand their climate-related risks and opportunities better. **It is intended as background reading for readers who wish to access more advanced material on the use of scenarios in climate-related risk and opportunity analysis developed as part of the same South Africa-UK PACT-funded project.** The material, a training workshop and best-practice disclosure example, are available here.[1]

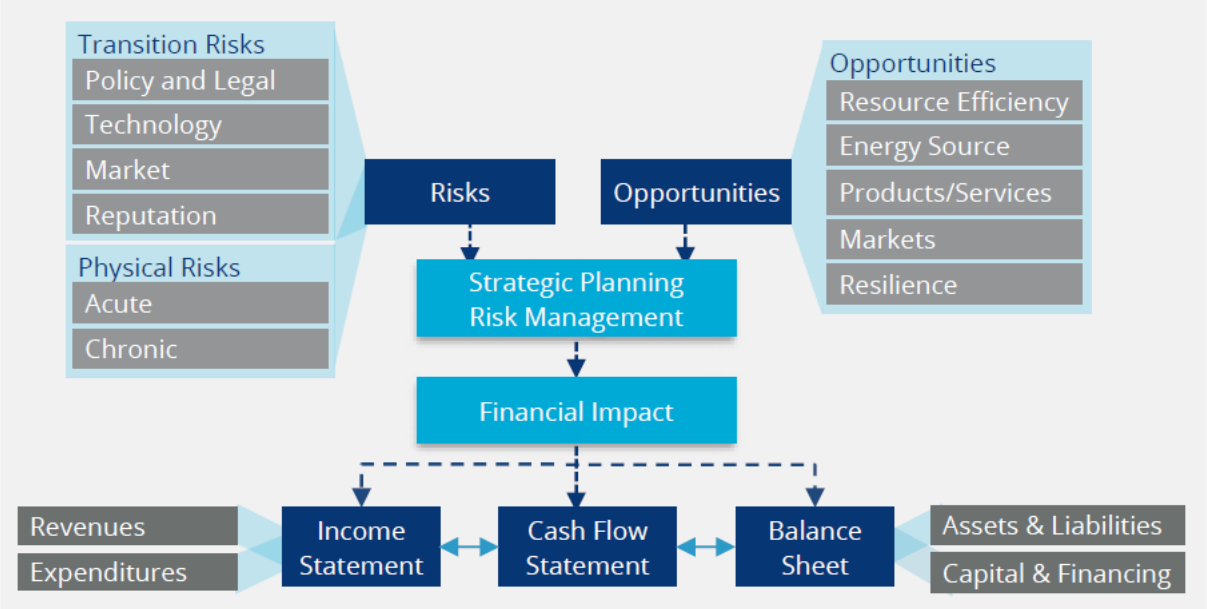
The remainder of this document is structured as follows: Section 2 discusses the nature of climate risks, while the following section explains what climate scenarios are. Section 4 highlights the usefulness of scenario analysis. Section 5 discusses different approaches to scenario analysis and Section 6 advises on how to approach a scenario exercise. Section 7 provides examples of scenario analysis in practice. Section 8 lists the sources referenced in this document, and additional resources that can assist organisations to undertake scenario analysis are included in Section 9.

[1] This document forms part of a larger *Transition Risk Analysis Support Toolkit*. An introduction to the Toolkit with a description of its other components is available at: www.dnaeconomics.com/pages/sa_climate_disclosure/

2. The nature of climate risks

Climate risks originate from two sources. **Transition risks** refer to market and technology shifts, policy and legal and reputation that will affect the value of entities, investments, and portfolios. **Physical risks** refer to the impact of physical changes (such as droughts, floods, increased temperatures, etc.) on the financial performance of an entity (TCFD, 2017). Efforts to contain climate change can also bring about **opportunities** that companies can seize which include resource efficiency, alternative green energy, introduction of new products and services, markets and being more resilient.

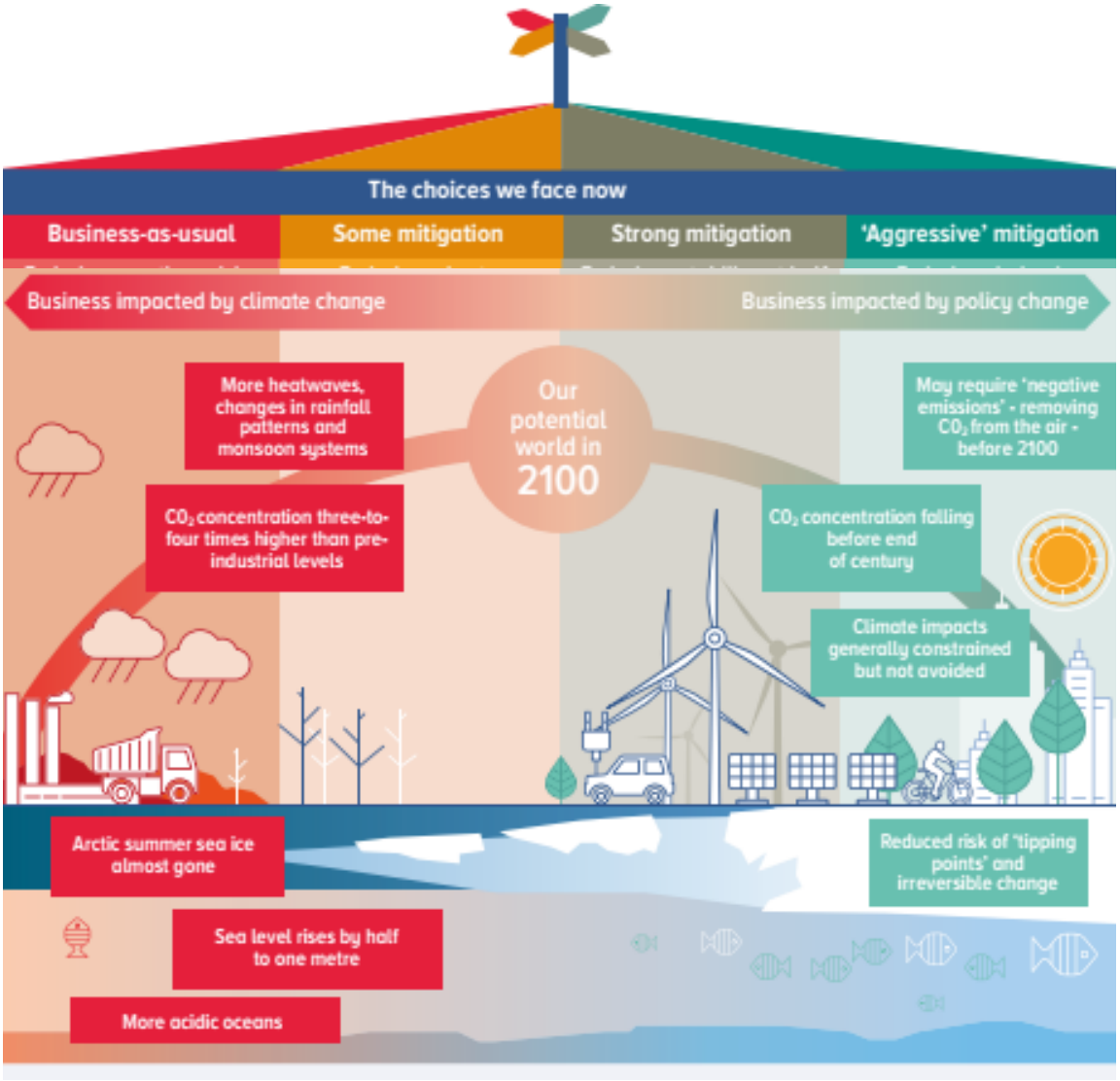
Figure 1: Climate-related financial risks and opportunities



Source: (TCFD, 2017b)

These transition risks, physical risks and climate-related opportunities are interlinked in that a timeous and strong policy response increases transition risks but decreases physical risk, and *vice versa*. The trade-off between physical and transition risks also impacts opportunities, in that a word with higher transition risks will also bring more opportunities related to the low-carbon transition, whereas a world with higher physical risk will bring greater opportunities in terms of adapting to climate change (provided that catastrophic climate change can be avoided). This trade-off between climate change mitigation and adaption is illustrated in the figure below:

Figure 2: The trade-off between physical and transition risk



Source: (IIGCC, 2019)

Estimating the impact of climate change on organisations is complicated by the fact that **the policy response to climate change is uncertain**. It is thus not clear how transition and physical risks will evolve. Current economic structures, arrangements and practices also impact the scale of both transition and physical risks and **impacts will differ by business type and sector** (TCFD, 2017b)**.** A myriad of factors affect how institutions are impacted, including, for example: low carbon inputs and technologies available to them, competition from lower carbon products and services, ability to pass on carbon costs, vulnerability to and ability to deal with physical impacts, etc.

In addition to policy and economic uncertainty, climate change as a physical process also has several characteristics that make it difficult to accurately predict what its impacts will be. Climate change, by its very nature, is:

- **Novel, unprecedented and uncertain**: the effects of climate change do not have a precedent and cannot rely on historical data to determine the future trajectory. Climate change is dynamic and uncertain and the required mitigation responses are equally complex with many unknowns (TCFD, 2020; Carney, 2021).
- **Location-specific**: the effects of the risks will occur on **local, regional, and global scale**, with different implications for different businesses, products and services, markets, operations, and value chains among others (TCFD, 2020).
- **Subject to changing magnitudes and non-linear dynamics**: climate related risks may manifest at different scales over time, with increasing severity and scope of impacts. Climate systems may exhibit thresholds and tipping points that result in large, long-term, abrupt, and possibly irreversible changes. It is important to understand these sensitivities and the tipping points within ecosystems and societies (TCFD, 2020).
- **Spread over the long-term horizon** given that the interventions implemented in the present will determine the severity of risks in the years ahead. These time horizons are likely to stretch beyond traditional business planning and investment cycles (Carney, 2021; TCFD, 2020).
- **Far reaching in breadth and magnitude** and will affect all the players along the supply chain even if they are in different locations, although the impacts will differ (Carney, 2021).
- **Prone to creating interconnected and systemic effects**: risks associated with climate change are interconnected across socioeconomic and financial systems. Such interconnected risks are often characterised by knock-on effects and systemic effects, requiring multidimensional perspective to assess the short-, medium- and long-term implications for a company (TCFD, 2020). Importantly, there is need to adopt bottom-up approaches relative to top-down approaches (Carney, 2021).

The compounding uncertainties involved in estimating the future impacts of climate change make it a much more complex issue than the conventional risks that companies typically contend with. Companies and investors will find it challenging to assess financial risks using standard methods such as stress testing. **To understand the financial implications of climate-related risks and opportunities, it is not sufficient to look at static historical factors like carbon intensity, but a forward-looking assessment of an institutions response to climate change, the evolving nature of the markets in operates in, the policies it and its competitors are and will be subjected to, and the broader international climate change response needs to be considered.** Such an analysis will allow an accurate assessment of an institution's resilience to both physical and transition risks and its ability to exploit climate-related opportunities (Carney, 2021).

Investors and asset managers are increasingly turning to scenario analysis as a tool to deal with this s complexity (Vivid Economics, 2021)**.**

3. What are scenarios?

The Task Force on Climate-related Financial Disclosure (TCFD) describes a scenario as a path of development that leads to a particular outcome. There is a misconception that scenarios should be used to present a full description of the future. Instead, scenarios should be used to highlight the central elements of a possible future, and to draw attention to the **key factors** that will drive future developments or outcomes (TCFD, 2017b). Scenarios are different from forecasts, predictions and sensitivity analysis in that they challenge traditional wisdom about the future by highlighting a range of future outcomes or identifying the range of actions or events required to reach a specific outcome (see Table 1).

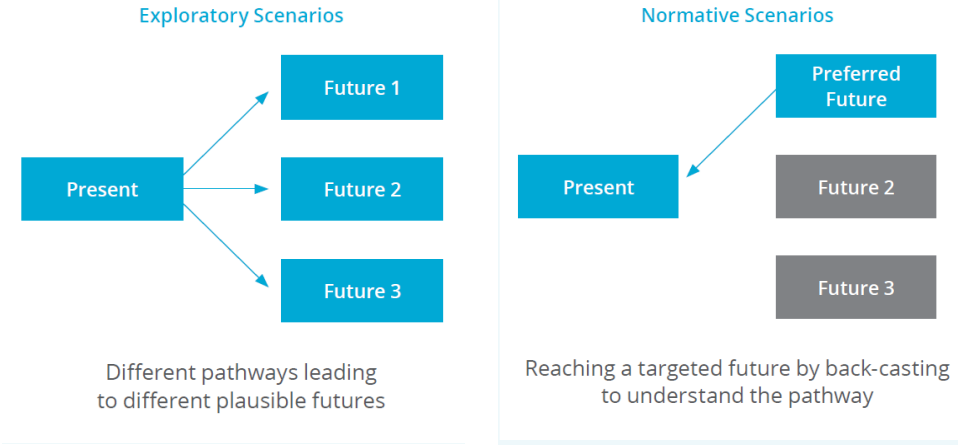
Table 1: Distinguishing between scenarios, sensitivity analysis and stress tests

	Definition
Scenario	A scenario is a possible future environment at a point in time or over a period. One or more events or changes in circumstances may be forecast, often over multiple time periods. Scenarios involve changes to, and interactions among many factors over time. It can be helpful in scenario analysis to provide a narrative to support the scenario and put it in context.
Sensitivity analysis	The effect of a set of alterative assumptions regarding a future environment. A scenario used for sensitivity testing usually represents a relatively small change in these risk factors or their likelihood of occurrence.
Stress test	A projection of the financial condition of a firm or economy, under a specific set of severely adverse conditions. This may result in several risk factors over multiple periods of time, or one risk factor that is short in duration.

Source: (IIGCC, 2019)

Scenarios can be categorised as either exploratory or normative. The former explores a range of different possible futures, while the latter defines a path towards a preferred future (TCFD, 2021b). With exploratory scenarios, organisations can explore a wide range of plausible future states and assess the potential uncertainties and test the resilience of various strategies against these future states. Normative scenarios start with a preferred or desired future and works backwards to inform the decisions or outcomes need to achieve this future. Often, companies apply both approaches e.g., using exploratory scenarios when testing their strategies for resilience and using scenarios normative for setting specific long-term targets such as net-zero emissions by a desired date.

Figure 1: Exploratory vs Normative scenarios



Source: (TCFD, 2021b)

Scenarios typically include 12 key characteristics that can also be used to assess the quality of a particular set of scenarios (TCFD, 2017b; A4S, 2021). The TCFD identifies the characteristics in red as the minimum requirements of a sound scenario.

Figure 4: Factors to consider in developing scenarios

#	Factor	Check that the Scenario Narrative:
1	Time Horizon	Has a future cutoff time that is sufficiently in the future (e.g., 2030, 2050, 2100)
2	Focal Question	Has well-formulated and focused critical question(s) or potential decision(s) the company seeks to assess by scenario analysis
3	Driving Forces	Has a clearly articulated set of underlying causes of change in relation to the focal question, and that these driving forces derive from external social, technological, economic, environmental, and policy processes
4	Scenario Logic	Has a clearly stated relationship between various drivers and change, including the causal assumptions underlying the described relationship, and an internal consistency between various statements and assumptions that underpin the scenario storyline
5	Pathways	Has a clearly described trajectory between the present and the future outcome of the scenario that results from the drivers and related cause-effect relationships laid out by the scenario logic
6	Uncertainties	Has explicitly described the uncertainties and their sources surrounding how drivers may play out
7	Storyline	Presents a seamless and integrated narrative describing the causal train of events (pathways) and underlying drivers, assumptions, and affected systems
8	Plausibility	Is possible and credible as to the events it describes
9	Distinctive/ Diverse	Focuses on different assumptions about key driving forces in each scenario, and should have enough scenarios to provide diversity in pathways and outcomes
10	Consistency	Is consistent in the application of the scenario logic between scenarios
11	Relevance	Contributes insight into the futures that relate to the strategic and/or financial decisions facing a company
12	Challenging	Challenges conventional wisdom and simplistic assumptions about the future

Source: (A4S, 2021)

4. Why use scenario analysis to support climate-related financial disclosure?

Scenario analysis has been around for a long time and is employed to develop strategic plans that are flexible or robust to a range of plausible future states (TCFD, 2017b)**.** While organisations have used scenario analysis to inform their **strategic thinking** and **strategy formulation**, scenario analysis is also used to **set long-term targets**. The TCFD recommends using scenarios to test the resilience of organisational strategy to climate change as part of its Strategy disclosure pillar (see **Table 2** overleaf). In this way, organisations can better understand resilience and explores alternatives that can alter the basis for "business-as-usual" assumptions.

Scenario analysis is "*[the] process for identifying and assessing a potential range of outcomes of future events under conditions of uncertainty. In the case of climate change, for example, scenarios allow an organization to explore and develop an understanding of how the physical and transition risks of climate change may impact its businesses, strategies, and financial performance over time"*. The process for scenario analysis requires (i) risk identification, (ii) risk assessment and (iii) risk response

Source: (TCFD, 2020; TCFD, 2021, p. 102).

Climate resilience speaks to businesses developing adaptive capacity to better manage the associated risks and take advantage of the opportunities brought by the transition to a net-zero carbon economy (TCFD, 2020). The concept of climate resilience involves organizations developing adaptive capacity to respond.

"[A] resilient strategy should describe the characteristics of their strategies that allow them to adapt to climate-related changes materially affecting their business while maintaining operations and profitability and safeguarding people, assets, and overall reputation"

Source: (TCFD, 2020).

Table 2 The TCFD's recommended four core elements of climate-related financial disclosure

Governance	Strategy	Risk Management	Metrics and Targets
Disclose the organization's governance around climate-related risks and opportunities	Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material	Disclose how the organization identifies, assesses, and manages climate-related risks	Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material
Recommended Disclosures: a) Describe the board's oversight of climate-related risks and opportunities. b) Describe management's role in assessing and managing climate-related risks and opportunities.	**Recommended Disclosures** a) Describe the climate-related risks and opportunities the organization has identified over the short-, medium-, and long term. b) Describe the impact of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning. c) **Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.**	**Recommended Disclosures** a) Describe the organization's processes for identifying and assessing climate-related risks. b) Describe the organization's processes for managing climate-related risks. c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization's overall risk management.	**Recommended Disclosures** a) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process. b) Disclose Scope 1, Scope 2, and, if appropriate, Scope 3 greenhouse gas (GHG) emissions, and the related risks. c) Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.

(TCFD, 2017a)

Unlike the TCFD, the PRI explicitly considers scenario analysis to be a component of risk management. The organisation believes that investors should assess the resilience of portfolio companies to climate risks using scenario analysis (and proposes using the Network for Greening the Financial System (NGFS) scenarios for this purpose. Likewise, the investors should encourage portfolio companies to disclose the resilience of their business models to different climate-related risks and pathways (PRI, 2021).

By undertaking scenario analysis, a business is better positioned to identify the risks and opportunities it faces in future, and in doing so, developing a more robust strategic direction. **A resilient strategy can position the company to tolerate or adapt to changes and uncertainties in the business environment and remain effective under most situations and conditions**.

The table below illustrates how scenario analysis can contribute towards developing a resilient enterprise by looking at the three components of resilience – resistance, recovery, and robustness (A4S, 2021).

Table 3: Scenario analysis and company resilience

Type	Resilience characteristics	How scenario analysis contributes for resilience
Resistance	The capacity of a business to maintain desirable operation and financial performance actively or passively in the face of change	Offers a perspective on how strategies and decisions would perform in different climate-related scenarios
Recovery	The time taken for a business's operational and financial performance to recover to desired levels following adverse changes	Helps in developing mitigation plans in response to risks and opportunities identified and reduces the likelihood of surprises
Robustness	The probability that a business will not cross an undesirable (and possibly irreversible) performance threshold following adverse change.	Aids to broaden strategic thinking to better prepare when faced with various plausible futures.

Source: **(A4S, 2021)**

Scenario analysis can assist organisations to frame and assess the potential range of plausible business, strategic, and financial impacts from climate change, along with the associated actions that may be needed in strategic and financial plans (TCFD, 2017b)**.** Scenario analysis is especially important given the disruptive and uncertain nature of climate risks described in Section 2.

Scenario analysis can assist organisations to identify indicators to monitor the external environment and signal when the environment is moving towards a different scenario state (or to a different stage along a scenario path). This allows organisations the opportunity to reassess and adjust their strategies and financial plans accordingly. For investors, scenario analysis can assist in understanding the robustness of organisations' strategies and financial plans and in comparing risks and opportunities across organisations. Indeed, expert users often find a company's description of how climate-related risks and opportunities have affected its business and strategy as the most informative component of climate-related financial disclosures (A4S, 2021).

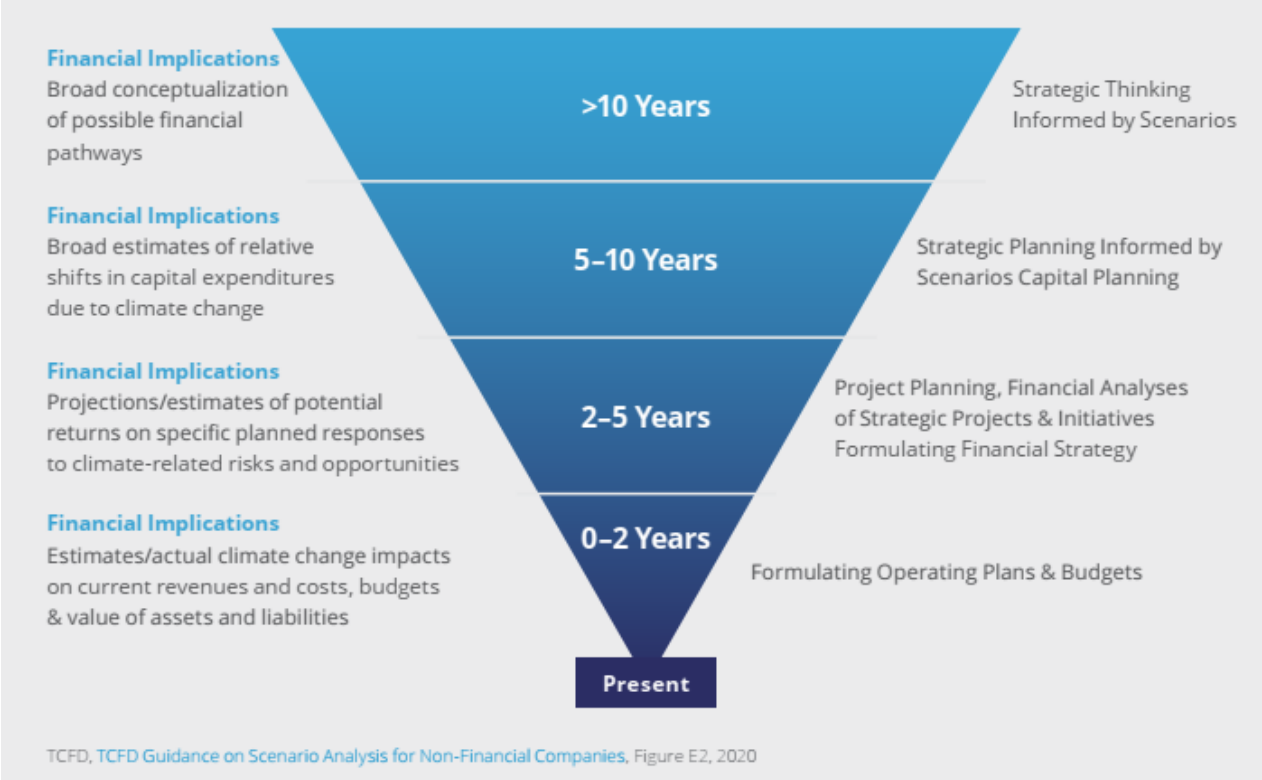
The objective of scenario analysis can be summed up into four components (A4S, 2021). First, scenario analysis aims to assist asset owners (or fudiciary managers) to understand the impact of climate change on overall solvency. Second, it assists asset owners and fund managers to incorporate climate change in the selection of investments. Third, investors are equipped to assess risks and /or opportunities to financial performance of portfolios, sectors or individual assets. Lastly, it supports various stakeholders in appreciating a company's alignment to a net-zero emissions future. These are summarised in the table below.

Table 4: High-level objectives of scenario analysis for institutional investors

Objective	Most relevant to	Feeds into
1. Understand impact of climate change on overall solvency, ability to pay liabilities.	Asset owner / fiduciary manager	Asset liability management.
2. Incorporate climate change into selection of investments.	Asset owner / fiduciary manager Fund of funds manager.	Strategic asset allocation, manager selection.
3. Assess risks / opportunities to financial performance of portfolios, sectors or individual assets.	All investors (asset owners and asset managers).	ESG integration processes, identification of investment opportunities, engagement / proxy voting.
4. Alignment to a 2°C or lower future.	Asset owners with specific climate investment beliefs or objectives. Mission or values-driven institutions, such as endowments. Asset managers designing products.	Depends on approach taken.
Source: **(IIGCC, 2019)**		

Assessing the potential financial impacts of climate-related risks and opportunities is difficult, but possible. In the short-to-medium term, the financial effects of a company's strategy can be quantified based on revenue and costs, budgets and value of assets and liabilities. However, in the longer term, the reporting can be presented as broad financial pathways or directional shifts in capital expenditures informed by forward-looking scenarios (TCFD, 2021). Below is an illustration of how companies can approach the assessment and reporting on the potential financial impacts.

Figure 2: Assessing Potential Financial Impacts



Source: (TCFD, 2021)

When reporting on scenario analysis, companies should be careful about making general claims of resilience that are not clearly and logically rooted in clear, consistent, and transparent use of scenarios (MIT, 2019)**.** Companies can utilise existing sources to support its approach to scenario analysis for climate-related financial disclosure such as those included in this document and the TCFD repository on Scenario Analysis.[2]

Even though scenario analysis is a useful tool for assessing climate-related financial disclosure, several drawbacks need to be mentioned and considered when undertaking scenarios. Modelling climate, energy, land use, and economic systems is inherently complex when each system is in isolation; to integrate these models is more complex yet. Each climate scenario will have its own set of temperature, emissions, and socioeconomic assumptions. Results will be sensitive to these assumptions (Vivid Economics, 2021). It is therefore important to always clearly

[2] https://www.tcfdhub.org/scenario-analysis/

disclose the assumptions, models and time periods when presenting the results of a scenario exercise.

5. Approaches to scenario analysis

There are many ways to undertake scenario analysis, ranging from basic narrative (qualitative) to sophisticated data-driven modelling exercises (quantitative). Qualitative assessments of transition risk by sector, for example, often rely on publicly available data and minimal modelling capacity. As the investors become more comfortable with scenario analysis, they can progress towards advanced methods of quantifying transition risks that can determine advanced metrics like net present value of impacts.

Data reported by FRC (2021) **shows that companies mostly undertake and report scenario analysis across three groups – comprehensive, targeted and tick box, each with decreasing level of detail and organisational coverage**. The comprehensive approach entails company-wide analysis across various climate impacts and is most suitable for carbon-intensive sectors. This approach is the most resource-intensive. The targeted approach focuses on a selected number of priority areas, assessing impacts with each iteration. This approach allows organisations to undertake deep and focused analysis. Lastly, the tick box approach aims to meet minimum disclosure expectations or requirements, and places little emphasis on strategic planning.

Figure 3: Three categories of approach to climate scenario analysis

Comprehensive	Targeted	Tick box
A comprehensive approach entails a company-wide analysis across a broad spectrum of climate impacts. This approach may be especially suited to carbon-intensive sectors that are set to undergo wide-reaching and fundamental changes during the global transition to net zero. However, this approach is resource-intensive and requires a high degree of climate literacy across the company.	A targeted approach focuses on a small number of priority areas and impacts in each iteration. These priorities may already be known or may be identified by the initial analysis. This allows sufficient focus for deep and rich analysis, while avoiding blind spots. As such, horizon scanning is a central task of each iteration, as this guides discussions on the focal areas for future iterations.	A tick box approach centres on meeting minimum disclosure expectations, placing little emphasis on strategic planning. This is the rarest approach among companies already conducting climate scenario analysis. A common view among interviewees was that pursuing a tick box approach is likely to be just as expensive as other approaches, because it depends on extensive external support rather than building internal capabilities.

Source: (FRC, 2021)

Conceptually, it is useful breaking down the continuum of scenario approaches into three approaches of varying complexity and resource requirements.[3]

Approach 1: Purely qualitative approach that is low cost and requires minimal time

Qualitative scenarios describe possible futures in the form of narrative texts or 'story-lines' that describe a logical and internally consistent sequence of events from the beginning to the end. As the future is inherently uncertain, these descriptions should explore different possible future states as they describe developments in the economic, technical, environmental, and social dimensions. This methodology entails extracting an overarching narrative from key scenario variables to inform qualitative risk disclosure. The qualitative narratives should identify and describe the drivers, constraints, assumptions, and logical relationships that lead to and define the hypothetical future (A4S, 2021).

The qualitative scenario narratives should be clear and comprehensive to facilitate their use and interpretation by external stakeholders such as investors. The scenarios' overall structure, internal logic, plausibility, and the likelihood of assumptions, should align with the twelve scenario characteristics identified in Section 3. The inputs include trajectories of key scenario outputs (such as carbon price and the energy mix) and exposure by sector.

The analysis from qualitative scenario analysis can yield qualitative risk rankings (low, medium, and high) by sector and time horizon, or directional outcomes (TCFD, 2021b; Vivid Economics, 2021). For instance, there may be an expected decline in demand or revenue for a portfolio under the tested scenario(s). This could identify areas where further analysis is required that could generate quantitative estimates of impacts (TCFD, 2021).

The qualitative approach requires low investments in time and cost and can be achieved using publicly available data. However, users are unable to quantify the net present value of the impacts, and it allows for minimal variation within high level sectors. Nonetheless, South African financial institutions can begin applying this approach using off-the-shelf scenario outputs.

[3] For practical examples of these approaches, please see the *Scenario Training Workshop* presented by Vivid Economics available at: http://www.dnaeconomics.com/pages/sa_climate_disclosure/

The current discussion focusses on using scenario analysis to consider transition risk. The three approaches can also be extended to consider the impact of physical risk or the impact impacts of transition and physical risk together. This, however, is beyond the scope of the current document.

Approach 2: A combination of qualitative and quantitative approach

This approach uses a combination of qualitative and quantitative approaches. For instance, financial institutions can extract total Scope 1 emissions and profits (measured by EBIDTA) for each of their clients in each sector. From there, the carbon price forecasts can be used to estimate the future share of earnings at risk of direct carbon costs. Preliminary scores can be assigned based on earnings at risk. These scores can be adjusted using qualitative insights from other scenario variables (Vivid Economics, 2021).

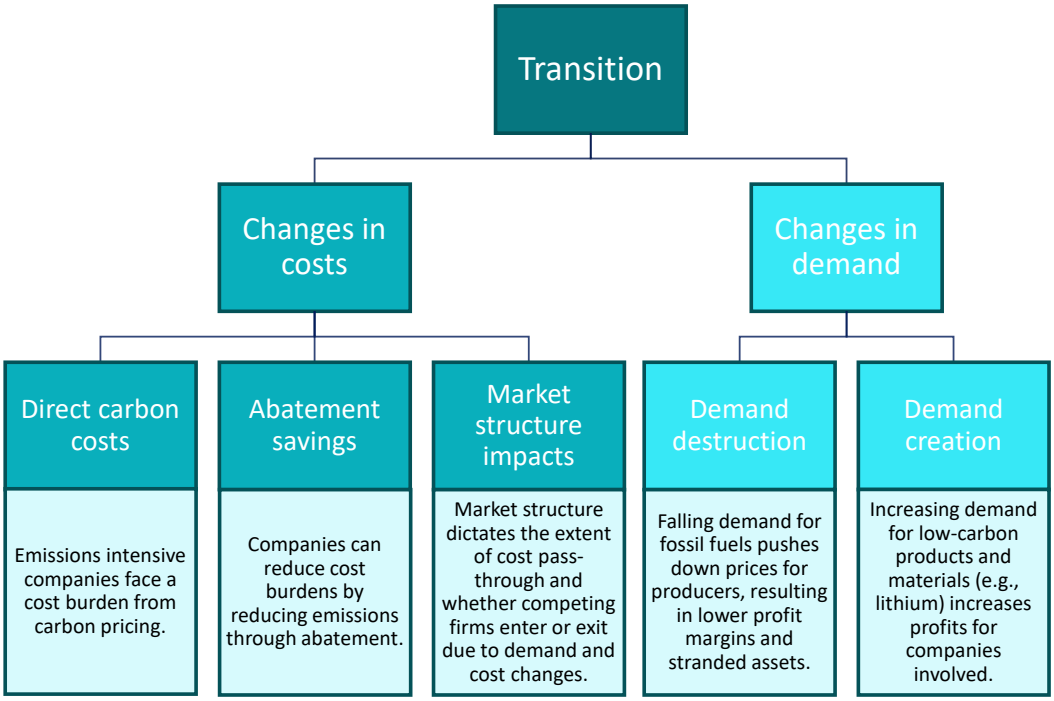
The inputs for this approach include (i) trajectories of key scenario outputs (e.g., carbon price, energy mix), (ii) client data on EBIDTA, emissions and revenue splits and (iii) level of exposure by sector. Like the first approach, the outputs include qualitative risk rankings (low, medium, and high) by sector and time horizon.

While this approach requires some data collection with respect to an entity's financials and emissions, along with some in-house modelling capacity, it improves the accuracy of assessing transition risk exposure by sector.

Approach 3: Using climate risk models

This approach provides the most reliable information but requires the most data collection and carries the highest time burden. Climate risk models are used to decompose net present value impacts into **impact channels and within each channel are transition specific variables**. The variables can be captured as changes costs and demand (see below). For instance, companies that are heavily reliant on fossil-based fuels are likely to face a higher burden on carbon pricing, which can be translated into a Rand amount.

Figure 4: Transition impacts can be disaggregated into five impact channels and within each channel are transition specific variables

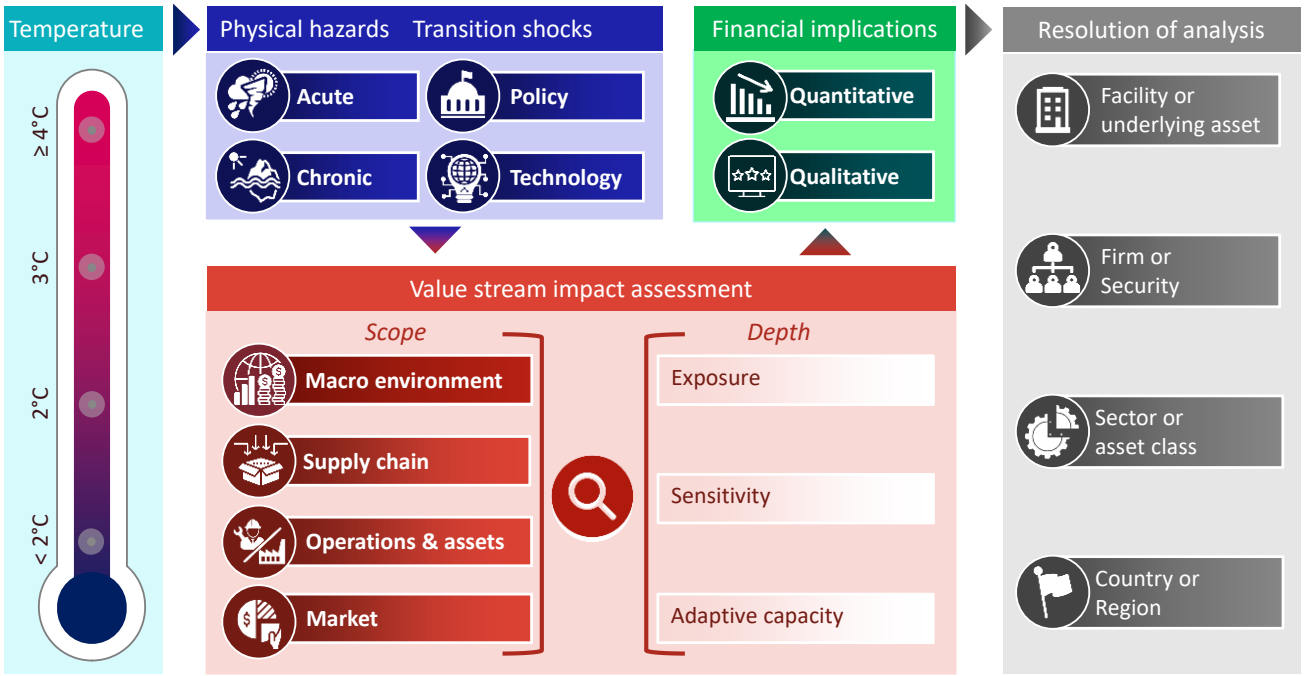


Source: (Vivid Economics, 2021)

Climate scenarios model how physical and transition risks impact different value streams and calculate the resulting implications (this is illustrated in Figure 5). The scenario analysis starts off with various temperature change scenarios – e.g., 1.5°C, 2°C or 4°C scenarios – and seeks to understand the likely pathways to a low carbon transition. The likely scenarios are then translated into the risks that accompany different temperature pathways: physical hazards relate to the acute and chronic physical risks (e.g., extreme weather events that can damage assets or disrupt supply chains), while transition shocks related to the policy, regulatory, technology or demand shocks (see **Figure 1**).

The value stream impact assessment considers two dimensions – the scope (or the breadth) and depth (or level of detail). In this way, the assessment can assess how the macro environment, supply chain, operations and assets and market will be impacted; and for each component, one can assess the level of exposure, sensitivity, and adaptive capacity. Notably, the financial implications can be captured using a balance of quantitative and qualitative indicators, given the nuance that qualitative information can provide. Lastly, the resolution of analysis will depend on the investor's perspective.

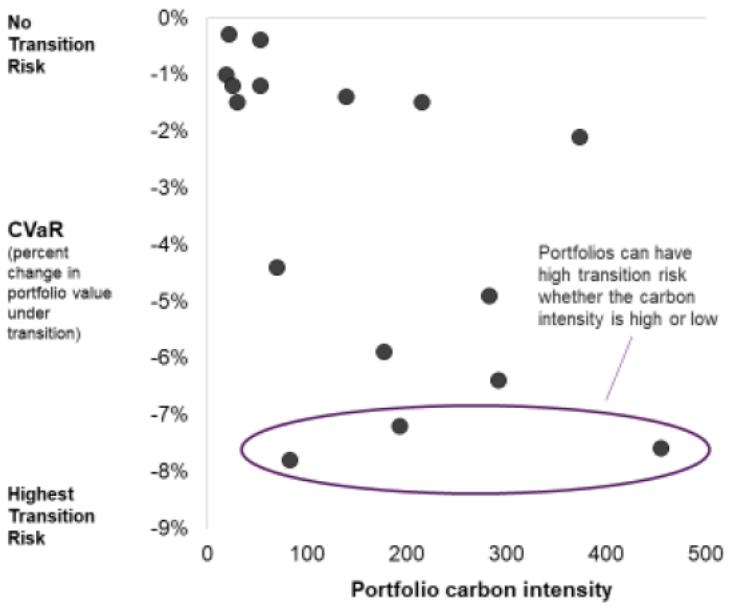
Figure 5: An illustration of how physical and transition risks impact different value streams



Source: (Vivid Economics, 2021)

The TCFD notes that there is a need to balance metrics that are backward-looking, with those that are forward-looking and climate or financial in nature. Measures on the financial impact, captured in the valuation of assets, are becoming more popular under a well below 2°C scenario. These financial impacts do not necessarily directly translate into climate-related metrics such as carbon intensity. For example, industries with an inelastic demand (or those that are regulated such as utilities) can pass through an additional carbon price to the consumers. This is not the case in other sectors where consumers are sensitive to price changes and where alternatives exist. This is illustrated below.

Figure 6: Differences between climate (carbon intensity) and financial metrics (carbon value at risk)



Source: (CFRF, 2021)

Due to the complexity of estimating financial impacts, it appears that companies use a combination of internal performance data, forecasts, organisation-specific scenarios, and external data for their analysis. Furthermore, the data collected along the supply chain or portfolios can also be used as input into the financial impact analysis (TCFD, 2021).

A report by the CDP found that 60% of financial companies in the international CDP 2020 dataset use scenario analysis to inform their strategy, including potential financial impact (TCFD, 2021).

Stakeholders interviewed as part of the CDP report in 2020 noted that the current climate models that are designed for policy and research purposes are often adapted to business-level scenario analysis. However, these cannot accurately scale to micro-analysis, while integrated financial models potentially offer a solution to this shortcoming as they combine multiple models and impact chains and assume more complex and non-linear relationships between variables (TCFD, 2021).

The data intensity of this approach allows the assessment to capture within- and cross-sectoral market spill over, and much more nuanced comparability between portfolio sectors. Financial institutions employing this approach are likely to require third-party modelling initially.

6. How to do scenario analysis

Preparing for scenario analysis

The TCFD developed a *Technical Supplement on the Use of Scenario Analysis in Disclosure of Climate-related Risks and Opportunities* (TCFD, 2017b). The Technical Supplement can be used by organisations to support the development of climate-related financial disclosures that align with the TCFD. The Technical Supplement is available here.[4]

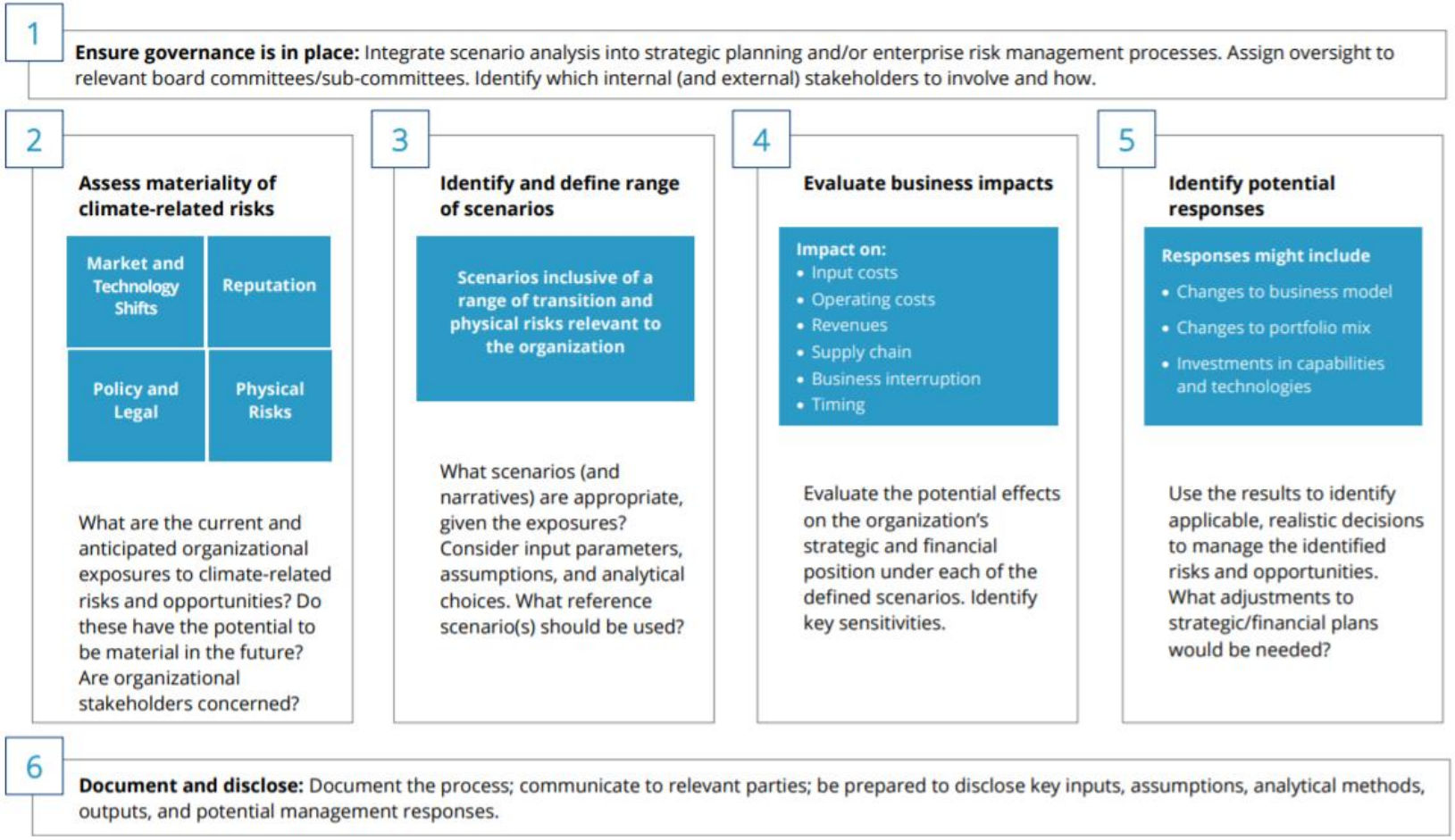
In selecting the approach to assessing transition risk exposure by sector, it is vital for **financial institutions to get the processing going, starting with applying Approach 1, which requires the least time and cost investment, and still provides organisations with vital qualitative information on risk disclosure.** The organisation can conduct research on existing scenarios and identify the ones that are most suitable to their need ad unit of analysis. For instance, the IEA and the IPCC have developed scenarios that are commonly employed by scientists and policy makers to assess future vulnerability to climate change (TCFD, 2017b). The NGFS scenarios developed more recently are also widely used for this purpose.

From there, the organisation needs to identify the climate-related risks and opportunities that it may be exposed to depending on different factors such as its: (i) geographic location, (ii) position in the value chain, (iii) assets and nature of operations, (iv) customers or market, and (v) other stakeholders. The impact on the business will also depend on the sectors or industries in which the business operates or has close interactions with (TCFD, 2017b).

Investors can apply scenario analysis depending on the intended purpose and the asset(s) being considered. For example, investors can examine energy transition pathways that are perceived to be optimal and/or likely and use them to measure the potential of different types of investment. Alternatively, investors can consider how different climate-related scenarios can affect the performance of an asset, sector, or region. From these analyses, investors can determine the relative expected risk-return profile of investments within a portfolio.

[4] https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Technical-Supplement-062917.pdf.

Figure 7: A process for applying scenario analysis to climate-related risks and 0pportunities



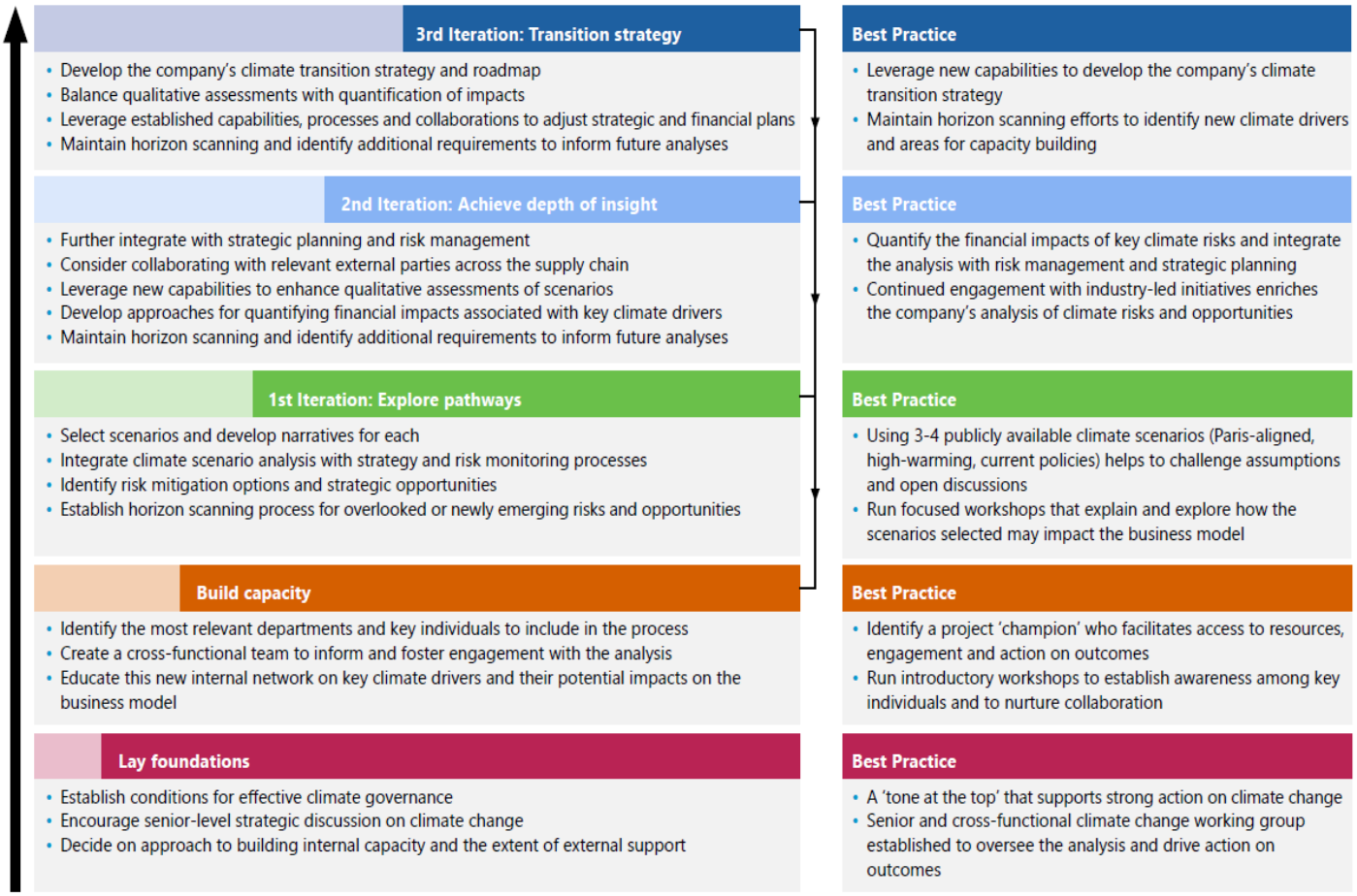
Source: (TCFD, 2017b)

There are four best practices that have emerged from existing research (FRC, 2021):

First, establish a climate change working group that creates the environment for effective climate governance. Senior-level staff with influence within the organisation should be part of the working group to ensure that the outcomes from climate scenario analysis are included in the strategic thinking and planning, and setting of metrics and targets.

Second, use the outcomes from the initial scenario analysis to shape future iterations. The first attempt at scenario analysis can contribute towards developing capabilities and identifying priority climate impacts to track. Going forward, the organisation should revisit the earlier iterations and refine the process in subsequent iterations. The figure below provides a model of how this can manifest.

Figure 8: Using the outcomes of climate scenario analysis to shape future iterations



Source: (FRC, 2021)

Third, the team undertaking scenario analysis should be well-versed with industry dynamics. Given the specificity of climate impacts, the team that is leading scenario analysis should be at the forefront of industry debates related to climate change and its impacts on the sector. In sectors such as utilities and financial services, where sector-specific scenarios already exist, should leverage existing scenarios and guidance. However, where such support does not exist, sector-specific workshops and initiatives to inform and guide the scenario development process will be necessary.

Lastly, climate scenario analysis should be used to develop transition strategies to manage climate risk. Integrating climate scenario analysis into strategic planning provides institutions with insight and value on how to determine and manage physical and transition risks. Given the resources required to develop a climate transition strategy, it is important for organisations to use the insights to develop a climate transition strategy and enhance business model resilience to a future reshaped by climate change.

Organisations should use climate scenarios to disclose how management perceives the business in the context of a dynamic environment that will evolve over time. Should any of the scenarios change with new information, the organisation will be better placed to respond to the expected changes identified. Some of the factors that need to be considered in developing scenarios are summarised in the box below.

Scenario analysis can be enhanced by following the following guidance:

- Scenarios help management to develop an agile mind-set. The focus should be on what plausible actions can be taken in response to events and do not report actions unlikely to be taken.
- The chosen scenarios will not always reflect what transpires and that is to be expected. The purpose of scenario analysis is instead to give comfort that a range of scenarios and outcomes are being considered. Disclosures of process, inputs, assumptions, actions and responses help investors obtain comfort over scenarios.
- All companies are affected by events or circumstances, but in different ways. Explain unique circumstances where relevant to users' understanding rather than providing generic scenarios and narrative.
- A scenario does not stand alone, it should be undertaken (and results disclosed) within a company's specific circumstances.
- Determining the future is not a perfect science and previous scenarios may not have been completely accurate. However, they should not be disregarded entirely as they are a vital source of information and learning. Explain how the scenario process has evolved (and is expected to continue evolving) over time.
- Be clear on the detail of a scenario exercise do not just state that one has taken place.

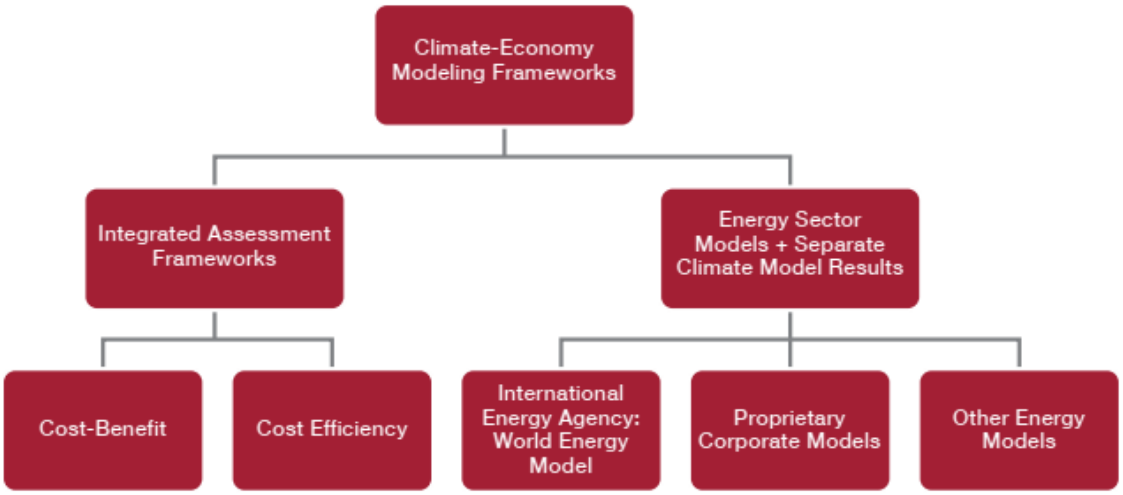
Source: (FRC, 2021)

Modelling scenario analysis

Models provide the scope, detail and outcomes of quantitative scenario exercises. Each scenario can be designed to model the transition to a low-GHG economy and represents relationships among overall economic activity, carbon-emitting activities (e.g. fossil-fuel use) and mitigation measures.

A lot of the existing models were designed for other purposes, unrelated to supporting corporate risk analysis and disclosure. Often, climate-economy models were developed to explore how policy can be used to attain certain goals and/or to assess the uncertainty embedded in technological assumptions. Oil and gas organisations mostly use the modelling frameworks that are outlined in the figure below, and available here.[5] While integrated assessment frameworks are designed to support studies looking at long-term climate influences and goals, energy sector models provide shorter-term simulations, focusing on fossil-fuel energy use and CO_2 emissions.

Figure 9: Climate-economy modelling frameworks used in Scenario Development



Source: (MIT, 2019)

[5] https://energy.mit.edu/publication/climate-related-financial-disclosures-the-use-of-scenarios/#:~:text=This%20MIT%20report%2C%20Climate%2DRelated,result%20of%20global%20climate%20change.

The choice of model is thus a critical decision when developing a scenario exercise, and three factors should be considered.

First, a key component of climate-economy modelling is determining the time horizon and models that are needed to underpin the analysis (FRC, 2021). While most companies employ horizons that align with existing planning cycles, such as, short (less than one year), medium (two to four years) and long-term (five to ten years). Time horizons spanning over 20 and 40 years, up to 2100, are common in climate modelling and can be used to challenge conventional thinking, and force users to think beyond what they see today.

Second, it is also important to identify the scenarios that are most relevant to the organisation's key climate drivers (FRC, 2021). Generally, organisations find it difficult to identify such scenarios. However, there are publicly available and widely used scenarios that focus on different areas and can be tailored for a particular need. Such scenarios include:

- Emissions pathways e.g. IPCC Representative Concentration Pathways (RCPs)
- Energy transition pathways e.g. those from IEA, IRENA and Bloomberg and the Deep Decarbonisation Pathways Project
- Socio-economic context e.g. the IPCC' Shared Socioeconomic Pathways (SSPs).

Lastly, the chosen scenarios should be relevant to the business (FRC, 2021). To identify the most relevant scenarios, most organisations rely on advice from industry bodies, their peers and external externals via forums like scenario development workshops. Ultimately, industry-led initiatives can drive the development of best practice climate scenarios.

Reporting on scenario analysis

The TCFD recommends transparency around the governance and management of scenario analysis. Companies should aim to disclose the internal processes, roles and responsibilities and flow of information associated with scenario analysis. This includes the role of different stakeholders, including the board, management and external parties involved in the process.

Investors are asking for greater comparability between scenarios, and this can only be assessed with greater transparency and harmonisation around companies' scenario processes and the disclosure of results (TCFD, 2021). Investors are interested in understanding the scenarios that companies utilise in assess the risks and opportunities presented by climate change. And, equally important, they want to understand what the outcome of the analysis implies for the company today, and in future.

A4S (2021) recommends that companies disclose the following information when reporting on the results of scenario exercises:

1. A **description of each scenario's narrative, time horizon, and endpoints** used by the company, with a rational of why those scenarios were selected for the analysis.
2. **Sources of the scenarios**, and where relevant, which scenarios within a scenario suite were used.
3. Important **features of the scenarios**, including the assumptions, limitations, key inputs to the models and drives
4. A **description of the pathways** in the scenarios **and the assumptions** involved and the relationship between the key drivers and their effects in the pathways
5. **Insights from the scenarios that are relevant to a business** such as change in demand for a product or service which may require the company to adapt and change its business model, impact on the effectiveness of the current or planned strategy or any operational changes that may be required in future.

7. Scenario disclosure case studies

This section provides examples of scenario analysis used in climate-related financial disclosure to illustrate the breadth of possible approaches and levels of disclosure that exists. For an example of a best-practice scenario analysis exercise undertaken on a portfolio of 55 of the largest companies on the JSE, please see (Vivid Economics, 2021a) available here.[6]

Shoprite

Company description: Shoprite Holdings Limited is an investment holding company whose combined subsidiaries constitute the largest fast moving consumer goods (FMCG) retail operation on the African continent. Its core business is in food retailing, complemented by furniture, pharmaceuticals, hospitality, ticketing, digital commerce, and financial and cellular services. Shoprite Holdings Limited is a public company listed on the Johannesburg Stock Exchange, with secondary listings on the Namibian and Zambian Stock Exchanges.

TCFD reporting: Shoprite discloses in line with the TCFD recommendations in the annual Sustainability Report, with the 2021 report available here.[7] The Sustainability Report is

[6] http://www.dnaeconomics.com/pages/sa_climate_disclosure

[7] https://www.shopriteholdings.co.za/sustainability/latest-sustainability-report.html.

accompanied by a Carbon Disclosure Report that collates information on how the Company collects information on how it measures and manages climate change, which is also available here.[8]

Scenario analysis: Shoprite Holdings employs qualitative and quantitative climate-related scenario analysis to inform its strategy. Specifically, the Company uses two scenarios. First, the Company uses IEA's Beyond 2°C Scenario (B2DS) that sets out a rapid decarbonisation pathway in line with international policy goals. Second, the Company uses the Nationally Determined Contributions (NDCs) that state a peak, plateau, and decline (PPD) greenhouse gas emissions trajectory range and considers associated policy instruments including the carbon tax and GHG reporting regulations.

Summary: Shoprite's scenarios are not provided in detail, and neither is information regarding their financial implications. But it has started engaging with scenario analysis as a way to understand climate risk, and its disclosure should thus be seen as a step in the right direction.

Ninety One

Company description: Ninety One is a global investment manager offering active strategies across equities, fixed income, multi-asset and alternatives to institutions, advisors and individual investors around the world. Established in South Africa in 1991, the independent firm has dual-listings in Johannesburg and London.

TCFD reporting: In 2020, Ninety One announced that the Company was working on their response to the TCFD recommendations. In the following year, Ninety One released a standalone TCFD report which includes both qualitative and quantitative disclosure. The disclosure report covers the four core elements of TCFD's recommended climate-related financial disclosure and is available here.[9]

Scenario analysis: Ninety One has been developing long-term scenario analysis to gauge how climate-related risks and opportunities will affect their business, available here.[10] The Company has been working with scientific-based institutions to assess and develop the necessary tools for scenario planning. While the use cases for the scenarios are still underdevelopment, Ninety One

[8] https://www.shopriteholdings.co.za/sustainability/latest-sustainability-report.html.

[9] https://ninetyone.com/en/south-africa/investor-relations/reports-and-presentations?ipnl=Financial+year+2021&subTab=Pillar+3+disclosures.

[10] https://ninetyone.com/-/media/documents/reports/91-tcfd-report-2020-en.pdf.

envisions that the scenarios will be used to speed up investment thinking and consider investment implications should specific conditions be met. Currently, three scenarios are being considered (Ninety One, 2020):

- Ambitious climate transition: on track to limit warming to well below 2 degrees by 2100
- Limited climate transition: on track to >2.6 degrees by 2100
- Backsliding scenario: on track to >3 degrees by 2100

Summary: Ninety One believes that its current scenario findings provide "questionable benefit for investors" (Ninety One, 2020), and as such has not provided additional detail on the scenarios or their expected financial impacts. It is, however, continuing to develop the scenarios and provides a good example of the iterative nature of scenario analysis. It also illustrates that there is no need to wait for a 'prefect' result before disclosing that scenario analysis is being undertaken. Ninety One is no doubt learning value lessons from the exercise, and the fact that it is engaging with scenario analysis should provide investors with confidence that Ninety One is engaging with climate risks and opportunities in a sophisticated and serious manner.

BlackRock

Company description: BlackRock, Inc. provides investment management services to institutional clients and to retail investors through various investment vehicles. The Company manages funds, as well as offers risk management services. BlackRock serves governments, companies, and foundations worldwide (Bloomberg, 2021a). It's primary listing is on the NYSE.

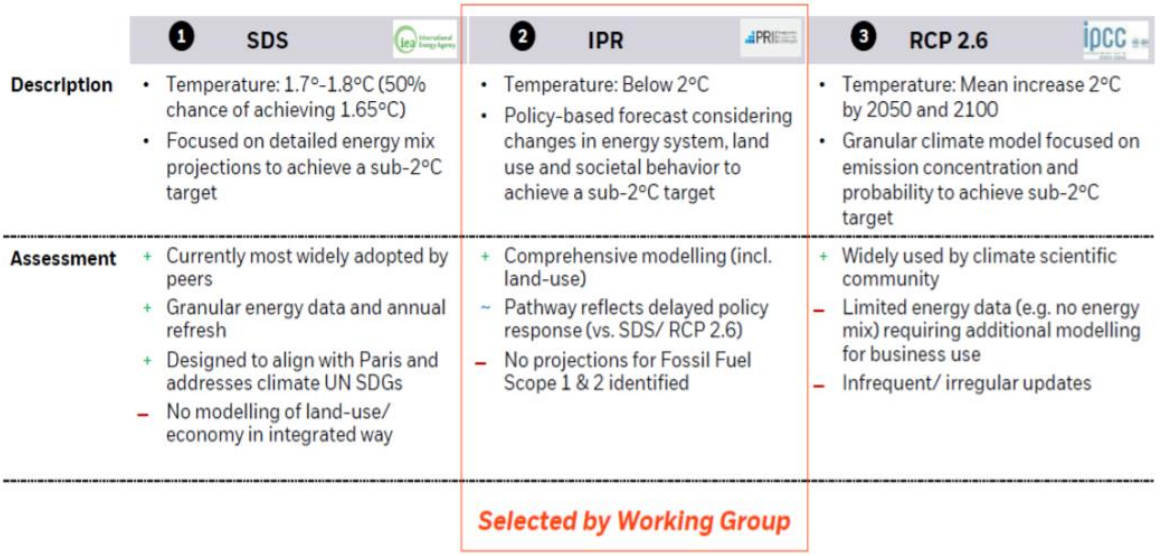
TCFD reporting: BlackRock conducted its first corporate climate-related scenario analysis exercise in 2020 to refine its understanding of the potential implications of climate-related transition risks on the business' strategy. The findings from this scenario analysis are described in the more detail in the company's TCFD Report 2020, which is available here.[11]

Scenario analysis: BlackRock implemented a sophisticated scenario development process that utilises climate risk models. The process involved three steps. First, the BlackRock **identified the key climate-related risks**. Second, this was followed by the **development of climate scenarios** using off-the-shelf scenario packages, that is, the UN PRI Inevitable Policy Response, as a starting point. The company focused on the 2°C scenario or lower, in line with the TCFD recommendations. Lastly, the **scenario implementation process** involved the identification of data inputs and

[11] https://www.blackrock.com/corporate/literature/continuous-disclosure-and-important-information/tcfd-report-2020-blkinc.pdf.

analytical specifications, and internal workshops to discuss the implications and assumptions. The findings from the modelling went through various internal iterations following reviews and updating.

Figure 10: The IPR Scenario considered by BlackRock



Source: (BlackRock, 2020)

In the 2021, Blackrock acquired Baringa Partners' Climate Change Scenario Model and integrated into its Aladdin® investment management and operations platform to develop sophisticated in-house scenario analysis capabilities (BlackRock, 2021). In its 2021 TCFD report BlackRock describes a sophisticated scenario analysis that included quantitative analytics from Aladdin Climate with qualitative assumptions about potential client reactions to the different scenarios draw conclusions about possible impacts on BlackRock's business. This analysis also includes physical risks. Two scenarios from the NGFS scenario suite were used for transition risk in the 2021 Scenarios, and two IPCC scenarios for physical risk. For each scenario, BlackRock considered the potential impact on its assets under management and profit margin.

Summary: BlackRock has fully integrated climate scenarios into its strategy and risk management processes. An iterative approach was followed that initially focussed on transition risk and incorporated physical risk later on. In its 2021 TCFD report BlackRock explained the implications of the findings on its business, and highlighted risks and opportunities.

Investec

Company description: Investec plc is an international specialist bank and asset manager. The Group provides corporate and investment banking, private banking, securities trading, asset management, property trading and management and trade finance services. Investec is publicly traded in London and Johannesburg. (Bloomberg, 2021b).

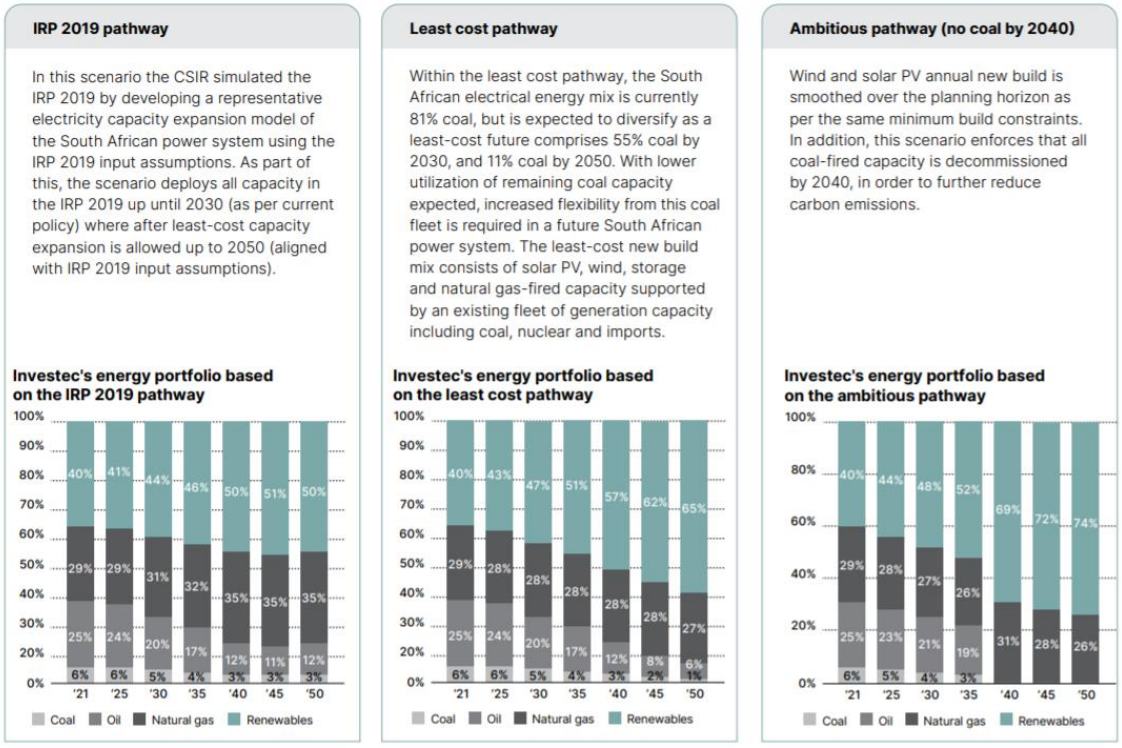
TCFD reporting: Investec began its TCFD journey in 2018, after indicated that the Company would embark on a process to understand the relevance of potential climate scenarios on its business. The first report including these considerations was released in the 2019 Integrated Annual Report. The disclosure covered two pages and was qualitative in nature. In the subsequent years, Investec has published more comprehensive reports, which include qualitative and quantitative disclosures. The 2021 report is available here.[12]

Scenario analysis: Investec's undertook a scenario analysis that combined qualitative and quantitative methods to consider the impact of three different decarbonisation pathways for the South African electricity market on its current energy lending portfolio. This was done within a context where climate-related risks are integrated into the company-wide management processes and are managed within the credit and lending portfolios. The company has started on the disclosure journey, despite noting a large degree of uncertainty around climate scenario analysis for the financial sector. The company believes that as it progresses, it will enhance subsequent disclosures to follow the recommendations of the TCFD.

In the 2021 report, Investec used information from the IRP 2019, the National Business Initiative future pathways, and guidance from the CSIR on alternative electricity pathways in South Africa up to 2050. This exploratory exercise allowed the organisation to extrapolate Investec Limited's energy portfolio and get an indication of potential outcomes, assuming no mitigation measures are in place.

[12] https://www.investec.com/content/dam/international/corporate-responsibility/Investec-Climate-related-financial-disclosures-2021.pdf.

Figure 11: South African electricity sector decarbonisation scenarios considered by Investec



Source: (Investec, 2021)

Investec aims to publish the results of the scenario analysis expressed as value-at-risk by March 2024.

Summary: The Investec case study illustrates that a climate scenario exercise does not have to start with all assets under management. Focusing on a key asset class or area of investment within a specific location is a good way to develop experience in undertaking scenario analysis. The analysis can then be expanded over time to include other assets and/or jurisdictions.

Sasol

Company description: Sasol Limited is an integrated energy and chemical company. The company is listed on the Johannesburg Stock Exchange in South Africa and the New York Stock Exchange in the United States.

TCFD reporting: Sasol published its third Climate Change Report that reports climate-related concerns in line with the TCFD recommendations in 2021. The report is available here.[13]

Scenario analysis: In 2020, Sasol (2020) reported the revised iteration of its scenarios and incorporated the most recent International Energy Agency (IEA) Sustainable Development Scenario (SDS), released in November 2019, to additionally test for robustness against the previous strategy. The four scenarios result in various (favourable and unfavourable) potential outcomes for the Group. The potential outcomes range from a politically fragmented world focused on regional and national energy security and economic growth (Fragmented scenario), to one strongly focused on limiting global warming to below 2 degrees Celsius (IEA SDS scenario). Based on these scenarios, Sasol estimated the primary energy and chemicals demand in 2030.

Figure 12: Scenarios considered by Sasol in its 2021 Climate Change Report

Source: (Sasol, 2021)

[13] www.sasol.com/sites/default/files/financial_reports/Sasol%20Climate%20Change%20Report_2021_22Sep21.pdf

Sasol undertakes analysis to develop a bottom-up view of the global energy landscape annually, and this forms a key input into its climate scenario analysis (Sasol, 2021). This led to three new climate risk scenarios being developed in 2021 (see Figure 12). These scenarios also included physical risks. Sasol used the scenario outputs to undertake qualitative resilience testing of its business areas considering the following lenses, the results of which is shown in the Climate Change Report:

- market demand;
- consumer preferences;
- stakeholder acceptance;
- affordability and ability to mitigate;
- feedstock acceptability;
- executability of the strategy; and
- just transition implications

Summary: Sasol's experience shows the value of continually refining and updating scenarios. It also highlights the role of both qualitative and quantitative approaches to scenario development. It is important to note that Sasol's 2030 GHG emissions reduction target and its ambition for Net Zero emissions by 2050 were informed by its scenario analysis (Sasol, 2021).

8. References

A4S. (2021). *TCFD Climate Scenario Analysis: A guide for finance teams on frequently asked questions.* TCFD. Retrieved from https://www.tcfdhub.org/resource/tcfd-climate-scenario-analysis-a-guide-for-finance-teams-on-frequently-asked-questions/

BlackRock. (2020). *2020 TCFD Report: BlackRock's climate-related diclosures.* New York: BlackRock. Retrieved from https://www.blackrock.com/corporate/literature/continuous-disclosure-and-important-information/tcfd-report-2020-blkinc.pdf

BlackRock. (2021). *2021 TCFD report - BlackRock's climate-related disclosures.* New York: BlackRock. Retrieved from https://www.blackrock.com/corporate/literature/continuous-disclosure-and-important-information/tcfd-report-2020-blkinc.pdf

Bloomberg. (2021a). *Company profile*. Retrieved from BlackRock : https://www.bloomberg.com/profile/company/BLK:US

Bloomberg. (2021b, November 9). *Company profile*. Retrieved from Investec PLC: https://www.bloomberg.com/profile/company/INVP:LN

Carney, M. (2021). *Building a Private Finance System for Net-zero: Priorities for private finance for COP26.* COP26. Retrieved from https://ukcop26.org/wp-content/uploads/2020/11/COP26-Private-Finance-Hub-Strategy_Nov-2020v4.1.pdf

CFRF. (2021). *Climate Data and Metrics.* Climate Financial Risk Forum.

DNA Economics. (2021). *Climate-related Financial Disclosure in South Africa.* UK PACT.

FRC. (2021). *Climate Scenario Analysis: Current Practice and Disclosure Trends.* Manchester: The University of Manchester & Financial Reporting Council. Retrieved from https://www.frc.org.uk/getattachment/0d28d5e8-ff89-4028-88a8-49e837db6022/FRC-Climate-Scenario-Analysis-in-Corporate-Reporting_October-2021.pdf

IIGCC. (2019). *Navigating climate scenario analysis - a guide for institutional investors.* IIGCC. Retrieved from https://www.iigcc.org/resource/navigating-climate-scenario-analysis-a-guide-for-institutional-investors/

Investec. (2021). *Climate-related financial disclosures.* Johannesburg: Investec. Retrieved from https://www.investec.com/content/dam/international/corporate-responsibility/Investec-Climate-related-financial-disclosures-2021.pdf

IPCC. (2018). *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change.* IPCC.

MIT. (2019). *Cimate-related Financial Disclosures: The Use of Scenarios.* Massachusetts: MIT: Office of the Vice President of Research. Retrieved from https://energy.mit.edu/publication/climate-related-financial-disclosures-the-use-of-scenarios/#:~:text=This%20MIT%20report%2C%20Climate%2DRelated,result%20of%20global%20climate%20change.

NGFS. (2021). *Climate Scenarios Database: Technical Documentation V2.2.* NGFS. Retrieved from https://www.ngfs.net/sites/default/files/ngfs_climate_scenarios_technical_documentation__phase2_june2021.pdf

Ninety One. (2020). *How Ninety One is supporting the recommendations of the TCFD: 2020 TCFD Report.* Cape Town: Ninety One. Retrieved from https://ninetyone.com/-/media/documents/reports/91-tcfd-report-2020-en.pdf

PRI. (2021). *The investor guide to climate collaboration: From COP26 to net zero.* Principles for Responsible Investment.

Sasol. (2020). *Climate Change Report.* Johannesburg: Sasol.

Sasol. (2021). *Climate change report.* Johannesburg: Sasol Limited. Retrieved from https://www.sasol.com/sites/default/files/financial_reports/SASOL%20CCR%202020.pdf

TCFD. (2017). *Recommendations of the Task Force on Climate-related Financial Disclosure.* Basel, Switzerland: Task Force on Climate-related Financial Disclosure. Retrieved from https://assets.bbhub.io/company/sites/60/2020/10/FINAL-2017-TCFD-Report-11052018.pdf

TCFD. (2017a). *Recommendations of the Task Force on Climate-related Financial Disclosure.* Basel, Switzerland: Task Force on Climate-related Financial Disclosure. Retrieved from https://assets.bbhub.io/company/sites/60/2020/10/FINAL-2017-TCFD-Report-11052018.pdf

TCFD. (2017b). *The Use of Scenario Analysis in Disclosure of Climate-related Risks and Opportunities: Technical Supplement.* Task Force of Climate-related Financial Disclosures. Retrieved from https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Technical-Supplement-062917.pdf

TCFD. (2017b). *The Use of Scenario Analysis in Disclosure of Climate-related Risks and Opportunities: Technical Supplement.* The Task Force on Climate-related Financial

Dislosure. Retrieved from https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Technical-Supplement-062917.pdf

TCFD. (2020). *Task Force on Climate-related Financial Disclosures: Guidance on Risk Management Integration and Disclosure.* TCFD. Retrieved from https://www.fsb-tcfd.org/publications/

TCFD. (2021). *2021 Status Report.* Basel, Switzerland: Task Force of Climate-related Financial Disclosure.

TCFD. (2021b). *Task Force on Climate-related Financial Disclosures: Guidance on Metrics, Targets and Transition Plans.* TCFD.

Vivid Economics. (2021). *Aligning South Africa's climate-related financial disclosure with global best practice.* UK PACT.

Vivid Economics. (2021a). *Transition Risk in TCFD Reporting - An example transition risk disclosure based on an illustrative South African portoflio.* Pretoria: South Africa-UK PACT supported project: Aligning South Africa's climate-related financial disclosure with global best practice.

9. Useful resources

A4S CFO Leadership Network. *TCFD Climate Scenario Analysis: A guide for finance teams on frequently asked questions*. Retrieved from https://www.tcfdhub.org/resource/tcfd-climate-scenario-analysis-a-guide-for-finance-teams-on-frequently-asked-questions/

CICERO. Pathways to Paris: A practical guide to climate transition scenarios for financial professionals. Centre for International Climate Research: Oslo, Norway. Retrieved from https://www.unepfi.org/publications/banking-publications/pathways-to-paris/.

Financial Reporting Council. (2021). Reporting on risk, Uncertainties, opportunities and scenarios: Closing the gap. Retrieved from https://www.frc.org.uk/getattachment/c9c271c4-1e74-413a-a767-ca1c1e6909e7/FRCLab-Risk-Report-2021.pdf.

MIT. (2019). Climate-related Financial Disclosures: The Use of Scenarios. Massachusetts Institute of Technology. Retrieved from https://energy.mit.edu/publication/climate-related-financial-disclosures-the-use-of-scenarios/#:~:text=This%20MIT%20report%2C%20Climate%2DRelated,result%20of%20global%20climate%20change.

TCFD. (2021). Guidance on Metrics, Targets, and Transition Plans. TCFD. Retrieved from https://www.fsb-tcfd.org/publications/.

TCFD. (2020). Guidance on Scenario Analysis for Non-Financial Companies. TCFD. Retrieved from https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Guidance-Scenario-Analysis-Guidance.pdf.

The University of Manchester & FRC. (2021). Climate Scenario Analysis: Current Practice and Disclosure Trends. Retrieved from https://www.frc.org.uk/getattachment/0d28d5e8-ff89-4028-88a8-49e837db6022/FRC-Climate-Scenario-Analysis-in-Corporate-Reporting_October-2021.pdf.

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