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FRAMEWORK

Guidelines of the Value to Business Methodologies

General Framework Paper

value balancing alliance

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About the VBA

The Value Balancing Alliance (VBA) is a coalition of around 30 multinational companies committed to driving sustainability by measuring and valuing corporate impacts on nature and society. Our world has been running through the most significant structural change in the last 250 years. We experience the environmental credit crunch: The paradigm of economic growth building on infinite resources is over. We enter the impact economy – requiring a new understanding of value creation[1]. VBA's mission as a not-for-profit alliance is to jointly create a globally applicable and comprehensive methodology together with the International Foundation for Valuing Impacts, Inc. (IFVI) for measuring sustainable value creation – impact accounting. Impact accounting has been successfully tested over the last fifteen years by leading companies across regions and industries. It gains more and more traction as a solution to translating ESG metrics into the language of business (monetization) and turning the sustainability reporting challenge into a force for value creation. The VBA is pioneering impact accounting in various collaborations, which contextualizes sustainability data and translates it into comparable monetary values, reflecting corporate impacts across the entire value chain.

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[1] UBS. (2023). *The Rise of the Impact Economy*

1. Introduction

The integration of sustainability-related topics into financial planning, risk management, and business valuation is no longer a voluntary exercise – it has become a strategic necessity. Regulatory requirements resulting from the TCFD and ESRS, rising expectations from investors and customers, and the growing awareness of the financial implications of climate and nature-related risks are forcing companies to fundamentally rethink their management and reporting systems.

This is not just about reporting and compliance: many companies face the concrete challenge of achieving their key climate targets by 2030. This milestone now falls within the typical 5-year planning cycle – what was once considered a distant future is now approaching rapidly and requires significantly greater attention and operational anchoring.

The aim of this paper is to provide a foundational framework that helps companies financially quantify sustainability-related risks and opportunities and systematically integrate them into their decision-making processes – whether in financial planning and forecasting, risk management, or investment and business valuation.

In practice, missing or incomplete data and the complexity of the sustainability-related topics are often cited as obstacles to quantifying the financial effects of sustainability risks and opportunities – especially regarding long-term impacts. But practice shows that many relevant pieces of information already exist within companies but are often not centrally available or consistently prepared. Reality is indeed complex – but that is precisely why it is necessary to capture it in a structured way and to engage with it logically and quantitatively. The attempt to quantify often opens new perspectives that purely qualitative analyses do not reveal. Moreover, this process creates new dialogue formats between different stakeholders, bringing the topic of sustainability more strongly into operational focus and on management attention. Additionally, necessary investments in decarbonization or other transition plans are sometimes delayed due to perceived economic unfeasibility – without adjusting the underlying and communicated climate targets. This creates an action vacuum with increasing implementation risks. Here too, a rational and well-founded analysis considering all relevant risks and opportunities helps to objectify the discussion and identify the best individual strategy.

A central concern of the framework is to build bridges between the relevant corporate functions – particularly between sustainability, finance, and operations. Through clear definitions, methodological explanations, and practical examples, a shared understanding is created that facilitates collaboration and accelerates implementation.

This Value to Business concept is divided into two parts:

- Value to Business Framework - The methodological foundations that provides the conceptual structure and general explanations. This document is intended for both experts and interested practitioners, serving as a guiding reference in cases where discretionary judgment is required.
- Value to Business Application Guidance – The description of a standardized implementation approach including tools, templates, and checklists. This part mainly refers to practitioners and aims to provide clear guidance-based examples.

Thus, both papers address not only practitioners within companies but also aim to serve as a conceptual-theoretical basis for experts working in this field.

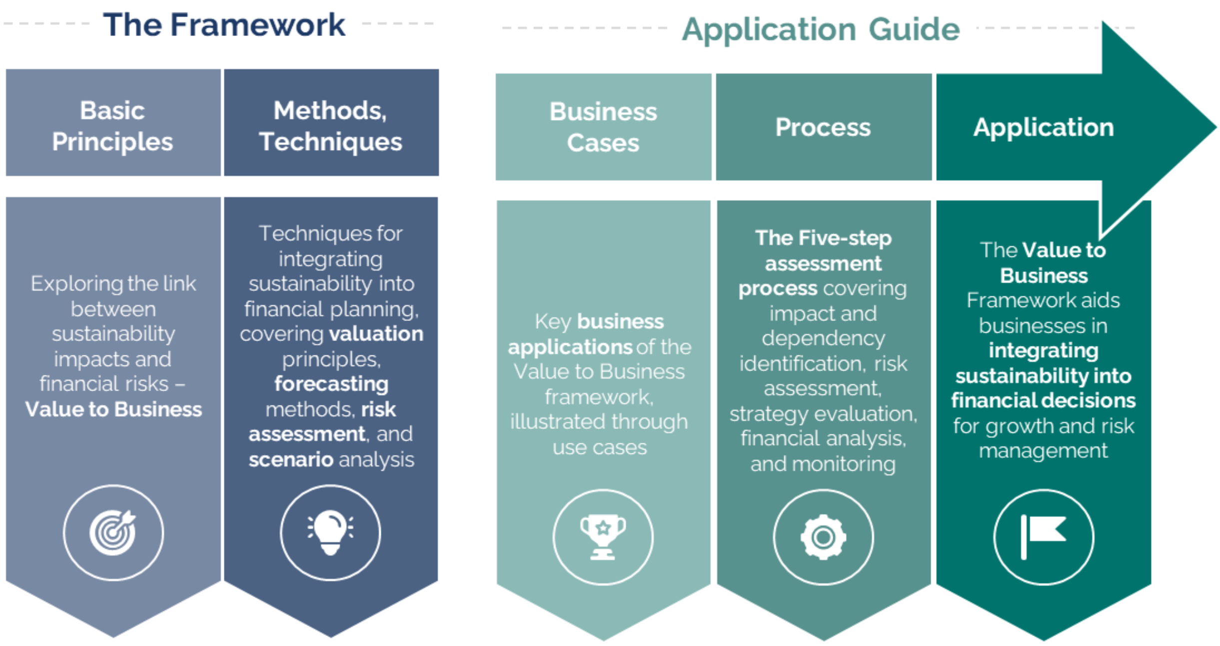

Figure 1 ***Overview V2B Publications - Application Guidance in next publication available***

This Framework provides in seven chapters an overview about:

- General definitions and scope related to Value to Business
- Links between Value to Society and Value to Business
- General concepts of planning and valuation principles
- Forecasting and valuation methods
- Concepts of risk in sustainability and capital market theory and practice
- Application of (macro) scenarios in the Value to Business context

The Value to Business concept is designed for broad applications across various business scenarios. The use cases outlined in Figure 2 provide a collection of potential applications.

	Transition Planning	Impact & Dependency Management	Sustainable Investment Decision-Making	ESG Due Diligence for Acquisition
Application	Strategy & Objective Setting	Performance	Strategy & Objective Setting, Performance	Review & Revision
Use case description	A steel manufacturer evaluates different scenarios for transitioning to CO_2-neutral production, balancing diverse risks and opportunities	A new director implements an IRO management system to monitor key sustainability factors affecting the business model	A packaging company assesses different investment options for new products, using financial and non-financial KPIs	A machinery manufacturer conducts ESG due diligence on a potential acquisition, to evaluate long-term value creation and synergies
Relevant businessunits	Corporate Strategy, Finance, EHS* & HR, Procurement & Operations	Finance, Accounting & Controlling	Corporate Strategy, Finance, R&D	Finance, Procurement & Operations

	Target Setting & Monitoring	ESG Reporting	Risk Stress Testing	Financial Planning for Relocation
Application	Performance, Review & Revision	Communication & Reporting	Performance, Review & Revision	Performance, Review & Revision
Use case description	A plastic producer sets sustainability targets while investing in R&D, tracking CO_2 emission reduction and share of recycled materials	A solar panel company implements ESRS reporting standards, using quantitative methods to assess financial impacts of IROs	A food supplier simulates various scenarios, assessing how potential risks could impact its business continuity and operational stability	A company repurposes an old site for real estate using fin. planning with social KPIs (social housing, etc.) to secure funding & manage liquidity risk
Relevant business units	Finance, Accounting & Controlling, EHS* & HR	Accounting & Controlling	Finance	Finance, Accounting & Controlling

*Environmental Health & Safety (EHS)

Figure 2 ***Excerpt from potential applications***

The use cases have been categorized based on application type and most relevant business units and aligns with the VBA use case framework[2]. While the Framework has already been tested in two specific case studies – covering strategic transition planning, product development, risk assessment, and reporting – it will continue to be refined through further testing with members of the VBA.

The framework proposes a four- or five-step process, resulting in quantifying financial effects of sustainability topics (step 4). This requires a fundamental understanding of the sustainability perspective of impacts, dependencies as well as resulting risks, and opportunities (step 1 and 2). It also needs a sound analysis of the current status of the business from an operational and financial perspective considering the competitive and regulatory environment (step 2). For this reason, steps 1 and 2 are particularly detailed.

[2] Value Balancing Alliance. (2025). *Impact Accounting Use Cases – Integrating Impact Accounting in Corporate Decision Making*. https://www.value-balancing.com/_Resources/Persistent/c/b/7/1/cb71b9a630f3cea846de7fc71e140cbde1acdbae/Impact_Accounting_Use_Cases_Vfinal.pdf

Figure 3 ***Value to Business Assessment Process***

The framework is built on existing work such as double materiality analyses, climate or nature transition and action plans, or climate risk assessments. It does not claim to explain or replace these in detail – rather, it serves as a methodological complement to financial evaluation and integration into management processes.

This framework aims not only to accelerate the transformation into sustainable business models but also to establish a common language and mindset that aligns profit, people, and planet. The goal is to minimize the initial hurdles that have so far prevented companies from engaging in a structured and intensive way with the quantification and implementation of sustainability measures. At the same time, it should encourage organizations to adapt the framework to their specific needs, offering guidance on how to reflect unique dependencies and impacts.

The complexity of financially evaluating sustainability topics – such as the uncertainty of long-term effects or the challenge of translating qualitative risks into quantitative models – is addressed in both, the Value to Business framework and application guidance. It provides concrete guidance such as sensitivity analyses, scenario and simulation techniques to manage uncertainties and create robust decision-making foundations. Due to the complexity of reality and the individuality of processes within companies, this framework does not prescribe simplified standard solutions. Instead, it outlines fundamental approaches, makes recommendations, and deliberately allows flexibility for individual application.

The concept of Value to Business is still evolving, even though various established frameworks – such as the Natural Capital Protocol (NCP), Social & Human Capital Protocol (SHP), TCFD/TNFD, WBCSD, and EU Life Transparent Project – already address specific aspects of it. The Value to Business framework and application guidance deliberately acknowledges and accommodates several limitations of those existing frameworks, which include:

1. ***Low degree of standardization to account for company specific circumstances:***
   Anticipated financial effects on entities do not only depend on sector specific circumstances but also on company specific characteristics, as well as actions and processes installed. E.g., dependencies on water scarcity could be different from entities A and B operating in the same area in the same sector due to different production technologies in place or different product designs. These specific circumstances which are directly related to risks and opportunities need to be considered in the Value to Business concept and limit the degree of standardization in the application of the Value to Business.

2. ***Direct mapping between sustainability risks and opportunities and affected financial line items in financial statements:***
   While numerous publications already attempt this, they often reflect simplified views due to the inherent complexity and individuality of these relationships. It is not the intention to define a standardized linkage to the financial sphere for every possible type and form of impact or dependency. Therefore, the framework focuses on outlining a general approach rather than providing static lists, which may be of limited practical use in implementation on company level.

3. ***Deliberate exclusion of detailed instructions and static lists:***
   To ensure broad applicability of the Value to Business concept, the framework deliberately avoids overly prescriptive instructions. Users are encouraged to apply different approaches and methods according to their specific needs and organizational context. This flexibility is essential to accommodate the diversity of business models, data availability, and strategic priorities. For this reason, static lists of planning parameters are excluded, as they tend to become outdated quickly. Instead, the framework points to potential sources that currently offer useful reference points.

It is not intended to replace specialized analyses such as double materiality assessments or transition planning, but rather to serve as a general foundation for understanding and structuring sustainability-related financial considerations. Sector- or entity-specific guidance may be developed in the future.

2. Definitions and Attributes of Value to Business

2.1. Definitions

Creating a framework related to the Value to Business concept requires a definition of the term itself. Therefore, the following section outlines the general concept of Value to Business and related definitions. At the heart of the concept is the double materiality perspective[3] considering an inside-out and an outside-in perspective.

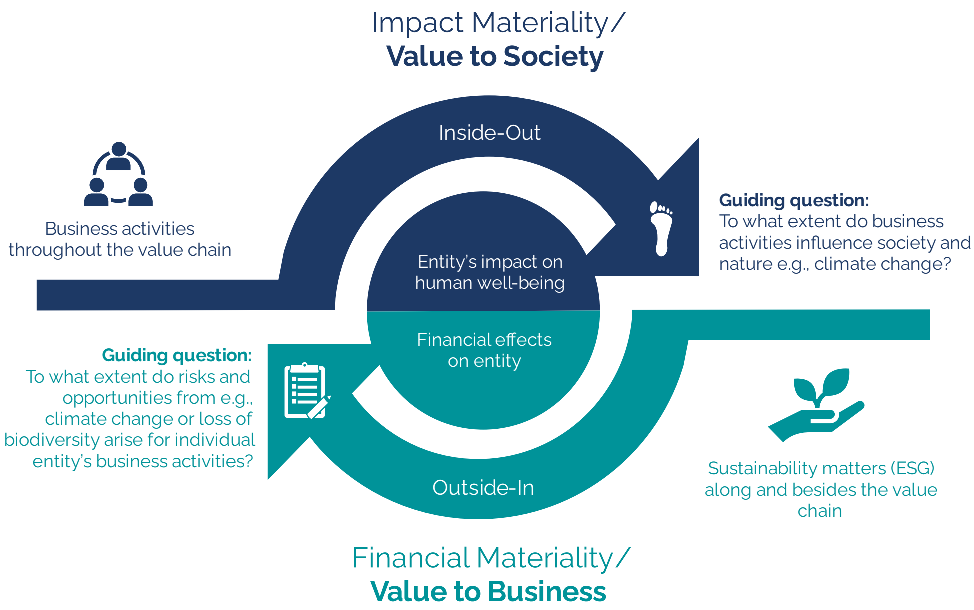

Figure 4 ***The interaction between Value to Business and Value to Society***
(Source: KPMG)

Inside-out deals with the impact of corporate entities (hereinafter referred to as "entities" or "entity") on nature and people while outside-in describes vice versa the current and anticipated financial effects environmental, social, and economic impacts and dependencies can have on the entities in turn. While the inside-out perspective is connected to the concept of Value to Society, the outside-in perspective mainly relates to the concept of Value to Business. Therefore, the Value to Business concept complements the concept of Value to Society and is of equal relevance for a holistic view on an entity's sustainable footprint. The European Sustainability Reporting Standards (ESRS) as well as other important frameworks like the Natural Capital Protocol also refer to the concept of double materiality. ESRS as well as other frameworks like the Taskforce for Climate-related Financial Disclosure (TCFD) and Taskforce for Nature-related Financial Disclosure (TNFD) address risks and opportunities resulting from actual and potential impacts and dependencies. This is further emphasized by the Network for Greening the Financial System (NGFS), that has introduced a task force on Biodiversity Loss specifically focusing on the consideration and incorporation of anticipated financial risks.[4] These standards and frameworks also request a quantification of the anticipated financial effects (ESRS) or financial impact (TCFD, TNFD) which is the core element of the Value to Business.

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[3] In accordance e.g. with ESRS 1 (3).
[4] Network for Greening the Financial System. (2023). *Nature-related Financial Risks: a Conceptual Framework to guide Action by Central Banks and Supervisors*. p. 4. ngfs_conceptual-framework-on-nature-related-risks.pdf

Generally, the goal of the Value to Business concept is to identify, understand, quantify, and value risks and opportunities to entities' business models in financial terms, arising from current as well as future environmental, social, and economic impacts and dependencies.

Besides **economic capital**, entities create impacts and depend on natural, human, and social capital and therefore in a final consequence people's well-being[5]. Through their activities, entities make use of and convert these capitals into outputs that in turn affect the stock of the capitals as well as entities' viability. At the same time, entities will experience risks and opportunities associated with impacts and dependencies arising from these capitals.[6]

Natural capital comprises both the stock of renewable and non-renewable natural resources that jointly affect people's well-being.[7] **Human capital** refers to individual knowledge, skills, competencies, and attributes that contribute to performance and well-being. **Social capital** refers to networks and their shared norms, values and understanding that affects cooperation within and among groups.[8]

Impact can be defined as a change in one or more dimensions of people's well-being directly or through a change in the condition of the natural environment. An impact can be actual or potential, direct or indirect, intended or unintended, and positive or negative.[9] The creation or erosion of value related to the well-being of people can be analyzed as a system of flows and stocks, in which flows of value are represented by impacts and stocks of value are represented by capitals.[10]

Dependencies[11] refer to the direct as well as indirect reliance of entities on natural, human, or social capital.[12] With respect to natural capital, dependencies are closely connected to ecosystem services[13]. **Ecosystem services** are the benefits that people obtain from ecosystems, including provisioning services (such as food, water, timber), regulating services (such as climate regulation, water purification, erosion control), cultural services (such as recreation, community enrichment), and supporting services (such as soil

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[5] OECD. *People's well-being should be understood in the context of OECD's well-being framework*, *Measuring well-being and progress*, Measuring Well-being and Progress: Well-being Research - OECD

[6] Capitals Coalition. (2019). *Social & Human Capital Protocol*. p. 9. Social_and_Human_Capital_Protocol.pdf (wbcsd.org); Capitals Coalition. (2016). *Natural Capital Protocol*. p. 15. NCC_Primer_WEB_2016-07-08.pdf (capitalscoalition.org)

[7] For a list of natural capital assets please refer to appendix 1

[8] Capitals Coalition. (2019). *Social & Human Capital Protocol*. p. 9. Social_and_Human_Capital_Protocol.pdf (wbcsd.org); Capitals Coalition. (2016). *Natural Capital Protocol*. p. 12. NCC_Primer_WEB_2016-07-08.pdf (capitalscoalition.org)

[9] International Foundation for Valuing Impacts and Value balancing alliance. (2024). *General Methodology 1*. TN. 49. IFVI_VBA_Public Exposure DRAFT_General Methodology 1_A4.pdf (value-balancing.com)

[10] International Foundation for Valuing Impacts and Value balancing alliance. (2024). *General Methodology 1*. (2024), TN 52, IFVI_VBA_Public Exposure DRAFT_General Methodology 1_A4.pdf (value-balancing.com)

[11] The term "dependencies" does not address interdependencies between different impacts and for example catalyst function of climate change for many other nature or social related consequences. For a list of potential dependencies refer to Appendix 5.

[12] For further analysis we focus on natural, human and social capital as the dependance on economic capital is well understood and monitored by the existing reporting and monitoring processes of entities.

[13] For a non-exhaustive list of ecosystem services please refer to Appendix 3.

formation, nutrient cycling).[14] Human and social dependencies are directly connected to people's well-being (e.g. capabilities, relationships, health) but also public goods like public education, health or infrastructure as well as security. Entities depend, for example, on healthy and skilled workers, trust in financial markets or the rule of law. Most entities depend on a good relationship with their affected communities because they use the same resources.[15] This may subsequently lead to risks and opportunities for the entity. As a result, dependencies can affect the ability of an entity to continue to use or procure the resources required for its business processes, as well as the quality and pricing of these resources. Dependencies often occur in an entity's value chain and are more difficult to detect. Furthermore, they can have a significant effects on potential business relationships that are essential for business processes. Importantly, dependencies are location-, industry- and entity-specific.[16]

The following figures present an overview of potential dependencies related to nature as well as human and social capitals:

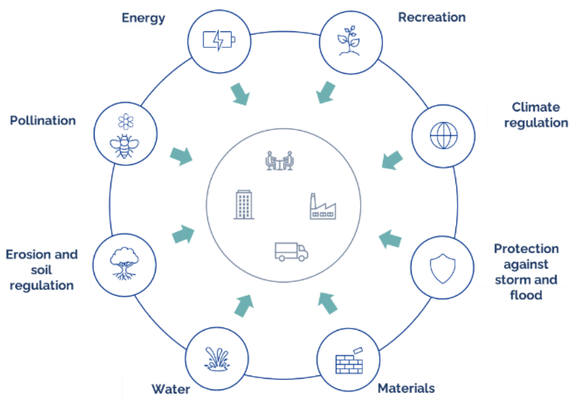

Figure 5 ***Nature Capital Dependencies*** *(left)**, Social & Human Capital Dependencies*** *(right) (Source: Capital Coalition)*

[14] Capitals Coalition. (2016). *Natural Capital Protocol*. p. 13. NCC_Primer_WEB_2016-07-08.pdf (capitalscoalition.org)
[15] Capitals Coalition. (2019). *Social & Human Capital Protocol*. p. 10. Social_and_Human_Capital_Protocol.pdf (wbcsd.org)
[16] Capitals Coalition. (2016). *Natural Capital Protocol*. p. 35. NCC_Primer_WEB_2016-07-08.pdf (capitalscoalition.org)
[Figure 5] Capital Coalition. (2016). *Social and Human Capital Protocol*. p. 11. Social_and_Human_Capital_Protocol.pdf (naturalcapitalcoalition.org); Capitals Coalition. (2016). *Natural Capital Protocol*. p. 17. NCC_Protocol_WEB_2016-07-12-1.pdf (naturalcapitalcoalition.org)

In contrast to direct dependencies, indirect dependencies are particularly prevalent in the tertiary sector. They occur when other key stakeholders within the value chain possess direct dependencies. Changes in capitals[17] utilized by these value chain participants can affect an entity's own operations, consequently leading to risks and opportunities.[18]

Consequently, both impacts and dependencies play an important role in defining Value to Business. The core of the Value to Business concept is to identify risks and opportunities resulting from the internalization of impacts and exposure to dependencies, and ultimately to quantify them in financial terms.

According to economic theory, **internalization** refers to the pricing in terms of external effects (i.e., externalities).[19] Externalities arise when a market participant does not bear all the costs it generates. This can result in a difference between the social (macro) and private (incurred by the market participant) costs and benefits. There is also the possibility of an effect on the welfare of (non-involved) third parties. Internalization, therefore, is the process of incorporating externalities into its producer's operational and financial sphere.[20] Furthermore, in line with the Social & Human Capital Protocol and with respect to impacts, internalization can be described as the effect when an entity's impacts fall back on the entity itself.[21] Internalization ensures that the prices of goods and services reflect their true costs and benefits. The "polluter pays" principle is used to assign environmental costs to those responsible, and governments play a key role by enforcing regulations to help businesses internalize the environmental impacts of their production.[22]

The Value to Business concept aims to embed quantified risks and opportunities into decision-making, steering, and reporting, integrating sustainability topics into entities' processes and accelerating the transformation towards sustainable business models. Therefore, we use the term internalization for integrating risks and opportunities arising from impacts and dependencies.

[17] For examples of driver of changes in natural capitals please refer to Appendix 4
[18] Capitals Coalition. (2016). *Natural Capital Protocol*. p.17. NCC_Primer_WEB_2016-07-08.pdf (capitalscoalition.org)
[19] European Environment Agency. (n.d.). *Internalisation of externalities. European Environment Agency*. https://www.eea.europa.eu/help/glossary/eea-glossary/internalisation-of-externalities
[20] N. G. Mankiw et. Al. (2021). *Grundzüge der Volkswirtschaftslehre*. p. 323 ff
[21] Capitals Coalition. (2019). *Social & Human Capital Protocol*. p. 10. Social_and_Human_Capital_Protocol.pdf (wbcsd.org)
[22] Luppi, B., Parisi, F. & Rajagopalan, S. (2012). *The rise and fall of the polluter-pays principle in developing countries*. p. 135. PolluterIRLE2012-libre.pdf

The following figure summarizes the interconnection between the defined concepts by illustrating the linkage between capitals, impacts, dependencies as well as risks and opportunities:

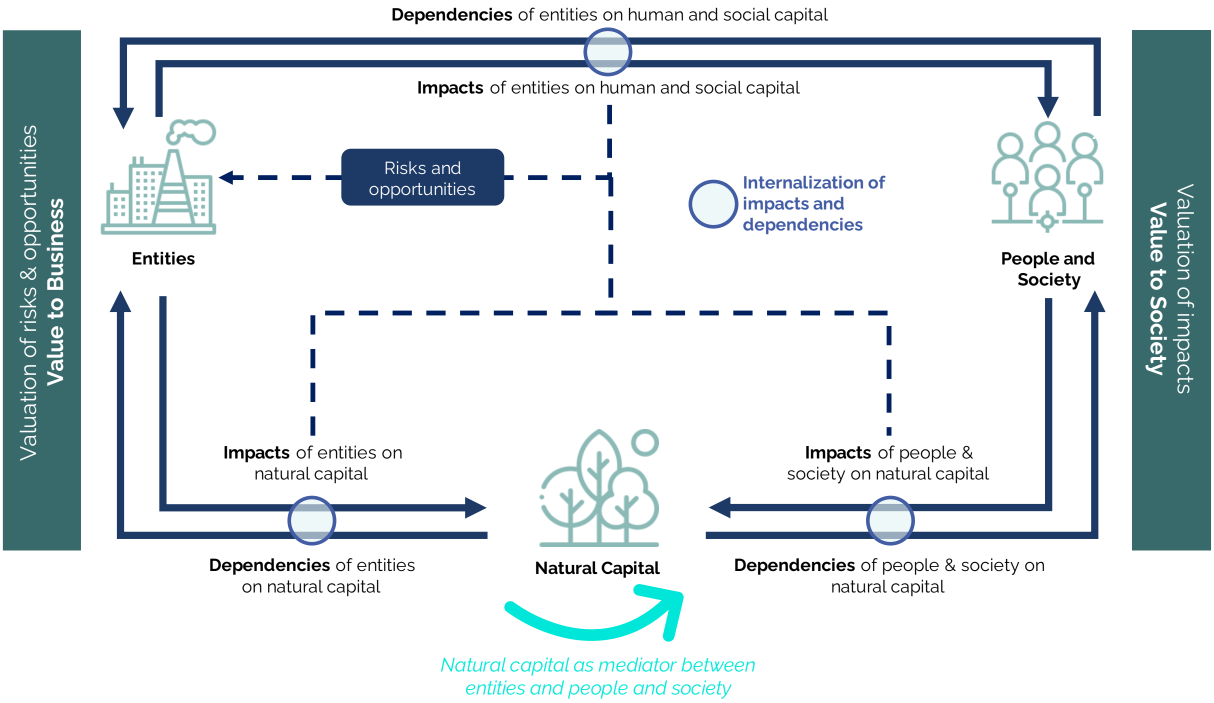

Figure 6 ***Linkage between capitals, impacts, dependencies as well as risks and opportunities***
(Source: Adaptation, based on Capitals Coalition, (2016), Natural Capital Protocol, p. 15, NCC_Protocol_WEB_2016-07-12-1.pdf (naturalcapitalcoalition.org); KPMG)

Building on identified impacts and dependencies, risks and opportunities may arise for entities. For the application of the Value to Business Concept, it is essential to have a clear understanding of what is meant by 'risk' and 'opportunity' in this specific context.
Risk can generally be defined as an effect of uncertainty on objectives. An **effect** is a deviation from the expected while it can be positive, negative, or both.[23] This is in line with the TNFD's definitions of risks and opportunities.[24] Risks and opportunities both arise from impacts and dependencies, which are either produced by companies or the overall society or important prerequisites for the activities of entities provided by the nature or the society.

Sustainability-related risks and opportunities are events or a change in conditions that could negatively or positively affect an entity's business model and consequently financial performance or reputation.[25] Risks and opportunities may derive from past or future events, from dependencies or from actions to address other sustainability matters.[26]

Climate- and nature-related risks are grouped into physical risks and transition risks with physical risks further divided into acute and chronic risks. Physical risks result, for example,

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[23] ISO. ISO 31000:2018 Risk management – Guidelines. ISO 31000:2018(en), Risk management — Guidelines
[24] Clifford Change. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 33. taskforce-on-nature-related-financial-disclosures-tnfd-recommendations-published.pdf (cliffordchance.com)
Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)
[25] Several frameworks like the TCFD, TNFD or Social and Human Capital Protocol as well as the individual ESRS standards provide guidance on topic specific risks and opportunities.
[26] ESRS 1, (3.5 and 3.6).

from extreme weather events or sea level rises for climate or oil spills and pollution stemming from pesticide use for nature. Transition risks can be prompted by policy changes or shifts in consumer preferences, technological improvements, and innovations and/or litigation and legal risks such as lawsuits as well as other drivers.[27] For nature-related risks a third category exists with systemic risks which arise from the destabilization of the ecosystem or the financial market,[28] which might be transferred on other sustainability related topics as well. Examples of social and human capital-related risks include labor rights violations, workforce diversity and inclusion challenges, health and safety hazards, and human rights infringements.[29] Companies that are exposed to these risks may face disruptions to their supply chains, increased costs, and reputational damage. A detailed categorization, definition as well as translation in other risks can be found in chapter 7 as well as a list of actual and potential risks and opportunities in Appendix 1.

Examples of climate-related opportunities include the development of low-carbon technologies, the adoption of sustainable business practices, and the creation of new markets for climate-friendly products and services Examples of nature-related opportunities include the restoration of ecosystems, the promotion of biodiversity, and the development of sustainable agriculture practices. Examples of social and human capital-related opportunities include enhanced employee well-being and engagement, improved productivity and innovation, and better access to talent and markets. Companies that are able to capitalize on these opportunities may gain a competitive advantage, enhance their brand reputation, and improve their relationships with stakeholders.

Risks and opportunities can affect the entire value chain of an entity and may have effects on the business models and may consequently lead to material financial effects. Actual financial consequences are normally considered within the actual financial statements therefore the anticipated financial effects resulting from potential future changes in capitals and resulting risks and opportunities are of major importance for entities. These anticipated financial effects are subject of the ESRS reporting requirements under ESRS 2 SBM-3 as well as of the TCFD and the TNFD.

[27] TCFD. (2023). *Recommendations of the Task Force on Climate-related Financial Disclosures*. pp. 5-7. FINAL-2017-TCFD-Report.pdf (bbhub.io)

[28] Clifford Change. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 35

[29] Capitals Coalition. (2016). *Natural Capital Protocol*. p. 18. capitalscoalition.org/wp-content/uploads/2021/01/NCC_Protocol.pdf

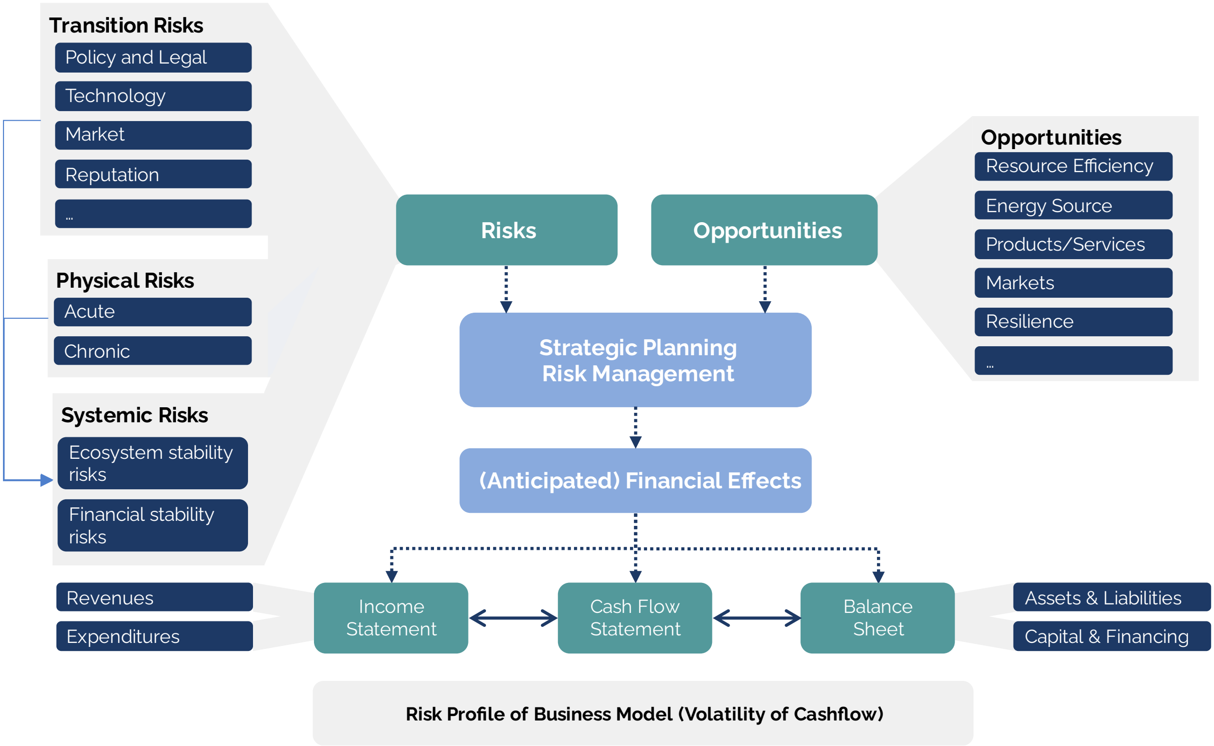

Figure 7 ***Relationship between opportunities and risks and financial performance***
(Source: Adapted from TCFD, TNFD)

While risks and opportunities should generally play an essential role, it is important to assess the financial materiality of identified risks and opportunities on the entity. This particularly depends on the potential magnitude of anticipated financial effects and the likelihood of occurrence.[30] Accordingly, financial materiality is highest if there is a significant magnitude for a risk or opportunity that is very likely to materialize.

2.2. Attributes of Value to Business

The Value to Business concept is fit for different use cases and stakeholders and their specific needs. Depending on the purpose of the use and the underlying standards to

[30] EFRAG. (2022). *Draft European Sustainability Reporting Standards ESRS E1 Climate Change*. p. 36 Tz. 51. 08 Draft ESRS E1 Climate Change November 2022.pdf (efrag.org)

serve, attributes of the Value to Business concept may need to be defined. Figure 8 summarizes potential attributes of the Value to Business concept, defining its scope and its characteristics.

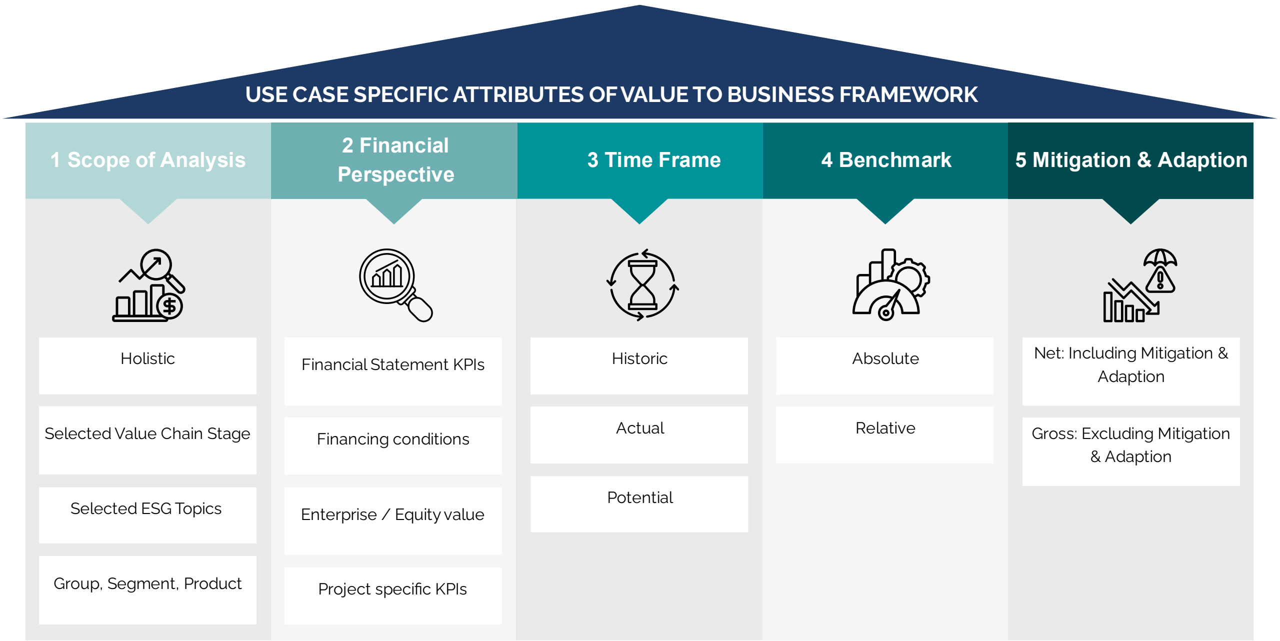

Figure 8 ***Attributes of Value to Business***
(Source: KPMG)

Definition and differentiation of the terms potential and actual are important when determining the attributes. ESRS defines actual impacts as those that have happened or are ongoing in the reporting period. Potential impacts are defined as those that have a likelihood of occurrence in the short-, medium- or long term.[31]

In line with the above definition the term **actual** relates to the existing status of the entity in the current reporting period or at the specific valuation date. This also includes circumstances which can have their origin in previous periods with ongoing consequences.[32] Based on the definition of actual impacts, actual dependencies refer to existing dependencies, including those that have not yet been recognized as relevant or critical. This is because it can be assumed that these dependencies exist today but have not yet come into focus due to a lack of sufficient resources. The term **potential** refers to potential future impacts, dependencies, and financial effects. For the assessment current circumstances of the entity, environment and society as well as current knowledge and expectations regarding magnitude and likelihood of the future developments in these aspects and relevant capitals shall be considered.[33] Potential dependencies may arise from a change in respective capitals or a change in the business model, which can either alter the characteristics of the dependency (e.g. increasing its relevance) or create new dependencies (e.g. from other resources). Depending on the use case of the Value to

[31] EFRAG. (2024). *Implementation Guidance, EFRAG IG 1, Materiality Assessment*. p. 53 Tz. 229. IG 1 Materiality Assessment_final.pdf (efrag.org)
[32] EFRAG, (2024), Implementation Guidance, EFRAG IG 1, Materiality Assessment, p. 53 Tz. 230, IG 1 Materiality Assessment_final.pdf (efrag.org).
[33] EFRAG. (2024). *Implementation Guidance, Draft EFRAG IG 1, Materiality Assessment*. p. 54 Tz. 231, Draft EFRAG IG 1 MAIG 231222.pdf

Business concept mitigation and adaptation actions may or may not be considered, but these actions do not qualify the definition of actual or potential.

3. Link Between Value to Society and Value to Business

Generally, the concept of Value to Business is closely linked to the concept of Value to Society. Consequently, this chapter describes the link between both concepts. For the application, it is essential to understand the interconnection and interdependence between Value to Business and Value to Society.

The idea of Value to Society and Value to Business is based on the concept of double materiality. Value to Society like impact accounts are designed to measure the positive and negative impacts of an entity on people and the natural environment.[34] Therefore, the central question of the concept is to what extent entities influence natural, human and social capitals and how this affects well-being of people. The methodology of Value to Society of the Value Balancing Alliance is developed in partnership with the International Foundation for Valuing Impacts and includes pre-defined value factors for greenhouse gas emissions, further air emissions, and water consumptions besides others[35]. The target of the Value to Society methodology (also referred to as impact accounting methodology) is to quantify and value these indicators in monetary terms, which can be either positive or negative. The impacts of entities can be seen as the starting point of the assessment of the Value to Business concept. A detailed understanding of entities' impacts for analyzing direct and indirect financial effects on entities is essential.

The previously described impacts of entities on environment, people and society consequently result from entities' operations and may lead to risks and opportunities, which companies might face afterwards.

Risks and opportunities can either result from

- the potential internalization of **direct impacts** produced by the entity or
- financial consequences resulting from **indirect impacts** induced from third-party activities or
- changes in **dependencies** on natural, human, and social capital.

[34] International Foundation for Valuing Impacts and Value Balancing alliance. (2024). *General Methodology 1, 1.2*. p. 28 ff Tz. 5. IFVI_VBA_Public Exposure DRAFT_General Methodology 1_A4.pdf (value-balancing.com)

[35] International Foundation for Valuing Impacts and Value Balancing Alliance. (2025). *A vision for the impact accounting methodology*. https://www.value-balancing.com/_Resources/Persistent/3/1/a/7/31a7b4f24a6ed00dd2550e57cedd10a820e2ecb0/Impact%20Accounting%20Methodology%20Architecture%20Public_Final.pdf

These changes in dependencies can be induced by – but is not limited to - direct or indirect impacts.

Internalization in this context is the effects on entities' business models and resulting financial consequences when an impact is reflected.[36] For the Value to Business concept this relates to direct impacts produced by the entity as well as to indirect impacts created by third parties. Internalization further relates to the effect that dependencies can also yield financial implications for the entity.

The examples of indirect impacts and dependencies show that especially these two topics are closely related and may not always be clearly distinguishable.

All this may lead to an integration of risks and opportunities within performance, financial position, cashflows and/or cost of capital for determining the Value to Business of an entity. Because of respective analyses, the outcome should be the assessment of whether an impact can be translated to a risk or an opportunity with an anticipated financial effect.

The following examples in Table 1 and 2 illustrate the relationship between impact, dependency, change in capitals, Value to Society, and Value to Business.

Examples for the internalization of direct impacts produced by the entity itself are

- additional capital expenditures (CAPEX) and changing operating costs for additional water treatment resulting from increasing regulation against water pollution or
- decreasing productivity due to unfair working conditions.

Examples of the financial consequences from indirect impacts of third parties are

- decreasing revenues and higher operating costs due to reduced product quality as the required water quality in production is no longer available due to pollution from third parties or
- increasing hiring costs resulting from controversial working conditions of leading competitors in the industry with adverse effects on the reputation of the entire industry.

Examples of risks and/or opportunities arising from dependencies on natural, human, and social capital are

- lack of licenses or production permits relating to commercial purpose due to increasing water scarcity or
- economic damages due to work stoppages and strikes in connection with potential and planned regulatory changes for example with regards to retirement age.

[36] Capitals Coalition. (2019). *Social & Human Capital Protocol*. p. 5. Social_and_Human_Capital_Protocol.pdf (wbcsd.org)

Table 1 ***Examples of natural capital related topics, related impacts, and dependencies as well as risk and opportunities***

Topic	Impact driver	Change in capital	Impact (Value to Society)	Risk and opportunity (Value to Business)
Natural capital related topics				
Water consumption (impact)	Entities' direct/indirect consumption of water	Increasing scarcity of clean surface and ground water	Affected health from malnutrition and water-borne disease Increased costs to access water for downstream users and future generations	Lower productivity due to higher sick leave Increased costs of access to water for future business operations
Natural resource timber (dependency)	Deforestation due to agricultural land use	Reduced stock of timber	Modified ecosystem services relating to alteration of erosion control, water flow, pest control, wood yield, carbon storage, local climate regulation, landscape scenery etc. Economic impact relating to fluctuations in harvest and market price in relation to resource availability	Increased investment need for protection from physical risks (e.g. erosion) Increased costs for wood and related products as raw material input factor (also for non-agricultural companies)
Other air emissions (impact)	Emissions of particulates and nitrogen dioxide	Reduction in air quality	Impact on human health related to respiratory or cardiac illnesses and premature deaths related to decreased air quality	Cost to the business for additional air filters in production or end products (e.g. cars) Increased demand and revenues for producers

(Source: Value Balancing Alliance Impact statement, Focus: Environment V0.1, (2021), (20210302_VBA Method_paper_Environmentals.pdf (value-balancing.com))

Table 2 ***Examples of social & human capital related topics, related impacts, and dependencies as well as risk and opportunities***

Issue	Impact driver	Change in capital	Impact (Value to Society)	Risk and opportunity (Value to Business
Social and Human capital related topics				
Human capital: School education of potential workforce (dependency)	Lower rate of (high school) graduates	Lower educational level (skills) of workforce	Worsened opportunities for self-determination in education and career choice Reduced purchasing power and employability	Higher recruiting and training costs due to the lack of suitable workforce Reduced profitability and growth potential in domestic market Opportunity for providers of second-chance education
Social capital: Non-existing measures for the protection of intellectual property (dependency)	Rate of patent applications and patent disputes	Limited or no protection of intellectual property and therefore reduced innovative and entrepreneurial power	Reduced purchasing power, employment, external investments, and growth potential	Additional litigation costs Economic damage e.g. lost revenues due to plagiarism etc.
Human capital: Occupational health and safety (impact)	Cases of injuries and diseases	Reduced human capital due to increased absenteeism/ sickness rate within the production workforce	Human health Costs related to the use of medical resources Lost output due to reduced economic output	Higher labor costs for production workforce due to higher sickness rates Reduced output and financial performance due to interruptions of the production or inefficiencies

(Source: Value Balancing Alliance Impact statement, Focus: Environment V0.1, (2021), (20210302_VBA Method_paper_Environmentals.pdf (value-balancing.com))

Overall, Value to Society and Value to Business are both essential for reflecting a holistic picture of the interdependencies among the factors that affect entities' ability to create value over time – taking a double materiality perspective. Therefore, both concepts are required to evaluate entities' behavior from a stakeholder perspective and for identifying areas of insufficiently addressed areas of concern (e.g. via regulation or internalization of externalities) and potential future areas of concern.

4. Valuation and planning principles

Financial planning plays a central role within the Value to Business concept in quantifying the anticipated financial effects of sustainability-related opportunities and risks.

It is the basis for decisions, target setting, controlling, and internal and external communication. It requires a thorough understanding of the underlying assumptions and interconnection of single value driver of the specific business model.

This chapter explains the basic principles of financial planning and valuation within the Value to Business concept. By understanding how consistent and reasonable financial plans can be set up, and learn about basic valuation principles, readers gain the ability to apply these concepts not only in standard cases, but also in complex situations where professional judgment and tailored solutions are required. Key findings are

- Operational value drivers connect capitals with financials and enterprise value.
- Financial and non-financial metrics should be integrated into planning.
- Internal and external consistency and plausibility safeguards forecast quality and credibility need to be ensured.

Entities operate on the basis of economic, natural, human, and social capitals and influenced by the overall economy, sector, competition as well as regulator and broader society. Entities operations and activities can be described and quantified with the help of operational value drivers like market share, number of employees, volumes of input factors or GHG emissions produced and compensated. These operational value drivers determine the financial performance of the entity which is expressed in the financial statements for actuals and financial planning for forecasted numbers. The financial figures are also the basis for the determination of an enterprise value.

Therefore, a thorough and material plausibility analysis of the business model, the material operational value drivers important for the future financial performance is key for the Value to Business. This explicitly includes a detailed understanding of risks and opportunities associated to actual and potential impacts and dependencies.

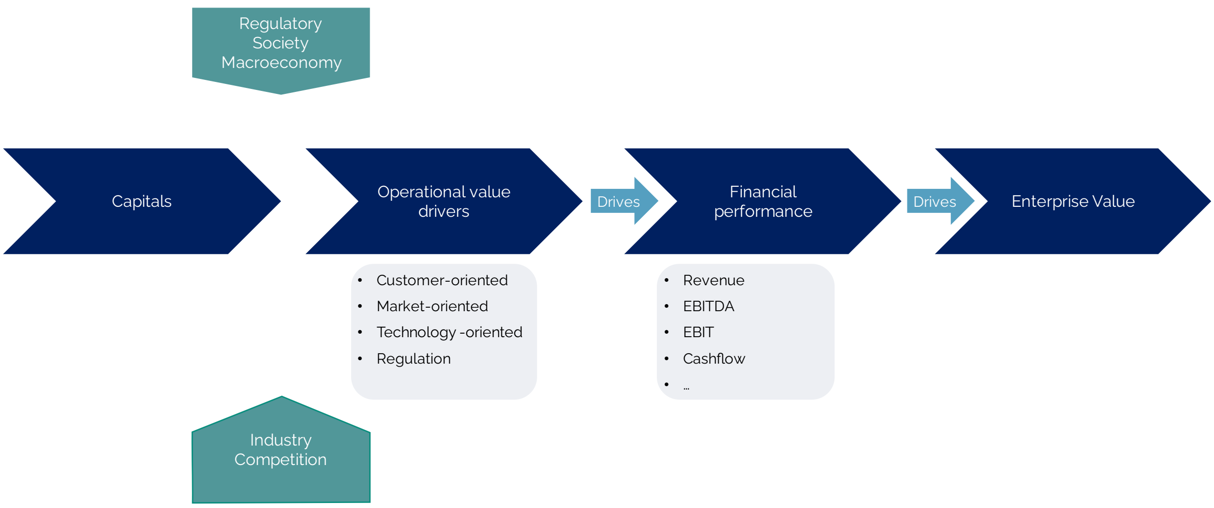

Figure 9 ***Linkage between capitals and enterprise value***
(Source: KPMG)

4.1. Financial planning

The financial planning of a company typically consists of profit and loss statements and balance sheets. Based on profit and loss statement and balance sheet, the cash flow statement can be derived.

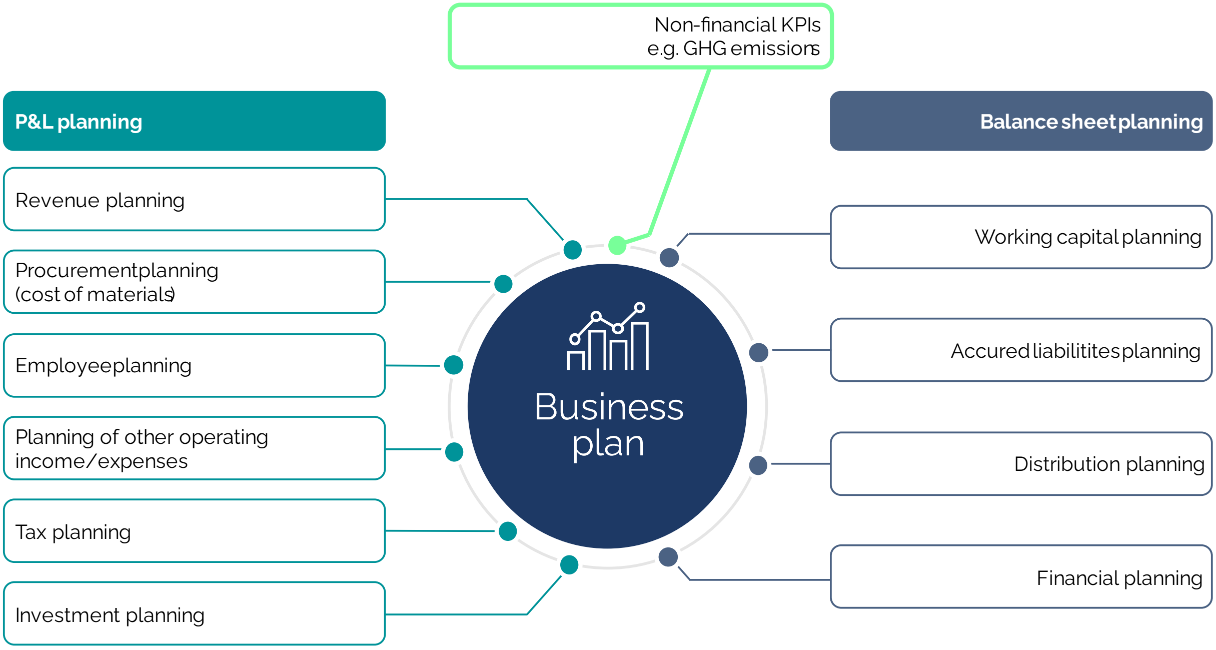

Figure 10 ***Extended integrated financial planning*** *(business plan)*
(Source: KPMG)

For the Value to Business financial planning, we may also consider the planning of non-financial metrics like emissions, volume of waste or recycled materials or number of employees. Forecasting of non-financial metrics can add several benefits, such as providing additional information for risks and opportunities, informing target setting and controlling, and used for consistent forecasting of the Value to Society. Therefore, integrated planning in the context Value to Business does not only address the interconnections between profit and loss statement and balance sheet but also the integration of non-financials metrics in the business plan.

This guideline defines the relevant characteristics of financial planning in the context of Value to Business. In the General Methodology 1 paper the following **qualitative characteristics** are addressed and defined[37]:

- Relevance,
- Faithful representation,
- Comparability,
- Verifiability and
- Understandability.

[37] International Foundation for Valuing Impacts and Value Balancing Alliance. (2025). *General Methodology 1 – Conceptual Framework for Impact Accounting*. p. 12ff

These characteristics shall also be considered for the determination of the Value to Business. For more detailed information on the qualitative characteristics, refer to General Methodology 1.[38]

For the purposes of financial planning in the context of Value to Business additionally the concept of "plausibility" is important:[39]

Computational and formal plausibility		Material, internal plausibility		Material, external plausibility	
Computational consistency	**Assumption consistency**	**Explanations from the management**	**Company analysis (including analysis of the past)**	**Market analysis**	**Analysis of competitors**
Accuracy of the calculations within the financial plans and between the differebt financial plans	Assessment of the consistency of assumptions within individual financial plans and between financial plans	Comprehensibility and consistency of the financial planning within the explanations, communications and documentations	Traceability of the consistency of the planning with the actual developments in the past and the company's potential as of the valuation date	Traceability of the consistency of financial planning, e.g. with economic forecasts, sales market analyses, etc.	Traceability of the consistency of planning, e.g. with actual figures and analyst estimates

Figure 11 ***Concept of Plausibility***
(Source: Practical Guidance of the Institute of Public Auditors in Germany IDW 2/2017: "Assessment of Corporate Planning in Valuation, Restructuring, Due Diligence and Fairness Opinion")

Plausibility is given when the assumptions and planning approaches for the respective occasion are comprehensible, consistent, and free of contradictions. The assumptions should be in line with the findings from the past, market, competition, environment, and company analysis. If there are deviations from the findings from the aforementioned analyses, they should be intersubjectively comprehensible. A knowledgeable third party should come to comparable assessments with the appropriate information.

Computational and formal plausibility

Computational plausibility covers accuracy, completeness, and consistency. First, it requires computational accuracy and accurate modelling techniques. Second, relevant information shall be complete considering the attributes of the specific Value to Business case. Third, actual data used as starting point in the financial planning shall match or be reconcilable with the financial statements.

Assumption consistency is another key aspect. It refers to internal consistency within a financial plan and alignment across different financial plans (e.g. between segments or entities of the same group). Financial plans should be developed and executed consistently across elements, profit and loss statements, balance sheets, and cash flow statements, and over time.

To ensure this, entities should establish clear, accounting-aligned guidelines for financial planning. These should cover major economic and sector-specific assumptions (e.g. inflation, exchange rates) and predefined value driver logics[40]. Regular reviews are essential to keep these guidelines aligned with organizational goals.

[38] International Foundation for Valuing Impacts and Value Balancing Alliance. (2025). *General Methodology 1 – Conceptual Framework for Impact Accounting*
[39] Aligned with IDW Praxishinweis. (2/2017). *Beurteilung einer Unternehmensplanung bei Bewertung, Restrukturierungen, Due Diligence und Fairness Opinion*
[40] For further details see Chapter 5.1

Understandability and verifiability are also important, supported by clear, consistent, and good documentation.

Material internal plausibility

Internal plausibility assesses whether assumptions align with management's explanations and insights from company analysis. Management expectations can be derived from stakeholder communications, official reports, target setting, or compensation programs, covering both financial and non-financial aspects. Interviews conducted for the specific Value to Business case also play a role.

The company analysis includes but is not limited to reviewing its legal structure, past financial performance, business model, supply chain and regional presence to identify strengths and weaknesses. It needs to be considered that the assumptions are aligned with the size, structure, nature, and future potential of the entity. The analysis of actual or potential dependencies may also be included in the company analysis. Wherever overlapping, assumptions made for the Value to Society assessment should align with those of the Value to Business calculations.

Material external plausibility

External plausibility means checking whether the planning assumptions match the results of market and competition analyses under the given framework conditions. This includes market and sector studies, consistency with short-, medium- and long-term planning, and benchmarking with comparable companies based on historical data and analyst estimates.

In sustainability-related financial planning, it must also be examined whether assumptions align with the latest climate and socio-economic scenarios, existing or expected regulations, and current science on impacts and dependencies, opportunities, and risks. Benchmarking should include non-financial indicators such as emissions or resource consumption.

The scale of financial planning depends on the purpose of the Value to Business determination. Restrictions may occur if access to planning data is limited. In such cases, the limited information basis must be disclosed in the report or documentation, and methods for dealing with uncertainty should be considered[41].

4.2. General valuation principles

As explained in Chapter 2, the Value to Business can be defined by various attributes. One of these attributes can be the consolidation of all financial aspects in enterprise value. The following section describes the general guidelines and principles of the existing valuation theory and applies them to the Value to Business concept.

Business administration and corporate valuation theory fundamentally distinguish between the terms "value" and "price". The quote "Price is what you pay. Value is what you get."[42] intuitively describes the relationship between these two terms.

[41] Refer to Chapter 0

[42] Warren Buffet

There are mutual relationships between the valuation purpose, applied valuation model, and used empirical data. These relationships determine the respective influence or suitability in deriving values or prices.

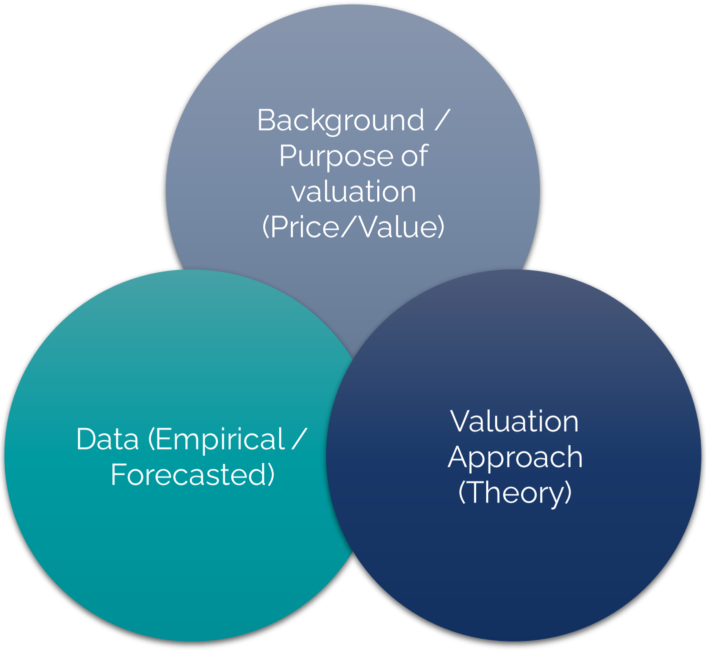

Figure 12 ***Relationship between valuation purpose, approach, and underlying data***
(Source: IDW Standard IDW Standard „Principles for the Performance of Business Valuations (IDW S 1) as of 2008. See also IDW, WPH-Edition, Bewertung und Transaktionsberatung, (2018), Kap. A. Tz.6)

There are five general guidelines for enterprise valuation which also apply to the Value to Business concept:[43]

- Relevance of valuation purpose

The valuation purpose determines the type of enterprise value. This has implications for the underlying valuation approach, as well as for the assumptions made for forecasting and discounting of future cashflows.

In general, the background for company valuations is divided into two groups with corresponding value concepts:

- Compliance-oriented occasions with observable market / transaction prices or an objectified enterprise value (fair market value),
- Decision-oriented occasions with (subjective) decision values.

Depending on the purpose of the determination of Value to Business either one or both occasions might be relevant e.g. for reporting or investment decision purposes.

- Valuation of the economic business unit and operational assets

Businesses – as a specific form of an entity - are purpose-oriented combinations of tangible and intangible assets that, by their interaction as well as use of economic, natural, human,

[43] Aligned with IDW Standard IDW Standard. (2008). *Principles for the Performance of Business Valuations (IDW S 1)*; IDW. (2018). *WPH Edition, Bewertung und Transaktionsberatung*. Kap. A. Tz. 70ff

and social capitals, are intended to produce goods and services to clients and customers as well as cash flows to their investors.

Therefore, the value of a business is not designated by the values of the individual items of assets and liabilities, but rather by the interaction of all items involved in the business.

In determining the business to be valued, all interacting business units, e.g. procurement and sales relationships/markets, research and development, organization, financing, and management shall be included, as all business units work together to contribute to future cash flows. This also includes the use of the above-mentioned capitals or intangible assets.

The object being valued must not necessarily be identical with the legal form of the entity, rather the business being valued is defined in terms of functional criteria (e.g. group, branch, strategic business unit).

The valuation of companies focuses on operating assets required for entire value creation process. This explicitly includes the economic, natural, human, and social capitals underlying the business activity of the entity.

- Valuation date

Enterprise values are to be determined at a particular point in time, the valuation date. Generally, the valuation date defines the relevant knowledge base for the valuation (information cut-off function) as well as the underlying cost of capital[44].

The consideration of this knowledge base is limited to circumstances whose origins were established before the valuation date. Only information that could have been acquired with due care up to the valuation date should be considered. The existing uncertainty at the valuation date must be considered.

This may also include for the purpose of decision-making the assessment of different scenarios e.g. different options relating to several regulatory outcomes or different scenarios relating to natural resources dependencies.

- Equal interests of stakeholder groups

Although the underlying valuation theory has a clear shareholder focus due to the underlying capital market theory (Capital Asset Pricing Model), for the projection of the expected cashflow an objective and neutral perspective with respect to different stakeholder groups should be assumed. The uncertainties associated with future developments must not influence the manner of valuing the business to an extent that there would be a one-sided disadvantage or advantage for one of the relevant stakeholder groups (e.g. by overestimating future employee compensations). This also refers to the equal consideration of the relevance of different capitals – with the same emphasis on planet and people. Nevertheless, the existing or potentially intended business strategy should be considered, which might disadvantage or advantage specific stakeholder groups.

The in some jurisdictions existing accounting principle of prudence (e.g. for German GAAP) also puts an uneven emphasis on the interests of specific stakeholder groups – especially creditors and therefore, must not be applied. The irrelevance of the principle of prudence does not mean that investors should be assumed to be risk neutral (see chapter 7).

- Comprehensibility of the valuation approaches

[44] Defined as return requirements of debt and equity investors, see also chapter 6.3

Valuations are regularly based on several assumptions and estimates which significantly influence the valuation result. In accordance with the principles outlined in General Methodology 1 it must be clearly documented which material assumptions and standardizations have been determined. It must be apparent whether the assumptions made are those of the valuer, management of the entity being valued, or from third party sources.

5. Forecasting and valuation methods

While chapter 4 outlines general principles underlying the Value to Business concept for planning and valuation, this chapter introduces accepted and applicable methods for forecasting and valuation. In the following, the concept of expected value is introduced, basic techniques for financial forecasting and different valuation approaches are explained. Additionally, general guidance and examples regarding their use and potential limitations in the Value to Business context are provided.

How to use this chapter	
Addressee	Controllers, finance, sustainability
Reason	To choose a fit for purpose method for financial planning and valuation
Content	Methods, time horizon, data availability and quality, dealing with uncertainty and the avoidance of double-counting
Tools	Value driver trees, examples of potential data sources

5.1. Preparation of Financial Forecasts

Predicting future developments is challenging, particularly for entities encountering transitional risks and opportunities. Consequently, financial forecasts are inherently uncertain and must account for this planning uncertainty.

In financial planning and valuation, the concept of expected value is pivotal. Valuation methods, such as the income approach, rely on the expected values of financial cash flows..[45] Even if we consider different scenarios (e.g. for stress-testing) and/or with decision-trees, an expected value perspective needs to be taken in the specific scenario.

The expected value is the weighted average of all possible outcomes of a random variable, where each outcome is weighted by its probability of occurrence. A simple example of expected value is flipping a coin. If we flip a fair coin, there are two possible outcomes: heads (0) or tails (1), each with a probability of 50.0%. The expected value is the average value we can expect if we flip the coin an infinite number of times, which is 0.5.

When planning financial outcomes, the range of possibilities is far more complex than the simple two-outcome scenario of a coin flip. Instead, there are numerous potential outcomes, each with varying probabilities, making the determination of expected values and the planning of future financial results particularly challenging. To improve forecast accuracy, it is crucial to account for expectations of operational performance and risk factors using the best available data. Additionally, forecasts should be detailed and integrated, based on an operating and financial value driver logic.

[45] Bewertung und Transaktionsberatung. (2018). Kap. A. Tz. 332

Forecasting sustainability related risks and opportunities presents significant challenges due to increasing uncertainty and decreasing accuracy over longer time horizons. As external factors such as regulatory changes, climate impacts, and technological advancements introduce complexity, long-term forecasting becomes even more unpredictable but remains crucial for strategic planning in the transition. Entities must address the inherent planning uncertainty by utilizing robust forecasting techniques tailored to these uncertainties. This is not a new development or a new challenge, as entities operated in the past in an uncertain market environment. Techniques and tools developed in such an economic and market environment can be applied for sustainability related topics as well.

There are a few points which need to be considered and determined before starting with financial planning and forecasting:

1) Planning Horizons

Business models are typically developed with the goal of indefinite operation, so business valuations often assume an unlimited useful life. However, internal factors (e.g., product life cycles) and external factors (e.g., technological changes) necessitate dividing the planning horizon based on data availability and forecasting accuracy. In practice, this horizon is divided into different phases, which vary depending on the size, structure, location and industry of the entity. The two- or three-phase models commonly used are:[46]

1. **Detailed Planning Phase:** A detailed annual forecast of financial surpluses or losses, typically spanning 3-5 years, focuses on individual components (e.g. product-specific revenue projections, margin profiles, cost structure) and short- to mid-term expectations. This phase often incorporates known market trends and regulatory changes, allowing companies to make more accurate estimates, particularly for tactical decisions such as CAPEX allocation or short-term decarbonization investments. While detailed planning calculations are usually available, their reliability must be carefully assessed through additional plausibility checks. See chapter 4 for details on financial planning principles.
2. **Convergence or Additional Planning Phase (optional – depending on specific circumstances):** A combination of detailed and high-level projections of key financial components on an annual basis reflects transitional trends. As the planning horizon extends, uncertainty increases, particularly due to sustainability factors like climate change and evolving regulations. The convergence or additional planning phase is especially used if e.g. transitional effects like decarbonization actions, introduction of new product groups expand beyond the detailed planning period but are of material importance for the future long-term performance of the entity.
3. **Perpetuity/Terminal Value Phase:** A simplified projection of financial surpluses at a certain level, including long-term growth expectations. This phase reflects a steady state where foreseeable market adjustments are incorporated.

Some sustainability related risks or opportunities will materialize after the detailed planning horizon. Transformation cycles are often not finalized within the planning horizon of the detailed planning phase. A prolongation of the detailed planning horizon is often required before entering the terminal value (see convergence or additional

[46] IDW S 1. (2008). Tz. 76

planning phase). This may extend the planning period materially (e.g. until 2050) to reach a regular long-term cash flow which can be extended into perpetuity.

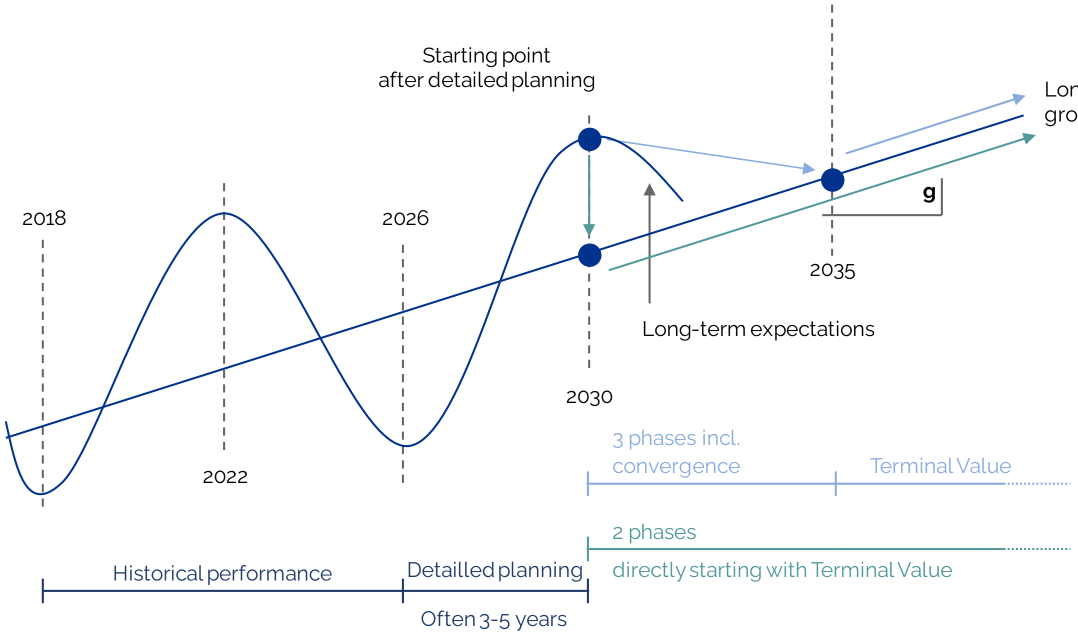

Figure 13 ***Time horizon and terminal value*** *(Source: KPMG)*

The perpetuity calculation (terminal value) does not simply extend past surpluses or the expectations of the last planning year especially not in the context of sustainability related topics which often have a strong transformative or physical risk / opportunity inherent. The perpetuity phase has high relevance as it typically represents 70-80% of total entity value[47], depending on the discount rate and the length of the detailed planning phase (3-5 years). Therefore, adjustments of financial surpluses and cashflows (based on the detailed planning projections) may be required in a two-phase model (see green arrows in Figure 13) or the consideration of a convergence phase (see blue arrows). With an increasing time horizon in the detailed and additional planning phase, the relevance of perpetuity decreases.

In some cases, it may be appropriate to assume a limited lifespan for the entity. Here, both operational surpluses/losses until closure and the present value of cash flows from liquidation (which can span several periods, e.g., for deconstruction and restoration) must be considered.[48]

[47] Entity value or enterprise value is the market value of the entity's underlying business before financing by equity and debt (free of any cash). The entity value reflects a pure financial perspective
[48] Bewertung und Transaktionsberatung. (2018). Kap. A. Tz. 247-259

2) Value driver logic

Financial planning shall be based on single operational and financial value drivers. Simplified value driver logic is shown in the Figure below.

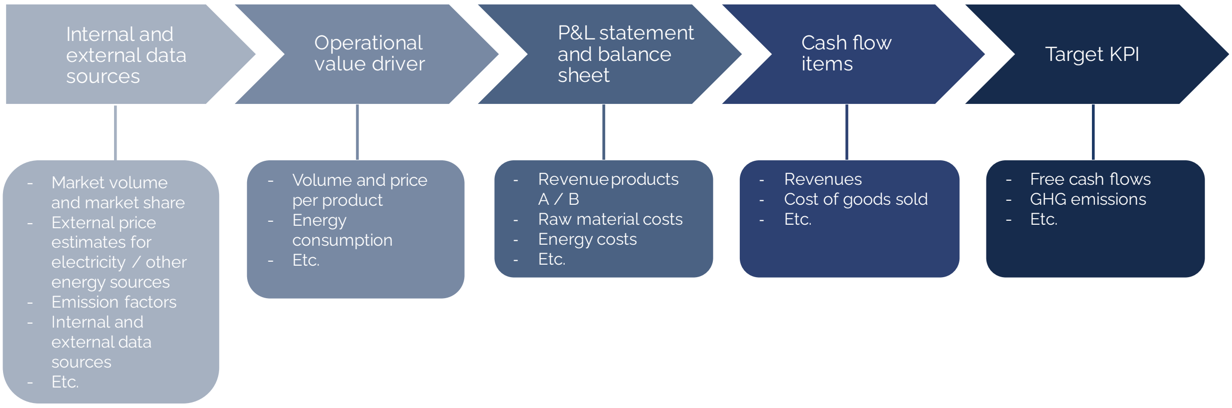

Figure 14 ***Simplified value driver logic*** *(Source: VBA)*

An example for a simplified value driver tree for decarbonization is illustrated in Figure 15.:

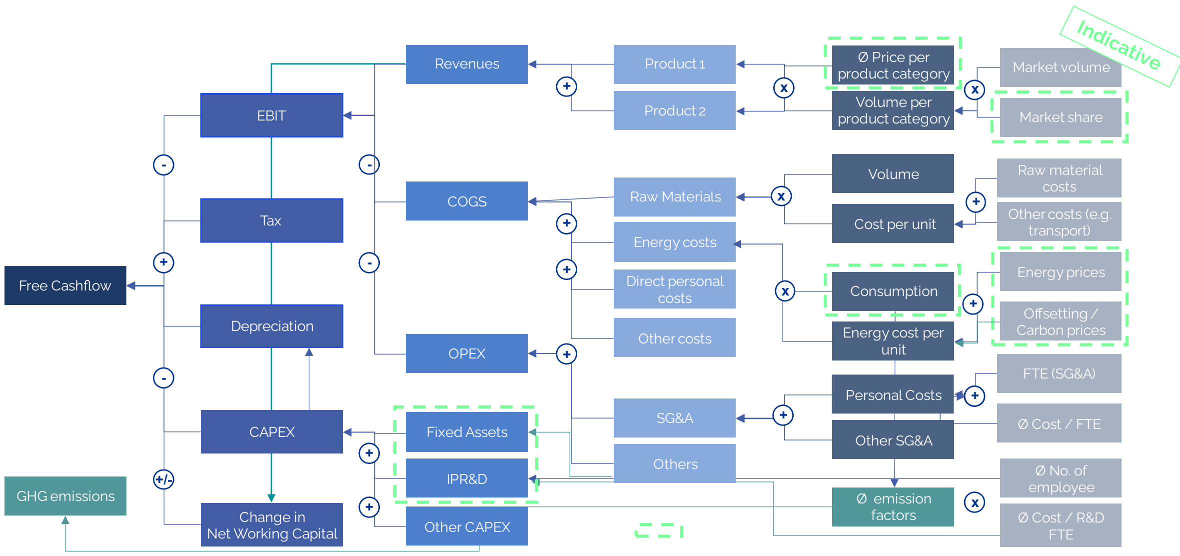

Figure 15 ***Example for value driver logic for decarbonization*** *(Source: KPMG)*

Note: Neon green lines highlight specific key performance indicators which have been assumed to be material for decarbonization example.

Planning by using a value driver logic allows for precise analysis and forecasting in complex scenarios. For instance, future revenue potential from decarbonization can be analyzed at the product level, considering factors such as total market volume, market share, pricing, and competitor responses. Instead of merely adjusting revenues or EBITDA by a fixed percentage, this approach tries to explain reality and focuses on estimating and modeling based on relevant value drivers. The key advantages of a value driver tree include the visualization of complex financial relationships and the connecting points between internal and external variables/input factors which need to be estimated in an ongoing process. This also helps to address the relevant stakeholders within the organization for their data input. Especially, if this involves experts which are not familiar with the planning process, this visualization may help in the discussions.

This level of detail allows for the integration of different levels of information (regarding source, quality, detail and uncertainty) into financial planning, ensuring a more accurate representation of future financial outcomes. Expectations for market volume growth can often be more reliable than predictions regarding market shares among competitors. In dynamic business environments, clearly identifying and mitigating risks is crucial for aligning entity strategy. Sensitivity analyses can further elucidate the impact of individual factors on overall planning.

Planning models can also be updated as new information emerges, and circumstances evolve. The level of granularity in value driver analysis depends on the specific business model, the availability of data (both historical and projected), and the accuracy of that data.

Please refer to the *Value to Business: Application Guidance* to gain more detailed insights including additional practical examples.

Data Availability and Quality

One of the central hurdles in financial quantification is the limited availability and quality of internal and external data, especially for long-term planning. The quality of available data decreases over time, making predictions less reliable. This is often named as one of the key obstacles for long-term projections.

The data sources might also vary depending on the purpose of the application of Value to Business (e.g., if norms require a certain level of external and objective data). The selection of data sources should consider:

- Accuracy and objectivity of estimates,
- Respective time horizon, and
- Level of uncertainty included in the estimate.

Consistency of the assumptions when combining different estimates should be considered and ensured. Ideally, multiple sources are used for verification and benchmarking.

Listed here is a non-exhaustive list of multiple data sources with examples and including comments for applicability:

Table 3 ***Examples of data sources***

Data source	Examples	Applicability
Contractual conditions	Prices in long-term contracts (energy, raw material prices, selling prices)	Low uncertainty Short-/mid-term estimates Relevant for assessing future liabilities and costs. The terms may include price adjustment clauses, which can introduce uncertainties over time.
Future market prices	Forwards/futures for specific products/materials Fundamental price estimates e.g. energy price developments from external data providers	Mid to high uncertainty Useful for estimating cost fluctuations in volatile markets like commodities or energy. However, accuracy diminishes over longer forecasting horizons due to unpredictable market shifts.

External market studies (regions, sectors, industries)	Prices, market volumes, market shares, competitors, macroeconomic data like Statista, potential transformational costs and/or CAPEX requirements and others	Provides external industry trends and forecasts. Best for benchmarking and long-term planning but may lack detailed entity-specific data and quality can vary significantly.
Internal projections	Revenues, margins, R&D efforts, CAPEX and others	Entity specific view Degree of accuracy and uncertainty can vary significantly
Benchmark data	Costs per unit from competitors/peers or other entities/ sectors, margins, growth rates	Market perspective Adjustments may be needed for unique entity-specific circumstances
Historic data (financial and non-financial)	(Moving) averages, regression analyses, trend extrapolation	Useful for internal entity data on revenues, expenses, and investments. Reliable for short-term planning but limited for long-term forecasts especially in dynamic environments
Government data bases	Eurostat, ILOSTAT	Objective macroeconomic data, useful for macro and implementation scenario planning, market data
Capital Market Data	Interest rates, ratings, cost of capital components, exchange rates	Short-, mid- and long-term projections from market perspective
Scientific Data Sources	Climate Studies, IPCC reports, WWF Risk Filter, social indicators	Useful for macro- and implementation scenario and detailed analysis. Data quality can vary, and industry-specific comparisons may be limited.

(Source: KPMG)

To overcome limitations in data quality and availability, entities should rely on a combination of internal and external data, strategic insights, and sector knowledge. External benchmarks and science-based information can offer guidance on aligning financial forecasts with sustainability objectives. Furthermore, the availability of benchmarking data will improve as sustainability becomes more embedded in business reporting and reporting requirements will increase data transparency and quality.

The integration of financial data with sustainability insights is essential. Entities should combine their knowledge of business models with sustainability considerations to generate accurate forecasts and strategies that address both financial and non-financial aspects of their operations like financial and emission reduction targets.

5.2. Quantification and forecasting techniques

The financial effects of sustainability risks and opportunities can be measured using both standard forecasting methods and new approaches tailored specifically for sustainability. The following section explains some of the common methods used. With the so-called impact internalization approach, we additionally highlight a method closely connected to the monetary valuation of impacts (Value to Society)[49].

[49] Also referred to as impact accounting

Before starting with the financial quantification, a qualitative assessment may be performed specifying the background, circumstances and situation of the specific opportunity or risk. It explains potential costs or benefits in non-numerical terms (e.g., increase in air pollution or reduced recreational benefits), but also elaborates about probability, magnitude, time horizon, affected segment/region/market/product, relevant boundaries as well as affected profit and loss statement (P&L) and balance sheet line items. This step also helps to assess which quantification and forecasting methods may be most appropriate.

This also depends on the degree of complexity and desired precision, data availability, and accuracy as time available. Simplified estimates can range from "rule of thumbs" to simplified adjustments (e.g. of EBITDA). Not every technique may be suitable for every purpose, desired level of accuracy and forecasted KPI.[50]

In the following section, some techniques and methods are highlighted which are especially suitable for Value to Business. Other additional techniques can be applied if they follow the principles listed in chapter 4.

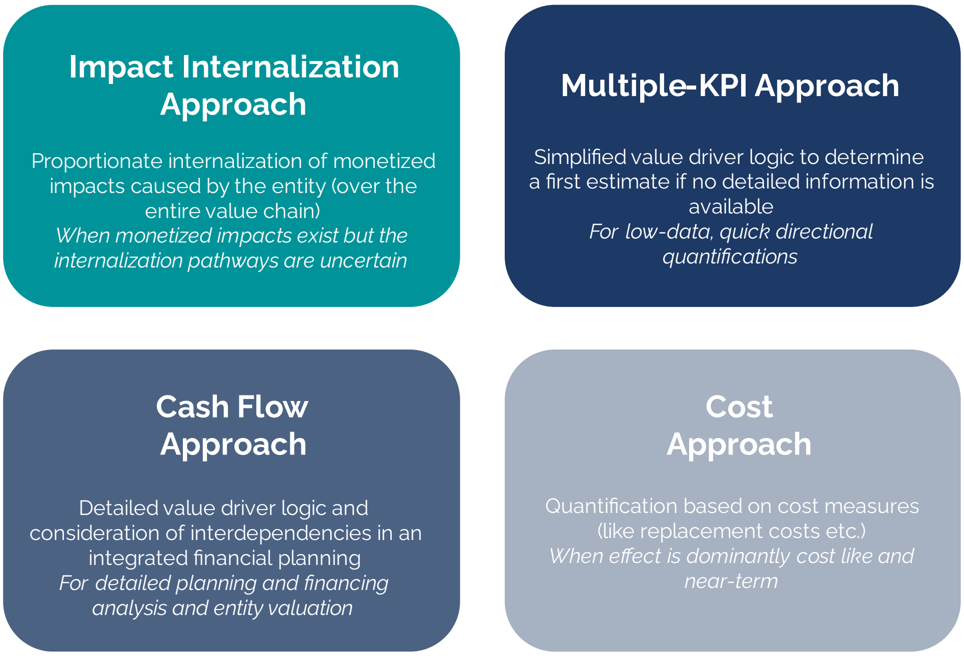

Figure 16 ***Overview of quantification methods***
(Source: VBA)

5.2.1. Impact Internalization Approach

Impact accounting methodologies (Value to Society) quantify positive or negative effects of entities activities on people's well-being in monetary terms. Monetized impacts take a societal perspective and therefore are not directly comparable with financial income, expenses or cashflows. Additional steps are required to use results from impact accounting to be used in financial planning. Valued impacts or can serve as an estimate of the potential degree to which externalities may be internalized.

[50] The NCP also highlights different valuation techniques (Capitals Coalition. (2016). p. 82. NCC_Protocol_WEB_2016-07-12-1.pdf (capitalscoalition.org))
These techniques mainly relate to the monetization of impacts and financial effects of opportunities and risks and are not suitable for this purpose

The impact internalization approach aims to specify and quantify the potential costs and benefits resulting from a future internalization of environmental and social impacts. This approach refers to the idea that those entities that cause environmental or social impacts bear the costs/benefits associated with it, including prevention, mitigation, and remediation measures. For using this approach an analysis of the relevant forces of internalization (e.g. political, economic, social, technological, environmental, legal/regulatory forces[51]) is highly relevant.

- **Key Elements:**
    - **Monetarization of positive and negative impacts** over the entire value chain, using impact accounting methodologies (Value to Society): This should be done – in the best case – on a granular basis distinguishing between positive and negative actual impacts for different countries/regions and value chain stages, for understanding the potential risk of internalization. See General Methodology 1 and 2 of the IFVI/VBA impact accounting methodology for more details.[52]
    - **Analysis of potential internalization**: This analysis should include the source of internalization (e.g. regulation, factual climate change, customer behavior), the extent of the internalization (e.g. full or just in parts), the time horizon (e.g. short-, medium-, long-term including if internalization may result in subsequent steps), affected financial line items in financial statements (e.g. revenues, costs, CAPEX or others) and current status of the entities resilience or response options (e.g. transfer of increasing costs to the downstream value chain, divestments, offshoring etc.) which may affect the internalization rate.
    - **Setting up a simplified quantification logic** using monetized impact and case-specific internalization rates: General assumption is that the monetized impact can be considered as additional costs (or benefits), but the extent may differ and be adjusted based on the internalization rate and the individual response rate of the entity, which reflects the ability and preparedness of the entity to adapt. The response rate may be determined by contractual terms, market position, substitutes of input factors and production process and may be closely connected to the resilience of the business model.

$$Financial\ effect = Monetized\ impact * internalization\ rate * (1 - response\ rate)$$

    - **Verification of results:** Plausibility checks should be made to doublecheck if general assumptions (e.g. assumptions regarding industry-wide costs etc.) are fulfilled.

- **Example:**

  An entity expects mid- to long-term wage increases in several emerging and developing countries in which it operates. The extent of the wage increase is difficult to quantify, but the sources for wage increases are mainly economic growth, increasing shortage of skilled workers and increasing power of worker friendly political parties and labor unions. As the wage increase is difficult to predict, the

[51] For details see Value to Business Application Guidance

[52] IFVI/VBA. (2024). *General Methodology 1: Conceptual Framework for Impact Accounting*; IFVI/VBA. (2025). *General Methodology 2: Measurement and Valuation Techniques*

entity decides to use living wages as reference point for their own paid wages and assumes that negative impacts from payments below living wage levels (1.2 million CU[53]) will be internalized within the next 3-5 years and even exceed the living wage impacts by 5%. The wage increase can only be partly compensated for (80%) by rolling over increasing costs to the downstream value chain, due to existing competition. The relocation of the production site is not an alternative. The resulting financial effect:

$$EBITDA\ effect = -1{,}200\ m\ CU * (1 + 0.05) * (1 - 0.8) = -252\ m\ CU$$

Wages are expected to increase within the next 3-5 years by 0.252m CU.

This simplified approach can be adjusted by additional factors e.g. if internalization of impacts may affect productivity, competition or other aspects of the entity's operations. It can be also applied for up- and downstream value chain stages.

- **Usage and limitations:**

The Impact Internalization Approach is valuable when there is uncertainty about the specifics of future internalization (e.g., regulations, market shifts), but it is clear that some form of internalization will occur. This is especially true for areas lacking concrete regulations or for long-term sustainability issues, like dependencies on ecosystem services. This approach is particularly useful for long-term effects with a high degree of uncertainty. The approach requires the calculation of impact information based on impact accounting methodologies.

It helps companies prepare for future costs, even without specific data, by allowing them to develop resilient strategies. Its flexibility in simulating different internalization rates and responses makes it useful for various strategic scenarios.

However, the model relies on simplified assumptions, meaning its accuracy may be affected by unforeseen changes in regulations or market dynamics. A thorough analysis of the entity's ecosystem is needed for better estimates.[54] Otherwise, there is a risk of generalization, particularly in complex, global operations with diverse impacts and regulatory environments.

It is important to note that monetized impacts are not directly related to cash flows and should not be treated as such. They may only become partially cash flow relevant if internalization is assumed. Consequently, the Impact Internalization Approach may not cover subsequent effects which can arise apart from the considered internalized impact. Additionally, the process of how some externalities may be internalized might be very complex and might affect companies differently. Some impacts and externalities may even never internalize, whether in the short-, medium-, or long-term. Nevertheless, the magnitudes of the monetized impacts can provide insights and indications where high risks of internalization exist.

5.2.2. Multiple-Key Performance Indicators (KPI) Approach

This method uses various KPIs to assess an entity's financial effects resulting from impacts and dependencies, using simplified value driver logic and multiple data sources. Key characteristics are the simplified forecasting logic with only a few assumptions,

[53] CU = currency unit
[54] For more details refer to the Value to Business Application Guidance

concentration of KPIs like revenues or EBITDA and reduced complexity of real-world circumstances.

- **Key Elements:**
    - Translation of underlying qualitative description of risks/opportunities and financial effects into a simplified value driver logic and definition of a target KPI (e.g. EBITDA).
    - Selection of main data sources: These data sources can vary between peer benchmarking data, industry data, science-based data, global estimates or other data sources depending on data availability.
    - Verification of results.
- **Example:**

  An entity plans to analyze the financial effect of increasing wages due to growing labor shortages and rising demand for skilled workers in several of its key markets. While the exact magnitude of the increase is difficult to estimate, it is anticipated that wages of €1,500 will increase by 60% over the next five years. However, the entity can only pass on 70% of the increased labor costs to the downstream value chain due to intense market competition. The impact on the EBITDA margin, which was originally €1,500, can be calculated as follows:

$$EBITDA\ effect = -1{,}500\ CU * 0.6 * (1 - 0.7) = -270\ CU$$

  This simplified approach could be adjusted by additional factors, such as the possibility that rising labor costs might increase investments in production efficiency. A similar analysis could also be applied to other value chain stages, such as suppliers or distribution partners, to obtain a more comprehensive picture of the financial impacts.
- **Usage and limitations:**

  The Multiple-KPI Approach is beneficial when an entity needs to assess financial effects while missing detailed data and expectations. This is especially true for circumstances expected in the long term, new emerging topics where the entity lacks experience or external market factors. Due to this data limitation the entity may work with approximations and rough assumptions to get at least a first estimate.

  This approach enables companies to analyze potential financial outcomes based on a few key metrics and limited forecasting inputs, allowing for quicker assessments. This is also helpful if the available time for quantification is limited. It may also be helpful for a first overall assessment or a plausibility analysis.

  It is important to recognize that this approach may oversimplify complex interdependencies, especially timing effects (e.g. delay in introducing new technologies or products) or indirect financial effects on balance sheet and financing capacity. As a result, further detailed analysis is recommended for companies operating in highly dynamic or regulated markets to ensure that key uncertainties are properly accounted for. Without this, there is a risk of misinterpreting the results or overlooking critical financial drivers.

5.2.3. Cash Flow Approach

The Cash Flow Approach calculates the financial effect by estimating underlying variables and detailed financial positions that lead to cash flow effects, using an advanced value driver logic and integrated financial planning. This approach requires a detailed estimation of individual financial line items across the P&L statement, balance sheet, and cash flow statement and their underlying assumptions and variables. By focusing on integrated planning, it ensures that interdependence between these financial elements is captured, including non-financial performance measures like water consumption or air emissions.

- **Key Elements:**
    - Translation of underlying qualitative description of risks/opportunities and financial effects into a detailed value driver logic and definition of interdependencies between financial line items.
    - Determination of point-estimates or value ranges for single forecasting variables: Multiple data sources can be used, and value ranges should vary depending on data quality and forecasting uncertainty.
    - Integration of assumptions and value driver logic into an integrated planning model including P&L statement, balance sheet, and cash flow statement as well as material non-financial KPIs projections.
    - Verification of results.
- **Example:**
  An entity evaluates the financial effect of anticipated wage increases coming from economic growth, increasing shortage of skilled workers and increasing power of worker friendly political parties and labor unions as expected over the next five years. The entity assumes that it is fully affected by these trends, but it may be able to compensate partly due to more efficient routines (including new machinery) and outsourcing of less important but labor-intensive parts and operations to subcontractors.
  In this case, the entity should estimate financial effects on different line items, and the following interdependencies:
  Direct labor cost effect: Labor costs may be based on the number of full-time equivalents (FTE) and gross average wages / FTE (differentiated per employee groups) that may increase due to the expected wage increases. Additionally, it needs to be analyzed whether the wage increase can lead to productivity increases (fewer sick days, more productivity etc.), potential reductions in employee turnover costs etc., partially offsetting the direct negative financial effect.

  Based on the analysis, the entity expects that from the currently 2.000 employees 1.000 will be affected by the wage increase within the next 5 years, 500 will not be affected, 300 may be outsourced and 200 may be reduced over the next 3 years.
  The average wage per FTE will increase from 1.000 to 1.200 CU. Average wage of non-affected FTE is already 1.300 CU. Outsourced workers will cost 1.050 CU.

$$A)\ Direct\ labour\ costs\ (old) = 1500\ FTE * 1{,}000\ CU + 500\ FTE\ *\ 1{,}300\ CU = 2{,}150\ CU$$

$$B)\ Direct\ labour\ costs\ (new) = 1000\ FTE * 1{,}200\ CU + 500\ FTE * 1{,}300\ CU = 1{,}850\ CU$$

$$C)\ Costs\ subcontractors = 300\ FTE * 1{,}050\ GE\ = 315\ CU$$

Resulting cost effect (including productivity effects) is 15 CU (B+C-A).

Revenues: It needs to be analyzed if the increased labor costs can be transferred via higher prices to the customers of the entity. This depends on the competitive structure of the relevant market, as well as on customer segmentation. Additionally, some entities may be positively affected by an overall wage increase due to their product portfolio resulting in higher sales volumes and/or prices.

Balance Sheet: Changes in liabilities due to higher wage commitments, adjustments in employee-related accrual may affect the balance sheet and cash management.

Furthermore, non-financial KPIs, such as employee satisfaction, retention rates, and workforce productivity, may be integrated into the model as relevant KPIs. This might be increasingly helpful if these KPIs are used as target metrics (e.g. in non-financial reporting or steering). In this case, financial modelling can work as single point of truth regarding multiple data points.

This approach uses flexible financial models that allow for adjustments and can incorporate sensitivity, scenario, and simulation analyses to account for uncertainties in the assumptions. By modeling different internal and external scenarios, the entity can explore how changes in key drivers (e.g., labor supply, economic conditions) affect outcomes. This is not limited to profit figures such as EBITDA or EBIT but considers overall financial planning including cash flow.

- **Usage and limitations:**

  The Cash Flow Approach is used for estimating financial effects by linking detailed financial variables and assumptions to cash flow effects. It employs integrated financial planning across the P&L statement, balance sheet, and cash flow statement, capturing interdependencies between financial and non-financial factors, such as water consumption or emissions.

  It also highlights how interdependencies, such as revenue increases leading to higher hiring needs, can be effectively captured. The use of detailed value driver logic ensures that specific variables, such as labor market conditions and regulatory changes, are accounted for in the financial forecasts. This approach allows for scenario analysis, capturing uncertainties in key drivers like economic conditions or labor supply.

  It is capable, especially for topics and circumstances with high relevance and complexity, and multiple interrelations. Limitations include reliance on assumptions, requiring a detailed understanding of interconnected factors to avoid oversimplification.

5.2.4. Cost Approach

The cost approach evaluates the financial effect by estimating the costs associated with a company's sustainability related risks and opportunities. This can include both direct costs, such as clean-up efforts or regulatory compliance, and indirect costs, such as reputational damage or operational inefficiencies. There are different costs which may be considered e.g. replacement costs (e.g. costs of replacing relevant capital with an artificial substitute), damage costs (e.g. potential costs of property, infrastructure, and production losses due to capital degradation), travel/transportation costs (e.g. considering transportation, mitigation costs (e.g., investments to avoid specific air emissions), and other costs incurred to get specific services originally provided by respective capital).[55]

- **Key Elements:**
    - Translation of underlying qualitative description of risks/opportunities and financial effects into corresponding direct and indirect costs.
    - Determination of estimates for the respective cost items and underlying assumptions.
    - Verification of results.
- **Example:** A company calculates the total cost the relocation of a production facility to a country with low labor costs, including construction costs, training costs, ramp-up costs and others.
- **Usage and limitations:**

  This approach is particularly useful when financial effects can be tied directly to cost measures, allowing for a more straightforward calculation of financial effects. It involves translating qualitative risks or opportunities into cost estimates and evaluating the underlying assumptions. However, its limitations lie in the dependency on accurate cost estimation and the ability to account for less tangible or indirect effects, which may lead to incomplete financial assessments if not carefully managed.

Each of the four approaches provides a unique lens through which companies can quantify the financial impacts of their sustainability risks and opportunities. These quantification methods can be applied individually or combined for more comprehensive assessments using different data sources. The applicability of each method varies based on the company's needs and timeline. The complexity of these methods also varies, with internalization and cost approaches being simpler compared to the more data-intensive Cash Flow approaches. Short-term risks may be better evaluated using the Cash Flow approach, while long-term environmental impacts may require an alternative approach.

For each of the methods described a detailed (i) impact and dependency, (ii) entity and market, as well as (iii) internalization analysis is required to understand current and future status of the entity within its market, and its natural, as well as societal ecosystems[56]. This also includes a qualitative description of specific risks and opportunities and resulting anticipated financial effects. Generally, a step-by-step approach from qualitative to financial quantification is recommended.

5.3. Dealing with future is dealing with uncertainty

Future and uncertainty are intrinsically linked. Any attempt to model, forecast, or plan for the future must acknowledge this connection. Rather than seeking to eliminate uncertainty, entities must learn to integrate it into their decision-making frameworks. Accepting uncertainty as a structural component of financial planning is not a weakness, it is a prerequisite for resilient and adaptive planning and steering.

[55] NCP, p. 86
[56] For further detail refer to the Value to Business Application Guidance

This chapter provides a short overview which techniques can be used to handle uncertainty in financial forecasting.

In general, it can be differentiated between static and dynamic planning techniques.

Static planning techniques assume that the future is predictable and that it will be similar to the past. These techniques rely on historical data and trends to forecast future performance. Examples of static planning techniques include *trend extrapolation and moving averages*. These techniques are useful when the business environment is stable and predictable, and when there are no significant changes expected in the future. Especially in the context of transforming business models or material changes, e.g. related to environmental or climate-related topics, these techniques are of limited use.

Dynamic planning techniques assume that the future is uncertain and that it will be different from the past. These techniques consider the events with a low / lower probability of occurrence, as well as changes in the business environment and the business model. Examples of dynamic planning techniques include *scenario analysis and Monte Carlo simulation*. These techniques are useful when the business environment is volatile and unpredictable, and when there are significant changes expected in the future.

The main difference between static and dynamic planning techniques is the level of uncertainty they can handle. While point-estimates of future financial effects are widely used, they are difficult to predict and apply for an environment characterized by a high degree of uncertainty, long-term planning horizons, and material difficulties in predicting macro- and microeconomic developments.

In such environments, operational and financial drivers should be systematically and transparently addressed by using expected values which have been derived based on probability-weighted scenarios and simulations.

Generally, there are different forecasting techniques which can address uncertainty inherent in long-term forecasts (see Figure 17), including:

1. **Sensitivity Analysis:** This method examines how changing a specific variable, such as cost of raw materials or carbon taxes, affects a financial outcome considering a pre-specified value range. By altering assumptions, entities can identify the main contributing variables which either have the most important effect and/or the broadest value range for further analyses.
2. **Scenario Analysis:** In this technique, companies generate multiple possible future scenarios (e.g., aggressive carbon regulation vs. lenient policies), characterized by different underlying variables and assign probabilities to each scenario. This helps evaluate the likelihood and financial effect of different scenarios in order to determine an expected value. It should be assured that the different scenarios fit the Value to Business case (e.g. extreme scenarios for risk management purposes, more realistic scenarios for business valuation purposes).

3. **Monte Carlo Simulations:** Entities may use Monte Carlo simulations, which assess a wide range of possible outcomes by running simulations across multiple variables, assigning distribution curves to each of the individual variables. This gives a clearer picture of risk profile and helps account for unpredictable variables like climate policy or technological disruption.

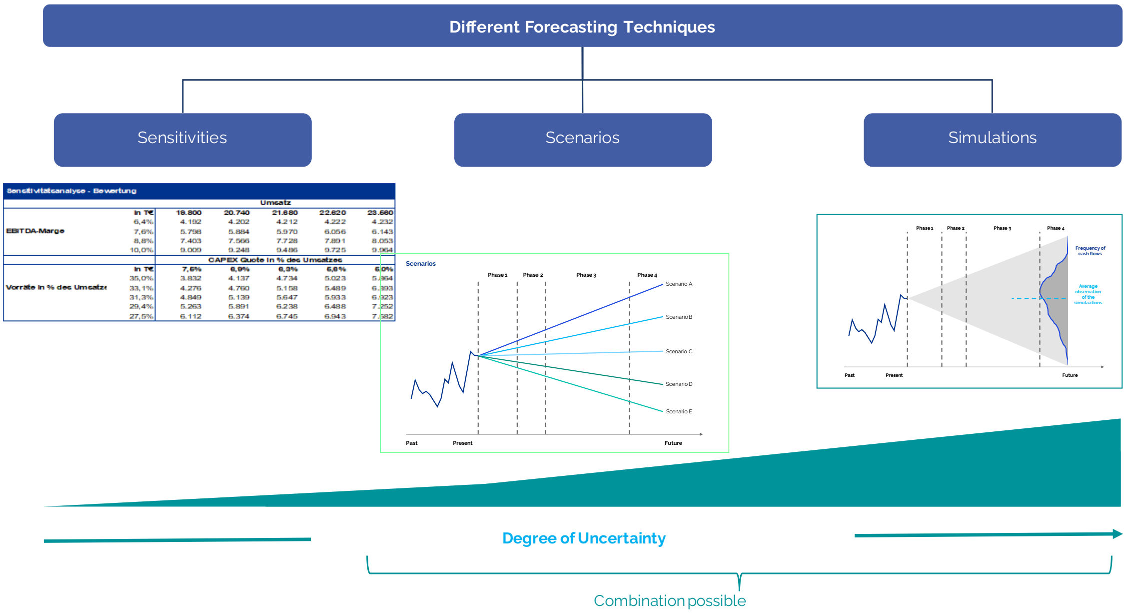

Figure 17 ***Techniques to handle uncertainty***
(Source: KPMG)

For the specific use and the advantages of the different sensitivities, scenarios and simulation analyses please refer to the *Value to Business: Application Guidance*.

5.4. Valuation methods

Theory of business enterprise valuation generally refers to three main valuation approaches measuring the value of entities: the market approach, the income approach, and the cost approach.[57] Valuation theory and practice, as well as reporting standards like the ASC 820 or IFRS 3 additionally provide examples of valuation techniques that are consistent with each valuation approach.

[57] For example, refer to IDW S 1 or ASC 820

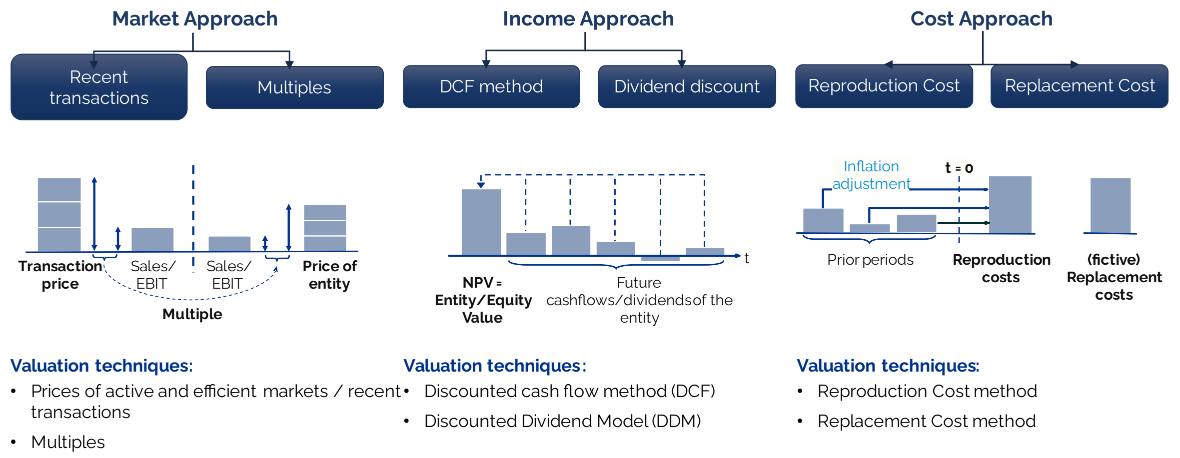

Figure 18 ***Valuation approaches***
(Source: KPMG)

If the use case and purpose of the Value to Business requires the determination of the value of the entity (e.g. in a transactional context) these valuation approaches are the basis for value determination.

Market approaches:

These approaches encompass both direct market approaches (market price of the traded asset, price of recent investment) and indirect market approaches (analogical approaches such as multiples based on listed companies or on recent transactions of comparable companies).

Income approaches:

These approaches are based on the premise that the value of an asset relies on the profitability it will deliver to its owner in the future. Thus, the value depends on the expectations of further income, on the risk attached to these expectations and on the remuneration expected for taking such risk. The discounted cash flows (DCF) method is one of these approaches.

Cost approaches:

These approaches are either based on the past (capitalization of incurred costs) or on the assumption of replacement/replication of assets (introducing modern-equivalent assets where the actual asset is no longer available on a first or second-hand market).

Each one of these approaches has pros and cons and is circumstantially more or less relevant for a specific valuation, depending on the context of the valuation and characteristics of the considered asset. Where possible, more approaches may be used for plausibility reasons. Again, characteristics, underlying assumptions, and pros and cons of each of these approaches are discussed and available in valuation literature, thus will not be detailed here.

In the Value to Business context, especially the income approach with the DCF approach is a useful approach as it is a prospective approach. It considers entity specific circumstances and explicitly addresses risks and opportunities. Additionally, it allows a broad flexibility regarding the consideration of time horizons, data quality and the depths of complexity.[58]

According to the DCF method, the entity's value is determined by discounting the future cash flow generated by the company to the valuation date at first. These future cash flows represent the cash flows available to both equity and debt holders of the company. The equity value of the company is then determined by deducting the market value of net debt from the entity value.[59]

To derive the value of the company, the determined cash flow must be discounted with an appropriate discount rate to the valuation date. The following figure illustrates the derivation of an entity's value based on discounted cash flows:

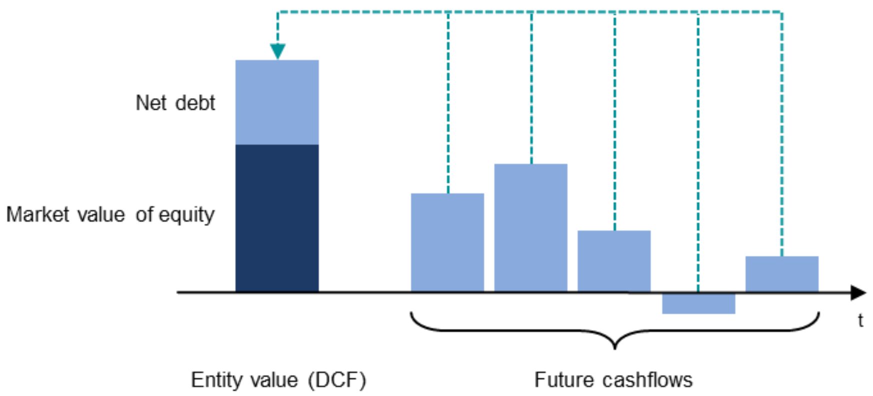

Figure 19 ***Income Approach***
(Source: KPMG)

There are usually four main components in a DCF approach:

- Detailed planning horizon (business plan often including a 3–5-year forecast),
- Terminal value year (considering long-term cashflow into perpetuity),
- Long-term annual growth rate,
- Discount rate.

With regards to the detailed planning horizon and terminal value please refer to the explanations above.

The long-term growth rate should capture inflation related growth drivers (company-specific inflation effects). These inflation effects differ from general consumer price inflation and are instead influenced by changes in input prices, operational efficiency improvements, and the company's ability to adjust prices in its sales markets. A key consideration is whether the company can consistently pass on these specific inflation effects to their downstream value chain. If not, the long-term growth rate should be adjusted downward.

General inflation is already reflected in the nominal risk-free rate and is embedded in the cost of capital, which represents the return investors expect for providing financial capital.

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[58] See also European Business Valuation Magazine. (1/2024). p. 14; Dejan Glavas (Laurent Inard). p. 100

[59] This does not relate to the DCF (Equity) method which directly refers to the cashflow of equity and therefore calculates the equity value

This ensures that investors are fully compensated for general inflation, so no additional adjustment is needed in the long-term growth rate in the terminal value.

Given the increasing relevance of sustainability-related risks and opportunities, a careful reassessment of the long-term growth rate is essential, especially when relying on historical assumptions. This includes evaluating how climate transition and adaptation costs, and physical climate risks may impact future growth expectations in markets.

For more detail on appropriate discount rates please refer to the next chapter.

6. Risks and opportunities in nature and climate related frameworks

This chapter provides an understanding of various risk concepts from the nature- and climate-related frameworks and risk concepts arising from capital market theory that are relevant for financial planning and valuation purposes.

The following sections describe a comprehensive approach that aims to integrate theoretical foundations, available data, and advanced forecasting techniques to a high degree. It should be acknowledged that this approach requires substantial valuation expertise and a considerable investment of time. Consequently, it may not be suitable for all users of the Value to Business concept or for every valuation purpose. In such cases, simplified methods that are commonly applied in practice may be used instead.

The Value to Business Framework seeks to advance the ongoing development of valuation practices by providing relevant theoretical context and practical guidance – especially in relation to the integration of sustainability-related matters. It is intended to support practitioners in more effectively embedding sustainability-related opportunities and risks into their valuation processes.

How to use this chapter	
Addressee	Controllers, finance, sustainability
Reason	Understand how to consider relevant opportunities and risks in financial planning and valuation
Content	Risk definitions in sustainability and finance, theoretical and practical consideration in cash flows projection and cost of capital
Tools	Preferred and alternative approaches

In nature- and climate-related frameworks, a distinction is made between risks and opportunities. Risks refer to potential challenges or adverse effects that could arise due to environmental and climate factors, while opportunities represent potential benefits or advantages that can be gained by proactively addressing these issues. This differentiation is essential for understanding how entities can navigate both the threats and positive outcomes linked to sustainability efforts, especially in financial planning and business valuation contexts.

6.1. Risk definitions in the climate and nature related frameworks

The TCFD and TNFD provide the basis for categorizing various climate- and nature-related risks. The TNFD definitions are based on the risk management standard 31000 of the International Organization for Standardization (ISO), according to which a risk is described as the “impact of uncertainty on objectives”. In this context, impact is defined as a positive or negative deviation from the expected.[60] In the further definitions of climate and nature related risks, the TNFD distinguishes between risks for negative deviations from what is expected and opportunities for positive deviations from what is expected. The classifications made by the TNFD can also be found in a similar form in other frameworks such as the TCFD and were used analogously in the ESRS. The distinction between risks and opportunities is also made in the Value to Business concept, highlighting that both represent the deviation from the expected (value) from a statistical perspective.

Three sub-categories can be identified under the overall category of **climate and nature related risks**. These are the **physical risks,** transition **risks**, and **systemic risks**.[61] Expanding climate- and nature-related risks as defined by the TCFD and TNFD to include perspectives on human and social capital transforms them into what is referred to as **sustainability-related risks**.

It needs to be emphasized that **systemic risks** are defined much more broadly than the term is usually used in the financial world for "the likelihood of a sudden, usually unexpected, event that disrupts information in financial markets, making them unable to effectively channel funds to those parties with the most productive investment opportunities".[62] It refers not only to the financial system, but in principle to all systems, including natural systems such as the Earth system or specific ecosystems. In general, climate and nature related systemic risks are defined as risks to an entity that arise from the breakdown of the entire system, rather than the failure of individual parts. These risks are characterized by modest tipping points combining indirectly to produce large failures, where one loss triggers a chain of others, and prevents the system from reverting to its prior equilibrium.[63] There are two categories of climate and nature related systemic risks: **ecosystem stability risks** and **financial stability risks**.[64]

Ecosystem stability risk is the risk of destabilization of a critical natural system so that it can no longer provide ecosystem services in the same way as before. This can include reaching tipping points, such as the Gulf Stream drying up, regime shifts[65] and/or the collapse of the complete ecosystem causing forms of physical and/or transition risks.

Financial stability risk, on the other hand, relates exclusively to the financial system and is defined as the risk that a materialization and compounding of physical and/or transition risks will lead to the destabilization of an entire financial system.[66]

According to the definition of financial stability risk and ecosystem stability risk, there are interdependencies, as the resulting physical/transition risks can destabilize the financial system in one form or another, for example by reaching tipping points, which can lead to a financial crisis.

[60] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 33. (Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)
[61] TCFD does not explicitly mention systemic risks; this is only done in the TNFD. In our view, however, systemic risks are also applicable to climate and social topics
[62] Mishkin, F. (1995). *Symposium on the Monetary Transmission Mechanism*
[63] IRGC. (2018). *Guidelines for the Governance of Systemic Risks. Lausanne: International Risk Governance Center (IRGC)*. (content (epfl.ch)
[64] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 35. (Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)
[65] Regime shifts are large, abrupt, persistence changes in the function and structure of systems
[66] Mishkin, F. (1995). *Symposium on the Monetary Transmission Mechanism*

In addition to ecosystem stability risk and financial stability risk, which cover the climate and nature perspective and the (financial) market perspective, the risk framework is supplemented by **societal stability risk** in order to consider the human and societal perspective. This refers to the resilience of systems such as political and regulatory frameworks, education, and healthcare, all of which are essential to the functioning of society and directly contribute to the well-being of individuals. Like ecosystem stability risk and financial stability risk, there are interdependencies with societal stability risk.

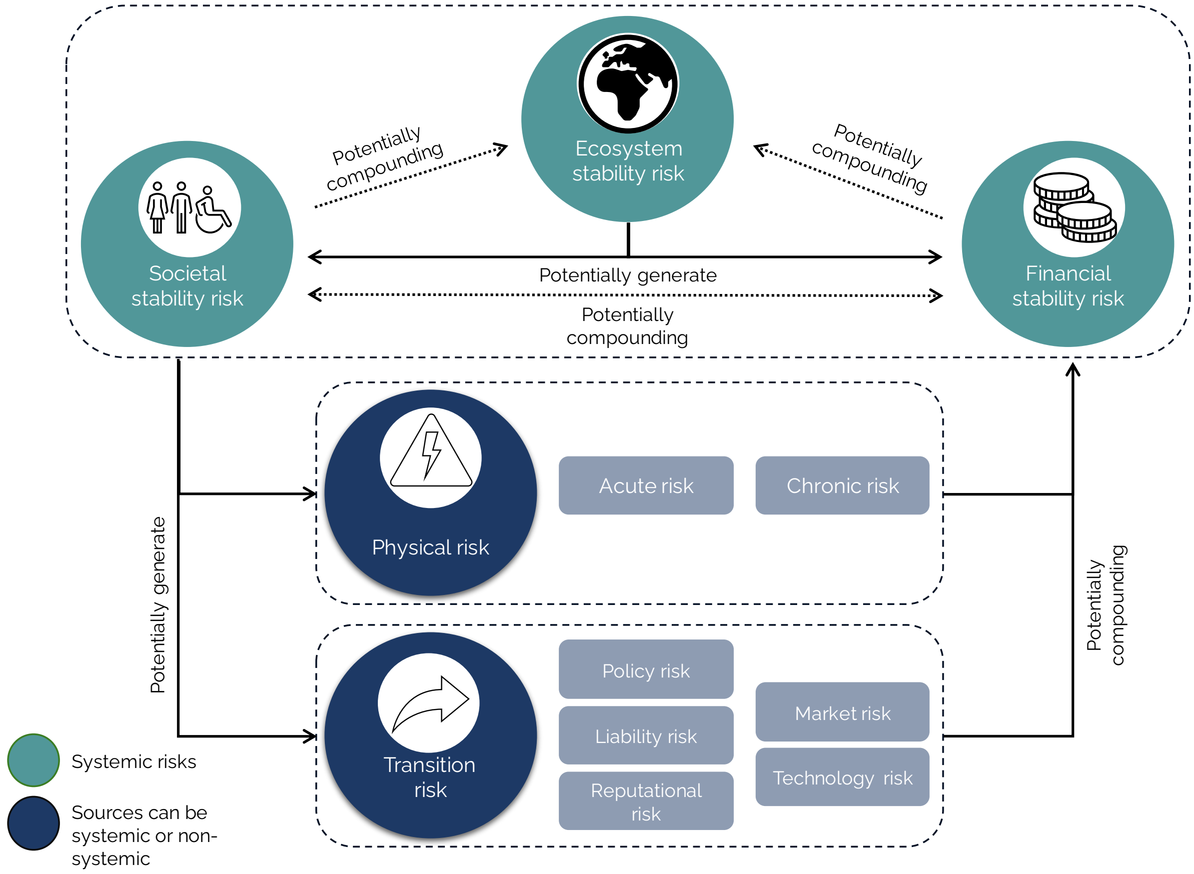

Figure 20 ***Interdependencies between systemic, physical and transition risks*** *(Source: KPMG)*

Climate and nature related **physical risks** are resulting from the impacts of climate change and the degradation of nature (such as changes in ecosystem equilibria, including soil quality and species composition) and consequential loss of ecosystem services that economic activity depends upon. These risks can be chronic (e.g. a gradual decline in species diversity of pollinators resulting in reduced crop yields or water scarcity) or acute (e.g. natural disasters, extreme weather events or forest spills). Climate and nature related physical risks arise because of changes in the biotic (living) and abiotic (non-living) conditions that support healthy, functioning ecosystems. These risks are usually location specific.[67] Furthermore, **acute risks** can be defined as risks that arise from increased frequency and severity of short-term and specific events that change the state of climate/nature in a location of region. Some examples of this are oil spills, forest fires or

[67] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 131. (Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)

pests affecting a harvest.[68] **Chronic risks**, on the other hand, do not arise from specific sudden events, but instead originate from long-term (chronic) shifts and thus gradual changes to the state of climate/nature such as climate change or pollution stemming from pesticide.[69]

Climate and nature related **transition risks** are risks to an entity that result from a misalignment of economic actors with action aimed at protecting, restoring and/or reducing negative impacts on climate and nature, such as the shift to a lower-carbon economy. These risks can be prompted, for example, by changes in regulation and policy, legal precedent, technology or investor sentiment and consumer preferences. Climate and nature related transition risks can be divided into policy risk, market risk, technology risk, reputational risk and liability risk.[70]

- **Policy risks** are expressed as changes in the policy context through new (or enforcement of existing) measures to create positive impacts on nature, such as promoting the use of green technologies, for mitigating negative impacts on nature, such as restricting operations that cause high GHG or air emissions.
- **Market risks** arise from changing dynamics in the overall markets, including changing consumer preferences resulting from changing physical, regulatory, technological, reputational and stakeholder dynamics. For example, an entity's market value is affected by assets that have lost value because there is insufficient freshwater available for the production process, or the value of the entity's production process is reduced by the emergence of new technologies that require less water to operate.
- **Technology risk** is defined as the risk of substitution of products or services with less impact on nature and/or less dependence on nature. The replacement of plastics with biodegradable containers, for example, falls into this category as it is based on a technological innovation that supports the shift to a lower-carbon, energy-efficient economy.
- **Reputational risks** stem from the changes in the perception concerning an entity's actual or perceived nature impacts, including at a local, economic and societal level. The change in perception can result directly from the entity, but also from the industry and/or the impact of activities upstream and/or downstream in a value chain.
- **Liability risks** arise directly or indirectly from legal claims. The probability that an entity will have an accelerating need for contingent liabilities can be linked to the increasing speed with which laws, regulations and case laws are developing in relation to an entity's preparation for nature-related measures.

[68] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 34. (Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)

[69] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 34. (Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)

[70] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 35. (Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)

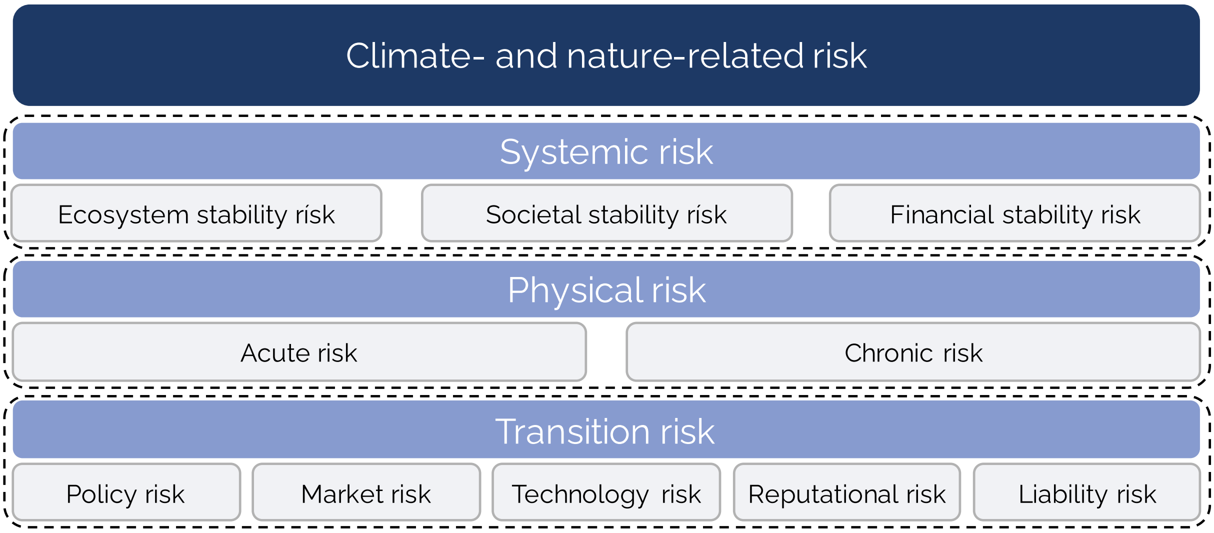

Figure 21 ***Risk types considered in nature- and climate-related frameworks***
(Source: KMPG)

6.2. Opportunity definitions in the climate and nature-related frameworks

Building on various types of risk, it is essential to also consider the range of climate and nature-related opportunities that arise in response to these risks. While physical risks impact operations, transition risks necessitate adaptation, and systemic risks can disrupt entire markets, economies or ecosystems, entities have the potential to capitalize on opportunities that foster resilience and sustainable growth. By proactively addressing these risks, entities can drive resource efficiency, tap into new market dynamics, and innovate through sustainable products and services, positioning themselves as leaders in a shifting global landscape shaped by climate considerations.

Climate or nature related opportunities refer to the potential positive financial effects that arise from efforts to address environmental challenges, including both climate change and ecosystem degradation. Efforts aimed at climate mitigation and adaptation can create various opportunities, such as improving resource efficiency, cutting costs, adopting low-emission energy sources, developing innovative products and services, and strengthening supply chain resilience. [71] Opportunities can also stem from the restoration and protection of natural ecosystems, which may provide benefits such as improved water management, enhanced biodiversity, and greater carbon sequestration. These opportunities vary by region, market, and industry, and can offer competitive advantages to entities that proactively engage in sustainability and environmental stewardship. The climate and nature-related opportunities can be categorized into the following six sub-categories:

Ecosystem protection, restoration, and regeneration opportunities involve activities that help safeguard, regenerate, or restore ecosystems, both within and outside the entity's direct control. [72]

[71] TCFD. (2023). *Task Force on Climate-related Financial Disclosures 2023 Status Report*. p. 137. 2023-Status-Report.pdf (bbhub.io)
[72] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 118. Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)

Market opportunities emerge from shifts in market conditions, such as access to new locations or sectors, driven by changes in consumer demand, investor expectations, and stakeholder dynamics.[73]

Product and service opportunities arise from delivering products or services that contribute to the protection, management, or restoration of nature, including through technological innovation.[74]

Reputational capital opportunities are linked to changes in how an entity is perceived regarding its nature-related impacts, influencing societal engagement and stakeholder relations.[75]

Resource efficiency opportunities relate to actions an entity can take to minimize its impact on and dependence on natural resources. This can lead to co-benefits, such as operational improvements and cost savings, for instance, using micro-irrigation to enhance plant health, conserve water, and reduce expenses.[76]

Finally, the **sustainable use of natural resources** offers opportunities through the replacement of traditional resources with recycled, regenerative, renewable, or ethically sourced organic materials, supporting both environmental goals and responsible sourcing practices.[77]

6.3.Considering risks in enterprise value calculations

Based on Capital market theory, valuation methods have been established which operate with various risk concepts. The most important terms and principles are briefly outlined below. A basic knowledge of this theoretical basis is important to understand how opportunities and risk are integrated in decision making metrics e.g. net present value calculations.

The basic concept of business valuation[78] is to estimate the economic value of a business based on the entity's expected future cash flows.[79] Therefore, the concept of expected value is of major importance.

The **expected value** is the weighted average of all possible outcomes of a random variable, where each outcome is weighted by its probability of occurrence.

In terms of planning financial outcomes or cash flows, however, there are numerous possibilities with different probabilities. This makes the determination of expected values

[73] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 127. Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)
[74] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 136. Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global).
[75] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 137. Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)
[76] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 138. Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)
[77] TNFD. (2023). *Recommendations of the Task Force on Nature-related Financial Disclosures*. p. 142. Recommendations_of_the_Taskforce_on_Nature-related_Financial_Disclosures_September_2023.pdf (tnfd.global)
[78] We refer to the income approach as broadly accepted valuation method
[79] Both, Harry Markowitz in his Modern Portfolio Theory (1952) and William F. Sharpe in his Capital Asset Pricing Model (1964) refer to expected value of return

and therefore the planning of future financial results and their valuation difficult. Therefore, the Value to Business Framework focusses on financial projections. [80]

In business valuation, expected future cash flows need to be discounted to the present value by using a discount rate to calculate an entity value of the enterprise (discounted cash flow – DCF). Since investors are risk averse, they prioritize avoiding losses and require compensation for taking on additional risk in form of deviations from the expected value. As a result, they demand a discount rate that includes a risk premium – not only compensating them for the time value of money but also for the uncertainty of future cash flows.[81] The risk premium is added to the discount rate in the denominator (interest premium method, risk premium method).[82] The greater the uncertainty, the higher the risk premium and discount rate needed to reflect the risk. Assuming a fixed infinite future cash flow, the entity value is determined as follows:

$$Entity\ Value = \frac{Expected\ future\ cash\ flows}{Discount\ rate}$$

This step translates the uncertain future cash flow into a net present value as of the valuation date (e.g. today) meaning a third party would agree to exchange the uncertain future cash flows for their present value. The discount rate includes, consequently, a risk component (which converts uncertain payments into certain ones) and a time component (which converts future payments into present ones).

The **discount rate** has to represent the return of an alternative investment with the exact same risk profile, the same width in terms of absolute amount, future growth expectations, currency and taxation and the temporal structure as the entity being valued resp. the cash flows being used for the valuation (equivalence principle).[83] In practical business valuation, it is not always possible to achieve full compliance with the equivalence criteria. Nevertheless, the aim should be to fulfil the requirements of the principles of equivalence. In particular, the focus should be on compliance with risk equivalence, which is discussed in this chapter.

Future financial returns cannot be forecasted with certainty due to the uncertainty of the future. Business activities are always associated with both opportunities and risks. In general, any possible positive or negative deviation from the expected value of future financial surpluses can be characterized as **operating risk**. The operating risk is influenced by both endogenous factors such as the entity's cost structure and operating leverage and exogenous factors such as dependence on market developments or the competitive situation in the market, changing the volatility of the financial surpluses from a business model perspective. It should be noted that, in contrast to common parlance, the term risk in the context of business valuation is generally used for both negative and positive deviations from the expected value.

Since no clear distinction can be made between the risks arising from endogenous and exogenous factors, it is important to ensure that future cash flows in the numerator accurately reflect all risks, ensuring an expected value of future cash flows. The discount rate may be determined according to the Capital Asset Pricing Model (CAPM), as is customary internationally.[84]

[80] How to work with these challenges is explained in more detail in chapter 5
[81] Berk, DeMarzo. (2014). *Corporate Finance Third Edition*. p. 340-341
[82] Berk, DeMarzo. (2014). *Corporate Finance Third Edition*. p. 341
[83] Berk, DeMarzo. (2014). *Corporate Finance Third Edition*. p. 273
[84] Berk, DeMarzo. (2014). *Corporate Finance Third Edition*. p. 342

The **CAPM** is a suitable method and the most widely used method in valuation practice for determining price of risk on a market basis.[85] According to the CAPM, which is based on the findings of modern portfolio theory, a risk reduction can be achieved by combining risky stocks (diversification).[86] The risk that is eliminated through risk diversification is referred to as **unsystematic risk**. Consequently, capital market participants only bear (and price) the risk that cannot be eliminated through diversification. This is referred to as **systematic risk**, which is attributable to both the uncertainty (volatility) of entity returns and the uncertainty of market returns.[87] [88]

According to the CAPM, the yield of a risky asset or an entity consists of three parameters: the risk-free base rate i_{rf}, the total market return i_m and the unlevered beta factor $\beta_{u,i}$ of an entity i:

$$discount\ rate = i_{rf} + \underbrace{(i_m - i_{rf})}_{ERP} * \beta_{u,i}$$

The equity risk premium (ERP), which represents the difference between the expected return on equities and the risk-free interest rate, serves as a general measure of the risk associated with investing in the market as a whole. In the CAPM, this premium is adjusted by a beta factor. The beta factor measures the change in the entity-specific return with changes in the equity market return.[89] Based on the calculation method[90], the beta factor is a relative measure of the systematic share of the risk of the entity return in relation to the risk of the market return.[91] It thereby accounts for the entity's exposure to systematic risk — the type of risk that cannot be diversified away. In this way, the optimal portfolio, which is the same for all investors, can be identified and by adjusting the optimal portfolio based on

[85] Berk, DeMarzo. (2014). *Corporate Finance Third Edition*. p. 380-381
[86] Berk, DeMarzo. (2014). *Corporate Finance Third Edition*. p. 366-367
[87] Berk, DeMarzo. (2014). *Corporate Finance Third Edition*. p. 382
[88] It should be emphasized that the distinction between systematic and unsystematic risks cannot be equated with market and entity-specific risks. For further information please refer to Bertram et al. (2012). *Zur Erfassung systematischer und unsystematischer Risiken im Bewertungskalkül*. BewP Nr. (4/2012). p. 134
[89] Berk, DeMarzo. (2014). *Corporate Finance Third Edition*. p. 340
[90] The beta factor can be broken down into three different components and thus influencing factors. These are the volatility of the entity return (σ_{r_i}) and the volatility of the market return (σ_{r_m}), which are set in relation to each other and then multiplied by the third influencing factor, the correlation coefficient of entity and market returns ($\rho_{i,m}$). The volatilities are to be regarded as a measure of the variation range, while the correlation coefficient reflects the systematic share of the variation range of the entity return. For further information please refer to Copeland, Weston, Shastri. (2015). *Financial theory and corporate policy*
[91] Berk, DeMarzo. (2014). *Corporate Finance Third Edition*. p. 382

the individual risk aversion the achievable return can be optimized. The ERP[92] is a residual variable and cannot be directly observed but is inferred from market performance.

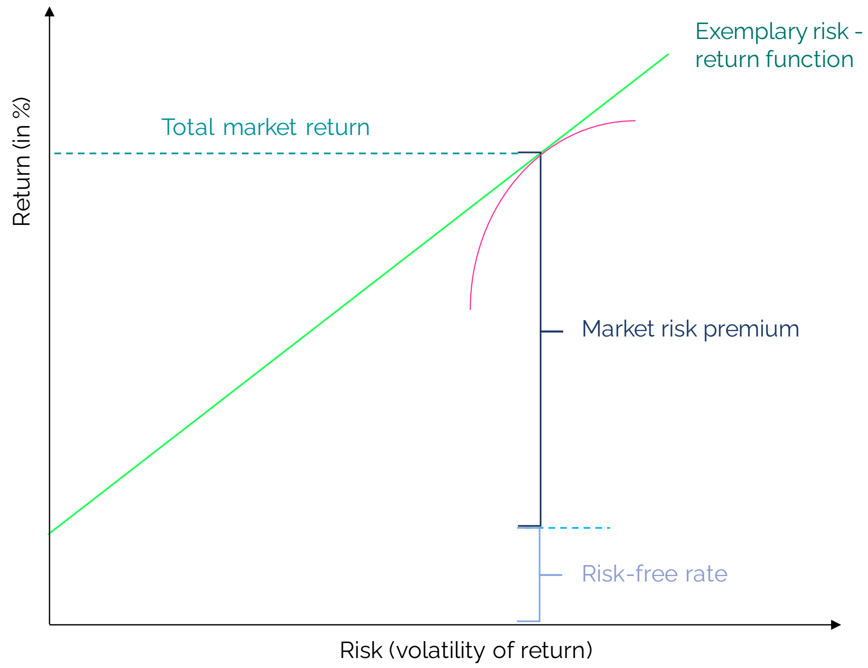

Figure 22 ***Derivation of the ERP from the risk-return matrix***
(Source: KPMG)

6.4.Consideration of risk in Value to Business

The types of climate and nature related risks defined in the TCFD and TNFD cannot be specifically categorized into systematic and unsystematic risks in CAPM due to the interdependence of the various exogenous and endogenous causes of risk. Similarly, the various types of risk cannot be clearly differentiated from one another. Further, the subcategories of systemic, physical, and transition risks cannot be unambiguously assigned to the risk types used in business valuation and thus also recognized in the capital market. Additionally, it is hard to assess in practice whether changes in the cost of capital components relate to e.g. climate-related topics based on historic and current capital market data, as multiple effects influence behavior of market participants.

Sustainability-related risks and opportunities may change operating risks of entities. Assuming functioning capital markets, all factors influencing operating risk (future volatility and correlation), including sustainability-related risks and opportunities, are taken into account in the (expected) beta factor and the ERP. Consequently, the consideration of a separate "climate or ESG alpha factor", as an additional risk premium, is not supported by financial theory and the determination in practice remains challenging. This is based on the following considerations which should be considered when performing valuations:

[92] The market price for assuming risk is identical for all market participants, under homogenous expectations and perfectly functioning capital markets, where everyone has access to the same information and makes investment decisions based on the same expectations of future returns and risks. As a result, the additional return required for taking on market risk is uniform across all investors and driven by the collective market behavior

Assumption of well-functioning capital markets, data availability and transparency

CAPM remains the most widely used and recognized accepted theoretical model for determining the cost of capital and therefore of the valuation of equity assets. A fundamental assumption of the CAPM is a fully functioning capital market. This includes that capital market participants have full transparency of information and are considering all (systematic) risks (and opportunities) in their valuation and pricing of assets. Accordingly, it is assumed that all systematic sustainability-related risks and opportunities are taken into account by the capital market participants in the risk–return characteristics of the market portfolio and, consequently, in the total market return and in the market, data used to determine the cost of capital. Under this assumption, an adjustment of the cost of capital for climate and nature related risks would not be necessary.

In practice, however, it remains uncertain to what extent sustainability-related risks and opportunities are already incorporated into market expectations. Capital market participants face significant challenges in accessing, interpreting, and quantifying sustainability information. The consequences of climate change or biodiversity loss, in particular, are difficult to predict, especially under high-impact scenarios or after reaching potential tipping points. It is therefore not possible at this stage to determine whether current market expectations reflect an appropriate assessment of sustainability factors or whether they are affected by gaps in knowledge, data availability, and analytical understanding. Considering a lack of information and transparency as well as information neglect – this could imply an additional risk premium either for the entire market (see also the section on Green Swans in the following chapter) or specific sectors and regions.

At the same time, scientific research, improved data quality, and emerging regulatory requirements (e.g., ESRS, TCFD, TNFD, CDP, etc.) are gradually enhancing transparency and comparability of the general but also company specific implications of sustainability, which may support a more consistent integration of sustainability aspects into valuation and pricing over time.[93]

As there is no conclusive evidence of market failures and no practical methods for determining additional risk premiums, the CAPM remains a well-founded and robust conceptual framework and can therefore be applied without additional adjustments to the cost of capital. Instead, the following principles should be considered when determining the individual components of discount rate like equity market return and beta factor.

However, for the determination of individual values in decision-making contexts or for stress-testing purposes, additional risk premiums may be applied to reflect specific exposures or uncertainties not captured by the market data.

Determining cost of capital components based on capital market data

Equity market return is not fixed and may change in the future if market participants require a higher return for taking over risk e.g. resulting from increased risk aversion. Nevertheless, analyses over the past years of the major capital markets have shown that total market return in contrast to the equity risk premium (residual of equity market return

[93] Current research shows a negative correlation between nature impacts and financial performance (e.g. low emission intensity correlates with high return on assets). See Prof. Dr. Dr. Dietmar Ernst / Prof. Dr. Werner Gleißner / Lars Wisotzki, B.Sc.: Der Zusammenhang zwischen Environmental, Social and Governance (ESG-)Ratings und Finanzleistungskennzahlen – Eine empirische Analyse der S&P 500-Unternehmen, in: Corporate Finance vom 26.09.2025, Heft 9-10/2025.

and risk-free rate) is fairly stable even during multiples crises (e.g. financial market crisis, COVID-19 crisis). As risk-free rates change due to macroeconomics factors like inflation but also based on central-bank interventions, stable total market returns results in a fluctuation of equity risk premiums. Therefore, these have to be assessed on a regular basis and are not stable (depending on risk-free rate developments). Nevertheless, development of total market returns shall be monitored regularly and closely to detect changes in investors' risk perceptions early on.

With respect to the determination of the **beta factor**, it should be noted that the beta factor is often determined exclusively based on historical data in practice. But for the valuation of assets and entities, the future risk associated with the expected cash flow needs to be considered in the beta factor. Particularly in the materialization of transition risks, historical beta factors could therefore show a misleading result. For this reason, beta factors should not be extrapolated without further scrutinizing their level but should always be critically assessed in relation to the course of historical development as well as the development of economic environment, market and sector. This applies to companies operating in sectors with particularly high transformation pressure.

It should also be noted that increased sustainability-related risks, regardless of the type of risk that affects the entity-specific returns, do not necessarily lead to a change in the beta factor. This can be shown on the underlying formula of the beta factor which consists of three parameters: the volatility of the entity returns; the volatility of the market returns and the correlation coefficient of both returns.

If increased entity-specific sustainability-related risks also have the same effect on market returns, the correlation coefficient and thus also the beta factor would remain constant. If the sustainability-related risks only have an entity-specific effect and the market returns remain constant or change in the opposite direction, the correlation coefficient of entity-specific returns and market returns could change accordingly, resulting in little or no change in the beta factor. This is due to the mathematical property of the beta factor as a relative measure of the volatility of entity returns to the volatility of market returns.

This means a simple prediction of the future development of sector or entity specific beta factors is difficult. Due to the transformative nature of many sustainability issues, such as climate change or resource scarcity, special attention should be given to the selection of comparable companies. These should not only be chosen based on factors like comparability of business model, regional operations, or size, as was the practice in the past. Company assessment should consider important sustainability topics like environmental targets and actions, regulatory background or regional footprint regarding physical risks for high comparability. Non-financial KPIs may be used, for example, metrics that allow for the comparison of decarbonization strategies or resilience to regulatory requirements. As number of comparable entities may be limited in many cases and entity specific information of peers may be limited, these analyses may be challenging.

Consideration of all risks in the expected value of future cash flows

Regardless of the challenges involved in deriving the cost of capital, it is crucial that the numerator in the valuation represents the expected value of future cash flows. This means that all risks and opportunities – whether systematic or unsystematic – must be reflected in the expected value.[94] Consequently, this also includes all sustainability related risks, such

[94] Damodaran. (2003). *Value and Risk: Beyond Betas*. p. 14

as physical, transitional, and systemic risks and opportunities. Future developments are difficult to predict, especially for entities facing transitional risks and opportunities. Therefore, financial forecasts are subject to a certain degree of planning uncertainty that needs to be addressed.

If there are uncertainties in the quantification process, the financial effects should be estimated based on the current available information and to the best of one's knowledge. The difficulties in quantification are often more related to a lack of knowledge on how to handle higher uncertainties in forecasting or a fear of making inaccurate estimates, rather than a lack of understanding about the effects of individual aspects or a fundamentally poor data situation. Existing scenario and simulation techniques can help to address this uncertainty and allow to determine expected values even in complex situations. These uncertainties in the quantification are also reflected in the uncertainties of expectations of market participants, which are accounted for in the cost of capital based on market expectations. If expectations are not fully considered in the cash flows, there might be an overstatement of the numerator in the valuation approach.[95]

What should be done if the available predictions do not represent an expected value?

In practice, financial plans and forecasts do not always meet the requirements of an expected value. This is particularly true for transforming business models and their long-term expectations which materialize in terminal value. As shown above, underlying valuation theory like CAPM assumes expected values. There are essentially two possible approaches:

1. **Adjusting the cash flows in the numerator to reflect an expected value** (using, for instance, the methodology described in Chapter 5).
2. **Applying the adjustment as an (alpha) factor in the denominator.**

Both approaches should, in principle, lead to the same result, since they are mathematically equivalent. In practice, approach (1) is often used to determine the financial effect (or result), while approach (2) is frequently applied for reporting purposes when the original forecast should remain unchanged.

This planning problem should not misleadingly be interpreted as a cost of capital adjustment, since, assuming efficient markets and the validity of the CAPM, the cost of capital correctly reflects the risk of the alternative investment. It may be seen as a correction to the numerator or the long-term growth rate. This should be clearly distinguished from data-driven risk premia as discussed above.

If the expected financial consequences of opportunities and risks are considered as an expected value in the cash flow, the planning horizon is sufficiently long, and the cost of capital is derived based on a comparable peer group, then an additional, and often unfounded, adjustment of the valuation approach seems unnecessary. Efforts should instead be directed toward a well-substantiated and thorough examination of the financial planning and underlying assumption. Following this comprehensive approach prevents potential double counting of risks.

[95] Please refer to chapter 5 and the Value to Business Application Guidance for more guidance

The focus of a Value to Business context should be on planning cash flows as expected values, with adjustments in the denominator used only in exceptional cases.

6.5. Digression: Green Swans

Against the background of the assumption that sustainability related risks are priced into the total market return the extent to which so-called green swan risks are priced into the CAPM needs to be examined. The concept of the Green Swan goes back to the concept of the Black Swan risk defined by Nassim Nicholas Taleb. According to Taleb, Black Swans are defined by three characteristics[96]:

- The Black Swan event is unexpected, rare and lies outside the realm of normal expectations.
- The impacts of these events are very far-reaching or extreme.
- These events can only be explained after they have already happened.

Examples of Black Swan events, according to Taleb's definition, are events such as the 2008 financial crisis, terrorist attacks such as 11 September 2001 or the breakthrough of disruptive technologies such as the rise of the internet. In a way, these were all events that were predictable up to a certain point, but the impact of these events could not be imagined as there was insufficient historical data to predict these far-reaching or extreme events.

Green Swans, also referred to as "Climate Black Swans", are characterized by many of the same features as Black Swans. Physical and transition risks can also be characterized by enormous uncertainties, and the effects do not necessarily have to be reflected in the historical data, so that events of extreme and far-reaching proportions can also occur.[97] It should be noted that not every physical or transition risk can be inevitably classified as a Green Swan. This depends on the probability of occurrence and the extent of the event.

Green Swans differ from Black Swans in three key aspects.[98] Firstly, although the effects of climate change are highly uncertain, it is already certain that a combination of physical and transition risks is highly likely to materialize in the future[99] leading to a sustainability-related systemic risk. Accordingly, it is already evident that very ambitious measures are needed to minimize the future impact, although the actual impact and timing of the event cannot be predicted.

Another distinction is that climate catastrophes in the form of Green Swans can have a much more severe impact than financial crises, which primarily affect the financial system. Due to the impact of climate catastrophes on ecosystems, for example, Green Swans can also become an existential threat to human and animal well-being.[100]

In addition, the complexity of the impact of the occurrence of such Green Swan events is significantly higher than with Black Swans due to complex chain reactions and cascade effects. Due to interdependencies, a physical or transition risk can also trigger a systemic risk as a result of interaction.

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[96] Taleb. (2007). *The Black Swan: The Impact of the Highly Improbable*
[97] Weitzman. (2009). *On Modeling and Interpreting the Economics of Catastrophic Climate Change*; Weitzman. (2011). *Fat-tailed Uncertainty in the Economics of Catastrophic Climate Change*
[98] Bank for International Settlements. (2020). *The green swan. Central banking and financial stability in the age of climate change*
[99] NGFS. (2019). *NGFS First Comprehensive Report. A Call for Action - Climate Change as a Source of Financial Risk*. https://www.ngfs.net/en/first-comprehensive-report-call-action
[100] Ripple et al. (2019). *World Scientists' Warning to Humanity: A Second Notice*

The extent to which such climate risks, that can be categorized as Green Swan, are priced into the total market return must be critically assessed. Due to its similar characteristics to the Black Swan, it can generally be assumed that the Green Swan cannot be priced into the total market return by capital market participants due to the unknown, far-reaching or extreme impact that the occurrence of such an event entail. Mathematically, this is primarily because the impact of such an event is not foreseeable, and therefore no meaningful expected value can be derived. In valuation practice, it is also not possible to determine whether investors would be able to impose an additional risk premium on the market in response, even if the expected value of the effects were known. The underlying reason is that these events can have such an enormous impact that all markets may be negatively affected in the same way. If this were to happen, investors would possibly not be able to impose an additional risk premium on the capital market, as there would be no other alternatives to invest in this scenario.

It should be emphasized that Green Swans, i.e. sustainability-related risks whose occurrence could have far-reaching or extreme consequences beyond the realm of current imagination, are not considered in the CAPM. In line with the principle of risk equivalence, such risks are also not to be considered when determining the expected values of future cash flows, as no meaningful expected value can be derived when the magnitude and probability of their impact are fundamentally unknown. Accordingly, Green Swan events should be only considered within specific stress-testing scenarios.

6.6. Risk of failure to maintain the license to operate

Another type of risk that needs to be examined more closely in the Value to Business context is the risk of failure to maintain the license to operate. The so-called license to operate is defined as permission for an entity to continue its business activities.[101] The license to operate can be formal in nature, for example through regulation, or informal if the acceptance of the business model by society and other stakeholders declines due to social or environmental changes. The internalization of this risk leads to a loss of confidence among society and, as a result, to significant financial losses or even the discontinuation of business activities. On the other hand, the extent to which an existing license to operate can generate opportunities should also be considered. These can include, for example, the continuous improvement of the entity's own reputation, easier access to new markets, better relationships with the stakeholders or increased crisis resilience. Recognition of the entity's operating activities by society means that the entity does not draw any negative attention, which may lead to competitive advantages over other entities with a non-existent or a 'less extensive' license to operate.

The fundamental dilemma is that the opportunities are reflected more in opportunity costs than in actual monetary benefits, which are difficult to quantify and hard to measure. The question therefore arises as to whether an entity should incur additional costs in order to guarantee the existing license to operate. It should be noted that social change is unpredictable and the risk of losing the license to operate must therefore always be reassessed. The conflict is to always make the minimum effort necessary to maintain the license to operate but not overdo it to avoid inefficiency.

This problem is comparable to the default risk associated with debt financing which also influences the cost of capital of entities. Entities generally benefit from taking on additional

[101] OECD. (2017). *OECD Due Diligence Guidance for Meaningful Stakeholder Engagement in the Extractive Sector, OECD Publishing, Paris.* http://dx.doi.org/10.1787/9789264252462-en

interest-bearing liabilities. On the other hand, the higher the debt ratio, the higher the risk of insolvency. This issue prompts entities to strive for an optimal debt structure that leads to a balanced risk ratio.

This reasoning shows that external effects (impacts and dependencies) may be internalized in the long term, which may lead to financial effects or changes in operating risk of the respective entity. This is comparable to the effect of potential insolvency costs of highly leveraged entities which also work as a market regulating mechanism. Therefore, active stakeholder involvement and information transparency is necessary.

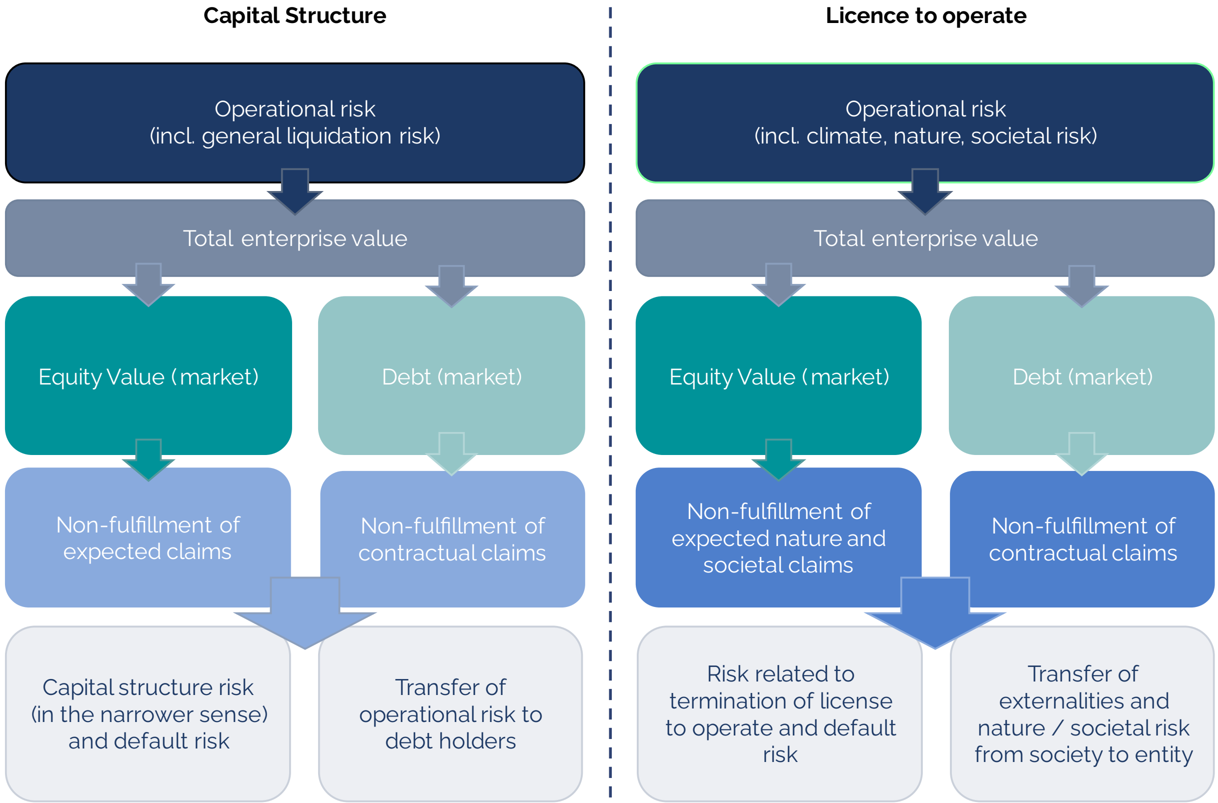

Figure 23 ***Analogy of default risks and risks of failure to maintain the license to operate*** *(Source: KPMG)*

Credit ratings, in particular the credit ratings from agencies like S&P, Moody's and Fitch, are well established for quantifying the entity-specific default risk. It should be assessed whether ESG ratings could, in the future, be used to quantify this risk of losing the license to operate. Since ESG ratings currently are not based on any standardized or comparable data and far too heterogeneous, it is currently not possible to draw a conclusive judgement on this. An entity's license to operate is directly linked to its going concern status and should be critically assessed in light of evolving regulatory frameworks and shifting societal acceptance. This might have effects on fundamental valuation parameters like cash flow projections, long-term growth rate and time horizon.

7. Application of macro scenarios in Value to Business

Climate, nature, and socioeconomic scenarios (summarized in the following under the term macro scenarios) not only form the basis for scientific and societal discussions but can also be beneficial for stakeholders when assessing anticipated changes due to sustainability-related matters. They assist entities in addressing issues, such as climate change or biodiversity loss, characterized by high uncertainty, medium to long-term outcomes, and potentially disruptive effects.[102] [103] Finally, consideration of macro scenarios is required by several reporting standards like ESRS or TCFD and TNFD.[104]

Entities can utilize scenario analysis in their strategic planning and risk management to extend risk analysis from the short term to the medium and long term, enhancing the understanding of their viability and resilience. It helps identify responses to risks and opportunities, including changes in key risk drivers like regulations or ecosystem integrity. It assesses if the organization's strategies can withstand unforeseen events, guiding necessary adjustments. Scenario analysis also reveals gaps requiring quantification and scientific modelling, justifies investments in risk mitigation, and helps prioritize business areas, which informs governance, risk management, capital allocation, and target setting.[105] Scenario analyses therefore play a crucial role in the context of sustainability.

The following chapter provides an overview of the most relevant macro scenarios and how they can be implemented in a company-specific scenario analysis for the context of Value to Business and the quantification of anticipated financial effects.

How to use this chapter	
Addressee	Controllers, finance, sustainability
Reason	Working with science-based scenarios in financial planning and quantification for improving forecast accuracy and risk assessment
Content	Overview of accepted macro scenarios, how to transfer to a company-specific scenario, probability of macro scenarios
Tools	Preferred and alternative approaches

7.1. Climate, nature, and socioeconomic macro scenarios

Macro scenarios are the foundation of any kind of forecasting and decision-making. They describe a version of the potential future – a potential world in which the entity will have to operate in. It is important to understand that the aim of most macro scenarios is to outline several plausible futures, rather than predicting or extrapolating from the present situation or depicting an ideal future the entity aspires to.[106] Therefore macro scenarios are

[102] Regarding the importance of the consideration of multiple scenarios in the determination of expected values in a valuation context, please refer to chapter 6

[103] By systematically exploring different future scenarios, including those with significant sustainability related impacts, scenario analysis may enrich strategic discussions and expand decision-makers' perspectives beyond business-as-usual. It should enable entities to frame and evaluate a wide range of potential consequences e.g. from climate change, informing more resilient strategies and financial plans amidst uncertain future conditions. Moreover, macro scenario analysis aims to support entities in identifying key indicators for monitoring the external environment, allowing for timely adjustments to strategies and financial plans as conditions evolve. When applying the analysis appropriately, it provides investors with insights into the robustness of entities' strategies and financial plans, facilitating comparisons of risks and opportunities across different entities. TCFD. (2017). p. 26. FINAL-2017-TCFD-Report.pdf (bbhub.io)

[104] For example ESRS 1 Tz. 89 and ESRS E1 SBM-3 (19 b, 20 b), TCFD. (2017) and TNFD. (2023)

[105] TNFD. (2023). p. 10. Guidance_on_scenario_analysis_V1.pdf (tnfd.global)

[106] TNFD. (2023). p. 4. Guidance_on_scenario_analysis_V1.pdf (tnfd.global)

quantitative projections and neither predictions nor forecasts. This needs to be considered if they are used as basis for scenario modelling and financial forecasting.

The selection of one macro scenario determines many other assumptions relevant for assessing anticipated financial effects like revenue growth (which may correlate to population growth), potential costs for physical climate risks or extent and consequences of lost ecosystem services. Therefore, the macro scenarios need to be aligned with each other as well as with the actions and financial consequences considered in the financial planning of the entities.

The focus of this section is on Climate and Nature Scenarios as well as on the underlying Shared Socioeconomic Pathways and their use as macro scenarios.

Climate Scenarios are potential pathways[107] of development with regards to climate change that lead to specific outcomes (e.g. temperature changes, sea level rise, extreme weather events). They are not meant to provide a comprehensive picture of the future. Instead, they aim to highlight key elements of a potential future and draw attention to the main factors that will drive future developments.[108] In this regard, key elements include greenhouse gas emissions, climate policies, economic growth, technological innovations, social and demographic trends, natural and environmental changes, market conditions, and societal acceptance. Although the precise outcome in the long-term remains uncertain, it is likely that a mix of these developments will unfold.[109] Widely used scenarios are the Intergovernmental Panel of Climate Change (IPCC) climate scenarios and the Network for Greening the Financial System (NGFS) climate scenarios.

The change in biodiversity and ecosystem services define **nature scenarios**. The main drivers of change in biodiversity and ecosystem services are change of land-use, climate change, pollution, invasive species and overexploitation of natural resources. These factors affect biodiversity and ecosystems in a variety of ways and require differentiated approaches to tackle the associated challenges.[110]

The key differences between nature-focused and climate-focused scenarios can be summarized as follows: The impacts of nature-related factors are often location-specific, while the effects of greenhouse gas emissions on climate change are global and independent of emission sites. Climate change has a clear global objective, such as the 1.5°C temperature limit while nature lacks a single global target.[111] Academic research confirms that the impact on biodiversity and ecosystem services varies from region to region. Certain regions are particularly vulnerable to biodiversity loss, while others are potentially more resilient or better able to adapt. Consequently, regional specificities need to be considered in conservation strategies.[112]

Climate and nature scenarios are strongly connected e.g. climate change accelerates biodiversity loss and land use plays a crucial role in the mitigation of climate change.

[107] The terms pathways and scenarios are used interchangeably in the literature as well as in the IPCC AR6 report
[108] TCFD. (2017). *The Use of Scenario Analysis in Disclosure of Climate Related Risks and Opportunities*. p. 2. FINAL-TCFD-Technical-Supplement-062917.pdf (bbhub.io)
[109] NGFS. (2024). NGFS Scenarios Portal
[110] Pereira et al. (2024). *Global trends and scenarios for terrestrial biodiversity and ecosystem services from 1900 to 2050*
[111] TNFD. (2023). p. 5
[112] Pereira et al. (2024). *Global trends and scenarios for terrestrial biodiversity and ecosystem services from 1900 to 2050*

Existing and upcoming macro scenarios are trying to cover this interconnectivity but reflecting the complexity of our planetary system is challenging.

Socioeconomic scenarios describe potential economic and societal assumption which often form the basis of climate and nature-related scenarios. Well-known are the so-called Shared Socioeconomic Pathways which are used for most climate-related scenarios.

In the following, selected climate and nature-related scenarios will be explained. Shared Socioeconomic Pathways will be covered in the section of climate-related scenarios.

7.2. Climate scenarios

Climate scenarios are projections of possible future climate conditions based on varying levels of greenhouse gas emissions and socio-economic pathways, used to understand and prepare for the potential impacts of climate change. Various associations create such scenarios that entities can use.

7.2.1. IPCC report and climate scenarios (including Shared Socioeconomic Pathways)

The Intergovernmental Panel on Climate Change (IPCC)[113] finalized and published the Synthesis Report for the Sixth Assessment Report (AR6) in March 2023. The report provides an overview of the state of scientific knowledge on climate change, with emphasis on new finding since the Fifth Assessment Report (AR5).

As a thorough understanding of the current state of observed changes as well as actions is important to understand the potential future development, this chapter also includes a short summary of the material findings of the IPCC AR6.

Summary of IPCC AR6

The report developed by three workings groups (WGI, WGII, and WGIII) highlights among others that global warming already reached global surface temperature of 1.1°C above historic mean with increased development since 1970. Global GHG emissions are still on their peak, with approximately 79% of global emissions coming from sectors of energy, industry, transport, and buildings and 22% from agriculture, forestry, and other land use.[114] Widespread and material changes in the atmosphere, ocean, cryosphere[115] and biosphere have been observed across the globe.[116]

[113] The IPCC is a scientific body that assesses current information from global climate research. Established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), its objective is to provide governments at all levels with scientific information to aid in the development of climate policies

[114] Global surface temperature was 1.09 °C higher in 211-2020 than 1850-1900, with larger increases over land (1.59°C) than over the ocean (0.88°C). In 2019, atmospheric CO_2concentrations were higher than at any time I at least 2 million years, and concentrations of methane and nitrous oxide were higher than at any time in at least 800,000 years. Greenhouse gas emission levels are approximated to two significant digits, which may lead to slight discrepancies in totals due to rounding. IPCC. (2023). p. 4, 5

[115] The cryosphere refers to the frozen water part of the Earth's system, including snow, ice, glaciers, ice sheets, and frozen ground (permafrost)

[116] For further details refer to Appendix 6

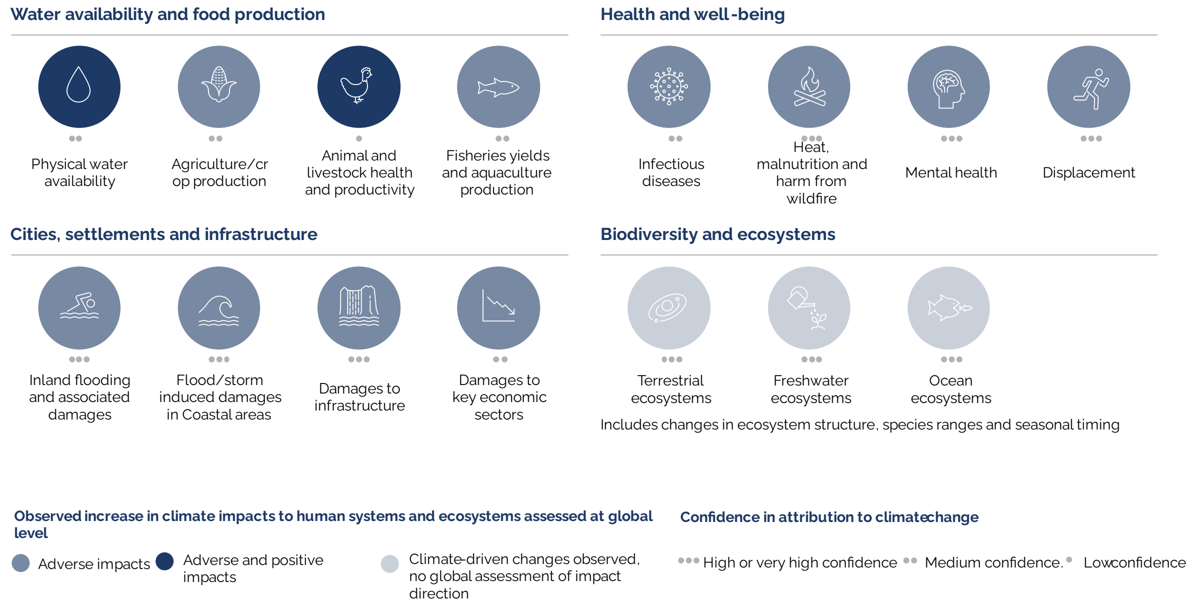

Figure 24 ***Observed widespread, substantial impacts and related losses and damages attributed to climate change***
(Source: IPCC 2023, p. 7.)

Assessing the adaptation actions and implementation, IPCC concludes that efforts have progressed across all sectors and regions,[117] but existing adaptation gaps and maladaptation are expected to grow. Current global financial flows for adaptation[118] are considered insufficient with increasing disparities between estimated costs of adaptation and the finance allocated to it.[119]

Regarding mitigation, policies and laws have consistently expanded since AR5, leading to a significant reduction in global emissions. However, these reductions have only partly offset global emissions growth. Nationally Determined Contributions (NDCs) announced by October 2021[120] suggest that it is likely that warming will go beyond 1.5°C this century, making it harder to limit warming below 2°C. Simulations consistent with NDCs until 2030 announced prior to COP26, assuming no further efforts, predict a median global warming of 2.8°C by 2100. There are differences between projected emissions from implemented policies and those from NDCs, indicating an implementation gap with a corresponding

[117] Examples of effective adaptation options include: Cultivar improvements, on-farm water management and storage, soil moisture conservation, irrigation, agroforestry, community-based adaptation, farm and landscape level diversification in agriculture, sustainable land management approaches, use of agroecological principles and practices and other approaches that work with natural processes. Ecosystem-based adaptation approaches such as urban greening, restoration of wetlands and upstream forest ecosystems have been effective in reducing flood risks and urban heat. Combinations of non-structural measures like early warning systems and structural measures like levees have reduced loss of lives in case of inland flooding (medium confidence). Adaptation options such as disaster risk management, early warning systems, climate services and social safety nets have broad applicability across multiple sectors. IPCC. (2023). p. 8. should be considered besides other investments in infrastructure like coastal protection, heat-resistant rail network, and power grid design for extreme weather events
[118] Adaptation finance has come predominantly from public sources, and a small proportion of global tracked climate finance was targeted to adaptation and an overwhelming majority to mitigation. IPCC. (2023). p. 9
[119] IPCC. (2023). p. 8-9
[120] Implementation of NDCs announced prior to COP26.

projection of global warming of 3.2°C by 2100. Additionally, finance flows are not sufficient to meet climate goals across all sectors and regions.[121]

For the assessment of future climate change potential climate scenarios play a crucial role and are an important part of the IPCC reporting.

Out of over 2.500 model-based climate pathways submitted to the IPCC, the IPCC picked five representative scenarios to illustrate key mitigation-strategies (so called Illustrative Mitigation Pathways (IMPs)[122]) and two scenarios to show consequences of higher emissions (so called pathways illustrative of higher emissions[123]).[124] The IPCC has categorized the different pathways into different classes of warming level (C1-C8). The representative scenarios can also be mapped to the Representative Concentration Pathways (RCPs) and the Coupled Model Intercomparison Project 6 Scenarios (CMIP6), a combination of RCPs and Shared Socio-economic Pathways (SSPs).

As different IPCC reports refer to different pathways and abbreviations, the following table provides an overview:

[121] Several mitigation options, notably solar energy, wind energy, electrification of urban systems, urban green infrastructure, energy efficiency, demand-side management, improved forest and crop/grassland management, and reduced food waste and loss, are technically viable, are becoming increasingly cost effective and are generally supported by the public. IPCC. (2023). p. 10-11

[122] Illustrative Mitigation Pathways include two groups of scenarios consistent with modelled global pathways that limit warming to 2°C (>67%) or lower, respectively. In these scenarios, warming is stabilized before 2100. Each IMP emphasize a different mitigation element: heavy reliance on renewables (IMP-Ren), strong emphasis on low demand for energy (IMP-LD), extensive use of carbon dioxide removal to achieve net negative emissions (IMP-Neg), broader sustainable development and shifting development pathways (IMP-SP) and the implication of less rapid and gradual strengthening of near-term mitigation actions (IMP-GS). See IPCC. (2023). WGIII. p. 1585

[123] Current Policies (CurPol) considers climate policies implemented in 2020 with only a gradual strengthening afterwards, leading to above 4°C warming. Moderate Action (ModAct) explores the impact of implementing the NDCs (pledged mitigation targets) as formulated in 2020 and some further strengthening afterwards, thereby limiting warming to less than 4°C, but above 3°C. In these two scenarios, there is no stabilization of temperature, meaning that further warming occurs after 2100 (and higher risk) even if stabilization could be eventually achieved. They are referred to as pathways with higher emissions. See IPCC. WGIII. p. 77f

[124] For a detailed storyline of the two reference pathways and the five Illustrative Mitigation Pathways (IMPs) please refer to Appendix 6

Table 4 ***Description and relationship of scenarios and modelled pathways in the IPCC AR6 Working Group reports***

Classification of emissions scenarios into warming levels: C1-C8 used in WGIII	Pathways illustrative of higher emissions	Illustrative mitigation pathways (IMPs)	RCP[125] in WGI & WGII	CMIP6 scenarios used in WGI und WGII
C8 exceeding warming of 4˚C			RCP 8.5	SSP5-8.5
C7 limit warming to 4˚C	CurPol			SSP3-7.0
C6 limit warming to 3˚C	ModAct		RCP 4.5	SSP2-4.5
C5 limit warming to 2.5˚C				SSP4-3.7
C4 limit warming to 2˚C				
C3 limit warming to 2˚C		IMP-GS (Sensitivities: Neg; Ren)	RCP2.6	SSP2-2.6
C2 limit warming to 1.5˚C after a high overshoot		IMP-Neg		
C1 limit warming to 1.5˚C with no or limited overshoot		IMP-LD IMP-Ren IMP-SP		SSP1-1.9

Source: IPCC 2023, p. 10; IPCC WGIII, p. 78.

In the following, the Representative Concentration Pathways and the Shared Socioeconomic Pathways and their underlying assumption will be explained.

Representative Concentration Pathways

Representative Concentration Pathways (RCPs) are representative pathways selected from a large set of potential pathways, including – but not limited to – RCP 1.9, RCP2.6, RCP4.5, RCP7.0, and RCP8.5. The number following RCP describes the additional radiative forcing

[125] RCP-based scenarios use “y” to represent the level of radiative forcing measured in watts per square meter. Radiative forcing refers to the change in energy balance in the Earth's atmosphere, and each RCP scenario indicates different levels of future greenhouse gas concentrations and their effects on climate

(in W/m^2)[126] caused by human-induced greenhouse gas increases by the end of the 21st century. [127] The higher the radiative forcing, the higher global warming.

Table 5 ***Overview of selected RCPs and correlating attributes***

Pathway	Effort to curb emissions	Energy generation	New technology	Tempera-ture 2100	Sea level increase 2100	Extreme weather events 2081-2100	Adapta-tion required
RCP 8.5	Low	Coal-fired power	n/a	4.4˚C	0.63-1.01m	Large increase	High level at high cost
RCP 7.0	Medium	Mix	n/a	3.6˚C	0.50-0.88m	Moderate increase	Medium level at medium cost
RCP 4.5	Medium	Renewable	n/a	2.7˚C	0.44-0.76m	Moderate increase	Medium level at medium cost
RCP 2.6	High	Renewable	Emissions capture	1.8˚C	0.32-0.62m	Small increase	Low level at low cost
RCP 1.9	High	Renewable	Emissions capture	1.4˚C	0.28-0.55m	Small increase	Low level at low cost

Source: IPCC (2023), IPCC_AR6_SYR_SPM.pdf

[126] Radiative forcing refers to the change in vertical net radiation at the tropopause due to an internal change or a shift in the external drivers of the climate system, such as variations in CO_2 concentration or solar radiation.
[127] CoastAdapt. (2014). 15-117-NCCARFINFOGRAPHICS-01-UPLOADED-WEB(27Feb).pdf (coastadapt.com.au)

Shared Socioeconomic Pathways

Shared Socioeconomic Pathways (SSPs) describe potential economic and societal development pathways that result in varying future greenhouse gas emissions and, consequently, different greenhouse gas concentrations. There are five distinct pathways, labelled SSP1 to SSP5, each illustrating a different scenario of how the world might evolve. These pathways are depicted in the subsequent figure.[128]

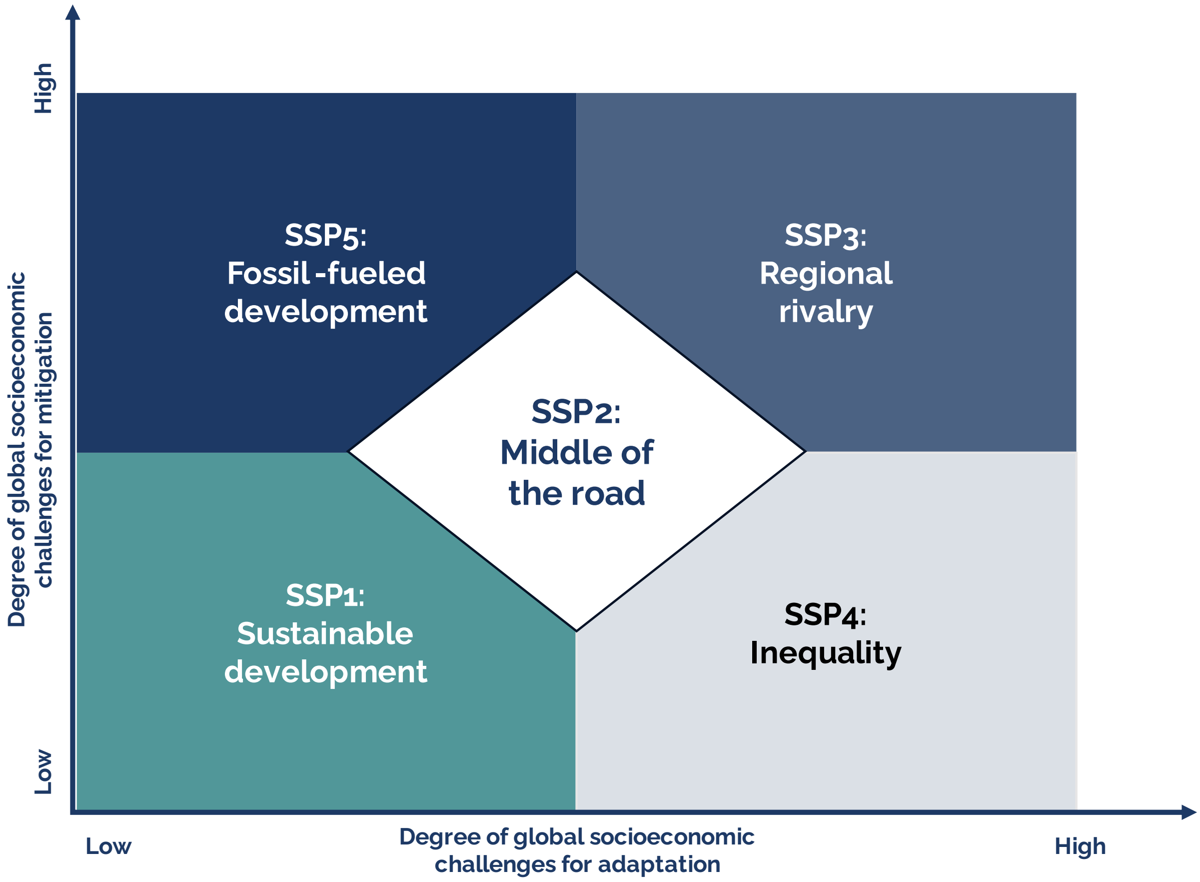

Figure 25 ***Illustration of the Shared Socioeconomic Pathways***
(Source: O'Neill et al. (2017), The roads ahead: Narratives for shared socioeconomic pathways describing world futures in the 21st century (du.edu).)

As outlined earlier, each pathway represents different socioeconomic development scenarios and their impact on greenhouse gas emissions:

SSP1: Sustainable development:

Envisions a world focused on sustainability and social equity. Countries collaborate closely to address global challenges like climate change and poverty. Significant investments in education and healthcare lead to lower population growth and higher quality of life. Economic growth is moderate but well-distributed, with a strong emphasis on green technologies and renewable energy. Technological innovations prioritize sustainability and environmental friendliness, resulting in lower greenhouse gas emissions and reduced environmental impact. International cooperation and effective global governance structures are robust.

[128] UNFCCC. (2016)

SSP2: Middle of the road

Describes a world that largely follows current trends. There are moderate challenges in adapting to and mitigating climate change, with slow and inconsistent progress and regional disparities persisting. Economic growth is moderate and unevenly distributed, with some regions developing faster than others. Technological advancement proceeds at a moderate pace, with a mixed use of fossil fuels and renewable energy sources. This leads to moderate greenhouse gas emissions and environmental impact. International cooperation exists but is often ineffective, and political decisions are inconsistent.

SSP3: Regional rivalry

Represents a fragmented world where national and security interests dominate. There is little international cooperation, and regional conflicts are common. Economic growth is low and uneven, with increasing poverty and inequality. Technological progress is slow and highly regionalized, with a continued reliance on fossil fuels. This results in high greenhouse gas emissions and significant environmental degradation due to uncoordinated and inefficient measures. National and regional policies prevail, and international collaborations are weak and ineffective.

SSP4: Inequality

Depicts a world characterized by high inequalities both within and between countries. Elites and technologically advanced nations have access to resources and wealth, while poorer populations and countries are left behind. Economic growth is polarized, with significant disparities between rich and poor groups and regions. Technological progress is unevenly distributed, with wealthy regions and elites benefiting from advanced technologies while poorer areas lag. This results in high greenhouse gas emissions from less developed regions and social strata, while advanced areas adopt greener technologies. Political power is concentrated in the hands of elites, with international cooperation existing mainly in the interest of affluent nations.

SSP5: Fossil-fueled development

Describes a world focused on rapid economic growth and technological progress, driven by the intensive use of fossil fuels to maximize economic output. High growth rates are fueled by consumption and fossil fuel utilization, leading to increased prosperity but also significant environmental degradation. Technological advancements occur rapidly, emphasizing efficiency and economic profitability, with environmental technologies being prioritized later. This leads to very high greenhouse gas emissions and substantial environmental impact, with environmental issues addressed only when they begin to impede economic development. International cooperation is geared towards maximizing economic benefits, with environmental policies being neglected until economic pressures necessitate action.

RCPs and SSPs are combined to create detailed scenarios that offer insights into future climates based on different socioeconomic and emissions trajectories. This approach allows a comprehensive analysis of how social, economic, and technological trends might impact future climate changes. The IPCC's AR6 highlights this interaction through projections of varying population growth, economic development, and technological advancements paired with RCPs that describe different levels of greenhouse gas concentrations and their effects on global temperatures. For example, increased population typically raises energy demand, leading to higher fossil fuel use, and greater strain on water resources and agriculture. Educational attainment affects technological progress, where higher education fosters cleaner technologies that can mitigate emissions.

Additionally, land-use changes like deforestation contribute significantly to emissions by releasing stored CO_2 and reducing the land's capacity to absorb it, thereby exacerbating the greenhouse effect.

An illustrative example of combining SSPs and RCPs is the scenario known as "SSP5-8.5" This scenario, which is based on the SSP5 pathway — characterized by rapid economic growth, high energy use, and a reliance on fossil fuels — in conjunction with the RCP8.5 pathway — representing a high-emissions path with substantial increases in GHG concentrations — describes a future with very high GHG emissions. Under this scenario, the world will experience significant global warming, severe impacts on ecosystems, and widespread challenges for human systems due to the continued dependence on fossil fuels and high energy consumption. In contrast, the "SSP1-1.9" scenario offers a more optimistic view. This combination of SSP1 — a pathway characterized by sustainable development, high levels of education, and significant advancements in clean technologies — and RCP1.9, which represents a low-emissions path aimed at limiting global warming to around 1.5˚C above pre-industrial levels, describes a future with very low GHG emissions. In this scenario, substantial efforts to reduce emissions and transition to renewable energy sources result in a more stable climate, with significantly reduced impacts on ecosystems and human societies compared to higher emission pathways.

In summary, integrating SSPs with RCPs enables a more detailed exploration of future climate scenarios by accounting for diverse socioeconomic factors and their interaction with different emission pathways, providing a clearer picture of how future changes could unfold under various development trajectories.[129]

7.2.2. NGFS climate scenarios

In addition to previously mentioned scenarios used by the IPCC, the Network for Greening the Financial System (NGFS) collaborated with climate scientists and economists and developed a comprehensive set of hypothetical scenarios, which were originally based on the IPCC scenarios. As of 2020, NGFS started to adapt to these IPCC scenarios. The scenarios should serve as a crucial reference for understanding the evolution of climate change and the associated physical and transition risks for the economy and the financial market under varying future conditions.

NGFS scenarios were originally developed to support central banks and supervisory authorities in analyzing the potential impact of climate scenarios on the economy and the financial system. In addition, they assist private and public sectors in aligning their strategies and policies with specific goals by highlighting key themes for decision-making and target setting. Additionally, these scenarios serve as a foundational tool for researchers and technical specialists to increase granularity and explore additional channels and feedback effects.[130]

As part of an update of the NGFS scenarios in 2024, the latest trends in renewable energy technologies (e.g., solar and wind), key mitigation technologies, and the energy-market effects of the Ukraine war have been incorporated. Additionally, a new damage function has been introduced to improve physical risk modelling by integrating the latest climate science and data, enhancing the financial system's resilience to the economic impacts of climate change.

[129] Climate Neutral Group. (2021)
[130] NGFS. (2024). NGFS Scenarios Portal

The NGFS scenarios are categorized into four main types: orderly', 'disorderly', 'hot house world', and 'too little, too late'.

Orderly scenarios assume early and progressively stringent climate policies, resulting in relatively low physical and transition risks. Disorderly scenarios examine the consequences of delayed or inconsistent policies, leading to higher transition risks and elevated carbon prices. Hot house world scenarios consider insufficient global climate efforts, resulting in severe physical risks and surpassing critical temperature thresholds. Too little, too late scenarios depict a fragmented and delayed policy response, causing significant physical risks globally and high transition risks in some regions. Initially designed to inform policymakers about climate risks and solutions, these scenarios have been adapted to aid central banks and financial supervisors in assessing economic and financial system impacts.[131]

The following figure illustrates the previously mentioned four categories:

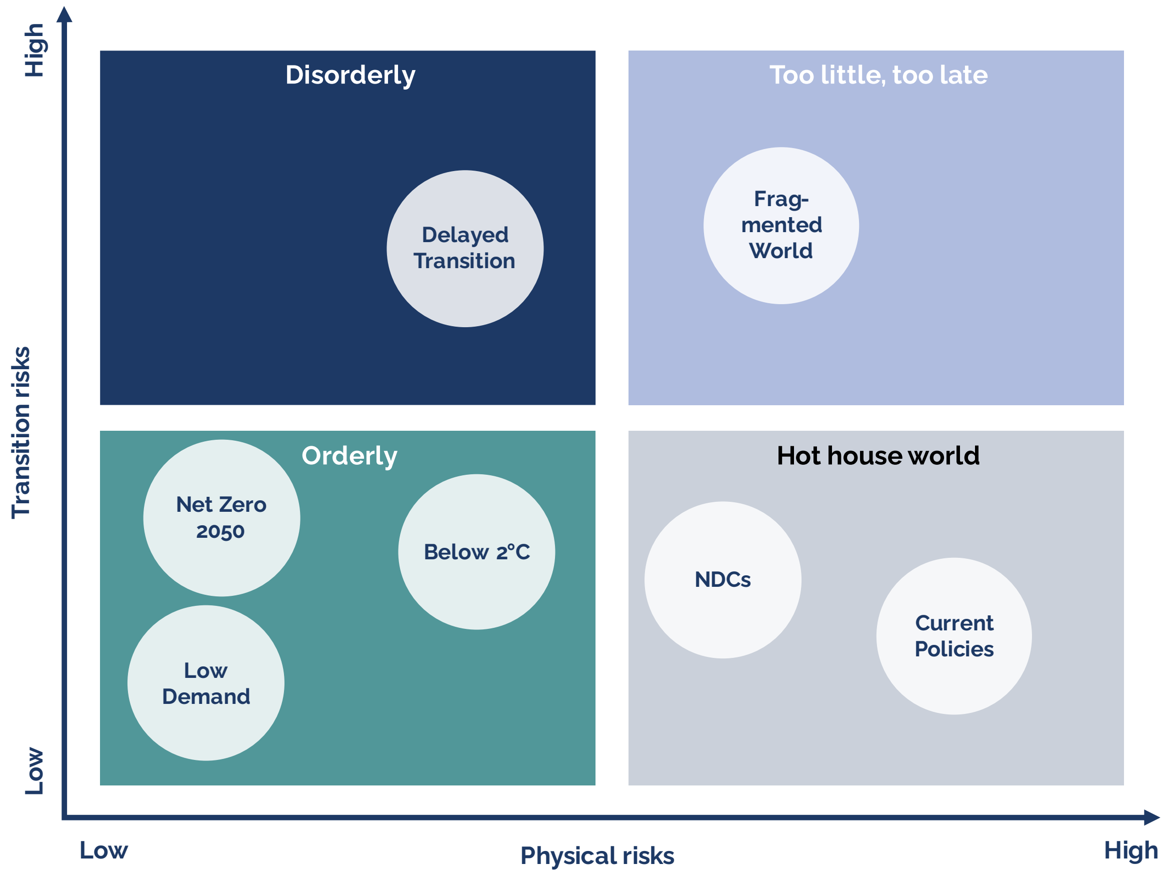

Figure 26 ***Illustration of NGFS scenarios***
(Source: NGFS (2024))

As depicted in Figure 26, each category can be understood as a cluster of different scenarios. The scenarios are described below.[132]

Orderly:

- ***Net Zero 2050:*** Net Zero 2050 scenario aims to cap global warming at 1.5˚C by implementing immediate strict climate policies and fostering innovation to achieve net

[131] NFGS. (2024)
[132] NGFS. (2024)

zero CO_2 emissions by around 2050. In this scenario, some regions, including the US, EU, and Japan, aim to achieve net zero emissions for all greenhouse gases by this time. Carbon Dioxide Removal (CDR) is used for acceleration of decarbonization but kept to a minimum in line with a sustainable level of bioenergy production.

- ***Low Demand:*** This scenario envisions that substantial changes in behavior and reduced energy consumption will help lower the economic burden of reaching global net zero CO_2 emissions around 2050. Shadow carbon prices[133] can be lower compared to the Net Zero 2050 scenario.
- ***Below 2˚C:*** Below 2˚C scenario involves immediate and progressively stricter climate policies, aiming for a 67% probability of keeping global warming below 2˚C. CDR usage is relatively low. Net zero CO_2 emissions are achieved after 2070.

Disorderly:

- ***Delayed Transition:*** The Delayed Transition scenario is based on the assumption that global annual emissions will not decrease until 2030. This means that strong policies will be required to limit the increase in global temperature to below 2˚C. However, the scenario also acknowledges that CDR will be limited. The scenario includes assumptions that new climate policies will not be introduced until 2030 and actions as well as their level differ across countries and regions. Low availability of CDR technologies lead to higher carbon prices than in the Net Zero 2050 scenario.

Hot house world:

- ***Nationally Determined Contributions (NDCs):*** The NDCs include all measures announced, even if they have not yet been implemented. This scenario considers a continuation of the moderate and heterogeneous climate actions reflected in the NDCs since 2021. Emissions decline but lead to 2.6˚C of global warming.
- ***Current Policies***: Current Policies assume that only policies are preserved, which are currently implemented, leading to emissions growing until 2080 and to 3.0˚C warming. This includes irreversible changes like higher sea level rise.

Too little, too late:

- ***Fragmented World:*** The Fragmented World scenario assumes delayed and divergent climate policy ambitions worldwide, leading to increased transition risks in some countries and high physical risks everywhere because the transition is ineffective overall.

[133] The shadow carbon price represents the estimated price of carbon that would be required to address climate change effectively. It is used by organizations and governments to estimate the cost of carbon emissions and to guide investment and policy decisions.
What is shadow carbon pricing? (2019). What is shadow carbon pricing? (ebrd.com)

Table 6 ***Illustration of NGFS Scenarios including mapping to IPCC Scenarios***

Scenario	Policy ambition	Policy reaction	Technology change	CDR	Regional policy variation	Mapping to IPCC scenarios
Net Zero 2050	1.4°C	Immediate and smooth	Fast change	Medium-high use	Medium variation	C1 / C2
Low Demand	1.1°C	Immediate and smooth	Fast change	Medium use	Medium variation	C1 / C2
Below 2°C	1.8°C	Immediate and smooth	Moderate change	Medium-high use	Low variation	C3 / C4
Delayed Transition	1.7°C	Delayed	Slow/fast change	Low-medium use	High variation	C3 / C4
Nationally Determined Contributions	2.3°C	NDCs	Slow change	Low-medium use	Medium variation	C6
Fragmented World	2.4°C	Delayed and fragmented	First slow, then fragmented	Low-Medium use	High variation	C5 / C6
Current Policies	3°C	None – current policies	Slow change	Low use	Low variation	C7 / C8

(Source: NGFS (2024), NGFS Scenarios Portal.)

For a comparison of the two opposing scenarios – Below 2°C and Current Policies – please refer to Appendix 8.

7.3. Nature scenarios

Nature scenarios are not yet as developed as climate scenarios but used to understand and prepare for the potential impacts of nature change. There are several initiatives and organizations like the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the Science Based Targets Network (SBTN) or TNFD that develop scenarios or at least models explaining the complexity of nature systems.

The IPBES Methodological Assessment of Scenarios and Models of Biodiversity and Ecosystem Services[134] from 2016 analyzes about 1500 scientific publications and provides guidance on using scenarios and models within IPBES. IPBES aims to develop multiscale scenarios for futures based on positive visions for human relationships with nature. According to IPBES, scenarios represent possible futures for one or more

[134] IPBES. (2016). https://ipbes.net/assessment-reports/scenarios

components of a system, particularly, for drivers of change in natural capital and nature's benefits, including alternative policy or management options.[135] Models are qualitative or quantitative descriptions of key components of a system and of relationships between those components.[136] The existing methodological assessment focuses mainly on models that can be used to address the effects of changes in indirect drivers on direct drivers of change in nature. Examples of direct drivers ("pressures") of biodiversity and ecosystem change are land-use change, climate change, pollution, natural resource use and exploitation, and invasive species. This aligns with the IFVI/VBA impact accounting methodology and the correlating impact drivers for the monetarization of impacts.[137]

The Science Based Targets Network (SBTN), founded in 2019, defined science-based targets for natures (SBTs) as measurable, actionable, and time-bound objectives, based on best available science, that allow actor to align with Earth' limits and societal sustainability goals. SBTs build on and complement the Science Based Targets initiative (SBTi)'s existing science-based targets for climate, which are focused on cutting GHG emissions.[138] With its targets for nature, SBTN first equips companies with a holistic and rigorous science-based framework to assess and prioritize their impacts on freshwater, land, ocean, biodiversity, and climate so they can then take on-the-ground action accordingly through targets, beginning with freshwater and land (and climate through SBTi).[139] The SBTs process include five steps: Assess, Prioritize, Set targets, Act and Track. In step 1 "Assess" the entity has to determine which of the eight pressure categories are material for each activity (Task 4):

Figure 27 ***SBTN's eight pressures categories***
(Source: SBTN Materiality screening – Science Based Targets Network.)

Task 8, the quantification of environmental pressures of entities' activities states that the assessment should focus on current pressures and state of nature. Future projections of pressures and states of nature (incorporating climate and socio-economic scenarios) could be helpful to consider and may be included in subsequent versions of SBTN methods.[140]

TNFD identifies two critical uncertainties that shape its nature risk scenarios: the degradation of ecosystem services and the alignment of market and non-market driving forces. Ecosystem service degradation, which is closely linked to physical risk and climate change, is driven by climate change as one of the five main causes of nature loss and affects crucial services like global climate regulation. The alignment of market and non-market driving forces relates to transition risk and involves efforts to combat both nature loss and climate change.[141] Beyond climate change, main causes of nature loss are invasive

[135] https://ipbes.net/scenarios-models/what/scenario-methodologies
[136] https://ipbes.net/scenarios-models/what/model-methodologies
[137] IPBES. (2024). What are scenarios and models? | IPBES secretariat
[138] SBTN. (n.d.). https://sciencebasedtargets.org/
[139] SBTN. (n.d.). https://sciencebasedtargetsnetwork.org/companies
[140] SBTN. (2024). Step 1: Assess (Version 1.1). Technical-Guidance-2024-Step1-Assess-v1-1.pdf
[141] TNFD. (2023). p. 7. Guidance_on_scenario_analysis_V1.pdf (tnfd.global)

species, changes in land and sea use, pollution and direct exploitation of natural resources.[142]

Figure 28 ***Five drivers of nature change***
(Source: TNFD (2022), p. 31)

7.4. Connecting climate and nature related scenarios with financial risk

The connection between climate and nature related scenarios, climate and nature related risk and financial risk will be explained on the example of climate change but can be applied in an analogous way on other nature, human or societal capitals.

In each of the modelled pathways e.g. presented by the IPCC, global warming will lead to a significant increase in physical climate risks, such as various natural hazards, by the year 2040 (medium term) and 2100 (long term). However, the extent of future risks is highly dependent on the respective pathway. Even a slight warming above 1.5°C would result in significantly more severe and often irreversible consequences compared to pathways that do not exceed 1.5°C. In the long term, ongoing climate change will result in global and cross-sectoral risks that far exceed current risks.

To limit global warming to 1.5°C or 2.0°C global GHG emissions need to peak at the latest before 2025. Net zero CO_2 emissions need to be reached in the early 2050s, followed by net negative CO_2 emissions for a 1.5°C pathway. Pathways that limit warming to 2.0°C reach net zero CO_2 emissions in the early 2070s.[143] Some hard-to-abate residual GHG emissions would need to be counterbalanced by deployment of CDR methods to achieve net zero CO_2 or GHG emissions.[144]

The United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol, and the Paris Agreement are supporting rising levels of national ambition.[145] Modelled pathways based on Nationally Determined Contributions (NDCs) for global GHG emissions in 2030 are likely insufficient to limit global warming to 1.5°C, even with full implementation of announced measures. Without stricter and more extensive climate protection measures

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[142] UN. (2023). *Five drivers of the nature crisis*. 5 key drivers of the nature crisis (unep.org)
[143] IPCC. (2023). p. 20
[144] IPCC. (2023). p. 21: This includes biological CDR methods like reforestation, improved forest management, soil carbon sequestration, peatland restoration and coastal blue carbon management. Carbon capture and storage (CCS) as an option to reduce emissions form large-scale fossil-based energy and industry sources like cement of chemicals production currently faces technological, economic, institutional, ecological-environmental and socio-cultural barriers. Currently, global rates of CCS deployment are far below those in modelled pathways limiting global warming to 1.5°C or 2.0°C.
[145] IPCC. (2023). p. 10

that go significantly beyond those implemented by the end of 2020, GHG emissions will continue to rise beyond 2025, leading to a median global warming of 2.8°C by 2100.[146]

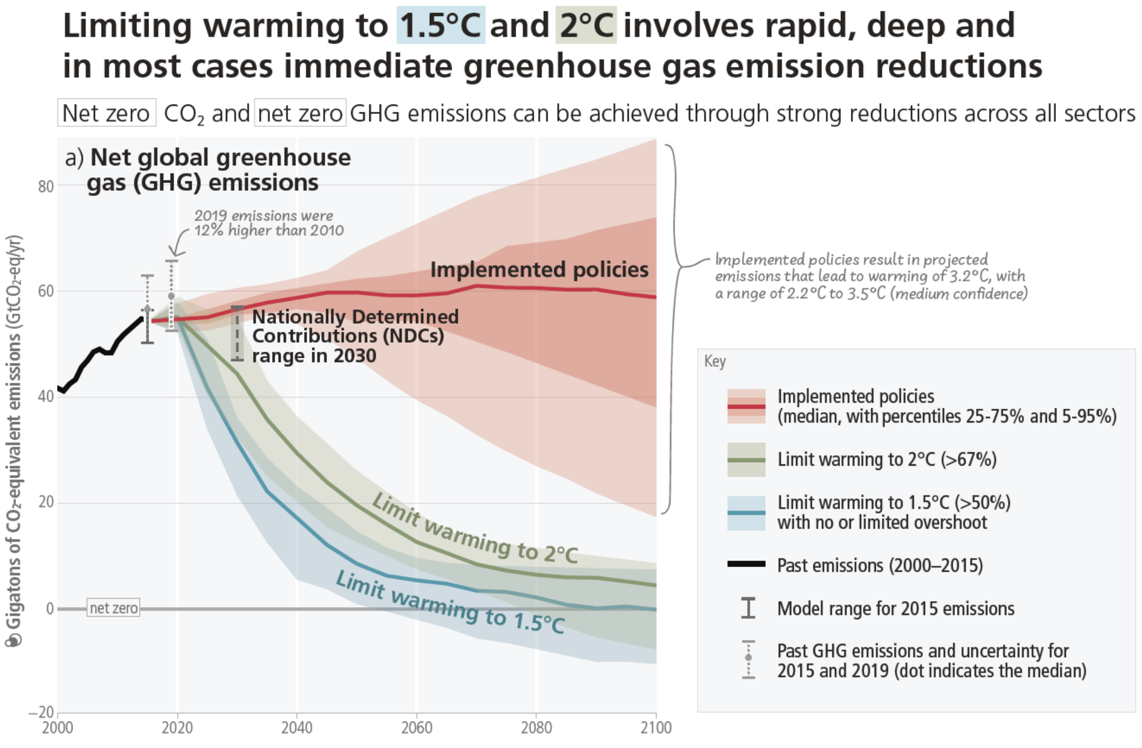


Figure 29 ***Climate scenarios according to IPCC (AR6)***
(Source: IPCC (2023), p. 22)

Climate scenarios can be characterized by their overall level of climate risks - physical and transition risks.[147]

Referring to the IPCC scenarios, the global warming levels reached along the two high-end pathways imply physical risk levels that are 'Moderate' until 2050 and 'Very High' in 2050–2100 (with low levels of adaptation). Noting, that 'Moderate' physical risk can mean for some countries significant and even hardly absorbable consequences (i.e., reaching hard adaptation limits). Transition risk can arise along these trajectories from changes in expectations of economic actors about which of the scenarios is about to materialize. High policy credibility is key to avoiding transition risk, by making expectations consistent early on with the scenario.[148]

[146] IPCC. (2023). p. 11
[147] For a detailed definition of climate risks please refer to chapter [x - Niklas].
[148] IPCC. WGIII. p. 1585

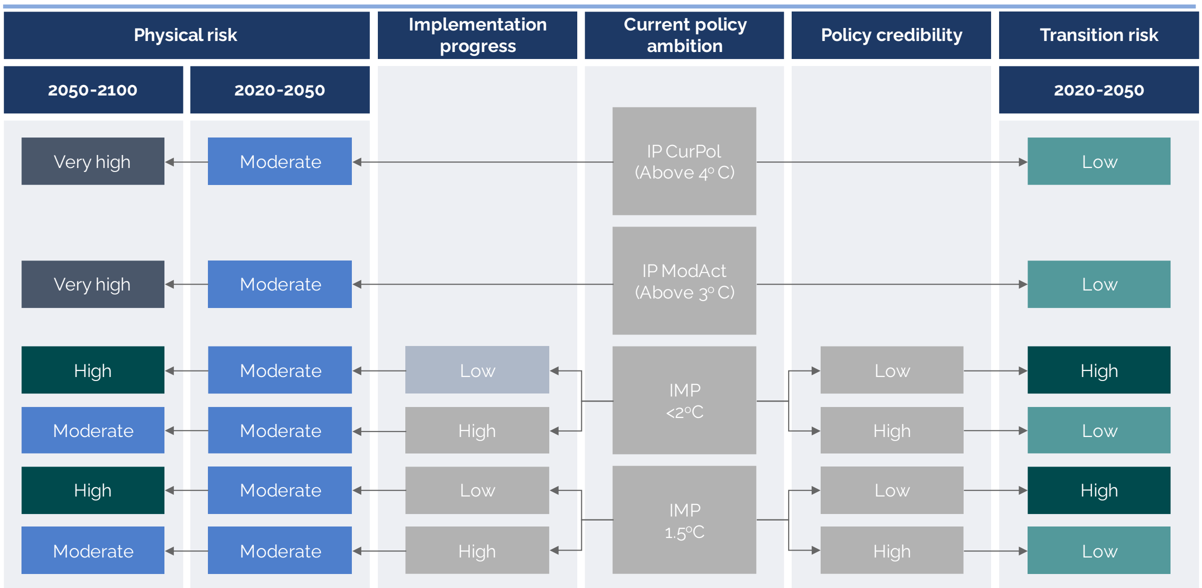


Figure 30 ***Connect between climate scenario, physical and transition risk***
(Source: IPCC 2023, WGIII, p. 1585)

Schematic representation of climate scenarios in terms of both physical and transition risk. *While the figure does not cover all possible events, it maps out how the combination of stated targets can lead to different paths in terms of risk, depending on implementation progress and policy credibility. IMP 1.5°C and IMP <2°C are representative for IMP-GS (Sens. Neg; Ren), IMP-Neg, IMP-LD; IMP-Ren; IMP-SP. Note that the figure defines 'High' progress as higher, but it is important that the physical risk varies by region and country. This means. that 'Moderate' physical risk can be significant and even hardly absorbable for some countries.*

A similar characterization can be found for the NGFS scenarios.[149]Climate risks could affect the economy and financial system through a range of different transmission channels or forces of internalization. This results in potential financial risks for entities.

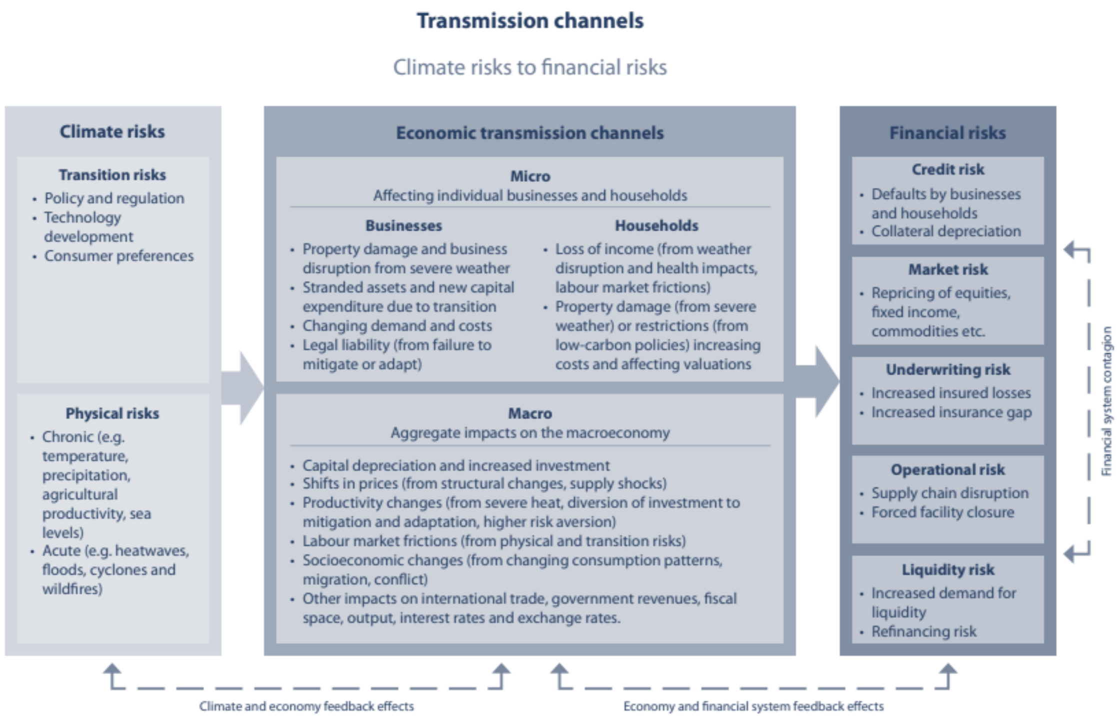


Figure 31 ***Connect between climate risks and financial risks***
(Source: NGFS (2021), p. 10)

[149] NGFS. (2021). p. 9. ngfs_climate_scenarios_phase2_june2021.pdf

A detailed description of climate risks can be found in chapter 6. More details about transmission channels or the topic of internalization can be found in the *Value to Business: Application Guidance*.

7.5. Transitioning from macro scenarios to company-specific scenario analysis

Macro scenarios, such as the nature and climate scenarios described above, can thus serve as the starting point for defining company-specific scenarios. In this process, multiple layers of sub-scenarios may be required.

Taking the case of climate scenarios as an example, there can be different pathways leading to the same result (e.g. 2.0°C global warming in 2100). Various mitigation strategies can achieve the net emission reductions necessary, e.g. through CDR, but the extent and techniques vary depending on the pathway, as do the relative contributions of bioenergy with carbon capture and storage, and removal by the agriculture, forestry, and other land use sectors. This has implications for emissions and other pathway characteristics.[150] Moreover, it pertains not only to CDR but also to any form of CO_2 mitigation. Additionally, global and local policy ambition can vary during the time horizon as well as international cooperation. All these factors play an essential role in determining more specific climate scenarios.
Furthermore, industry specific pathways as well as entity-specific implications have to be considered. As mentioned, the IPCC report – specifically WGII and WGIII – provide details on both regional and sector level. Considering the intended but also potentially changing regulation, emerging new technologies or other sector specific circumstances help to specify scenarios for the quantification of the Value to Business. Within the Value to Business Framework, these additional layers or sub-scenarios are called implementation scenarios. Based on these regional and sector specific implementation scenarios, entity specific scenarios can be built. These should cover the entity-specific circumstances like current status of adaptation and mitigation efforts and potential strategy, resilience of business model etc.

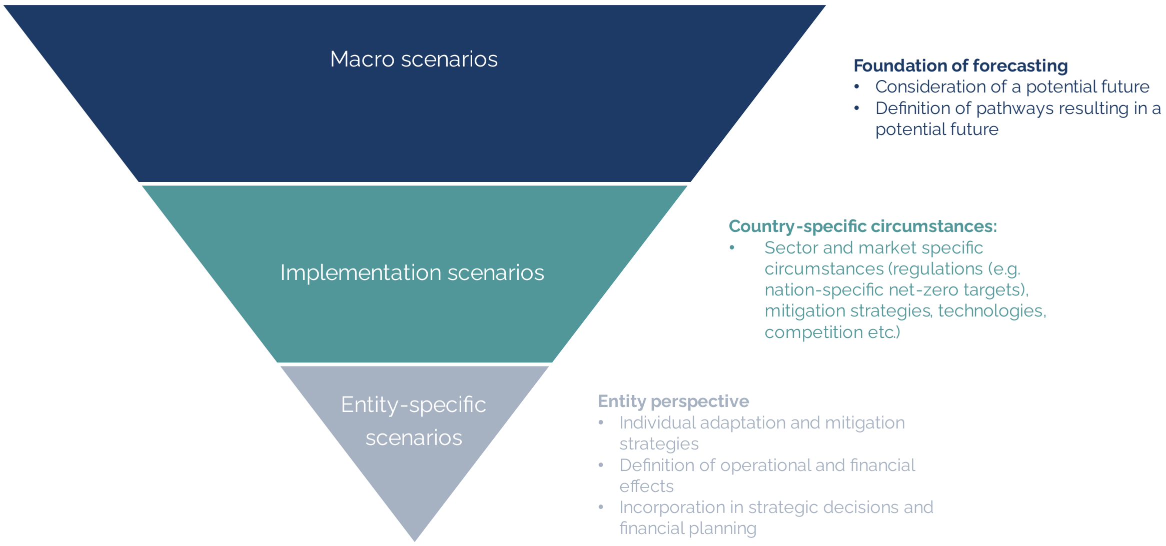


Figure 32 ***Layered model for scenario analysis***
(Source: KPMG)

[150] IPCC. (2018). p. 18. 1,5 °C Globale Erwärmung (Zusammenfassung für politische Entscheidungsträger) (ipcc.ch)

Macro scenarios defined by third parties like IPCC or NGFS provide a starting point and offer consistent sets of assumptions for the application of scenario analyses. This framework does not prescribe one specific macro scenario for applying the Value to Business concept, as scientific knowledge continues to evolve rapidly, and the circumstances and requirements of entities differ widely.

Entities shall undertake scenario analyses to assess risks and opportunities. A qualitative approach may be suitable for those entities initiating scenario analysis, while more experienced entities may benefit from using rigorous and complex quantitative data and models. Entities can opt to use existing external macro scenarios and models or develop their own in-house modelling capabilities, depending on their specific needs, resources, and capabilities.

Nevertheless, it is necessary to analyze at the level of an individual entity which scenario or which range of several scenarios provides a probable depiction of the future from the entity's perspective. It is also necessary to work out the key implications of these scenarios for the individual entity and incorporate them into financial planning.

According to ESRS1 (2023) E1, it is recommended to take the following guidance into account:

- TCFD Technical Supplement on "The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities" (2017),
- TCFD "Guidance on Scenario Analysis for Non-Financial Companies" (2020),
- ISO 14091:2021 "Adaptation to climate change — Guidelines on vulnerability, impacts and risk assessment",
- any other recognized industry standards such as NGFS, and
- EU, national, regional, and local regulations.[151]

When it comes to practically applying and using macro scenarios e.g. climate scenarios, various entities provide action recommendations. TCFD has developed a guidance how to use scenario analysis in the disclosure of climate-related risks and opportunities that follows six essential steps with step 3 being "Identify and define range of scenarios" which addresses the development of scenarios that encompass a range of transition and physical risks.[152]

TCFD provides major considerations which entities are facing during the overall process of applying scenario analysis. As part of a triad consisting of 'Parameters/Assumptions', 'Analytical Choices' and 'Business Impacts/Effects', the TCFD provides companies with instructions on the details they need to consider. A list of these assumptions is included in Appendix 8.

Existing data providers, such as the IPCC Scenarios Data Explorer, can be used to examine the development of a variety of key parameters (e.g. world population, temperature increase, carbon price, electricity capacity).[153]

NGFS provides different transition and economic variables, provides selected climate variables and further data on the NGFS Climate Scenarios website.

When applying to Value to Business, users should follow the following steps in their assessment:

[151] EFRAG. (2022). p. 90/284
[152] TCFD. (2017). p. 7
[153] Global Change Data Lab

1) Define and understand the respective macro scenarios that are necessary for the assessment. This may be predefined by regulatory requirements. Collect and define the underlying assumptions. Don't mix inconsistent RCP/SSP/NGFS assumptions.
2) Use country, sector or technology specific implementation scenarios for further specification. Ensure consistency of assumptions. This step should not be skipped.
3) Compare own circumstances like geographical footprint and circumstances with underlying macro and implementation scenarios and align with individual situation of the entity.
4) Create entity-specific scenarios considering individual circumstances, structures, strategies and resilience. Finalize the basic set of assumptions. Reconcile scenario assumptions to the actual planning model (e.g. currencies, inflation etc.).
5) Understand how the different Value to Business topics evolve in each scenario and how they will affect financial position, performance and cash flow.
6) Combine with sensitivity or simulation analyses (e.g. Monte Carlo) if required.

7.6. Probability of climate scenarios

In the context of financial planning and business valuation, the concept of expected value plays a significant role. The expected value is the weighted average of all possible outcomes, where each outcome is weighted by its probability of occurrence. It provides a single representative value for a range of possible outcomes or scenarios.

Considering the probabilities of occurrence, the results from various scenarios can be consolidated into an expected value. In this context, the probability of climate scenarios plays a decisive role, especially when the objective is not just to analyze individual scenarios, but to derive an expected value for purposes such as financial planning or business valuation.

It should be emphasized that no direct probabilities are assigned to the IPCC climate scenarios. However, the information provided by the IPCC suggests that the probability of achieving warming below 1.5°C is very low. Scenarios that fall between 1.5°C and 2.0°C would require that global emissions must be reduced by ~25% by 2030 (compared to 2019). Considering that GHG emissions of countries like China, India, and other emerging countries[154] will probably rise, developed countries would need to reduce their GHG/ CO_2 emissions by 85% (twice as high as current NDCs consider) – circumstances with low likelihood considering current political situation in the US and EU.[155] The UN environmental program (UNEP) confirms this view and assesses the likelihood of achieving the 1.5°C goal as virtually zero based on current policies, unconditional or conditional NDC scenarios.[156] The only scenario that gets close to the Paris Agreement's temperature goal is the most optimistic one. It assumes all countries fully implement their strictest pledges, including conditional NDCs and net-zero targets. This scenario could limit warming to 1.9°C (range: 1.8–2.3°C) with over 66% chance. It is the only scenario where global warming is stabilized this century.

[154] This also includes important emitters like Russia, OPEC countries, Indonesia, Mexico, Brasilia, South Africa and Turkey (besides others)
[155] Renate Neubäumer. (2024). in Wirtschaftsdienst. 104(1). 47-52
[156] UNEP. (2024). p. IX. Emissions Gap Report 2024 | UNEP - UN Environment Programme

Scenarios	1.5°C	2°C	3°C
Current policies continuing	100% (85-100%)	97% (28-100%)	37% (1-80%)
Unconditional NDCs continuing	100% (86-100%)	94% (28-100%)	22% (1-75%)
Conditional NDCs continuing	100% (77-100%)	79% (19-100%)	10% (0-69%)
Conditional NDCs + all net - zero pledges	77% (64-97%)	20% (64-97%)	0% (0-6%)

Figure 33 ***Likelihood of warming exceeding a specific temperature limit (%)***
(Source: UNEP (2024))

Collectively the NDC targets of the G20 which account for 77% of global GHG emissions, are far from the required reduction to align with 2.0˚C and 1.5˚C scenarios. .[157] Current unconditional and conditional NDCs are projected to cut emissions by only 4% and 10% respectively by 2030, far below the needed 28% reduction needed for 2030 emissions to be aligned with 2.0˚C and a 42% reduction for 1.5˚C.[158] Immediate, accelerated, and substantial mitigation actions are essential to address the large emissions gap. The lack of action and time lost has immediate implications and costs. UNEP also highlights that the emission reduction potential based on existing technologies and at reasonable costs of below USD200 per ton of CO_2e appear to be sufficient to bridge the emissions gap in 2030 and 2035.[159] Nevertheless, it should be emphasized that achieving Paris-aligned climate goals is not impossible, but it will require additional efforts, including net negative emissions beyond 2030.

Scenarios that determine warming around 3.0˚C appear to be more probable. The development of renewable energy technologies and emerging climate policy have made it considerably less likely that high-end scenarios which include no, or only modest climate policy will potentially emerge. But high emissions cannot be ruled out for e.g. political reasons or higher population and economic growth. High-end scenarios can also result from strong feedback from climate change.[160]

This has direct implications for setting up scenarios and the planning of expected values, as is elaborated in detail in chapters 5 and 6. The IPCC report provides many details and summarizes the current state of studies at regional, sectoral and topic level. Physical climate effects, in particular, depend heavily on local conditions. Some regional climate simulations are available for this purpose, e.g. from the Federal Environment Agency or from professional providers.

TCFD and ESRS E1 define specific reporting requirements, which address physical risks and transition risks considering a high-end scenario or a low-end mitigation pathway

[157] UNEP. (2024). p. V. Emissions Gap Report 2024 | UNEP - UN Environment Programme
[158] UNEP. (2024). p. VII. Emissions Gap Report 2024 | UNEP - UN Environment Programme
[159] UNEP. (2024). p. IV. Emissions Gap Report 2024 | UNEP - UN Environment Programme
[160] IPCC. WG III. p. 316, 386

respectively. Based on the current state of science and decarbonization actions, it is likely that a mixture of physical and transition risks will represent the most realistic case. Understanding the interplay between physical and transition risks is therefore vital for developing a comprehensive approach to incorporate the risks' effects on strategic decisions and the derivation of an entity's financial planning. Entities should decide individually which mixture is most appropriate from their viewpoint and their specific use case in order to draw their own conclusions.

8. Conclusion

The transformation toward sustainable business models is only beginning, and much will change in the years ahead. These developments will be fast-moving and dynamic, bringing both challenges and opportunities.

This framework is designed to provide the conceptual foundation and practical context for financially quantifying sustainability-related risks and opportunities and for systematically integrating them into decision-making processes, whether in financial planning and forecasting, risk management, or investment and business valuation. Where necessary, contextual information is provided to support the application of the concepts and techniques introduced, equipping users of the Value to Business Framework with the background knowledge required for effective implementation.

The Value to Business Framework and its components can be used to take concrete steps such as developing or refining transition plans, identifying sustainability-related market opportunities, and enhancing risk management practices. Ultimately, the Value to Business concept enables the integration of sustainability considerations into everyday planning and decision-making.

In addition, this framework illustrates how insights from impact accounting (the Value to Society perspective) can inform understanding of how sustainability impacts affect both financial performance and enterprise value. A comprehensive understanding of the impacts caused by entities is essential for identifying and quantifying key business risks. Through this framework, existing impact accounting methodologies, developed in partnership between IFVI and VBA, are complemented and further integrated into financial planning tools and decision-making processes.

Building on forecasting, as outlined in this document, not only helps create a clearer view of the future and support better decisions, but also fosters dialogue across departments, encourages closer collaboration, and opens new channels of communication as data are collected and calculation models are developed. This cross-departmental collaboration is essential to the transformative process ahead, enabling businesses to become more resilient, unlock new opportunities, and remain successful in a rapidly changing environment. Effectively utilizing newly available data will be key to making well-informed decisions.

While this framework establishes the theoretical and contextual foundation, a complementary publication, the Value to Business: Application Guidance, will provide a practical, five-step process with examples to support implementation. Used together, these resources can help companies move from ambition to concrete action.

9. Glossary & Appendix

Actual	Relates to the existing status of the entity in the current reporting period or at the specific valuation date. This also includes circumstances which can have their origin in previous periods with ongoing consequences. Based on the definition of actual impacts, actual dependencies refer to existing dependencies, including those that have not yet been recognized as relevant or critical.
Below 2˚C	Below 2˚C scenario involves immediate and progressively stricter climate policies, aiming for a 67% probability of keeping global warming below 2˚C
Biogeochemical Flows	Excessive input of nitrogen and phosphorus into the environment.
Biosphere Integrity	Rate of species extinctions and loss of biodiversity which can impair ecosystem functionality.
Business activity	Includes everything that an entity does, including operations, the procurement of inputs, the sale and provision of products and/or services, as well as any supporting activities.
Climate Change	Concentration of greenhouse gases in the atmosphere and its impact on Earth's climate system.
Current Policies	Assumes that only policies are preserved, which are currently implemented, leading to emissions growing until 2080 and to 3.0˚C warming. This includes irreversible changes like higher sea level rise.
Delayed Transition	The Delayed Transition scenario is based on the assumption that global annual emissions will not decrease until 2030. This means that strong policies will be required to limit the increase in global temperature to below 2˚C
Dependencies	Refer to the direct as well as indirect reliance of entities on natural, human, or social capital
Drivers of nature change	Climate change, changes in land, freshwater and ocean use, resource use and replenishment, pollution and pollution removal, and the introduction or removal of invasive alien species
Dynamic planning	Assumes that the future is uncertain and that it will be different from the past
Economic capital	The human-made goods and financial assets that are used to produce goods and services consumed by society.
Ecosystem services	These are the benefits that people obtain from ecosystems, including provisioning services (such as food, water, timber), regulating services (such as climate regulation, water

	purification, erosion control), cultural services (such as recreation, community enrichment), and supporting services (such as soil formation, nutrient cycling).
Effect	is a deviation from the expected while it can be positive, negative, or both
Fragmented World	Assumes delayed and divergent climate policy ambitions worldwide, leading to increased transition risks in some countries and high physical risks everywhere because the transition is ineffective overall.
Freshwater Change	Utilization and distribution of freshwater resources, essential for the survival of humans, animals, and plants.
Human Capital	The knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being.
Impact	A positive or negative change in one or more dimensions of people's well-being directly or through a change in the natural environment. An impact can be actual or potential, direct or indirect, intended or unintended, and positive or negative.
Industry rivalry	This refers to the level of competition among entities in the industry.
Internalization	Referring to the pricing in of external effects (i.e., externalities). Externalities arise when an operator in the market does not bear all the costs it causes itself.
Low Demand	This scenario envisions that substantial changes in behavior and reduced energy consumption will help lower the economic burden of reaching global net zero CO_2 emissions around 2050. Shadow carbon prices can be lower compared to the Net Zero 2050 scenario.
Macro scenarios	determine one version of a potential future – a potential world in which the entity will have to operate in
Nationally Determined Contributions (NDCs)	This scenario considers a continuation of the moderate and heterogeneous climate actions reflected in the NDCs as at 2021. Emissions decline but lead to 2.6°C of warming
Natural Capital	The stock of renewable and non-renewable natural resources that combine to yield a flow of benefits to people.
Net Zero 2050	aims to cap global warming at 1.5°C by implementing immediate strict climate policies and fostering innovation to achieve net zero CO_2 emissions by around 2050. In this scenario, some regions, including the US, EU, and Japan, aim to achieve net zero emissions for all greenhouse gases by this time.
Outcome	The change in the state of capital(s) experienced by people, or the natural environment that results from an entity's activities.

Output	The direct result of an entity's activities, including an entity's products, services, and any by-products. These by-products resulting from the business activities represent unintended outputs like emissions or waste
Planetary boundaries	Describes the biophysical and biochemical systems and processes known to regulate the state of the planet within ranges that are historically known and scientifically likely to maintain Earth system stability and life-support systems conducive to the human welfare and societal development experienced
Potential	refers to potential future impacts, dependencies and financial effects
Primary data	Refers to information directly collected by the entity, such as data from suppliers or customers.
Proxy data	Is a subset of secondary data, is collected for one purpose but repurposed for impact and dependency measurement.
Risk	Defined as an effect of uncertainty on objectives.
Secondary data	Is gathered by external sources and may include resources like lifecycle impact assessment (LCIA) databases or industry reports.
Simplified techniques and detailed analyses	Simplified estimates can range from "rule of thumbs" to simplified adjustments (e.g. of EBITDA). Detailed analyses like modelling of value drivers– especially when based on operational value drivers – aim to incorporate the real circumstances and relations as detailed as possible in the calculations.
Social capital	The networks together with shared norms, values and understanding that facilitate cooperation within and among groups.
Static planning	Assumes that the future is predictable and that it will be similar to the past.
Stratospheric Ozone Depletion	Reduction of the protective ozone layer in the stratosphere
Sustainability-related risks and opportunities	events or conditions that could negatively or respectively positively affect an entity's business model and consequently financial performance or reputation.

Appendix 1: Exemplary non comprehensive list of actual and potential risks and opportunities

ESRS Category	Opportunity / Risk	Sub-category	Example of O&R	Potential financial effects	Source
E1 – Climate change	Opportunity	Energy source	Use of lower-emission sources of energy (e.g. electricity instead of gas)	Reduced exposure to future fossil fuel price increases, price volatility and supply constraints (e.g. driven by geopolitical dependencies and resource availability) Reduced exposure to GHG emissions and therefore less sensitivity to changes in cost of carbon and other regulatory measures Increased capital availability (e.g., as more investors favor lower-emissions producers) Increasing revenue due to raising demand for low-emission products and services Cost benefits from decreasing costs of sustainable energy sources (e.g. green electricity)	TCFD Full Report p. 18ff.; McKinsey July 16, 2024, Net-zero electrical heat: A turning point in feasibility,
E1 – Climate change	Transition risk	Market	Uncertainty in market signals and increased price volatility	Abrupt and unexpected shifts in costs for relevant production input (e.g. water, electricity, gas) Increased costs for hedging Increased business risk leading to higher cost of capital Increased monitoring costs	TCFD Full Report p. 18ff., TNFD Guidance on Bioms p. 25ff., ESRS E3 p.8f.
E2 - Pollution E3 - Water and Marine Resources	Physical risk	Pollution	Acid rain reducing agricultural productivity / crop yields	Revenue losses due to lower sales volume Price increases due to lower market supply Possible food shortages with potentially drastic effects on social and political structures, which ultimately also have a negative impact on companies' ability to operate	Natural Capital Protocol p. 73
E3 - Water and marine resources E5 - Resource use and circular economy	Opportunity	Resource efficiency	Use of: - more efficient production and distribution processes - recycling and circularity - Reduced water usage and consumption	Reduced operating costs (e.g., through efficiency gains and cost reductions) Increased production capacity, resulting in increased revenues Benefits to workforce management and planning (e.g., improved health and safety, employee satisfaction) resulting in lower costs	TCFD Full Report p. 18ff.
E4 - Biodiversity and ecosystems	Opportunity	Policy and Legal	Increased governmental efforts for protection of natural capitals	More sustainable agricultural yields: Increasing fish populations and therefore increasing fishing volumes due to ocean protection Maintaining cost stability due to ecosystem service stability and resource availability	ESRS E3 p.8f.
S1 - Own Workforce S2 - Workers in the Value Chain	Risk	Labor rights	Workers being paid less than the legal minimum wage	Cost of financial penalties and restitution Reputational loss due to high-profile convictions	WBCSD Enterprise Risk Management p. 104
G1 - Business conduct	Risk	Monitoring	Lack of oversight for trading operations (e.g. of complex products like derivatives)	Cost of financial penalties Above-average trading losses	WBCSD Enterprise Risk Management p. 104
...					

(Source: KPMG)

Appendix 2: List of Natural Capital Assets

Atmosphere	The atmosphere is the mass of air surrounding the earth. It's components (such as oxygen) and it's processes (such as temperature regulation) support a number of essential ecosystem services.
Habitats	Habitats refer to the conditions of the environment necessary for life to prosper. These conditions vary widely between species but can include such elements as water and food availability, temperature range, or absence of predators. Habitats can be defined very narrowly for one population of a particular species or more widely by type such as forests or coastal habitats that host many different species.
Land geomorphology	Land geomorphology describes the structure of the land, such as mountains and valleys. Land geomorphology supports the provision of regulatory services, like erosion control.
Minerals	Minerals are naturally occuring compounds not produced by living beings. They can be metallic or non-metallic and play an important supporting role in the provision of services like soil quality.
Ocean geomorphology	Ocean geomorphology describes the structure of the marine environment such as shelfs and slopes. Ocean geomorphology supports the provision of regulatory services, like dilution by ecosystems.
Soils and sediments	Soils and sediments are the layers of the earth's surface that support life. They comprise top-soil, sub-soil and ocean sediments and support a number of regulatory services.
Species	Species includes plants, animals, fungi, algae and genetic resources, which can be wild or domestic/commercial, for example livestock. Like habitats, species underpin a wide range of ecosystem services.
Water	Water includes surface water, ground water, ocean water, fossil water and soil water. Water is essential for a wide range of ecosystem services.

(Source: Encore: ENCORE (encorenature.org))

Appendix 3: List of Natural Capital Services

Millennium Ecosystem Assessment (4 ecosystem services)	CISL Based on Swiss Re Institute (5 ecosystem services)	IPBES (18 nature's contributions to people)	ENCORE Based on CICES (21 ecosystem services)	TNFD Based on SEEA/IUCN (25 ecosystem services)
• Provisioning Services	• Food and other goods provision	• Food and feed • Energy • Materials and assistance • Medicinal, biochemical and genetic resources	• Fibres and other materials • Animal based energy • Genetic materials • Ground water • Surface water	• Biomass provisioning • Genetic material • Water supply • Other provisioning services
• Regulating Services	• Air quality and local climate • Water security • Hazard regulation • Habitat intactness	• Regulation of air quality • Regulation of climate • Pollination and dispersal of seeds • Regulation of ocean acidification • Regulation of hazards and extreme events • Regulation of organisms detrimental to humans • Regulation of freshwater quantity, location and timing • Regulation of freshwater and coastal water quality	• Ventilation • Climate regulation • Filtration (air) • Filtration (water) • Pollination • Disease control • Pest control • Water flow maintenance • Bio-remediation • Dilution by atmosphere and ecosystems • Mass stabilisation and erosion control	• Air filtration • Local/Global climate regulation • Pollination • Flood/storm mitigation • Rainfall pattern regulation • Biological control • Noise attenuation • Soil quality regulation • Water flow regulation • Water purification • Other regulating and maintenance services
• Cultural Services	• Habitat intactness	• Habitat creation and maintenance • Learning and inspiration • Physical and psychological experiences • Supporting identities • Maintenance of options	• Maintain nursery habitats • Dilution by atmosphere and ecosystems	• Nursery population and habitat maintenance • Recreation-related services • Visual amenity services • Education, scientific and research services • Spiritual, artistic and symbolic services • Other cultural services
• Supporting Services	• Habitat intactness	• Formation, protection and decontamination of soils • Habitat creation and maintenance	• Soil quality • Buffering and attenuation of mass flows • Mediation of sensory impacts • Water quality • Flood and storm protection	• Soil and sediment retention • Solid waste remediation

(Source: NGFS (2023), p. 19., Categorization of ecosystem services using various levels of granularity)

Appendix 4: List of Drivers of Environmental Change

Diseases	Harmful pathogens and microbes that are originally found within the ecosystem(s) in question, but have become "out-of-balance" or "released" directly or indirectly due to human activities.
Droughts	Periods in which rainfall falls below the normal range of variation.
Earthquakes	Earthquakes manifest themselves by shaking and displacing or disrupting the ground. They may also cause associated events such as tsunamis, landslides, or even volcanic activity.
Fire	Suppression or increase in fire frequency and/or intensity outside of its natural range of variation.
Flooding	Extreme precipitation events leading to the submergence of dry land.
Habitat modification	Major changes in habitat composition and location, for example deforestation.
Human modification of genetic material	Human altered or transported organisms or genes.
Human movement	Migration by people from one place to another with the intentions of settling, permanently or temporarily in a new location.
Industrial or domestic activities	Non-agricultural human activities including non-consumptive use of resources.

(Source: Encore: ENCORE (encorenature.org))

Industrial or domestic construction	Process of constructing a building or infrastructure for industrial or domestic purposes.
Intensive agriculture and aquaculture	Threats from farming and ranching as a result of agricultural expansion and intensification, including silviculture, mariculture and aquaculture (includes the impacts of any fencing around farmed areas).
Invasive species	Harmful plants, animals, pathogens and other microbes not originally found within the ecosystem(s) in question and directly or indirectly introduced and spread into it by human activities.
Landslides	Landslide events leading to geological changes.
Ocean acidification	Changes to the ocean chemistry which occurs when carbon dioxide is absorbed from the atmosphere and reacts with seawater to produce acid.
Ocean current and circulation	Large scale movement of waters in the ocean basins.
Overfishing	The harvesting of aquatic wild animals or plants at a rate that is greater than their capacity for regeneration. Harvesting can occur for commercial, recreation, subsistence, research, or cultural purposes, or for control/persecution reasons; accidental mortality/bycatch are also included.

(Source: Encore: ENCORE (encorenature.org))

Example indicator in a given location (see indicators in Step 05)	Impact driver category	Example of changes in natural capital, in a given location, resulting from the impact driver
Cubic meters of water consumed from surface water	Water use	Change in physical water resources (may be seasonal)
Hectares of forests converted to pasture	Terrestrial ecosystem use	Change in wildlife populations, stocks of timber and non-timber forest products, erosion control
Hectares of valley flooded for a dam	Fresh water ecosystem use	Change in various capital stocks and ecosystem services (e.g., wildlife, carbon sequestration, flood control)
Hectares of mangrove ecosystem cleared	Marine ecosystem use	Change in fish stocks and ecosystem services (e.g., protection from storm surges)
Tons of Atlantic Cod caught	Other resource use	Change in Atlantic Cod stocks, which can include resilience of population
Tons of CO_2e released to air	GHG emissions	Change in CO_2e concentration and contribution to global climate change
Tons of PM2.5 released to air	Non-GHG air pollutants	Change in $PM_{2.5}$ concentration and increased frequency/severity of smog
Kilograms of arsenic released to surface water	Water pollutants	Change in arsenic concentration and reduction in fish abundance
Kilograms of organophosphate pesticide to soil	Soil pollutants	Change in organophosphate concentration and reduction in invertebrate abundance
Tons of non-hazardous waste incinerated	Solid waste	See GHGs, other air emissions, terrestrial ecosystem services
Decibels of noise above normal background level	Disturbances	Change in numbers or reproductive success of nesting birds

(Source: NCP, p. 69, Examples of relevant changes in natural capital for different impact drivers)

Appendix 5: List of Dependencies

Business inputs	Dependency category	Specific dependencies
Consumptive	**Energy**	Solar, wind, hydro, geothermal, biofuel, fossil fuel
	Water	Fresh water (ground, surface, or rain) or sea water
	Nutrition	Human or animal food
	Materials	Wood fiber, genetic resources, metals, minerals, plant and animal materials
Non-consumptive	**Regulation of physical environment**	Flood attenuation, water quality regulation
	Regulation of biological environment	Crop pest control, pollination
	Regulation of waste and emissions	Waste assimilation, noise and dust regulation
	Experience	Nature-based recreation, tourism
	Knowledge	Information from nature (e.g., for "bio-mimicry")
	Well-being and spiritual/ethical values	Employee satisfaction and stress release, sacred sites and indigenous traditions that support company staff or operations

(Source: NCP, S. 48 Examples of possible dependencies)

Overharvesting	The harvesting of plants, fungi, trees and other woody vegetation, and other non-timber/non-animal products at a rate that is greater than their capacity for regeneration. The harvesting can occur for commercial, recreation, subsistence, research or cultural purposes, or for control reasons.
Overhunting	The killing or trapping terrestrial wild animals or animal products at a rate that is greater than their capacity for regeneration. The killing or trapping can occur for commercial, recreation, subsistence, research or cultural purposes, or for control/persecution reasons; includes accidental mortality/bycatch.
Pests	Harmful plants or animals that are originally found within the ecosystem(s) in question, but have become "out-of-balance" or "released" directly or indirectly due to human activities.
Pollution	Threats arising from the introduction of contaminants into the natural environment.
Population changes	Changes in species populations over time and space.
Sea level rise	Increase in global mean sea level as a result of an increase in the volume of water in the world's oceans or heat dilation.
Sea surface temperature	Periods in which sea surface temperatures exceed or go below the normal range of variation.
Storms	Extreme precipitation and/or wind events.
Volcanoes	Volcanic events which may lead to changes in natural capital assets.
Water abstraction	Changing water flow patterns from their natural range of variation due to human activities.
Weather conditions	Weather conditions outside of the natural range of variation.

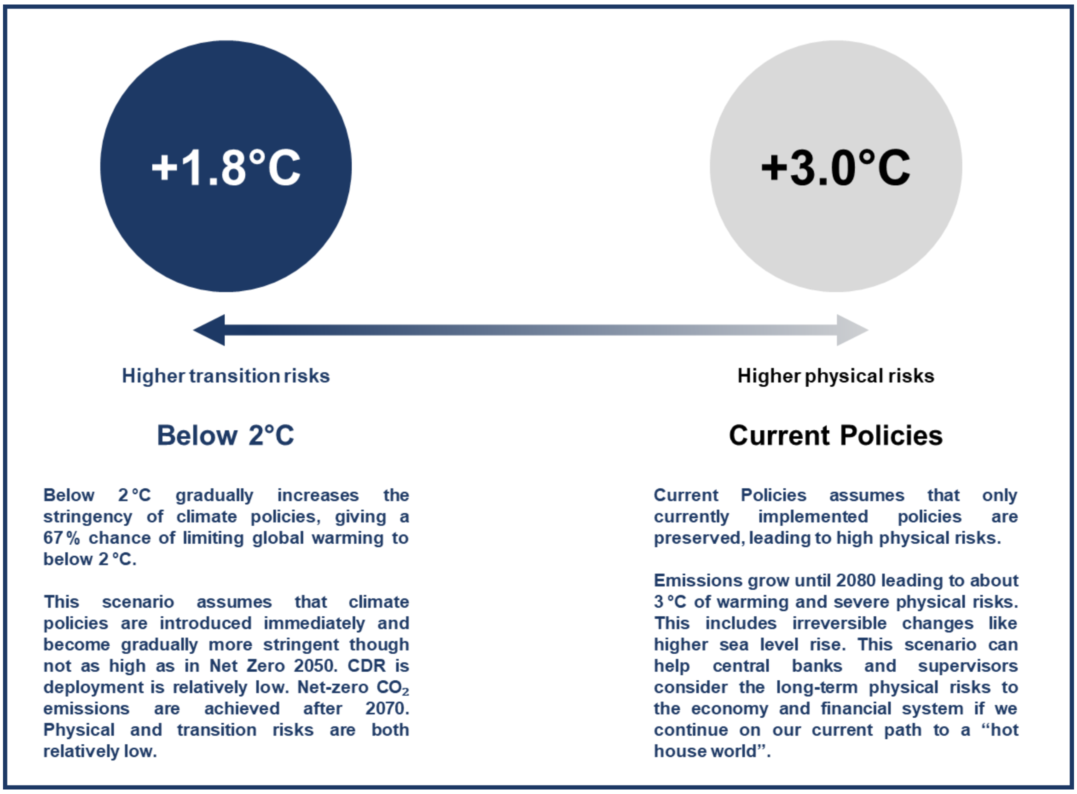
(Source: Encore: ENCORE (encorenature.org))

Appendix 6: IPCC AR 6 Reference pathways and five illustrative IMPs

		General char.	Policy	Innovation	Energy	Land use, food biodiversity	Lifestyle
CurPol		Continuation of current policies and trends	Implementation of current climate policies and neglect of stated goals and objectives; grey COVID-19 recovery	Business as usual; slow progress in low-carbon technologies	Fossil fuels remain important; lock-in	Further expansion of western diets; further slow expansion of agriculture area	Demand will continue to grow; no significant changes in current habits
ModAct		NDCs in 2030 as announced in 2020, fragmented policy landscape; post-2030 action consistent with modest action until 2030	Strengthening of policies to implement NDCs; some further post-2030 strengthening and mixed COVID-19 recovery	Modest change compared to Cur-Pol	Mostly moving away from coal; growth of renewables; some lock-in in fossil investments	Afforestation/ reforestation policies as in NDCs	Modest change compared to Cur-Pol
IMP	**Neg**	Mitigation in all sectors includes a heavy reliance on carbon dioxide removal that results in net negative global GHG emissions	Successful international climate policy regime with a focus on a long-term temperature goal	Further development of CDR options	Heavy reliance on CDR in power sector and industry; CDR used to compensate fossil fuel emissions	Afforestation/ reforestation, BECCS, increased competition for land	Not critical – some induced via price increases
	Ren	Greater emphasis on renewables: rapid deployment and technology development of renewables; electrification	Successful international climate policy regime; policies and financial incentives favouring renewable energy	Rapid further development of innovative electricity technologies and policy regimes	Renewable energy; electrification; sector coupling; storage or power-to-X technologies; better interconnections		Service provisioning and demand changes to better adapt to high renewable energy supply
	LD	Efficient resource use as well as shifts in consumption patterns globally, leading to low demand for resources, while ensuring a high level of services and satisfying basic needs		Social innovation; efficiency; across all sectors	low demand for energy, while ensuring a high level of energy services and meeting energy needs; modal shifts in transport; rapid diffusion of best available technology in buildings and industry	Lower food and agricultural waste; less meat-intensive lifestyles	Service provisioning and demand changes; behavioural changes
	GS	less rapid introduction of mitigation measures followed by a subsequent gradual strengthening	Until 2030, primarily current NDCs are implemented and gradually strengthened moving gradually towards a strong, universal climate policy regime post-2030		Similar to IMP-Neg, but with some delay	Similar to IMP-Neg, but with some delay	
	SP	Shifting the global pathway towards sustainable development. including reduced inequality and deep GHG emissions reduction	SDG policies in addition to climate policy (poverty reduction; environmental protection)		low demand for energy, while ensuring a high level of energy services and meeting energy needs; renewable energy	Lower food and agricultural waste; less meat-intensive lifestyles; afforestation	Service provisioning and demand changes

(Source: IPCC 2023, WGIII, p. 1878. Storylines for the two reference pathways and five illustrative Mitigation Pathways (IMPs) limiting warming to 1,5°C-2°C considered in the report)

Appendix 7: Comparison of selected NGFS scenarios



(Source: NGFS (2024), NGFS Scenarios Portal)

Appendix 8: List of assumptions related to TCFD

Parameters/Assumptions	
Discount rate	The discount rate is the rate used to convert future values into present values, reflecting the organization's time preference for money. It determines how future cash flows, benefits, or costs are valued today.
Carbon price	Assumptions about carbon price involve its projected development over time within tax or emissions trading frameworks, including the geographic scope of implementation. This encompasses whether the price applies only at the margin or as a base cost, its application to specific sectors or the entire economy, and regional variations. It also includes whether a uniform or differentiated carbon price is used, and the assumptions about the scope and modality of a CO2 price via tax or trading schemes.
Energy demand and mix	This parameter involves projections of total energy demand and the energy mix across different sources such as coal, oil, gas, nuclear, and renewables. It considers how these demands and mixes evolve over time with improvements in supply and end-use efficiency. Factors include energy conversion efficiencies for each source and end-use efficiency improvements over time.
Price of key commodities/products	The organization's conclusions on the future development of market prices for key inputs and energy commodities, such as coal, oil, gas, and electricity, based on various input parameters and assumptions.
Macro-economic variables	This includes assumptions about key economic indicators such as GDP growth rate, employment rate, and other relevant macroeconomic variables used in the analysis.
Demographic variables	Assumptions made about population growth and migration trends, which influence the overall demand for energy and other resources.
Efficiency	The extent to which positive aspects of efficiency gains, clean energy transitions, and physical changes are incorporated into the scenarios and business planning. This includes improvements in energy use and reductions in resource consumption.
Geographical tailoring of transition impacts	Assumptions about potential regional differences in input parameters, considering variations across countries, asset locations, and markets. This reflects how transition impacts might differ geographically.
Technology	Assumptions about the development, performance, and cost of various key technologies over time. This includes both supply-side technologies like solar PV, wind, and CCS/CCUS, and demand-side technologies like electric vehicles and efficiency technologies in industrial and infrastructure sectors.
Policy	Assumptions regarding the strength and evolution of different policy signals over time. This includes national carbon emissions targets, energy efficiency or technology standards, subsidies for fossil fuels, and support for renewable energy sources.
Climate sensitivity assumptions	Assumptions about the relationship between CO2 increases and temperature rise, which influence the organization's understanding of climate impact and necessary mitigation strategies.

Analytical Choices	
Scenarios	This parameter involves the different scenarios the organization uses to analyze transition impacts, including the sources used to assess physical impacts for both central/base cases and sensitivity analyses.
Quantitative vs. qualitative or 'directional'	Determines whether the scenario exercise is fully quantitative, a mix of quantitative and qualitative, or primarily qualitative and directional.
Timing	Considers how the organization addresses the timing of implications under different scenarios, such as whether the analysis is conducted at decadal intervals (e.g., 2030, 2040, 2050, 2100).
Scope of application	Identifies whether the analysis is applied to the entire value chain, including inputs, operations, and markets, or is limited to the direct effects on specific business units or operations.
Climate models/data sets	Specifies which climate models and data sets are used to support the assessment of climate-related risks.
Physical risks	Details the specific physical risks included in the assessment, such as temperature changes, precipitation patterns, flooding, storm surges, sea level rise, hurricanes, water availability/drought, landslides, and wildfires. It also addresses the severity of these risks, their impact on the organization's portfolio (especially on the largest and most vulnerable assets), and how these risks are incorporated into investment screening and future business strategy.
Value chain	Examines to what extent the organization has considered the impact on prices and availability throughout the whole value chain, including knock-on effects from suppliers, shippers, infrastructure, and access to customers.

Business Impacts/Effects	
Earnings	Conclusions about the impact on earning and the expression of that impact, such as through EBITDA, EBITDA margins, EBITDA contribution, or dividends.
Costs	Implications for operating and production costs and how they develop over time.
Revenues	Implications for revenues from key commodities, products, and services, and their development over time.
Assets	Implications for asset values under various scenarios.
Capital Allocation/Investments	Implications for capital expenditures (capex) and other investments.
Timing	Conclusions about the development of costs, revenues, and earnings over different time frames, such as 5, 10, or 20 years.
Responses	Information about potential impacts and intended organizational responses, including changes to capital expenditure plans, portfolio adjustments through acquisitions and divestments, retirement of assets, entry into new markets, and development of new capabilities.
Business interruption due to physical impact	Conclusions about potential business interruption and productivity loss due to physical impacts, including direct effects on the entities' assets and indirect effects from supply chain or product delivery disruptions.

(Source: TCFD (2017), p. 9, FINAL-TCFD-Technical-Supplement-062917.pdf (bbhub.io))

Appendix 9: Details of IPPC report (AR6)

(f) Examples of regional key risks

Absence of risk diagrams does not imply absence of risks within a region. The development of synthetic diagrams for Small Islands, Asia and Central and South America was limited due to the paucity of adequately downscaled climate projections, with uncertainty in the direction of change, the diversity of climatologies and socioeconomic contexts across countries within a region, and the resulting few numbers of impact and risk projections for different warming levels.

The risks listed are of at least *medium confidence* level:

Small Islands
- Loss of terrestrial, marine and coastal biodiversity and ecosystem services
- Loss of lives and assets, risk to food security and economic disruption due to destruction of settlements and infrastructure
- Economic decline and livelihood failure of fisheries, agriculture, tourism and from biodiversity loss from traditional agroecosystems
- Reduced habitability of reef and non-reef islands leading to increased displacement
- Risk to water security in almost every small island

North America
- Climate-sensitive mental health outcomes, human mortality and morbidity due to increasing average temperature, weather and climate extremes, and compound climate hazards
- Risk of degradation of marine, coastal and terrestrial ecosystems, including loss of biodiversity, function, and protective services
- Risk to freshwater resources with consequences for ecosystems, reduced surface water availability for irrigated agriculture, other human uses, and degraded water quality
- Risk to food and nutritional security through changes in agriculture, livestock, hunting, fisheries, and aquaculture productivity and access
- Risks to well-being, livelihoods and economic activities from cascading and compounding climate hazards, including risks to coastal cities, settlements and infrastructure from sea level rise

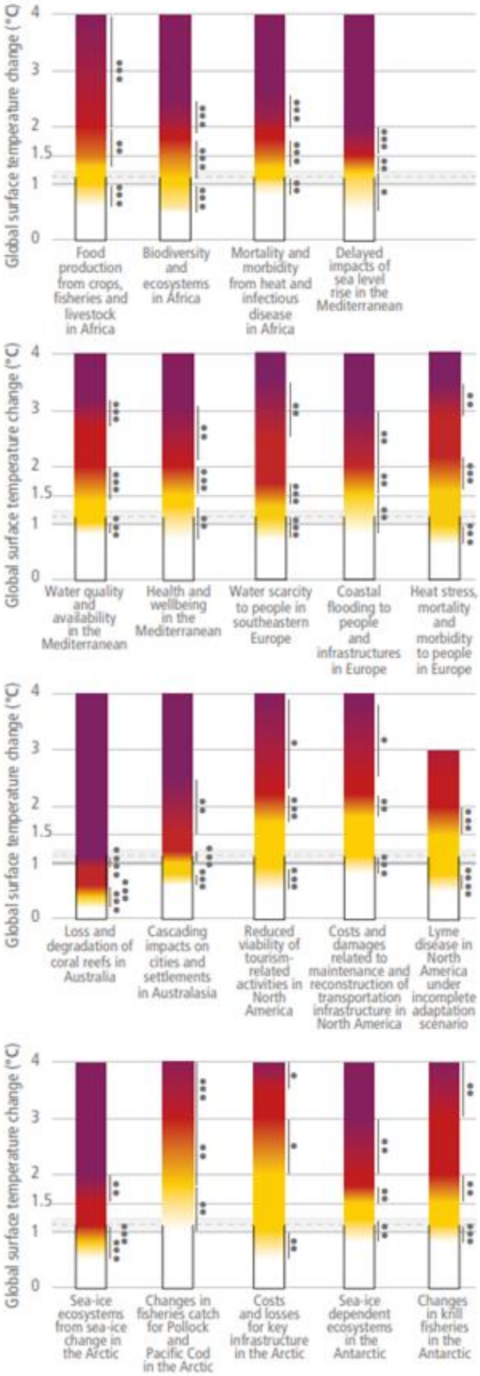
Europe
- Risks to people, economies and infrastructures due to coastal and inland flooding
- Stress and mortality to people due to increasing temperatures and heat extremes
- Marine and terrestrial ecosystems disruptions
- Water scarcity to multiple interconnected sectors
- Losses in crop production, due to compound heat and dry conditions, and extreme weather

Central and South America
- Risk to water security
- Severe health effects due to increasing epidemics, in particular vector-borne diseases
- Coral reef ecosystems degradation due to coral bleaching
- Risk to food security due to frequent/extreme droughts
- Damages to life and infrastructure due to floods, landslides, sea level rise, storm surges and coastal erosion

Australasia
- Degradation of tropical shallow coral reefs and associated biodiversity and ecosystem service values
- Loss of human and natural systems in low-lying coastal areas due to sea level rise
- Impact on livelihoods and incomes due to decline in agricultural production
- Increase in heat-related mortality and morbidity for people and wildlife
- Loss of alpine biodiversity in Australia due to less snow

Asia
- Urban infrastructure damage and impacts on human well-being and health due to flooding, especially in coastal cities and settlements
- Biodiversity loss and habitat shifts as well as associated disruptions in dependent human systems across freshwater, land, and ocean ecosystems
- More frequent, extensive coral bleaching and subsequent coral mortality induced by ocean warming and acidification, sea level rise, marine heat waves and resource extraction
- Decline in coastal fishery resources due to sea level rise, decrease in precipitation in some parts and increase in temperature
- Risk to food and water security due to increased temperature extremes, rainfall variability and drought

Africa
- Species extinction and reduction or irreversible loss of ecosystems and their services, including freshwater, land and ocean ecosystems
- Risk to food security, risk of malnutrition (micronutrient deficiency), and loss of livelihood due to reduced food production from crops, livestock and fisheries
- Risks to marine ecosystem health and to livelihoods in coastal communities
- Increased human mortality and morbidity due to increased heat and infectious diseases (including vector-borne and diarrhoeal diseases)
- Reduced economic output and growth, and increased inequality and poverty rates
- Increased risk to water and energy security due to drought and heat



(Source: IPCC AR 6 WG II, p. 17.)

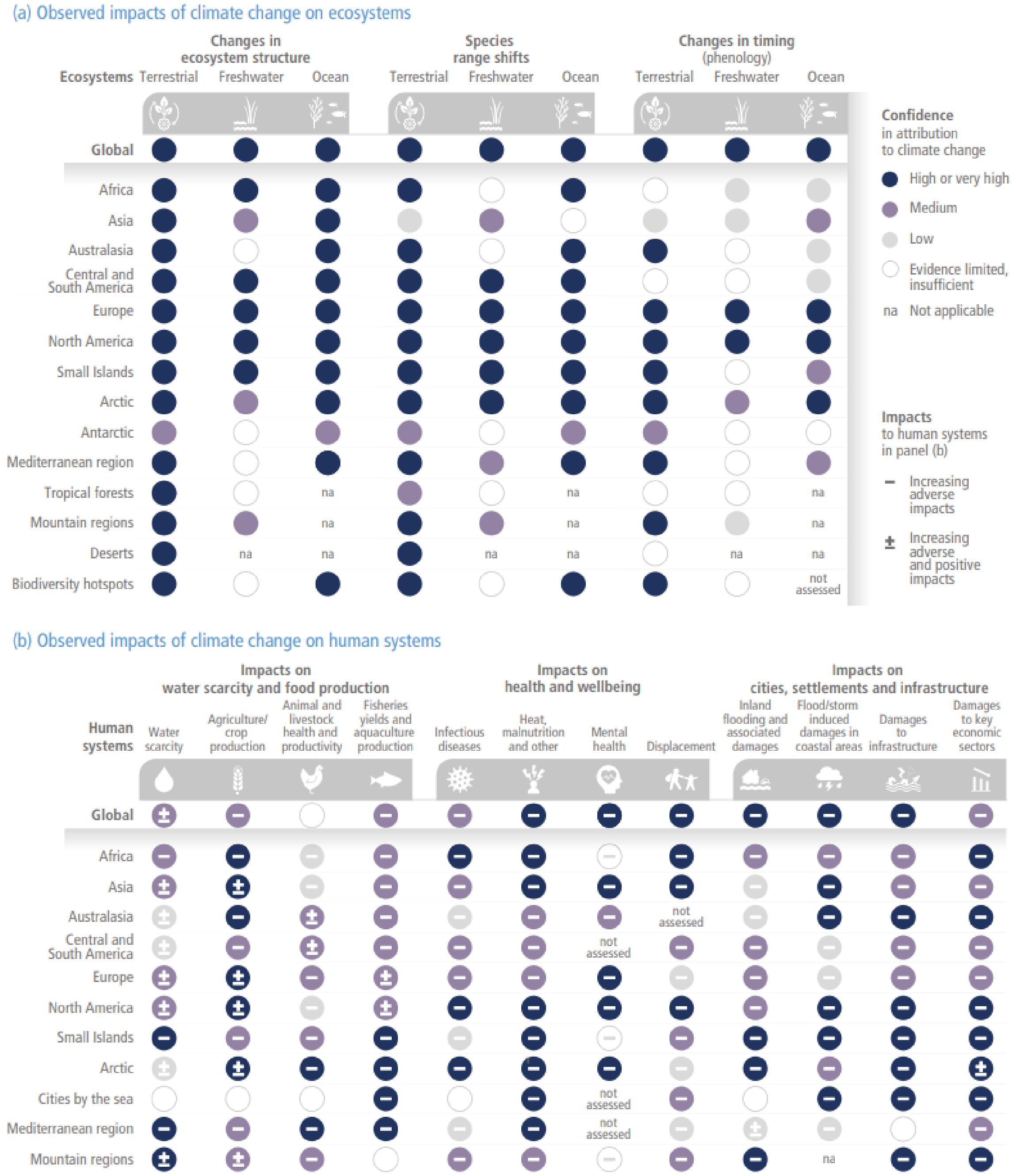


Figure TS.3 | **Observed global and regional impacts on ecosystems and human systems attributed to climate change.** Confidence levels reflect uncertainty in attribution of the observed impact to climate change. Global assessments focus on large studies, multi-species, meta-analyses and large reviews. For that reason they can be assessed with higher confidence than regional studies, which may often rely on smaller studies that have more limited data. Regional assessments consider evidence on impacts across an entire region and do not focus on any country in particular.

(Source: IPCC AR 6 WG II, p. 46)

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