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The Food Industry in the Spotlight of Climate Change

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Introduction

In 2008, we published our first study on the impacts of climate change on the retail and consumer goods industry, focusing on insights from interviews with leading German retailers and consumer goods companies.[1] We identified the retail and consumer goods industry as being highly susceptible to the risks posed by climate change (e.g. shortages of raw materials) and recommended that these companies integrate these risks into their strategic decision-making.

A decade on and climate change has become one of the most important issues globally, putting increasing pressure on the business models of companies in the food and beverage sector due to increasing physical and transition risks. PwC has since integrated and refined Climate Excellence, a climate scenario analysis tool that helps companies to assess these risks and opportunities. It may therefore also help the food and beverage industry to better understand and manage this global challenge.

- Climate change will affect all parts of the world, but local and regional impacts will vary. The physical and transition risks of climate change may have major financial impacts and could lead to changes in resource availability and cost, reconfiguration of supply chains, and changes to production costs and revenues. This would lead to changes in margins, thus posing a financial threat to companies in the sector.
- Physical risks primarily affect agricultural production, with impacts on crop yields and livestock production. As such, physical risks could relate to disruption of supply chains (including supply of raw materials) and production processes.
- Transition risks relate in part to a carbon price on direct emissions from livestock and crop production in the agricultural sector. They may also take the form of price increases for raw materials (due to physical impacts on crop yields) and increased costs of energy, particularly in energy-intensive production processes.
- Impacts on agricultural production translate directly to impacts at subsequent value chain levels. In order to understand individual impacts, an analysis needs to be performed for each company and each value chain step, depending on specific regional, production, product, consumer and go-to-market characteristics. Their financial impact ultimately also depends on companies' individual market position and their negotiating power vis-à-vis other actors.

As recommended by the Task Force on Climate-Related Financial Disclosures (TCFD)[2], scenario analysis makes it possible to assess the impact of different global warming pathways on companies' financial performance. In a potentially disruptive world, it can provide the information required for building resilient strategies for the future.

Future climate risks and opportunities can be assessed on the basis of various climate scenarios using approaches such as the PwC Climate Excellence method. Climate Excellence calculates the financial consequences of specific risks and opportunities arising from the transition to a low-carbon world – for example, changing prices and demand, technological progress, regulatory intervention and the associated changes in competition. This enables material financial effects, risk and opportunity drivers, and changing competitive environments to be identified and integrated into the company's strategic decision-making processes on the basis of the scenarios.

This paper will shed light on the potential impacts of different climate scenarios on consumer markets and financial performance, how they might affect the profitability of companies in the food and beverage industry and how scenario analysis can help identify the material impacts facing the food and beverage industry.

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[1] Cf. PwC (2008): Klimawandel: Schlagwort oder Wirklichkeit? Die Auswirkungen auf Handel und Konsumgüterindustrie, www.pwc.de/de/handel-und-konsumguter/assets/pwc_studie_klimawandel_august_2008.pdf.

[2] Cf. Task Force on Climate-Related Financial Disclosures (TCFD) (2017): Final Report: Recommendations of the Task Force on Climate-Related Financial Disclosures.

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A Future prospects for the food and beverage sector

1 Market developments in the food and beverage sector

The current food system, which is responsible for feeding the world's population, is under increasing pressure. According to the Intergovernmental Panel on Climate Change (IPCC), per capita food supply has increased by more than 30% since 1961.[3] Population and income growth will require a 50% increase in food supply to feed almost 10 billion people by 2050[4], putting agricultural production and water resources under immense strain.

New trends are fundamentally challenging the traditional business models of food and beverage manufacturers. We see six main trends that are shaping future market development in the food and beverage sector worldwide:

- Consumer attitudes are shifting towards a healthier and more sustainable lifestyle, which will lead to a greater demand for vegetarian and low-fat food, reduced-sugar drinks, additional health benefits and smaller carbon footprints.

[3] Cf. Mbow, C., Rosenzweig, C., Barioni, L.G. et al. (2019): Food Security. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems, p. 441.
[4] Cf. Searchinger, T., Waite, R., Hanson, C. et al. (2018): World Resources Report: Creating a Sustainable Food Future, p. 1.

- Regulatory pressure will increase as governments seek to protect their public health systems against rising costs resulting from obesity (e.g. by implementing nutritional scores) and implement measures to reduce the impact of climate change.
- New innovative brands and traditional retail brands alike are challenging the manufacturers of large global consumer brands. In the digital age, successful innovation and access to consumers no longer depend on business size.
- With large food and beverage players gaining a foothold in emerging markets and traditional players revising their business models, deals activity and market consolidation will increase.
- Sourcing risks and commodity prices will increase, due to the effects of climate change on the one hand, and trade conflicts on the other.

With the global population expected to increase by 24% by 2050[5], average demand for food and beverages will increase.

Potential climate-related risks and opportunities come on top of these megatrends and assessing their impact on business models and company values poses a challenge for companies clinging to traditional methodologies. Backward-looking analysis, which focuses on past and present data and derives trends from this data, does not fully capture these potentially disruptive effects and interdependencies. Scenario analysis, on the other hand, allows companies to explore the impacts of different future climate pathways and conduct a forward-looking analysis of climate-related risks and opportunities. The following chapters provide practical insights on the relevance of scenario analysis for companies and showcase its application through a case study of listed companies in the food and beverage industry.[6]

2 Climate-related risks and opportunities for the food and beverage sector

As one of the biggest manufacturing sectors and the largest purchaser of raw materials globally[7], the food and beverage industry could be – and already has been – exposed to significant climate-related risks from upstream agricultural production. This is due to disruption in supply of raw materials and the resulting steep price increases and severe volatility.

Droughts in 2012 in the American Midwest, for example, caused a price hike for corn and soybeans due to reduced crop yields.[8] Recent droughts in Germany in 2018 led to a 16% reduction in cereal yields per hectare compared to the previous three-year average.[9]

[5] Cf. United Nations Department of Economic and Social Affairs (2019): World Population Prospects 2019.
[6] All listed companies active in the food & beverage industry (over 1400).
[7] The food and beverage industry is the largest manufacturing sector in the European Union in terms of turnover, value added and employment. Cf. FoodDrinkEurope (2018): Data & Trends of the European Food and Drink Industry 2018.
[8] Cf. Sijbesma, F., and Verkooijen, P. (2019): Climate Change Is Making It Harder for Us to Feed Ourselves, Fortune, fortune.com/2019/07/25/climate-change-food-supply-chain.
[9] Cf. Bundesministerium für Ernährung und Landwirtschaft (2019): Trockenheit und Dürre 2018 – Überblick über Maßnahmen, www.bmel.de/DE/Landwirtschaft/Nachhaltige-Landnutzung/Klimawandel/_Texte/Extremwetterlagen-Zustaendigkeiten.html.

As such, the consequences of climate change are highly relevant to the future performance of the entire food and beverage industry and are already having a major financial impact, which is likely to increase further. Climate change could ultimately threaten both the stability and affordability of food supply, impacting industry players while potentially creating related social conflicts. However, companies may also be able to seize opportunities within this environment. This may involve finding innovative approaches to substituting existing ingredients with cheaper, more resilient or less carbon-intensive alternatives, as well as considering more explicitly regional advantages in terms of vulnerability, cost impacts and transition regulation.

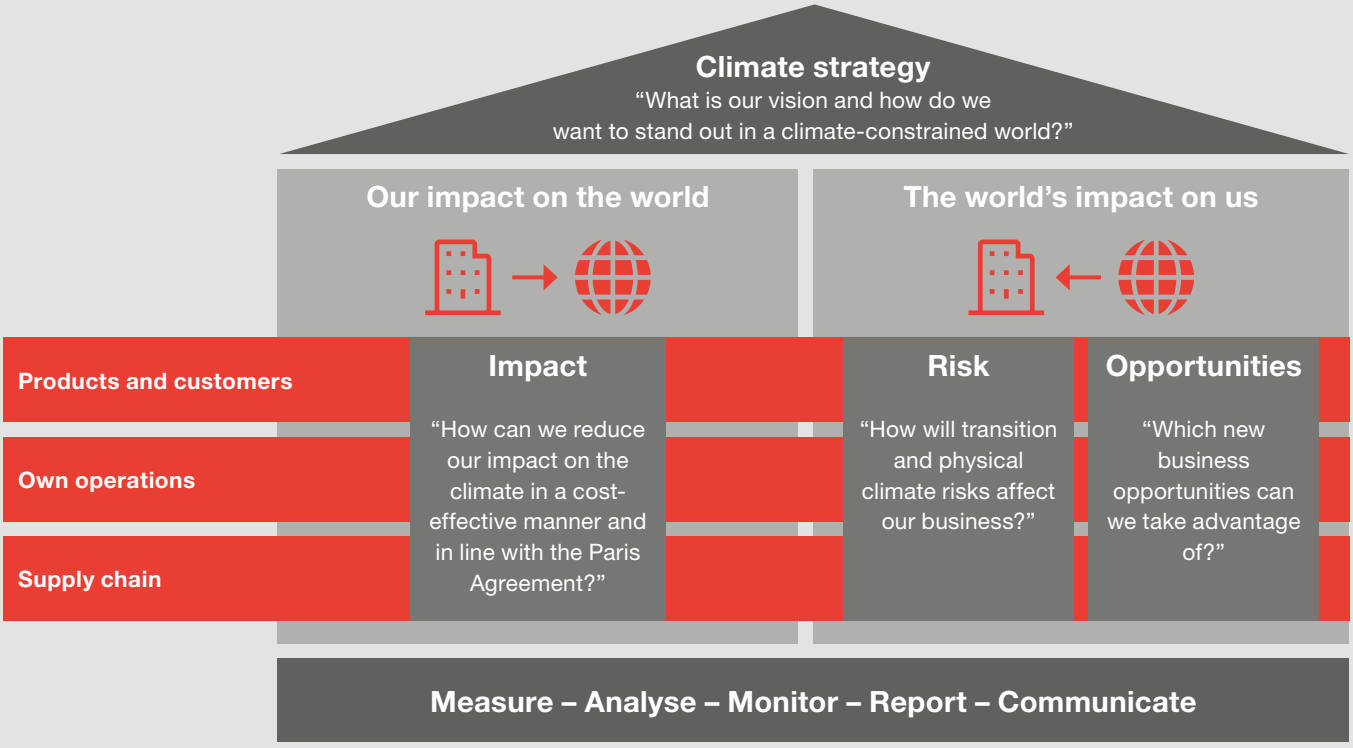
Taking a science-based and broadly recognised approach to better understand where major climate-related risks and opportunities could materialise is vital for taking appropriate action. It requires tools that allow for detailed analysis at company level.

To effectively mitigate risk and adapt to the changing climate, companies will have to integrate climate into their core strategy. According to current best practice, a climate strategy enables a company to adopt a double perspective: to consider both its own impact on climate change and the effects of climate change on the company.

A holistic climate strategy that considers both internal and external factors rests on three pillars (see Figure 1):

- Climate impact: how can we as a company reduce emissions in a cost-effective manner and in line with the requirements of the Paris Agreement?
- Climate risks: how will risks relating to society's response to climate change and the physical effects of global warming affect my company?
- Climate opportunities: what opportunities will arise for my company in the context of climate change?

Fig. 1 Main pillars of a holistic climate strategy



Scource: PwC.

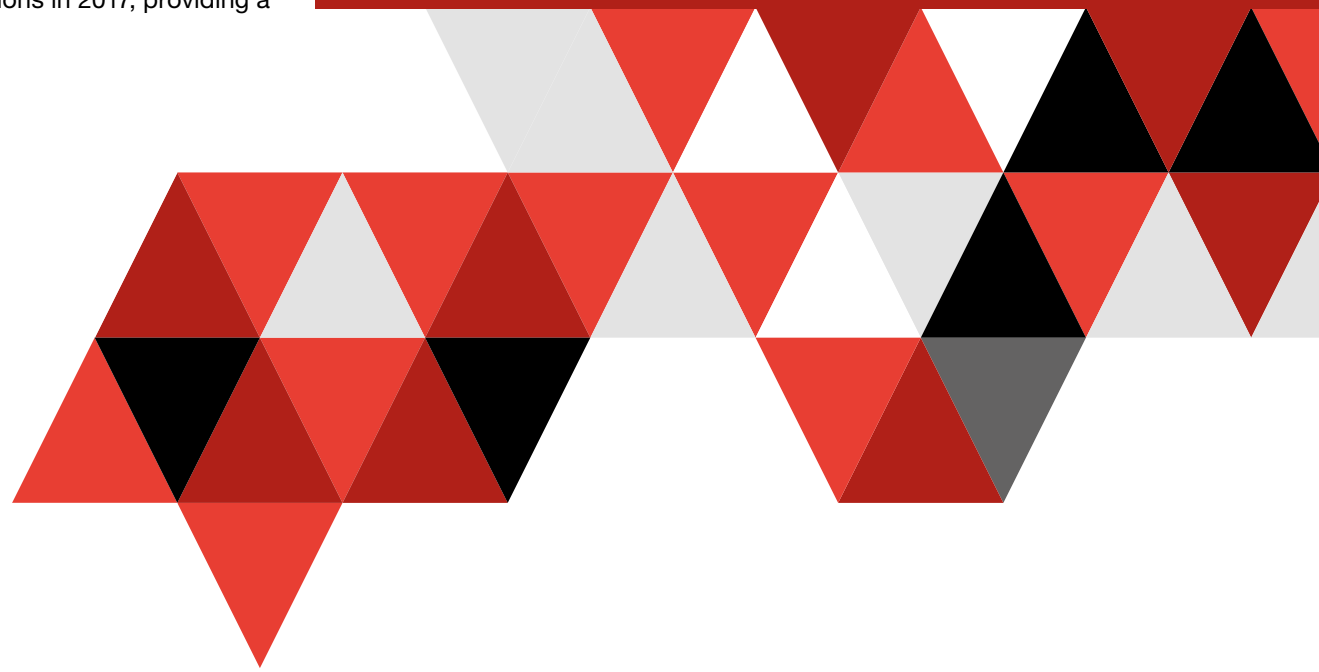
For the purposes of this report, we will focus on the two pillars on the right, i.e. the impact of climate change on companies operating in the food and beverages sector.

The Global Climate Risk Index 2020 shows that even high-income countries are increasingly feeling the effects of climate change.[10] The financial risks and opportunities posed by climate change are still often overlooked. In its 2019 Status Report, the TCFD found that only 45% of companies in the agriculture, food and forest products sector disclosed the impact of climate-related risks and opportunities on their organisation's business, strategy and financial planning – and only 4% took different climate-related scenarios into consideration.[11]

Companies have largely failed to adequately integrate climate-related risks into decision-making. This is due to the great amount of uncertainty surrounding climate change, its long-term nature and the resulting challenge of assessing climate change using existing risk metrics. Against this background, the TCFD published its recommendations in 2017, providing a framework for companies to voluntarily disclose the impacts of climate change on their financial performance.[12] The TCFD identifies scenario analysis as a useful tool to better understand how climate-related risks and opportunities may evolve and what their implications might be. Scenario analysis can deliver invaluable insights into the potential impacts of these risks and opportunities on a company's performance (see info box).

Task Force on Climate-Related Financial Disclosures (TCFD)

The TCFD was established in 2015 by the Financial Stability Board (FSB) to introduce voluntary, routine disclosures on climate-related financial risks that can be used by companies to provide information to lenders, insurers, investors and other stakeholders. In 2017, the TCFD published recommendations for effective climate-related reporting in four key areas: governance, strategy, risk management, and metrics and targets. The TCFD divides climate-related risks into two major categories: risks that relate to the transition to a lower-carbon economy (transition risks) and risks that relate to the physical impacts of climate change (physical risks). Climate-related risks translate into changing capital flows that may affect companies' financial positions. Financial impact varies by industry, geographical location and the individual organisation concerned.



[10] Cf. Eckstein, D., Künzel, V., Schäfer, L. et al. (2019): Who Suffers Most from Extreme Weather Events? Weather-Related Loss Events in 2018 and 1999 to 2018, Global Climate Risk Index 2020.
[11] Cf. TCFD (2019): 2019 Status report, www.fsb-tcfd.org/wp-content/uploads/2019/06/2019-TCFD-Status-Report-FINAL-053119.pdf.
[12] Cf. TCFD (2017): Final Report: Recommendations of the Task Force on Climate-Related Financial Disclosures.

B Scenario analysis in the food and beverage sector

The future is uncertain, but scenario analysis can help to predict future world situations and understand their effects. By applying scenario analysis, we are able to identify potential risks and opportunities and thus address the impact of climate change on the food and beverage industry (see Figure 1).

Furthermore, regulation regarding the management and disclosure of climate-related risks and opportunities is becoming more commonplace, and supervisory activities indicate that scenario-based climate-related disclosure is likely to become mandatory. Scenario analysis provides a tool that can help companies meet the demands of regulators, supervisory authorities and investors, as recommended by the TCFD.

If global greenhouse gas (GHG) emissions continue to rise, climate science scenarios illustrate that high levels of global warming are imminent. This will result in unprecedented physical risks in the form of extreme weather events or chronic changes such as recurrent heatwaves, rising sea levels or changes in rainfall patterns.

If we are to keep global warming well below 2°C, current climate scenarios suggest that global GHG emissions will have to be drastically reduced as early as 2020 and that we will have to achieve global carbon neutrality by 2050 or shortly after. This level of decarbonisation can only be achieved through a radical transformation of the economy, which may result in significant transition risks. The consequences include increasing regulatory intervention such as the introduction of carbon taxes, the introduction of new technologies such as electric or hydrogen-powered vehicles, and the transformation of markets – for example, due to changing cost structures.

Future climate risks and opportunities can be assessed on the basis of various climate scenarios using approaches such as the PwC Climate Excellence method. Climate Excellence calculates the financial consequences of specific risks and opportunities arising from the transition to a low-carbon world – for example, changing prices and demand, technological progress, regulatory intervention and the associated changes in competition. This enables material financial effects, risk and opportunity drivers, and changing competitive environments to be identified and integrated into the company's strategic decision-making processes on the basis of the scenarios.

For this study, PwC conducted an analysis of the main risks and opportunities for listed companies in the food and beverage industry.[13] The findings are presented as examples in the following sections.

1 Scenario assumptions

For this case study, the scenario assumptions are based on data from the IEA. Figure 2 shows the main differences in terms of assumptions for two different temperature trajectories (non-exhaustive list).

When compared with the 2.7°C IEA scenario, the IEA's 2°C scenario features higher carbon prices, with the highest prices in Europe and North America.[14]

The IPCC further expects a decline in livestock of 7–10% at about 2°C warming, as well as the following reduced yields for wheat, maize and soy:[15]

- Wheat: –6% to –12%
- Maize: –9% to –15%
- Soy: up to –6.2%

It should be noted that both assumptions and impacts will change under different scenarios. With an increase in temperature of approximately 2.7°C, a lower carbon price would accordingly reduce transition risks, while the physical impacts of climate change on crop yields may be greater. In order to emphasise the importance of responding to climate-related risks and opportunities, we have also assumed that the companies analysed have no adaptive capacity. This means that, in our analysis, companies do not take any steps to mitigate these challenges (e.g. energy efficiency measures).

Fig. 2 Example, non-exhaustive scenario description based on IEA scenarios[1]

	National policy commitments (~2.7°C)	2°C target
Policy lever	• Phasing-out of fossil fuel subsidies within the next ten years • Subsidy schemes for energy efficiency	• Large-scale deployment of most current, readily available technologies for greater energy efficiency
Climate policy	• Carbon price in 2040: $24–44 per tonne	• Carbon price in 2040: $95–112 per tonne
Market levers	• Increasing demand for oil and gas despite ongoing electrification of passenger transport • Aviation and shipping driving global oil consumption	• Growing demand for gas (until 2030–2035) • Peak oil demand in 2020–2025, followed by reduction of approx. 20% compared to current levels by 2040
Technology levers	• Large-scale wind and solar power becoming cheapest source of electricity in most countries • Nuclear playing important role in achieving climate targets	• Large-scale deployment of carbon capture and storage (CCS) projects in the power and oil and gas sectors, especially in 2040–2050 • Nuclear playing important role in achieving climate targets

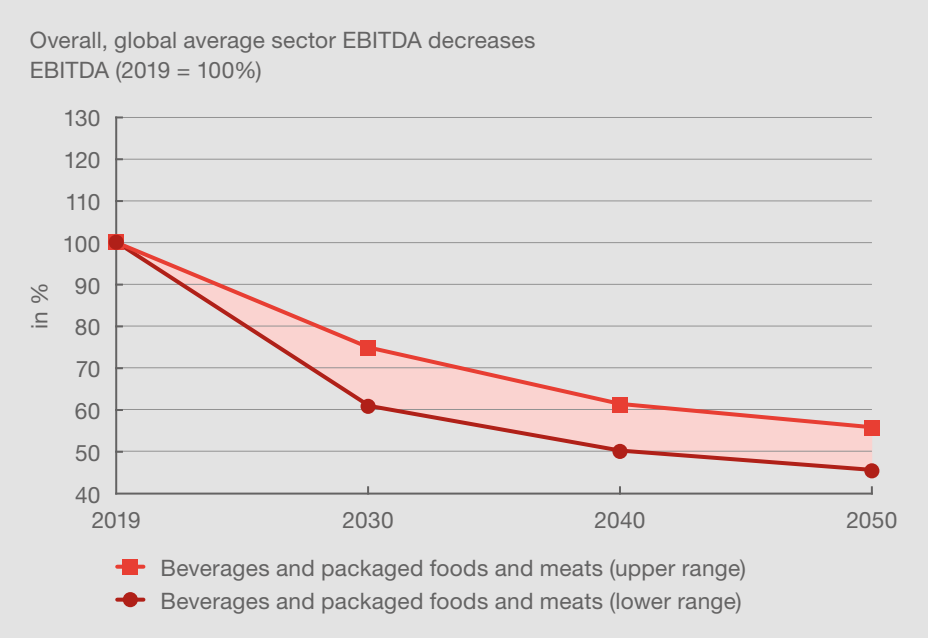
[1] Cf. International Energy Agency (IEA) (2017): Energy Technology Perspectives (ETP) 2017 and IEA (2018) World Energy Outlook (WEO) 2018.

[13] All listed companies active in the food & beverage industry (over 1400).
[14] Cf. International Energy Agency (2018): World Energy Outlook.
[15] Cf. IPCC (2018): Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, pp. 237–238.

2 Scenario analysis results

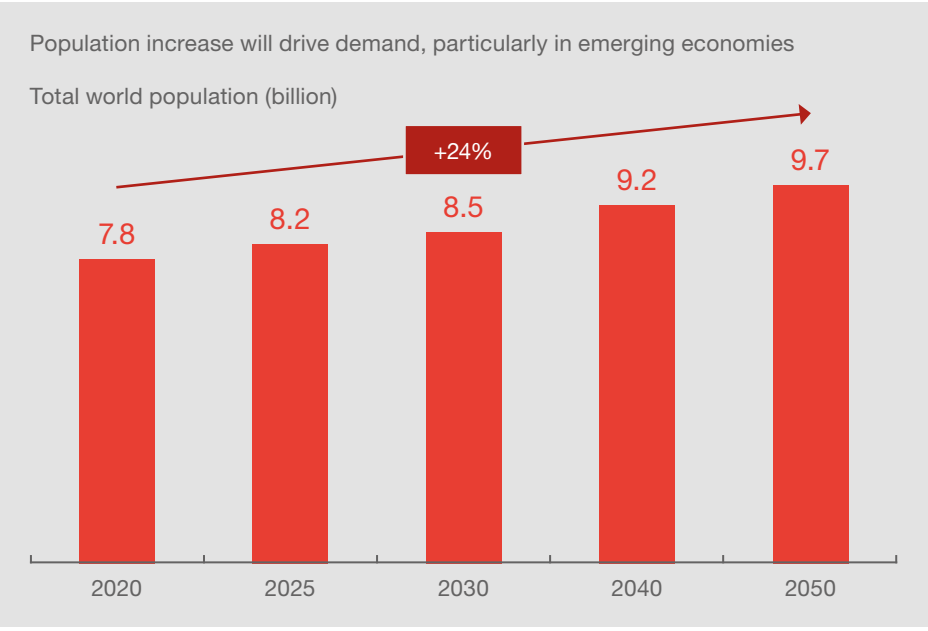
An analysis of listed companies in the food and beverage sector reveals that, in a 2°C scenario,[16] EBITDA will significantly decrease (by 44%) by 2050 (see Figure 3), even if companies can pass on their costs to downstream actors in the value chain (i.e. retailers).

Fig. 3 Average sector EBIDTA change in a 2°C scenario: 2019–2050



This decrease will not be offset by population growth: global population is expected to reach 9.7 billion by 2050, an increase of 24% on current levels (see Figure 4). [17]

Fig. 4 Global population increase by 2050



[16] Financial impact is calculated under the assumption that a company remains inactive and does not adapt to a changing environment.
[17] Cf. United Nations Department of Economic and Social Affairs (2019): World Population Prospects 2019.

If, however, individual companies are unable to transfer costs and therefore have to bear the financial consequences, they could experience a decline in EBITDA of up to 55%.[18]

As further discussed in chapter 3, EBITDA development depends on the industry's value chain structure, companies' individual market position and their negotiating power. This produces an upper and a lower range for EBITDA development (see Figure 3).

To better understand this development, we need to look at sector-specific risk and opportunity drivers.

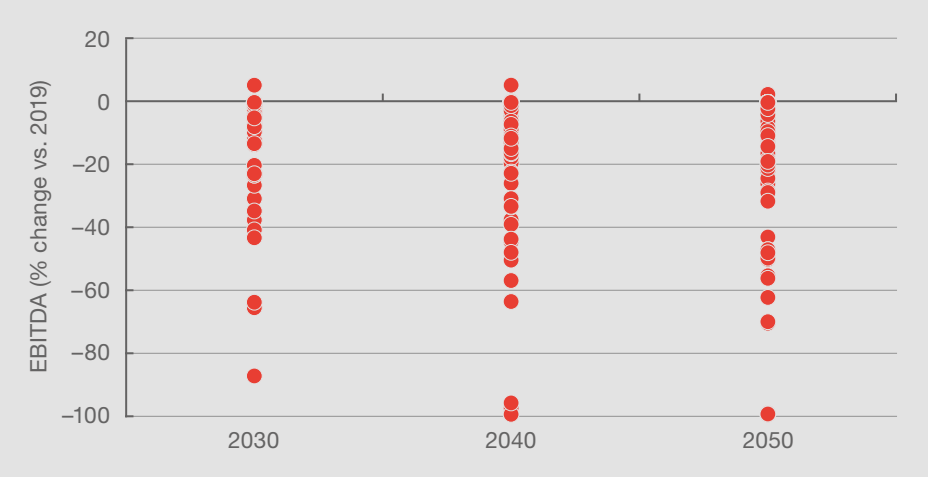
In a 2°C scenario, global cost of production could increase – on average – by almost 30% by 2030.[19] The increase in production costs could partly stem from physical climate risks that, from the perspective of the food and beverages industry, lie upstream within the value chain. For example, increasing temperatures and reduced water supply that this may cause could have an impact on agricultural productivity, as these physical risks could reduce crop yields, negatively affect livestock production and subsequently lead to rising production costs. These impacts could, in turn, cause a global average increase in costs for raw materials in the food and beverage sector of 10% by 2030, posing a significant climate-related market risk to the sector. Furthermore, transition risks, such as the increased cost of electricity (up 60%, on average) and the introduction of carbon pricing on direct emissions would, in this scenario, drive costs up further, particularly in emissions-intensive and energy-intensive production processes.

Water stress could also pose a key risk to the sector. Water is central to both agricultural production and manufacturing processes. Water risk – the risk of insufficient water being available to meet demand – and related disruption to water supplies could pose a serious threat to business continuity. Data from the World Resource Institute demonstrates that one quarter of the world's population, residing in 17 countries, faces extremely high levels of baseline water stress, where on average more than 80% of available supplies are withdrawn every year.[20] While water is not currently a major cost factor, this might change with increasing pressure on water resources.[21]

Despite these risks, sector analysis reveals that a steady increase in demand caused by population and income growth could also lead to a situation in which companies could successfully capture shares of a growing market.

But even though overall sector performance will decrease if companies do not respond to climate change, not all companies will be affected by this trend to the same extent, as illustrated below by the spread of company performance in a 2°C scenario. Some companies will hardly be affected at all, whereas others are at risk of losing their entire EBITDA margin (see Figure 5).

Fig. 5 Spread of company performance in a 2°C scenario



[18] For price elasticities cf. Andreyeva, T., Long, M.W., and Brownell, K.D. (2010): The Impact of Food Prices on Consumption: A Systematic Review of Research on the Price Elasticity of Demand for Food, American Journal of Public Health, Vol. 100, No. 2, pp. 216–222.
[19] Please note that values are sector averages and may vary widely within subsectors/products.
[20] Cf. Hofste, R., Reig, P. and Schliefer, L. (2019): 17 Countries, Home to One-Quarter of the World's Population, Face Extremely High Water Stress, www.wri.org/blog/2019/08/17-countries-home-one-quarter-world-population-face-extremely-high-water-stress. Baseline water stress measures the ratio of total water withdrawals to available renewable water supplies.
[21] Water prices may increase significantly if desalination of sea water becomes necessary in regions with high water stress.

In the 2 °C scenario, better-performing companies exhibit certain characteristics (e.g. geographical coverage, product portfolio), as do less successful companies. Therefore, it seems reasonable that companies should investigate – on an individual level – how they are likely to prosper and/or suffer in the face of climate change.

As illustrated below (see Figure 6), significant regional differences can be observed due to regional variation in how physical and transition risks materialise along the value chain.

Companies in the Middle East, for example, could experience average production cost increases of over 45% by 2030, as they are particularly at risk of high levels of water stress. For extremely water-intensive manufacturing processes, such as in the beverage sector, local production processes could be deemed unprofitable, leading to shutdown of production capacity in the region. In Europe and North America, a higher carbon price of up to $100 per tonne by 2030 could lead to competitive disadvantages and a loss of margins. Cost increases for electricity of over 65% and raw materials of over 10% by 2030 could drive overall production cost increases in Europe (almost +30%). In Latin America, the smaller expected impact of these risks could positively influence profitability, despite potential average production cost increases of about 20% by 2030.

In short, regional differences in risk exposure could lead to competitive advantages for certain production locations. This might require shifting production to locations where physical and transition risks are lowest in order to avoid negative financial impacts.

On the other hand, there could be many opportunities for companies to capture shares of a growing market. Overall demand could also be driven by income growth in emerging economies and characterised by changes in supply structures – for example, conventional meat vs. protein-based alternatives – which could allow some companies to capture a greater market share.[22] Although this will lead to overall growth, the result will be less positive than would otherwise be the case, as the food and beverage sector will have to face steep cost increases as well as changing consumer preferences as a result of climate change.

Fig. 6 Regional differences in EBITDA changes in a 2°C scenario[1]

EBITDA 2030 vs today	
Middle East (–)	A sharp increase in production costs due to extreme water stress could have a particularly severe impact on water-intensive production processes and subsectors.
Europe and North America –	Energy-intensive production processes are at odds with high energy prices, in part driven by rising carbon prices.
Latin America +	EBITDA growth driven by population increase and the comparatively lower impact of water stress and carbon pricing.

[1] This analysis is based on companies' regional revenue splits or information on company headquarters.

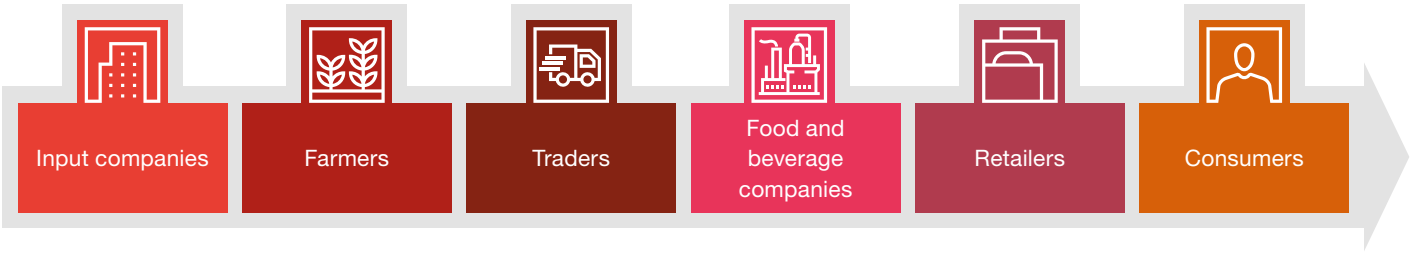
[22] Assuming a CAGR of 3% for protein demand (cf. Gerhardt, C. et al. (2019): How Will Cultured Meat and Meat Alternatives Disrupt the Agricultural and Food Industry? A.T. Kearney) and taking into account the reduction in livestock of 7–10% projected by the IPCC, we have calculated that alternative protein would need to hold a market share of 62% in 2050 to satisfy increasing demand.

3 Contextualising the impact based on market power assumptions

Climate-related risks primarily materialise through market risks. The value chain structure of the food and beverage industry is especially vulnerable to the impacts of climate change. Financial impacts largely depend on the extent to which market risks emerge from the upstream value chain or can be passed on to downstream actors in the value chain. The individual market, relationships and negotiating power dynamics between traders and farmers and between manufacturers and retailers are highly relevant here. At the same time, such dynamics are generally very context-specific, differing by region and country and being influenced by company size.

As one specific example, companies in the food and beverage industry in Germany are dependent on sales through large retailers. Over the last two decades, the global retail market has become highly concentrated into a handful of companies. In Germany, just four companies had a market share of 85% in 2015 (compared to 70% in 1999).[23] By virtue of their gatekeeper function, retailers have an influence on both pricing and product range, among other things. Processing companies tend to make around a quarter of their sales to a single retail costumer. But manufacturers, too – particularly global players with significant brand value – might be the dominant power when negotiating pricing against retailers, who are dependent on being able to offer these brands to their customers. At the same time, farmers further up the value chain might not always be able to pass on the impacts of climate-related risks to the processing companies, since they are often bound by long-term contracts with fixed prices.

Fig. 7 The food and beverage value chain



In order to better understand climate scenario analysis in the food and beverage industry, it is important to focus on the material financial impacts. Climate change could pose substantial financial risks (through changes in production costs and revenues) to a range of actors in the global agriculture and food value chain, which encompasses various actors from input companies to end consumers (see Figure 7).

As such, risk drivers integrated at different levels along the value chain create significant dependencies that are characteristic of the industry. As agricultural production lies upstream within the food system's value chain, climate-related risks in agriculture and related impacts on agricultural production could, in turn, present a market price risk in the food and beverage sector. Financial performance ultimately also depends on the industry's value chain structure, companies' individual market position and their negotiating power with other actors. These factors influence a company's ability to pass on climate-related cost increases along the value chain.

Successful companies will require the necessary knowledge to align their strategies, in order to maintain and improve their competitive position.[24] Against this background, the following section illustrates a practical case study of how scenario analysis could be implemented.

[23] Cf. Fuldaer Zeitung (2016): Die 'Big Four' haben 85 Prozent Marktanteil. 20 February 2016. www.bundeskartellamt.de/SharedDocs/Publikation/DE/Interviews/2016/160220_Fuldaer_Zeitung_Die_Big_Four_haben_85_Prozent_Marktanteil.pdf?__blob=publicationFile&v=2.
[24] Cf. TCFD (2019): 2019 Status Report, www.fsb-tcfd.org/wp-content/uploads/2019/06/2019-TCFD-Status-Report-FINAL-053119.pdf.

C Case study: impacts of climate change in the meat industry

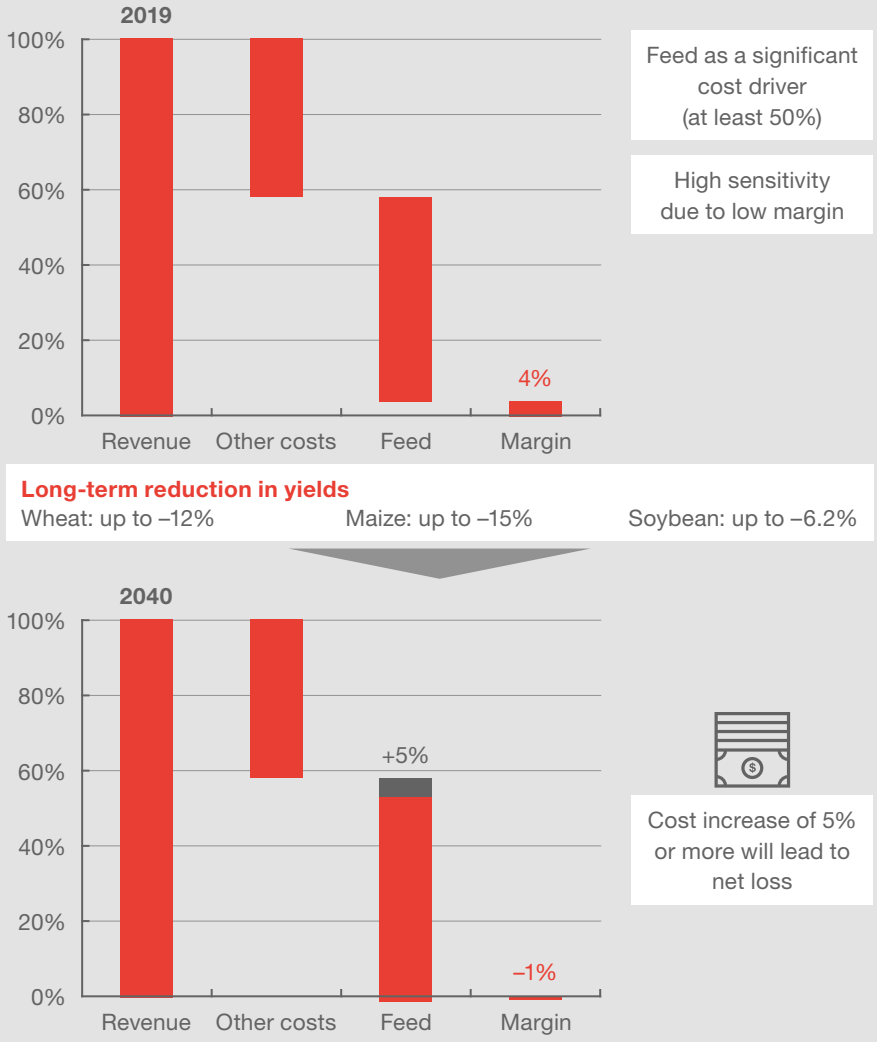
The meat sector is an example of how climate change-related demand could have disruptive effects on existing business models in the industry.

Several key risks could materialise in a 2°C scenario, which could impact both revenues and production costs of companies in the industry and potentially reduce profitability (see Figure 8).[25,26]

- **Livestock reduction:** a decline in livestock of 7–10% could lead to an overall reduction in meat productivity and availability.
- **Meat substitution:** companies could be significantly affected by factors such as changes in consumer demand for conventional meat and the availability of substitutes in the form of protein-based alternatives. Studies suggest that while global meat consumption may increase by around 3% annually, conventional meat will lose a substantial market share in favour of meat alternatives, including cultured meat and meat substitutes.[27]
- **Increased feed costs:** physical impacts on crops could also lead to price increases for raw materials for animal feed (affecting feed companies in particular).
- **Carbon pricing of energy:** companies could also face increased costs for energy due (in part) to increased carbon pricing, particularly in energy-intensive production processes.

[25] Cf. Gerhardt, C. et al. (2019): How Will Cultured Meat and Meat Alternatives Disrupt the Agricultural and Food Industry? A.T. Kearney.
[26] Cf. IPCC (2018): Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, pp. 237–238.
[26] For calculating financial impacts, we currently assume that companies in the meat industry will lose a substantial market share (and subsequently EBITDA) due to the likely shift to meat alternatives, and that these companies will fail to actively adapt to this new environment and enter the market with new alternative products. In fact, adjusting product portfolios offers an opportunity for companies to realise exceptional growth potential over the coming years. Evaluating a company's potential to adapt would require an analysis of the company's financial position and an assessment of whether the company is capable of steering through such a strategic shift, among others.

Fig. 8 Financial impacts on the meat industry of a 2°C scenario



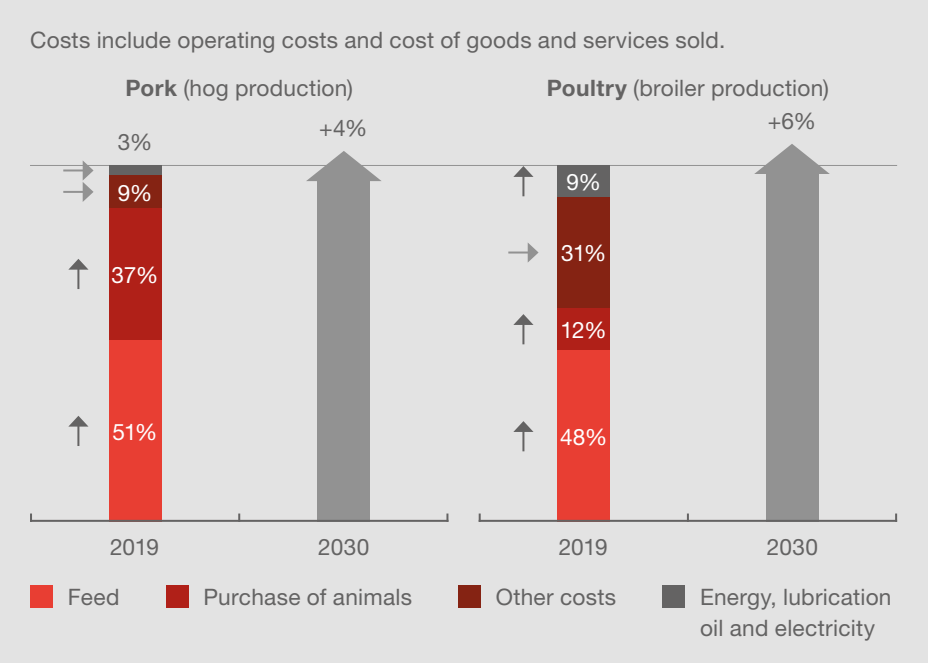
Source: Gerhardt, C. et al. (2019): How Will Cultured Meat and Meat Alternatives Disrupt the Agricultural and Food Industry? A.T. Kearney.

Reduction in livestock and increasing feed and energy costs could in turn lead to increased production costs (see Figure 9), particularly affecting cost items making up a relatively high proportion of the overall cost structure. For food processing companies, the financial impact from increases in feed costs depends on the extent to which these cost increases are passed on along the value chain. Nevertheless, changes in demand structures will create a long-term threat to existing business models in the conventional meat industry.

In light of this, companies should think about the following strategic considerations:

- Should we assume that the meat alternative market will continue to grow? And if so, how should we adapt our product range?
- Can we and should we take a proactive stance towards climate change-related impacts (e.g. decarbonisation of feed mix if carbon pricing is introduced)?
- To what extent will raw-material price increases affect our own cost structure? What suitable substitutes could there be?

Fig. 9 Changes in animal production costs in a 2°C scenario



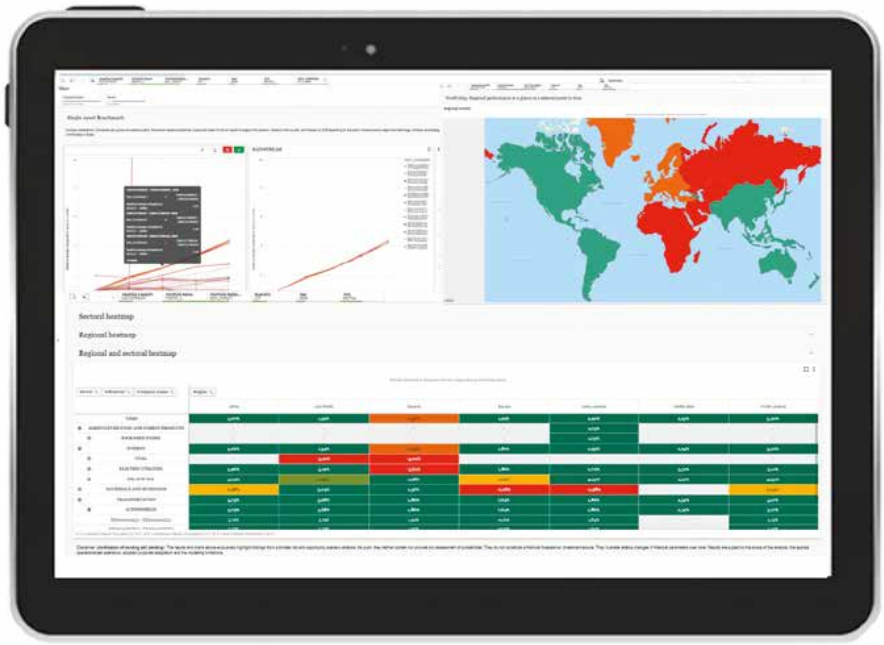
PwC's Climate Excellence tool helps businesses assess climate risks and opportunities

Scenario analysis makes it possible to identify risks that have a major financial impact, thus forming the basis for financial risk assessment and for informing existing approaches to risk management and strategy development. This helps with identifying key risk drivers in different possible future scenarios. However, sector trends are also driven by dynamics other than climate change (e.g. changing consumer preferences regarding meat consumption); it is therefore not always easy to make a clear distinction.

To counteract this problem, PwC developed Climate Excellence, a proprietary scenario analysis tool which can be used to analyse climate-related risks and opportunities in the food and beverage industry. This tool offers a peer-reviewed and proven methodology, and has a long-standing track record with clients in both the real economy and the financial sector.

Fundamental analysis and market-based assessment allow Climate Excellence to provide comprehensive coverage of scenario impacts. This analysis enables an integrated understanding of scenario-specific climate risk drivers, as per TCFD recommendations. It is based on underlying, sector-specific market dynamics, enabling climate analyses to be integrated into existing risk, valuation, credit or underwriting processes, as well as internal macroeconomic outlooks and microeconomic prospects. This allows for consistent assessment of risks and opportunities across financial instruments and underlying assets. Climate Excellence reflects the strategic choices of companies, considering their ability to anticipate transition risks and develop mitigation strategies, as this ability impacts future asset development and company financial performance.

Fig. 10 Climate Excellence offers a one-click overview



PwC's experts have been using Climate Excellence for many years to advise asset owners and managers, banks, insurers and companies in the real economy. Now the tool is also available as a digital solution in the PwC Store, enabling asset managers and owners to make tangible the financial impact of climate risks and opportunities for their portfolios.

For more information, please visit:
www.pwc.de/en/sustainability/climate-excellence-making-companies-fit-for-climate-change.html

To access Climate Excellence, please visit our digital store:
store.pwc.de/en/climate-excellence

D Deep dive: methodological approach – scenario analysis and how it works[28]

As already discussed, scenario analysis is one tool that can be used to determine how company performance will develop in different future scenarios. The TCFD (2017) describes scenario analysis as a way to evaluate "a range of hypothetical outcomes by considering a variety of alternative plausible future states (scenarios) under a given set of assumptions and constraints".[29]

Scenarios are hypothetical and provide a narrative of how key parameters could evolve in a plausible future world. As illustrated in Figure 11, scenarios are not linked to a probability, unlike predictions and sensitivity analyses (or stress tests). As such, analysis of multiple scenarios allows users to develop their own ideas of how the future might look and what trends need to be reflected in future actions. Although various scenarios exist, all climate scenarios describe a plausible and consistent development path that leads to a specific carbon dioxide particle concentration in the atmosphere and – with an assumed probability – limits global warming to a certain temperature level. A scenario can therefore provide a plausible explanation of the circumstances associated with a world 2°C warmer than today, for example, and can map out the interdependencies that may arise in this world. The carbon budget is the concept of capping global carbon dioxide emissions, and thus serves to limit global warming to a certain level.

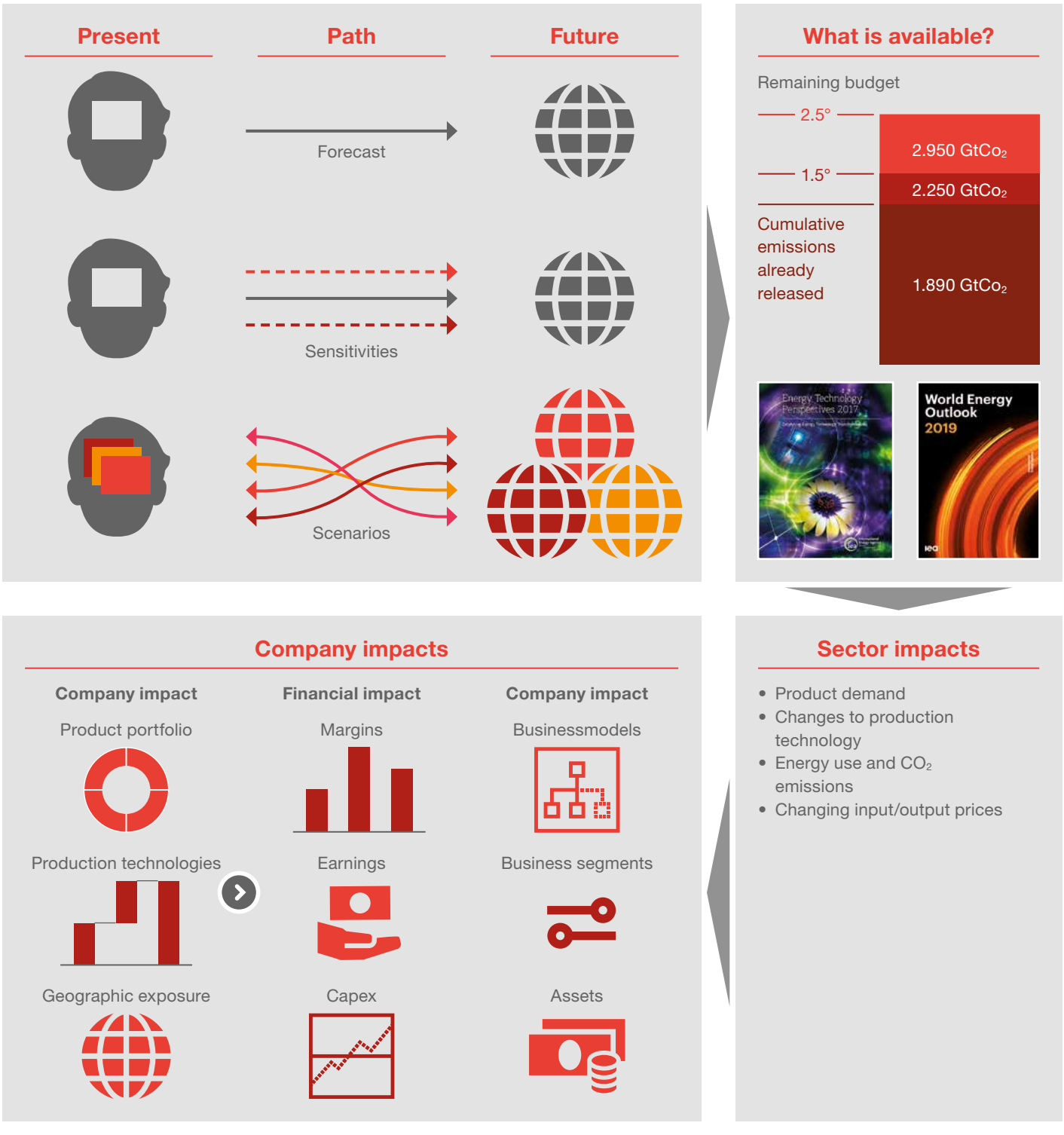
Development paths are often subject to an approach that leads to the lowest overall economic costs. The way in which a future path develops is mostly determined by key indicators such as economic and population growth, sector-specific or country-specific CO_2 emissions, costs of technology, or commodity prices at selected points in time. These target paths must be plausible, consistent, meaningful and transparent with regard to the assumptions involved.[30]

In the context of climate change, scenario analysis offers a means of linking the assumptions of scientific climate scenarios – such as those provided by the International Energy Agency (IEA) or IPCC – with impacts on the economy (see Figure 11).

[28] Cf. Kepler Cheuvreux, The CO-Firm (now PwC) (2018): Investor Primer to Transition Risk Analysis.
[29] Cf. TCFD (2017): Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities, www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-TCFD-Technical-Supplement-062917.pdf.
[30] Cf. Röttmer, N. (2018): Szenarioanalysen und TCFD – ein Beitrag zum Risikomanagement und zur Finanzierungs- bzw. Investitionsstrategie? In: Stapelfeld, M., Granzow, M. and Kopp, M: Greening Finance. Der Weg in eine nachhaltige Finanzwirtschaft, pp. 269–282.

Climate Excellence builds on climate and energy system models that have a scientific and peer-reviewed basis. Climate models provide information about the impacts of different levels of GHG emissions on the climate system and the resulting forward-looking change in frequency for defined severity thresholds of specific extreme weather events. Climate models also serve as the basis for energy system models, which are a building block for transition risk analysis. For this purpose, the results of climate models – emissions targets which the global community would have to meet in order to limit global warming with a certain probability to below 2°C, for example – create the framework for energy system models which then provide information about which technical measures, regulations and market developments are needed to achieve a specific goal and/or which combination of measures contributes to which goal. Energy system models map parameters such as relative price development of electricity or global commodities. Climate Excellence then translates the scenarios developed in the energy system models mentioned above into business dynamics and their financial impact on a country, sector, company, or individual assets. It incorporates not only the direct effects on a plant or a company (based on factors such as relative price changes), but also the impact of competitive dynamics – i.e. how the future market share will be distributed. Overall, Climate Excellence provides a flexible framework for analysing both investment portfolios and underwriting portfolios with the same conceptual logic. Whereas transition risk analysis is based on a fundamental market modelling approach to calculate the financial impact, the physical risk analysis is based on a top-down modelling approach.

Fig. 11 Relationship between climate scenarios, carbon budget and sector impacts



E Outlook and call to action

By 2050, the world's population is likely to have exceeded 9 billion, and the resulting increased demand for food production will put additional pressure on the global food system.[31] At the same time, rising input prices may drive up consumer prices. The impact on company profitability will ultimately be determined by the actual global warming path the world takes, by companies' individual exposure and market power, and by their actions and capacity to adapt.

The fact is that the growing number of national and international regulations, the ever-higher expectations of stakeholders and the increasing climate-related risks are forcing companies in the food and beverages industry to address the issue of climate change. However, a proactive response should be pursued, as this also brings new business opportunities. The drivers for a holistic approach to climate change can be classified into three categories:

[31] Cf. Searchinger, T., Waite, R., Hanson, C. et al. (2018): World Resources Report: Creating a Sustainable Food Future, p. 1.

'Must' – regulatory developments and disclosure requirements relating to climate change

Regulatory efforts regarding the management and disclosure of climate-related risks and opportunities have gained momentum across the globe, and supervisory activities indicate that mandatory scenario-based climate-related disclosure is on the rise. Signatories of the United Nations Principles for Responsible Investment (PRI), for example, will be required to report on climate indicators – which include the application of scenario analysis – from 2020 onwards; the financial sector is thus aware that action is required. Scenario analysis provides a tool that can help identify internal strategic priorities while fulfilling the requirements of regulators, supervisors, and also investors, who are paying greater attention to the climate risks of their investments.

'Should' – climate-related risks

Companies should integrate some key concerns into their strategic considerations in order to avoid negative financial impacts and seize every opportunity to remain competitive. Analysis shows that the regional distribution of production will play a key role in identifying the winners and losers of low-carbon development in the sector, due to regional differences in exposure to the impacts of climate change. Company strategic considerations could address questions such as:

- Will climate-related risks have an impact on the availability and pricing of resources needed for our production processes?
- Has water risk been adequately considered during production capacity planning?
- Could new technologies cut costs and reduce our CO_2 emissions?
- Should we adapt our product portfolio?

'Want' – advantages and opportunities offered by climate change

Our example analysis shows that companies in the sector could experience overall negative performance in a +2°C world. Performance may be hampered by climate-related risks driving up production costs (e.g. raw-material price increases, energy and carbon prices, costs relating to water stress). In addition, companies' individual market power will determine whether they will have to bear all the costs, or if other actors along the value chain will have to deal with the financial consequences. Nevertheless, there could also be opportunities for companies to capture shares of a growing market by seizing existing opportunities, e.g. related to changes in supply structures or regional demand changes.

While this study has given some insights into potential impacts under a 2°C scenario, companies in the food and beverage sector might also want to look at scenarios in excess of 3°C, which experts currently consider to be more realistic.[32] Such temperature pathways would lead to decreased transition risks, while physical risks would have an even greater impact.[33]

[32] At COP25 in Madrid, Secretary-General Petteri Taalas of the World Meteorological Organisation stated: "We are nowhere near on track to meet the Paris Agreement target."

[33] The TCFD recommends the use of multiple scenarios to explore how changes and temporal developments of key factors can lead to different outcomes. Cf. TCFD (2017): Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities, p. 3.

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