



# Five key transformations to watch to navigate the global food system amid increasing volatility

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## Summary

The global food system is entering a period of significant transformation. After decades of substantial growth, the demand for food and agriculture products is slowing in many regions due to slower population growth and the maturation of food markets where economic growth no longer significantly impacts demand growth. Simultaneously, global production growth is declining because of diminishing returns from additional inputs and environmental constraints. Furthermore, increasing economic statecraft is affecting multilateral trade agreements that previously spurred local sector growth.

All these elements collectively contribute to increased uncertainty and volatility, thereby exerting pressure on the food system and elevating overall production costs, which in turn heightens the risk of food inflation. Stakeholders in the value chain may mitigate these enhanced risks and costs by prioritizing strategic sourcing and consolidation.

Meanwhile, planetary boundaries have become a topic of consideration in the boardrooms of food and agriculture supply chain participants and capital providers. This is driven by government regulations and an increased awareness of sustainability risks. At the same time, there has been a reallocation of responsibilities between the public and private sectors, with governments reducing their sustainability ambitions, asking more from the private sector, and prioritizing strategic autonomy.

In this report, we explore the five key transformations that will shape the global food system over the coming decade and what to watch for in each.

## Introduction

In most parts of the world,<sup>1</sup> food systems have transformed from being primarily local and rural networks to a globally interconnected sector reliant on international trade and efficient industrialized distribution and processing. Farms have expanded in size and capital investment, with their suppliers becoming highly concentrated and specialized. The distribution of commodities now rests in the hands of a few major traders. Similarly, the food manufacturing, retail, and service sectors have experienced significant growth and consolidation. As a result, food availability and affordability have substantially improved.

<sup>1</sup> This note primarily focuses on medium- and high-income regions with modern agriculture and connected to global supply chains. Smallholder and subsistence agriculture is out of scope.

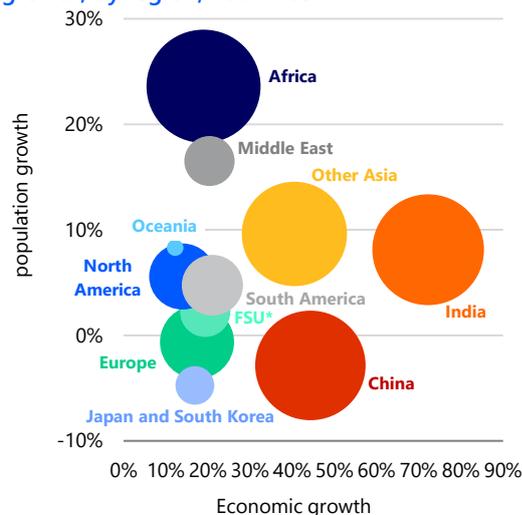
Several factors have fueled continuous developments in the global food system. These include advancements in agricultural and food technology driving production growth, specialization based on local resources such as land and climate, a global food transport network, multilateral trade agreements, and global population and economic growth. It has also become evident that the development of the global food system has adversely affected the planet's natural resources, impacting both nature and climate. While nutritious food is now widely available in many parts of the world, overconsumption and unbalanced diets together with changed lifestyles have led to an increase in obesity and related health issues among the population.

## 1. Slowing food demand growth

Economic growth and population growth will remain the most important drivers of food demand and will determine how much it will grow and which sectors are most impacted. Global population growth is slowing. While populations in Africa and the Middle East continue to grow fast, those of China, Japan, South Korea, and Europe are declining, as illustrated in figure 1. Also, economic growth varies widely by region. In Asia, we expect income growth will continue to drive the shift in diets toward animal-based products, though cultural factors will also impact food preferences for animal-based products. This potential ongoing dietary shift could accelerate demand for agricultural products, such as grains and oilseeds for animal feed. In Africa and the Middle East, population growth will remain the most important driver for food demand, while in high-income regions with mature food markets, consumer demand will continue to center around better quality and service instead of volume growth or a shift in diets.

Additionally, the growing biofuels sector has increased demand for agricultural goods since the early 2000s, driven by the goal to reduce carbon emissions (see figure 2). This has intensified competition between food, feed, and fuel. Strong policy support in the US, Brazil, and, to a lesser degree, the EU has supported this growth. Recently, focus on decarbonization has lessened, especially in the US. However, dropping biofuel support may affect farmers' backing of the current US administration. Given the significance of these policies for environmental goals in the EU, agricultural stakeholders in the US, and fuel security in Brazil, we think it is unlikely they will be discontinued.

**Figure 1: Forecast population and economic growth, by region, 2024-2034**

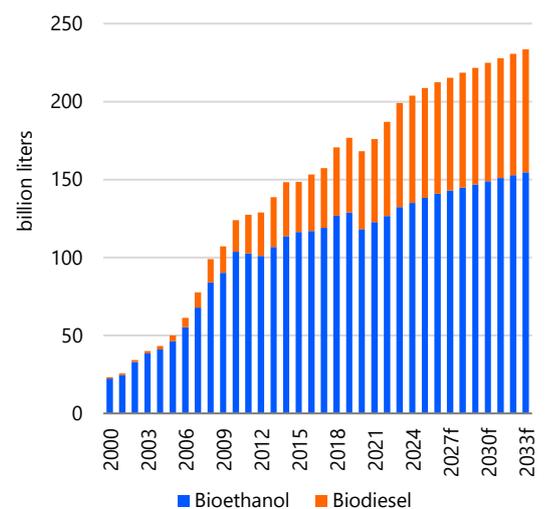


Note: FSU consists of former Soviet Union Republics, excluding Baltic countries.

Economic growth is expressed as real per capita income growth in international dollars, in purchasing power parity.

Source: IMF, UN Population Division, RaboResearch 2025

**Figure 2: Global biofuel production, 2000-2033f**

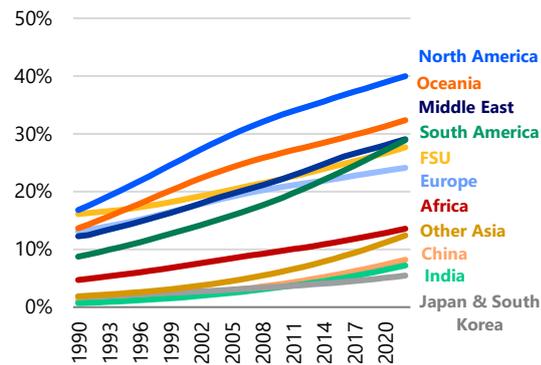


Source: OECD, RaboResearch 2025

## Impact of food-related diseases on food demand

The composition of diets in high-income regions may be up for change, potentially impacting demand for sugar, animal proteins, and, consequently, animal feed, among other foods. Among other factors, overconsumption and unhealthy diets, especially but not exclusively in high-income regions, have led to higher rates of food-related diseases. The resulting healthcare costs are becoming increasingly significant. Obesity affects 25% to 40% of the population in the Americas, Europe, the former Soviet Union (FSU), and the Middle East, almost 15% of the population in Africa, and about 5% to 10% in Asia, as depicted in figure 3. Obesity leads to increased healthcare costs and productivity loss among working-age people. The rising prevalence of diabetes and unhealthy diets in general present another food-related health challenge (see figure 4).

**Figure 3: Percentage of adult population with obesity (body mass index > 30), 1990-2022**



Note: FSU consists of former Soviet Union Republics, excluding Baltic countries.

Source: WHO, UN, RaboResearch, 2025

**Figure 4: Ranking of causes attributed to "years lived with disability," 2021**

Region	Cause 1	Cause 2	Cause 3	Cause 4	Cause 5
World	diabetes	malnutrition	high BMI	occupational risks	tobacco
Africa	malnutrition	diabetes	occupational risks	high BMI	unsafe sex
India	malnutrition	diabetes	occupational risks	air pollution	high BMI
Other Asia	occupational risks	diabetes	malnutrition	high BMI	tobacco
China	diabetes	high BMI	occupational risks	tobacco	air pollution
Japan and South Korea	diabetes	high BMI	tobacco	dietary risks	occupational risks
Middle East	high BMI	diabetes	malnutrition	occupational risks	tobacco
FSU	high BMI	diabetes	high alcohol use	tobacco	occupational risks
Europe	high BMI	diabetes	tobacco	high alcohol use	occupational risks
South America	high BMI	diabetes	malnutrition	occupational risks	high alcohol use
North America	high BMI	diabetes	drug use	tobacco	dietary risks
Oceania	high BMI	diabetes	occupational risks	tobacco	high alcohol use

Note: Red cells relate to malnutrition, orange cells relate to food-related diseases, yellow cells refer to tobacco- and alcohol-related diseases, while blue cells refer to other non-food-related causes.

Source: The Institute for Health Metrics and Evaluation, RaboResearch, 2025

In high-income regions, the high and growing shares of animal-based proteins, processed foods, and out-of-home consumption are held partly responsible for the rise in food-related diseases. All three shares seem to have reached or may soon reach their highest point in these regions. The production of animal-based proteins requires more agricultural products than plant-based proteins. With consumption of animal protein peaking in these regions, we can expect that demand volume for agricultural products in high-income countries will not increase much more.

Despite the significant challenges that food-related health issues pose for society, governments have not yet succeeded in materially altering consumer purchasing behavior toward healthier diets. Consumers are exposed to a plethora of food information as well as substantial misinformation. Social media platforms are increasingly becoming prominent sources of such information. However, the growing presence of (mis)information has not, to date, led to healthier and more environmentally sustainable choices.

In contrast, malnutrition remains the main health challenge in low-income regions, caused primarily by a lack of purchasing power, with supply-side issues such as domestic turmoil, droughts, or crop infestations aggravating the situation during certain periods.

### Things to watch:

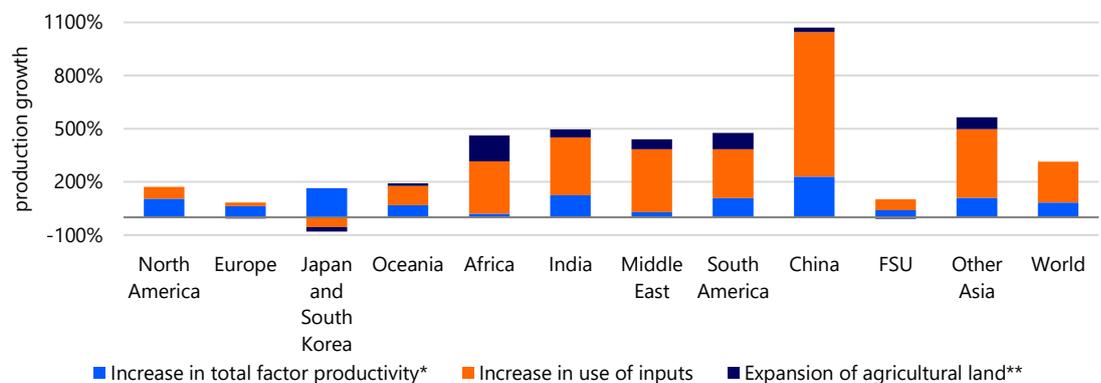
- The development of meat and dairy consumption in Asia, particularly China and India.
- The growth of non-food applications of agricultural products, such as biofuels and materials for the biobased economy.
- The rise in healthcare costs due to food-related diseases and the efficacy of efforts to steer consumers toward healthier choices.
- The impact of GLP-1 medications on total food intake in light of a recent study<sup>2</sup> that shows reduced spending at grocery stores, fast-food chains, and coffee shops among GLP-1 medication users.
- The role of social media in food consumption and consumer choices.

## 2. A slowdown in supply and production growth

Agricultural production is maturing globally, with opportunities for expansion becoming more limited. Over the past decades, synthetic fertilizers, improved seeds, and advanced machinery have been key drivers of agricultural productivity. However, in more advanced agricultural economies, the gains from these inputs are now significantly smaller (see figure 5). A yield gap remains, and although it is smaller, bridging this gap will be increasingly costly and challenging. An exception to the trend has been the significant growth of aquaculture over recent decades. Aquaculture's contribution to global food production has increased from less than 1% in 1961 to nearly 7% today, and it is projected to continue outpacing other animal protein categories. This growth can be attributed to the untapped potential of production locations, both offshore and onshore, aquaculture's low resource needs, and rapid technological advancements.

In general, growers are shifting focus from merely increasing input use to employing inputs more strategically. While costs are an important consideration, sustainability efforts are also driving this transition.

Figure 5: Agricultural production growth and its drivers, 1961-2022



Note: \*More strategic use of inputs. \*\*Weighted by productivity.

Source: USDA/ERS, RaboResearch 2025

While achieving productivity gains remains essential, maintaining current productivity levels, reducing agriculture's environmental impact, and mitigating the effects of climate change on agriculture are becoming increasingly important. Consequently, ongoing initiatives focus on enhancing soil quality, building resilience against climate change and the rising occurrence of

<sup>2</sup> Hristakeva, S., Liaukonyte, J., & Feler, L. The No-Hunger Games: How GLP-1 Medication Adoption is Changing Consumer Food Purchases (December 27, 2024). Cornell SC Johnson College of Business Research Paper.

droughts, wildfires, and flooding, improving disease resistance in plants and animals, and discovering biological alternatives to chemical pesticides.

Moreover, emerging technologies such as artificial intelligence (AI), precision fermentation, and gene editing present new opportunities to accomplish these objectives.

- Precision farming, tailored intelligence, better predictions, and detailed insights are important to increase resource efficiency, reduce food loss, lower environmental footprint, and increase output. AI can enhance the efficiency of current technologies but requires detailed digital information generated by sensors. The use of sensors in agriculture is growing rapidly but is still not a given. Therefore, this technology is not expected to significantly boost yields in the short term. The use of AI in farm robotics, processing, and logistics can improve resource efficiency in the short term.
- Precision fermentation has significant potential as a substitute for animal-based protein ingredients, due to its low environmental footprint and other benefits. Advancements have been made in the production of whey and casein ingredients, but direct alternatives for milk and other proteins remain distant due to long approval processes, technical challenges, consumer acceptance, costs, and difficulties in scaling up.
- Gene editing is advancing rapidly, though regulatory differences significantly influence its adoption rate. The EU has been particularly reluctant to adopt these new technologies. However, its focus on strategic autonomy and food security might change this.

In the long term, technological advancements, including AI-driven and digitally controlled systems, will be crucial in achieving productivity growth. The capital requirements for these innovations are higher than those for traditional technologies, making farming increasingly capital-intensive and access to capital essential.

Farmers need their supply chain to enable them to adapt and to recoup additional costs for improvements in sustainability performance that are not rewarded in the market. In such instances, they need their supply chain partners to contribute by sharing the additional risks and/or offsetting (part of) the additional costs.

#### Things to watch:

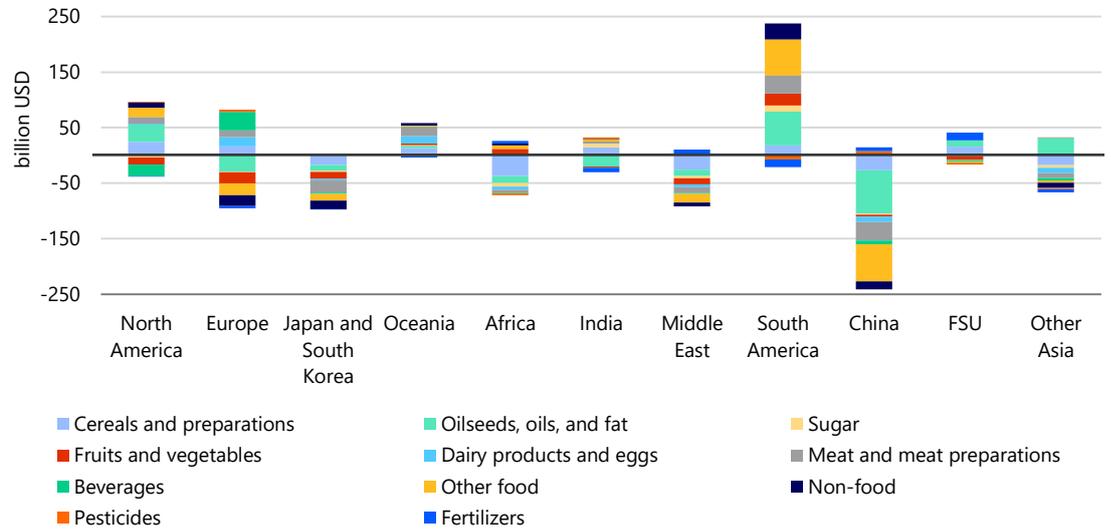
- The consequences of technology becoming more capital-intensive.
- The rapid advancement of aquaculture technology and its impact on production and product prices.
- The development of “green” nitrogen fertilizer (made from renewable energy sources) to support decarbonization.
- The growth of biological alternatives for chemical products, such as pesticides and mineral fertilizers.
- The measures food and agribusiness sectors undertake to improve resilience and adapt to climate change.
- The development of precision fermentation and its applications.
- The development of EU policies related to gene-editing techniques, such as CRISPR-Cas.

### 3. Volatility as a result of crumbling multilateral trade agreements

We are entering a new era in which “[grand macro strategy](#)” is replacing the multilateral rules-based world order and increasing both geopolitical and policy risks. Over the last few decades, South America has surpassed North America as the largest net supplier of agricultural products, as can be seen in figure 6. China, Japan, South Korea, and the Middle East have emerged as the largest net importers in global trade, with China overtaking Europe to assume the position of the world’s largest net importer. These changes are the outcome of lowering trade barriers, which

enabled optimization of local resources to meet global demand, but improved logistics at lower costs also facilitated them. Global food trade might be reaching its peak soon, due to increased restrictions on trade. However, several of these trade flows have become difficult to reverse due to ever larger imbalances between local supply and demand. Therefore, we don't expect a structural decline in global trade despite rising geopolitical tensions.

**Figure 6: Net trade in agricultural products, 2022**



Source: FAOSTAT, CRU, RaboResearch 2025

Trade restrictions add to volatility. In net exporting regions, this increases pressure on the supply side (i.e., farmers). In net importing regions, pressure will be felt most by the downstream supply chain, such as food processors, food retail, foodservice, and consumers.

We see a shift in government policies toward safeguarding strategic autonomy. This means focusing on the competitive position of domestic food industries and supporting their development to become less dependent on imported inputs.

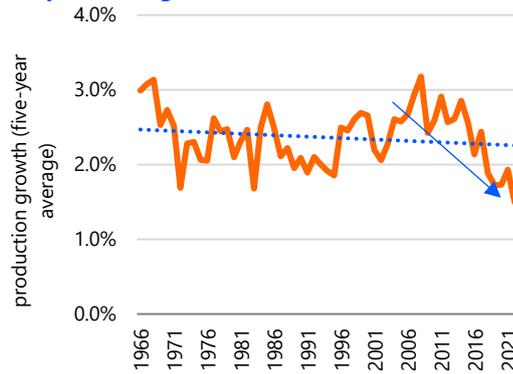
#### Things to watch:

- The increased prevalence of restrictive trade policies, such as import tariffs, alongside tariff exemptions.
- The continued focus on onshoring and friendshoring to mitigate the negative effects of trade restrictions.
- The ongoing developments in logistics and storage technology – for example, ultra-low oxygen storage and transportation of fresh products by ship.

## 4. Increased volatility impacting supply chains

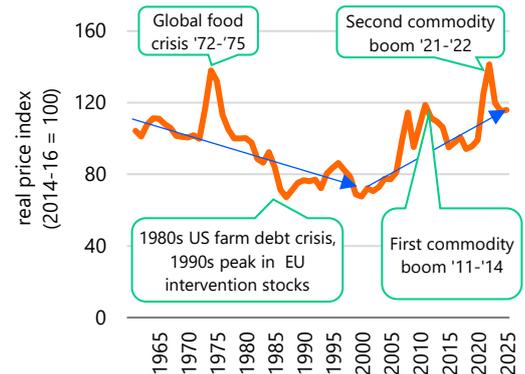
Around the year 2000, and after decades of oversupply, the global food system moved into a situation where supply and demand differ less from each other. Production growth is leveling off (see figure 7), climate risks are increasing, and planetary boundaries are beginning to limit opportunities to expand supply and may even cause decline in certain regions. Annual production growth has declined from 3% in the early 1960s to less than 2% today. Food markets are becoming increasingly volatile and cyclical, as can be seen in figure 8.

**Figure 7: Global agricultural production growth, five-year average, 1966-2022**



Source: USDA-ERS 2024

**Figure 8: FAO food price index, 1965-2025**



Source: FAO 2025

In the past two decades, markets have switched from a buyer's market to a seller's market and vice versa every few years, depending on local and global supply and demand dynamics. More recently, rising geopolitical risks and their impact on trade are adding to volatility.

Companies within the food supply chain face a dilemma between securing supply through long-term contracts during periods of low availability and maximizing flexibility by purchasing in the spot market during times of abundance. As a result, food processors typically require higher margins to manage the increased volatility in raw material prices. Furthermore, consolidation within the food chain from farm to fork is anticipated to continue, particularly in markets where growth remains subdued.

#### Things to watch:

- The consolidation among consumer food companies as the primary avenue for growth, amid reduced demand due to slower economic and population growth in high-income countries. See this [paper](#) for an example.
- The way companies respond to volatility in supply chains – for example, developments in the share of volumes under longer-term contracts vs. the spot market in agricultural commodity markets.

## 5. Reallocation of responsibilities between the public and private sector

Sustainability policies, voluntary sustainability targets in the private sector, and the speed with which they need to be realized differ substantially between regions.

High-income regions have been driving the process of setting targets. In these regions, many companies (including 13 of the global top 15 food retailers) have set goals for reducing the environmental impact of their activities and that of their supply chains, including farming. These targets are partly policy driven, partly a business decision to ensure that sourcing and production activities can continue, and partly an initiative to create brand value.

After an initial phase of setting ambitious and far-reaching sustainability targets, companies are starting to rationalize their targets. This means targets are sometimes lowered and/or the scope of the targets is reduced to focus on hot spots. In some instances, companies may abandon certain sustainability targets due to mounting public pressure to do so. At the same time, common guidance for sustainability target setting is being developed. Examples include the Science Based Targets initiative (SBTI) and the EU's Product Environmental Footprint method (PEF).

In most cases, sustainability targets go beyond the company's operations (scope 1 emissions), addressing purchased electricity (scope 2 emissions) and the supply chain (scope 3 emissions). Although this development initially leads to stronger cooperation and increased collaboration between farmers and the supply chain, over time that will likely fade when meeting new sustainability criteria becomes mainstream.

For capital providers, sustainability risks are a threat to value growth and future cash flows. Therefore, they need to manage three risks in their portfolios:

- physical risks – for example, risks related to climate change.
- transition risks related to becoming compliant with (future) policies.
- future liability claims related to today's negative external effects.

At the same time, many sustainability risks and rewards do not materialize over the tenor of capital issued by capital providers, which in most cases is less than 10 years. This means not all sustainability risks will be priced in by capital providers.

In some regions, like the EU, when it comes to meeting sustainability targets, the regulated banking sector is pushed to execute a supportive "sheriff's role," among others. But capital providers also rationalize their targets. In recent years, some capital providers have backtracked their sustainability efforts, reprioritizing short-term financial returns. For example, several US banks stepped out of the Net Zero-Banking Alliance.

In the past five years, both the EU and the US launched ambitious climate initiatives (the Green Deal and Inflation Reduction Act, respectively). However, the new administration in the US withdrew from the Paris Agreement and is expected to reverse parts of the Inflation Reduction Act. In the EU, the new European Commission is shifting its focus from new policy initiatives toward simplifying and, in some instances, lowering the ambitions of the policies that were recently adopted, reprioritizing competitiveness. As previously noted, government policies are shifting toward safeguarding strategic autonomy. In some instances, this aligns with sustainability goals such as reducing dependency on fossil fuels, pesticides, and mineral fertilizers. However, on a global level, this entails the risk of moving away from optimizing resources worldwide.

Furthermore, sustainability policies are moving beyond decarbonization only and toward adaptation to the climate and local planetary boundaries, like water, soil, and biodiversity. This means that sustainability policies are shifting toward meeting local sustainability requirements.

#### Things to watch:

- How far and how fast policies and NGOs push private companies to become more transparent about and reduce their direct and indirect footprint.
- How companies handle scope 3 targets approaching near-term deadlines given that many struggle to meet them.
- How strongly consumers push back against increasing discretionary costs in a climate of food inflation.
- How capital providers' priorities concerning people, planet, and profit evolve over time.

## Conclusion

Growing uncertainty and increased volatility in food supply chains worldwide will be the key development of the coming decade. Today, supply and demand differ less from each other than in the past, when there was structural overcapacity. While growth in agricultural production is leveling off, global trade is increasingly subject to restrictions. These developments are resulting in rising food inflation and increased volatility. Strategic sourcing is becoming a recurring theme, leading to a continuous reallocation of power among the various players along the supply chain. While supply chain actors and capital providers continuously balance people, planet, and profit, governments are prioritizing strategic autonomy and making their sustainability agendas somewhat simplified, rationalized, and more local.

# Imprint

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