



# Mitigating linear risks

*Building resilient and  
sustainable businesses*

December 2025



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Circle Economy has been at the forefront of the circular economy since 2011. Our annual *Circularity Gap Report* (CGR®) sets the standard for measuring progress, and we manage the world's largest circularity database, encompassing data from over 90 nations, 350 cities, and 1,000 businesses.

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# Acknowledgements

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# 1. Introduction

Business practices that follow the linear ‘take-make-waste’ model are widely recognised as unsustainable.<sup>1</sup> The short product lifespans and resource-intensive nature of this model result in a highly polluting system that amplifies global sustainability challenges.

**Beyond environmental concerns, the linear economy also creates significant economic vulnerabilities for organisations.**<sup>2</sup> Consider a fashion retailer that depends heavily on suppliers of virgin materials sourced from around the world. Such a company faces multiple risks, from supply chain disruptions caused by geopolitical events to price fluctuations, resource scarcity, and increasingly stringent regulations on product sourcing and waste handling. Recent measures, such as US import tariffs, have added further layers of uncertainty to the global marketplace.<sup>3</sup> Material flows to and from the US have become less attractive and more costly, posing additional challenges for organisations that rely on linear business models.

**Risks are inherent to doing business, and as this report highlights, the circular economy offers a promising pathway to minimise certain risks.** By enhancing supply chain resilience, reducing dependence on virgin materials, and fostering long-term relationships between supply chain actors, circular strategies can contribute to more sustainable and profitable business performance.

**This report examines the current landscape of linear risks and explores opportunities for risk mitigation through the lens of the circular economy,** building on a first version of a linear risks paper published by Circle Economy in 2018 titled [‘Linear Risks’: How Business As Usual Is A Threat To Companies And Investors](#). To inform our updated analysis, we interviewed senior employees from predominantly linear companies and experts in circular economy practices to hear about the most pressing risks faced today. Their insights—in combination with Circle Economy’s extensive experience working with businesses— have shaped the findings and recommendations presented here.

**This report provides tools and guidance to make linear risk assessment an integral part of business decision-making, enabling the identification and adoption of circular strategies that support long-term value creation and profitable performance.** To help operationalise linear risk mitigation for businesses, we introduce the perspectives of internal and external origin of risks, sphere of influence, and map strategies for mitigating a variety of risks along any given supply chain.

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<sup>1</sup> Garza-Reyes, J. A., Kumar, V., Batista, L., Cherrafi, A., & Rocha-Lona, L. (2019). From linear to circular manufacturing business models. *Journal of Manufacturing Technology Management*, 30(3), 554–560. <https://doi.org/10.1108/JMTM-04-2019-356/FULL/PDF>

<sup>2</sup> Meshram, K. K. (2024). The circular economy, 5R framework, and green organic practices: pillars of sustainable development and zero-waste living. *Discover Environment*, 2(1), 147. <https://doi.org/10.1007/s44274-024-00177-4>

<sup>3</sup> Trump, D. J. (2025, July 31). *Further Modifying the Reciprocal Tariff Rates – The White House*. <https://www.whitehouse.gov/presidential-actions/2025/07/further-modifying-the-reciprocal-tariff-rates/>

## 2. Contemporary linear risks

### Describing linear risks

The linear economy relies on continuous growth and overconsumption, leading to ever-increasing resource extraction and waste generation.<sup>4</sup> Its ecological consequences are extensive, including resource depletion, environmental contamination, and high greenhouse gas (GHG) emissions. At the core of this system are the companies that operate within it, characterised by linear business models. These models often share a set of common practices that contribute to extensive and unnecessary resource depletion and waste generation throughout supply chains and end markets, ultimately resulting in landfilling, incineration, or export of materials.

Stemming from the '[Linear Risks: How Business As Usual Is A Threat To Companies And Investors](#)' report from 2018, common business practices in linear models are still characterised as:<sup>5</sup>

- **Dependence on scarce and non-renewable resources:** Relying on primary inputs that are finite or becoming increasingly scarce.
- **Prioritising sales of new products:** Designing for short product lifecycles and prioritising marketing and sales-driven growth.
- **Lack of collaboration:** Maintaining strict control over knowledge and avoiding partnerships or joint initiatives.
- **Resistance to change:** Adhering to established market views and failing to innovate or adapt to evolving conditions.

Businesses that engage in such practices face a range of risks that extend beyond environmental impacts—risks often overlooked in traditional risk evaluation frameworks. These are referred to as 'linear risks'. Linear risks are inherent to linear business models, arising from both internal decision-making processes and external market conditions. They can undermine a company's overall resilience, profitability, and ability to achieve broader organisational goals and long-term value creation. In short, linear risks pose a threat to a company's ability to continue as a going concern.

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<sup>4</sup> Kim, J. S., Jun, Y.-S., Jun, J. H., & Cho, J. Y. (2021). Transition from Linear Economy to Circular Economy. *Resources Recycling*, 30(3), 3–17. <https://doi.org/10.7844/kirr.2021.30.3.3>

<sup>5</sup> Circle Economy, PGGM, KPMG, WBCSD, & EBRD. (2018). *Linear risks*. [https://cdn.prod.website-files.com/5d26d80e8836af2d12ed1269/5de8eff3bbf4da023e254ea4\\_FINAL-linear-risk-20180613.pdf](https://cdn.prod.website-files.com/5d26d80e8836af2d12ed1269/5de8eff3bbf4da023e254ea4_FINAL-linear-risk-20180613.pdf)



## Key linear risks identified

A total of 13 interviews were conducted with circular economy experts and company representatives from organisations operating under both linear and circular business models. From these conversations, a long list of potential linear risks was identified. This report presents a short list of the ten most frequently mentioned risks, selected for their particular relevance in today's business environment.

Table one on the following pages presents an overview of these top ten risks (**not listed in order of importance**). Some of the risks share the same root cause, or may influence each other, and differ in impacts - for this reason, there can be overlapping concepts between risks. The column titled 'Supply chain relevance' indicates the specific stage in the supply chain where a risk originates—not necessarily where its effects are ultimately felt. For example, impacts from unsustainable material extraction occur upstream in the supply chain (their point of origin), yet they may also influence downstream stages, such as customer demand, by creating a misalignment between company practices and customers' expectations of environmental performance.<sup>6</sup>

No	Linear risk	Supply chain relevance / Risk origin	Description
1	Reputation damage due to procurement of unsustainably sourced materials	Upstream / midstream	Negative publicity/reputational damage because of practices such as pollution and/or human rights violations. Such instances can lead to strained business relationships that do not want to associate themselves with unsustainable practices or scandals, or increased investor pressure to avoid negative publicity.
2	Undetected malpractice in supply chain due to lack of transparency	Upstream / midstream	The lack of information sharing and communication between parties in a supply chain can increase vulnerability to fraud and quality defects. The absence of transparency prevents companies from verifying ethical conditions, posing a significant liability, as supply chain transparency is becoming more important

<sup>6</sup> Liem, V. T., & Hien, N. N. (2024). Customer pressure and environmental stewardship: The moderator role of perceived benefit by managers. *PLoS ONE*, 19(7), e0306616. <https://doi.org/10.1371/journal.pone.0306616>

			for improving ESG performance and overall reputation.
3	Failure to integrate disruptive innovations due to lack of understanding and awareness.	Midstream	The lack of understanding and awareness of new technologies and materials that are disruptive to the status quo, may prevent businesses from providing better quality and/or experience to customers. For example, companies, especially senior leadership teams, who are resistant to innovation may not attract new skillsets from the newest workforce, thereby decreasing competitiveness and resilience.
4	Lack of innovation due to organisational/ institutional lock-in	Midstream	Current business models are built around practices that prevent innovation and change of business models, while deprioritising circular economy solutions. For example, changing an established supply chain/ network of suppliers and stakeholders makes changing business models very difficult to achieve, especially for financial and knowledge reasons.
5	Unmitigated ESG risks due to growing waste volumes and reliance on export	Downstream	<p>An overdependency on exporting waste and its complementary challenges to developing countries creates significant social, economic, and environmental risks abroad.</p> <p>Interviewees raised concerns about growing difficulties of managing waste flows generated by linear economic activities. Looking at the problem from a macro-lens, the waste problem is both due to lack of infrastructure and space, augmented by a lack of ownership and responsibility from businesses. Current waste generation trends are putting massive amounts of pressure on infrastructure, but also on businesses to store waste, pay for removal services, and rely on spatially distant solutions (export).</p>



6	Loss of profitability due to price volatility of virgin materials	Upstream	The degree of fluctuation in prices of material inputs, especially where there is a high concentration of resources in a few geographical locations, or strong competition from businesses with higher purchasing power. Prices can fluctuate as a consequence of many incidents, such as environmental or geopolitical crises. Such dynamics pose a risk to a business's profitability and competitive advantage.
7	Disrupted supply chains due to scarcity of virgin materials	Upstream	The continuous rise in consumption and overextraction of virgin resources, amplified by climate change and competition among companies and countries, can make these materials costly or even unavailable for production.
8	Disrupted supply chains due to global crises and shocks	Upstream / midstream	Supply chain disruptions that arise as a consequence of hard-to-predict external shocks, like for example wars, trade disputes, sanctions, pandemics, or natural disasters. <sup>10</sup> Businesses with concentrated suppliers are particularly vulnerable in such instances, leading to operational disruptions, increased costs (like shipping), and/or overall reduced resilience.
9	Loss of market position due to changing customer behaviour and expectations	Midstream	Increased customer awareness of environmental damages caused by a specific industry or company, leading to a demand for more sustainable products and services. Changing demands can lead to a loss in brand relevance.

10	Non-compliance risks due to tightening sustainability regulations and transparency requirements	Upstream / midstream / downstream	New laws and regulations—such as the Extended Producer Responsibility Policy, the Packaging and Packaging Waste Regulation or the Corporate Due Diligence Directive (CDDD)—are making linear practices financially unsustainable and non-compliance a liability. This will force large organisations to adopt transparency measures, which will consequently trickle down to smaller supply chain partners.
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*Table one: Top ten linear risks identified.*

A key difference between risks identified in the 2018 report compared to the risks identified today is significant at the macro-economic level. Although many of the risks have remained the same since 2018, **exposure, speed and frequency of disruptive events and societal developments have magnified most risks**. For example, the COVID-19 pandemic disrupting global supply chains, the USA tariffs on imported goods amplifying price volatility, social media playing an increasingly dominant role in spreading scandals, and an overall increased awareness of topics such as sustainability among investors, customers and other stakeholders. Such macro-level influences have impacted how risks are perceived and felt by businesses.

Understanding where risks originate can help businesses to anticipate certain risks and prepare to react. In the following section, the dimensions of linear risks and how they relate to business decision-making are outlined.

## Dimensions of linear risks in business decision-making

For the purposes of this report, linear risks are categorised into two dimensions: the origins of the risks (internal or external) and the associated sphere of influence (high or low sphere of influence, or SOI) that a business has in creating or mitigating them. The dimensions are further explained in Table two below.

Risks related to...	Definition
Internal decision making (High SOI)	Risks associated with strategic or operational decisions made by a business. Examples include how materials are sourced and managed in the supply chain, strategies for improving brand reputation and customer loyalty, or which markets to enter.

External forces (Low SOI)	Risks that originate from external forces that a business must respond to or anticipate but has no or limited control over. Such forces include geopolitical shocks, changing national and international regulations, climate change related shocks or pandemics.
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Table two: Risk dimensions.

Figure one below maps the top ten linear risks illustrating the sphere of influence a company may have of the risks, and their respective location within a supply chain. It is important to note that these dimensions are not always strictly or exclusively applicable to every risk. Each risk factor is highly dependent on the unique characteristics of a given business. For instance, some risks categorised as external forces may, in practice, be more influenced by internal processes.



*Figure one: The linear risk overview—when risks originate from internal decisions, the sphere of influence (SOI) is high compared to when the risks originate from external forces.*

Together, Table two and Figure one outline the origins of risks and how they are likely addressed by businesses, either proactively or reactively. By using the value chain perspective to map the origins of risks, businesses can better understand which stakeholders are most likely involved when deciding on a mitigation strategy and way forward.

There is a clear difference between risks that can be mitigated and avoided depending on the origin of the risk (internal or external). Where risks commonly originate internally, businesses will have a high SOI: they can mitigate them with strategy planning and adjustments to their business operations. For risks that commonly originate from external forces, for which SOI is low, **businesses can plan for resilience by anticipating weak points along their value chains and implementing strategies to avoid the effects of future catastrophes** (e.g. shortage of raw material). The circular economy paradigm presents a compelling set of strategies for linear risk mitigation and overall business resilience in the face of global economic shocks. Such strategies and how they can play a role in mitigating the ten identified linear risks are explained in the following section.

### 3. Circular strategies for risk mitigation and resilience

To effectively mitigate linear risks, circular strategies play a crucial role. These strategies can take many forms, but are grouped into four flows for simplicity, as illustrated in Figure two. Based on the work of Bocken et al. (2016), the Four Flows Framework provides a clear approach to managing resource flows in a circular economy by focusing on: using less (narrow), using for longer (slow), using again (cycle), and using clean, regenerative materials and energy (regenerate).<sup>7</sup>

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<sup>7</sup> Bocken, N. M. P., de Pauw, I., Bakker, C., & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, 33(5), 308–320.  
<https://doi.org/10.1080/21681015.2016.1172124>

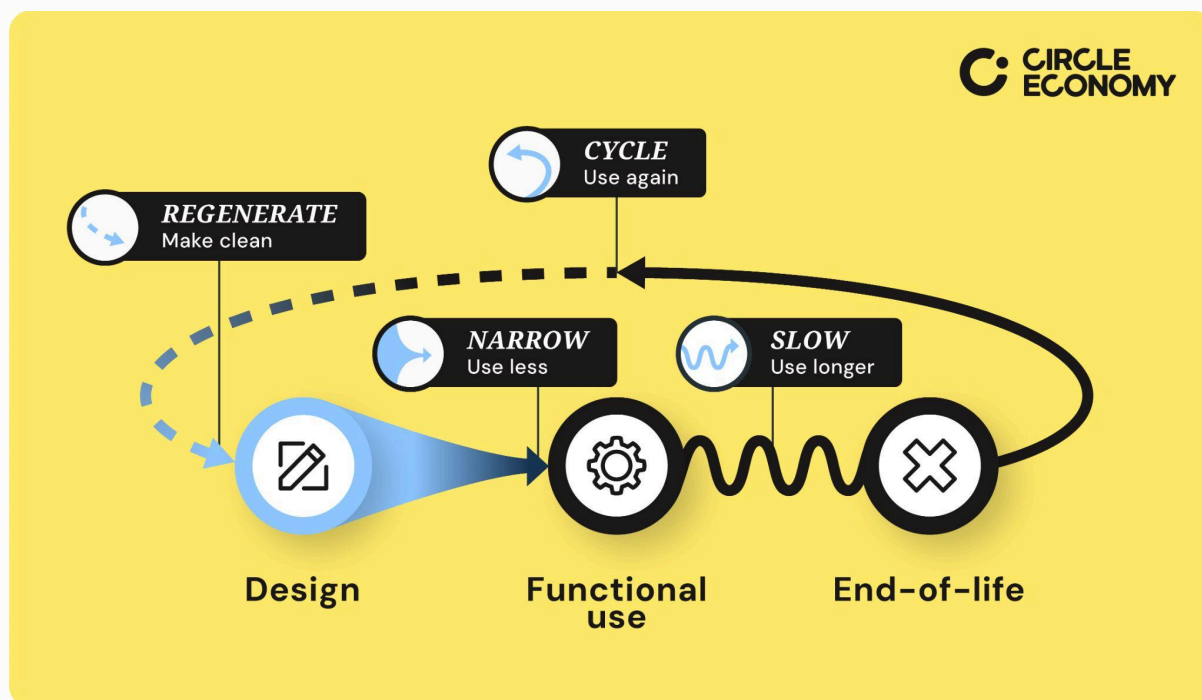


Figure two: Visual of the Four Flows Framework.<sup>8</sup>

The principles of the circular economy can be applied across socioeconomic systems by designing long-lived assets—such as buildings, infrastructure, machinery, and vehicles—as future resource banks, while ensuring manufactured goods and consumables are designed to circulate continuously and regenerate natural systems. At the core of this approach is the goal of generating more value from fewer materials. **By implementing the four key strategies outlined above, organisations and businesses can reduce material use, restore ecosystems, and prevent resource losses.**

## The potential of circularity

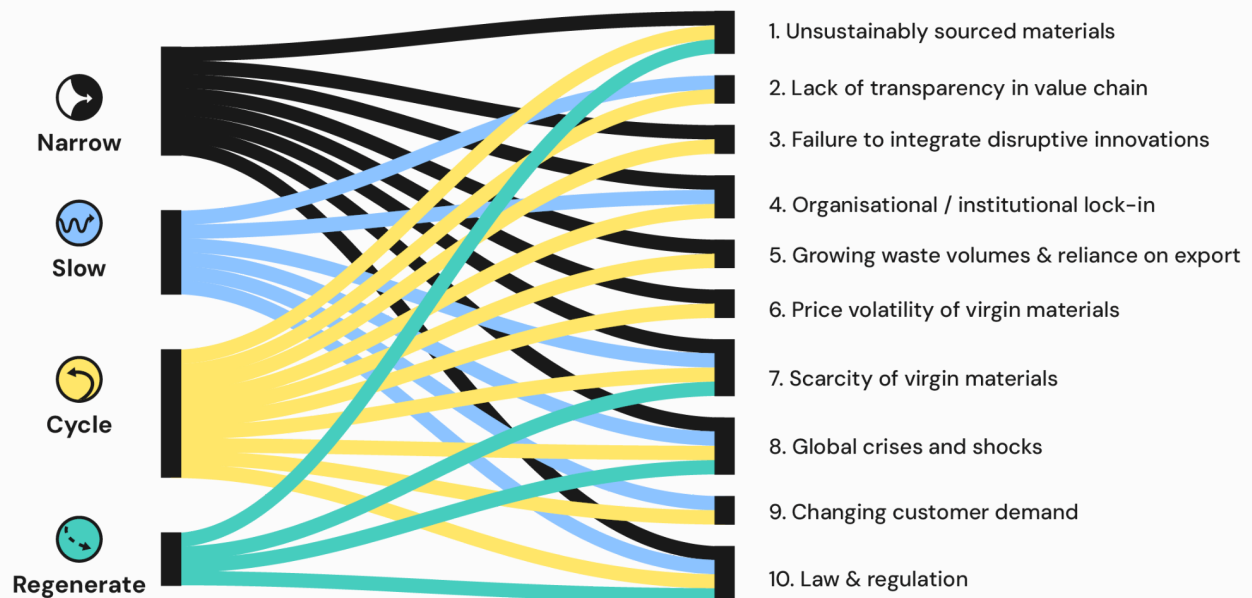
The circular economy strategies presented in Figure three illustrate the potential to mitigate a broad range of risks inherent in the linear economy model. It is important to note, however, that specific opportunities for risk reduction are context-dependent and vary according to each business's unique circumstances.

Figure three shows how the Four Flows Framework can address a variety of risks currently faced by companies. The insights depicted are based on the expertise of Circle Economy, rather than empirical data. As shown in the figure, the strategies outlined by the Four Flows Framework can be used to mitigate many of the most relevant risks businesses face today. Although specifics are not outlined in this figure, it highlights instead the **vast possibilities of mitigation using**

<sup>8</sup> Four Flows Framework - Knowledge Hub | Circle Economy Foundation. (n.d.).  
<https://knowledge-hub.circle-economy.com/frameworks/695?n=Four-Flows-Framework>

**the circular economy as the means.** For illustration, more specific strategies are provided in the next section, in Figure four.

Example case studies demonstrating how the four flows mitigate these risks are discussed in the following section.



*Figure three: Circular mitigation strategies—The Four Flows of the circular economy can help mitigate a variety of linear risks.*

## Circular cases for risk mitigation

The following case studies illustrate how circular strategies can help mitigate various linear risks across different stages of the supply chain—upstream, midstream, and downstream. Each example highlights a distinct type of risk and demonstrates how circular approaches can effectively address it. More case studies can be found on Circle Economy's [Knowledge Hub](#) site.

### Regenerative agriculture on Brown's Ranch

**Flow:** Regenerate

**Mitigating Risk eight:** Global crises and shocks



Brown's Ranch in North Dakota has become a leading example of how regenerative agricultural practices can help farms withstand and adapt to global shocks, particularly those related to climate events.

By regenerating natural ecosystems through methods such as cover cropping, diverse crop rotations, managed grazing, and minimal soil disturbance, the farm has significantly improved its soil health and ecosystem resilience. As a result, crops at Brown's Ranch are better able to withstand extreme weather events, including strong winds, heavy rainfall and heatwaves.<sup>9</sup>

## Signify's Light-as-a-Service

**Flow:** Slow

**Mitigating Risk four:** Organisational and institutional lock-in

Signify invests roughly 4.5% of quarterly sales<sup>10</sup> in research and development, resulting in innovative circular solutions such as Light-as-a-Service. This model transforms the traditional product-based offering to a service-based approach, eliminating the need for customers to purchase physical lighting products. Instead, Signify retains ownership of its lighting systems and remains responsible for maintenance, repair, and performance optimisation. This extends product lifespans (slowing resource flows) and promotes greater resource efficiency. By adopting circular design principles and service-oriented strategies, Signify has transformed the traditional way of selling light. Lighting is no longer treated solely as a commodity but also as a service, reducing material waste while simultaneously expanding market reach and supporting sales growth.<sup>11</sup>

## IKEA's design for renewable or recycled materials

**Flows:** Closing and Regenerating

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<sup>9</sup> *Soil Health – Brown's Ranch*. (n.d.). <https://brownsranch.us/soil-health/>

<sup>10</sup> Signify Press Release. (April 25, 2025).

<https://ml-eu.globenewswire.com/Resource/Download/455bf142-48ec-4a92-946e-8ee6caeb67a8?utm>

<sup>11</sup> *Sustainability | Signify*. (n.d.). Signify. <https://www.signify.com/global/sustainability>

### **Mitigating Risk seven:** Scarcity of virgin materials

IKEA has adopted circular design principles, including the use of recycled or renewable materials within its products. By focusing on closing and regenerating resource flows, these principles help reduce the company's dependence on virgin and fossil-based materials. This design strategy not only lowers IKEA's environmental footprint but also enhances resilience against material scarcity and supply chain disruptions.<sup>12</sup>

### **C&A's We Take It Back programme**

**Flow:** Close

### **Mitigating Risk ten:** Laws and regulations

C&A's 'We Take It Back' programme implements reverse logistics to collect used clothing directly from stores. The initiative enables garments to be reused, repaired, or recycled, reducing textile waste and closing material loops. By actively managing post-consumer products, C&A is better prepared for tightening sustainability regulations, including Extended Producer Responsibility (EPR) policies. This approach, centred on closing resource flows, strengthens compliance readiness while supporting circularity within the fashion industry.<sup>13 14</sup>

## Putting it into context: A consumer goods retailer

Figure four illustrates how a company can identify linear risks across a supply chain and determine the targeted circular strategies that can help mitigate them. While the example is drawn from a generic consumer goods retailer, it is important to note that each actor in the chain faces a unique set of risks. Therefore, the figure serves as a single illustrative case. Taking a systematic, supply chain-based approach to identifying linear risks and circular strategies to

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<sup>12</sup> *Designing for a circular future – IKEA Global*. (n.d.). IKEA.

<https://www.ikea.com/global/en/our-business/sustainability/designing-for-a-circular-future/>

<sup>13</sup> C&A. (z.d.). Sustainability 2022. <https://share.google/6U6qvLLjtuJFcitCL>

<sup>14</sup> *We take it back: Nederland* | C&A. (z.d.). <https://www.c-and-a.com/nl/nl/shop/we-take-it-back>

mitigate the identified risks can help integrate circularity into existing risk management and strategic processes.

In the figure, the upper bar represents various linear risks associated with a specific supply chain stage, while the lower bar outlines a circular strategy to mitigate the risk, and which flow best represents the mitigation opportunity. In some cases, multiple flows are present, meaning that multiple strategies can be applied to mitigate the specific risk.

Although many linear risks originate from the external environment (low SOI) —such as resource scarcity, supply chain disruptions, or shifting consumer behaviour—a company’s ability to build resilience ultimately depends on internal decision-making processes (high SOI). By embedding circular principles into the core business strategy and integrating circular strategies in operational processes, organisations can proactively respond to these pressures rather than remain vulnerable to them.

Circular strategies often produce overlapping benefits across multiple supply chain stages. For example, investing in supply chain transparency not only helps identify and manage environmental and social risks upstream but also strengthens compliance readiness and enhances consumer trust, which can influence purchasing behaviour.<sup>15</sup>

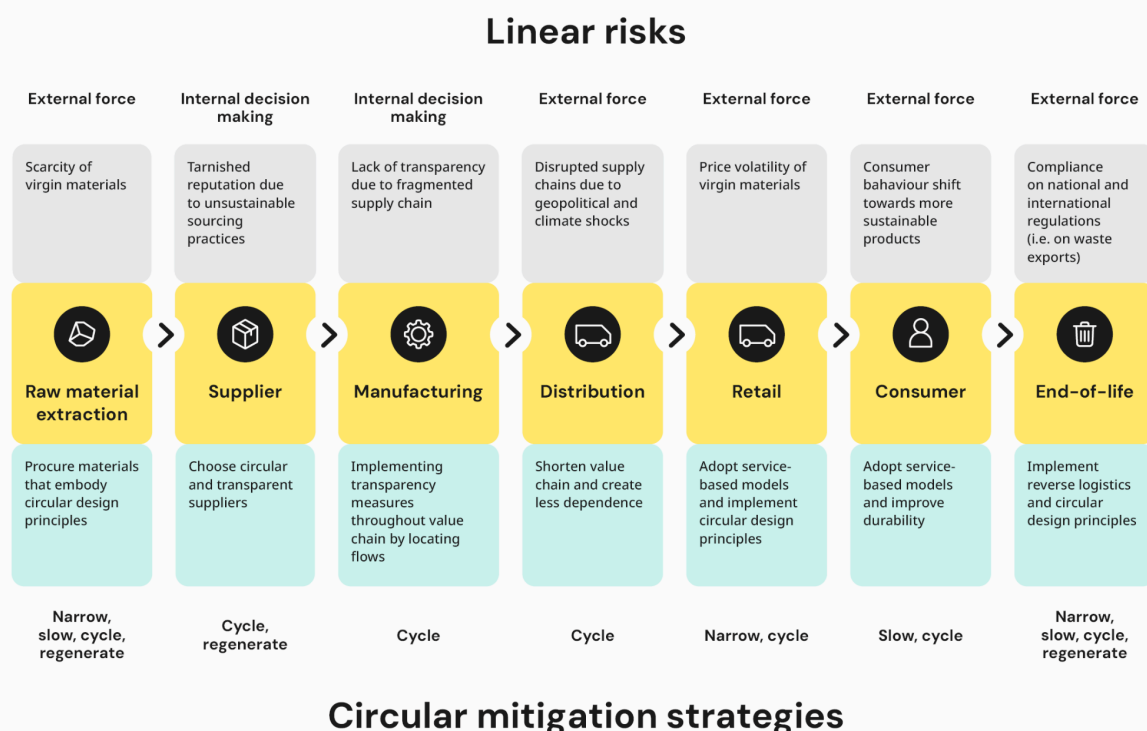


Figure four: Example supply chain for a consumer goods retailer—identifying circular strategies that can help mitigate linear risks along the supply chain.

<sup>15</sup> Jun, B., MA, Liu, S. S., Huang, G. Q., & Ng, C. (2025). How does consumer quality preference impact blockchain adoption in supply chains? *Electronic Markets*, 35(1). <https://doi.org/10.1007/s12525-025-00767-x>

Additionally, as depicted with a supply chain perspective illustrated in Figure four, all supply chains are composed of a variety of stakeholders– multiple parties are involved for a business to provide a product or service to its customers before any given product or material reaches its end of life. It is important to recognise the delicate interconnectedness of businesses along supply chains and how implementing change in one stage can have an effect on stakeholders in another stage. This means that while businesses may be able to make decisions internally to adopt a circular strategy, like for example reverse logistics, the business will likely need to collaborate with other parties to ensure success. Therefore, **partnership and collaboration is an important enabling factor for the circular economy.**

## 4. Looking ahead: Building resilience through circular strategies

The traditional linear ‘take-make-waste’ model exposes businesses to escalating risks, including resource scarcity, supply chain fragility, and increasing environmental, social, and governance (ESG) pressures. In contrast, the circular economy offers a forward-looking alternative, redesigning systems to retain material value, regenerate natural capital, and minimise waste. By adopting circular strategies—from sustainable design principles to reverse logistics—businesses can reduce reliance on virgin raw materials, enhance operational resilience, and respond effectively to evolving regulatory and consumer expectations.

While linear risks may originate within or even beyond an organisation’s sphere of influence, circular strategies remain a useful tool: businesses may not be able to prevent or solve the root causes of all linear challenges they face, but they can control how these challenges affect operations by **adopting circular approaches that strengthen adaptability and reduce vulnerability.**

To address linear risks effectively, companies should regularly assess business resilience by identifying risks across their supply chains, evaluating potential impacts, and understanding their sphere of influence. Once linear risks are identified, organisations can select the most relevant circular strategies to mitigate them. This report provides a set of frameworks to understand linear risks and respective mitigation strategies. In short, companies can begin by:

- 1) **Determining main linear risks present and its ‘sphere of influence’** – *can the risk be approached proactively or reactively?*

- 2) **Understanding the supply chain context** – *where are your easy wins and/or most challenging lock-in areas?*
- 3) **Identifying which mitigation strategies are the best fit for your business** – *who is best suited to champion a circular strategy adoption internally?*

Accelerating this transition requires organisations to share experiences, challenges, and best practices. Open exchange fosters collective learning, enabling industries to develop a deeper and more practical understanding of circularity, while partnership and collaboration will further enable businesses to successfully transition towards more circular supply chains.

Understanding that business-as-usual can also pose significant risks to businesses, the frameworks presented are intended to provide an optimistic perspective on business transitions towards more sustainable and circular practices. Through the insights and perspectives provided in this report, our aim is for the circular economy to become a core consideration for businesses when strategising for long-term resilience and market stability.

# Endnotes

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