10/2/2023

ICC and EY team

[company name]

**DRAFT FOR COMMENT - NOT FOR CIRCULATION OR DISTRIBUTION**

Contents

[1. Executive summary (SECTION NEEDS UPDATE – TO BE UPDATED AFTER ALL REVIEWS) 2](#_Toc147087118)

[2. Background 3](#_Toc147087119)

[2.1. Background on circular economy 3](#_Toc147087120)

[2.2. Research methodology 4](#_Toc147087121)

[3. Barriers to circular economy - Learnings from stakeholders 5](#_Toc147087122)

[3.1. Advanced manufacturing 5](#_Toc147087123)

[3.2. Life sciences and chemicals 7](#_Toc147087124)

[3.3. Renewable energy 8](#_Toc147087125)

[3.4. Information technology 9](#_Toc147087126)

[3.5. Textile and retail 10](#_Toc147087127)

[4. Opportunities for policy interventions – recommendations 13](#_Toc147087128)

[4.1. Advanced manufacturing 13](#_Toc147087129)

[4.2. Life sciences and chemicals 14](#_Toc147087130)

[4.3. Renewable energy 15](#_Toc147087131)

[4.4. Information technology 15](#_Toc147087132)

[4.5. Textiles and retail 16](#_Toc147087133)

[5. Annex 18](#_Toc147087134)

[5.1. Summary of literature review 18](#_Toc147087135)

[5.2. Analysis - Commonalities across all sectors 20](#_Toc147087136)

[6. References 24](#_Toc147087137)

# Executive summary (SECTION WILL BE UPDATED AFTER ALL REVIEWS)

# Background

## Background on circular economy

There is no singular definition for the circular economy. However, circular economy can be defined as an **economic model** that aims to maximise **resource efficiency, reduce waste, and minimise environmental impact** by promoting the continuous **use, reuse, and recycling of materials and products.** For the purposes of this report, circular economy is viewed as a transformative process to reimagine and redesign social and business interactions.

|  |
| --- |
| The United Nations defined the triple planetary crisis as the three main interlinking issues that humanity currently faces: **climate change, pollution, and biodiversity loss**.[[1]](#endnote-2) These crises are all driven by human activities and pose significant threats to the Earth's ecosystems, as well as to the well-being and survival of various species, including humans. Turning the tide on this “triple crisis” is one of the core objectives of the circular economy, the concept that offers a comprehensive and integrated approach to addressing the triple planetary crisis.  |

Unlike the traditional linear economy, which follows a "take-make-use-waste" pattern, the circular economy seeks to create a **closed-loop system** where materials and products are kept in **circulation, at their highest value,** for as long as possible. (See Figure 1) The circular model creates value by simultaneously enabling economic growth and positive ecological impacts.​



Figure 1 Transition from Linear to Circular Economy

According to the Ellen MacArthur Foundation[[2]](#endnote-3), a circular economy is based on three key principles, all driven by design.

1. **Eliminate waste and pollution:** The first principle of the circular economy is to eliminate waste and pollution. In the linear economy, we take raw materials from the Earth, we make products from them, and eventually, we throw them away as waste.
2. **Circulate products and materials (at their highest value):** The second principle of the circular economy is to circulate products and materials at their highest value. This means keeping materials in use, either as a product or, when that can no longer be used, as components or raw materials. This way, nothing becomes waste and the intrinsic value of products and materials are retained.
3. **Regenerate nature:** The third principle of the circular economy is to regenerate nature. By moving from a take-make-use-waste linear economy to a circular economy, we support natural processes and leave more room for nature to thrive.

Other principles of the circular economy are set out in the following table:

|  |  |
| --- | --- |
| **Principles** | **Definition** |
| Design for Longevity | Products are designed with durability, repairability, and reusability in mind, extending their lifespan and reducing the need for constant replacement. |
| Reuse and Remanufacturing | Used products or components are refurbished, repaired, or remanufactured to create "as good as new" items, minimizing waste and conserving resources. |
| Recycling and Recovery | Materials from products at the end of their life cycle are recovered and recycled into new products or materials, reducing the demand for virgin resources. |
| Resource Sharing | Collaborative consumption models, such as sharing, renting, or leasing products, enable multiple users to use the same resource over time. |
| Waste Prevention | Minimizing waste at the source through better production processes, efficient resource use, and reduced packaging. |
| Biomimicry and Renewable Energy | Emulating natural systems and using renewable energy sources to power processes, reducing their environmental impact. |
| Digitalization and Innovation | Using digital technologies to optimize processes, track materials, and create new business models that support circular practices. |

Table 1 Key principles of circular economy[[3]](#endnote-4)

Applying the above circular economy principles, businesses have the potential to not only reduce waste and social and environmental harm but also to foster **innovation and create new business opportunities.** Transitioning from the linear economy to a circular economy requires collaboration among businesses, governments, consumers, and other stakeholders to reshape production, consumption, and waste management practices.

## Research methodology

This report aims to comprehensively examine the barriers that hamper the adoption of circular economy solutions and provide specific solutions to help address these barriers. To achieve a thorough understanding of the challenges, the research methodology employed combines **literature review, stakeholder interviews, and surveys.**

**Literature review:** A literature review on both national and international circular economy initiatives, including government documents, policy reports, and research papers, identified commonly observed barriers that policy instruments seek to address and related government-led interventions. This analysis provides a contextualised backdrop for understanding stakeholder inputs in formulating policy recommendations in this report.

**Stakeholder interviews**: Interviews were conducted with industry stakeholders from the **advanced manufacturing, life sciences and chemicals, renewable energy, information technology, and textile and retail sectors**. Interviewees were selected based on experiences, implementing circular economy initiatives leveraging ICC’s global network. These interviews were structured with an interview guide, allowing participants to provide in-depth insights into their experiences, challenges faced, and recommendations for implementing circular initiatives. The qualitative data obtained from interviews offer nuanced perspectives and real-world examples that contribute to a deeper understanding of the subject. Additionally, we al

**Survey:** To gather inputs from a broader base of stakeholders, a survey was sent to the ICC Circular Economy Working Group. The survey questionnaire aligns with the interview guide, asking respondents about the challenges encountered enacting circular economy initiatives. This data supplements stakeholder inputs during the interview process, contributing to a more holistic understanding of the challenges.

Qualitative insights from interviews were analysed at the sector level, then synthesised for industry-agnostic themes and patterns. Survey responses were reviewed and integrated into the interview analyses to form the industry perspectives. These insights were cross-referenced with findings from the literature review to identify potential gaps that could be addressed through policy interventions. By employing a mixed-methods approach that combines interviews, literature review, and surveys, this research methodology combines the pain points from practitioners with learnings from existing policy frameworks. The triangulated analyses established a well-rounded evidence base for informed and practical policy recommendations.

# Barriers to circular economy - Learnings from stakeholders

Table 1: Most common barriers encountered by sector as described by stakeholders. The table ranks the barriers mentioned in each sector.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| # | Advanced Manufacturing | Life Sciences and Chemicals | Renewable Energy | Information Technology | Textiles including retail |
| 1 | Broader quality assurance tolerance ranges | Cost of collection and processing | End-of-life management of renewable energy equipment | Consumer behavior | Connection between circular economy and reporting frameworks |
| 2 | Design for circularity | Lack of incentives and/or investments | Practicality of translating circular economy ambition into actions | Consumer preference for convenience | Large distances between location of waste and recycling facilities |
| 3 | International waste regulations | Profitability | End-of-life material collection | Extended producer responsibility (EPR) regulatory complexity | Finding recycling partners |
| 4 | Quality assurance allowing for circular principles | Public perception (chemophobia, technology discomfort, job loss, quality, and not recognizing value) | Coordinating circular economy partnerships between industries and companies | Lack of regulation harmonization | No harmonized definition or approach for policy and infrastructure |
| 5 | End-of life visibility of products | Alignment between CE and climate change or other sustainability frameworks | International waste regulations, specifically the Basel Convention | Global supply chain coordination | Consumer perception of quality and public sentiment |
| 6 | Access to recycled material | Demand and willingness to pay or cost share along the supply chain | Current accounting practices do not align with circular economy objectives | Lack of procurement strategies shaping market demand | Profitability |
| 7 | Developing circular KPI’s | Partnership for sorting and collection | Consumer engagement and behavior | Lack of public procurement initiatives | Supply chain risk |
| 8 | Recycled material contamination | Clear accountability of cost bearing (e.g., EPR) | Stakeholder agreement on the benefits of circular economy | Lack of focus on nature and biodiversity within the sector | Perceived trade-off between recyclability and durability |
| 9 | Availability of recycling data | Costly and risky investment | Addressing overconsumption | International waste regulations | Additional cost for circular products |
| 10 | Comparable LCA scope and boundaries | Global collaboration for scaling (knowledge transfer and building infrastructure in the developing world) |  | Regulatory classification of waste versus used products | Certifications are resource intensive |

## Advanced manufacturing

Advanced manufacturing converts raw or virgin materials into usable products. The challenges with remanufacturing in the context of circular economy are usually due to insufficient raw materials and/or poor-quality remanufactured goods and materials. On average, remanufacturing uses 85% less energy, 86% less water, and 85% less raw material compared to new goods.vi Interviews with industry players reveal that (1) **perception** of a technical barrier plays as strong of a role as an actual barrier,(2) **standardization** is needed to bring legitimacy to a products’ life cycles,and (3) **international waste regulations** hinder the movement of materials for recovery and recycled materials.

#### Technical and aesthetic barriers

Technical and aesthetic barriers arise due to the quality of products. Engineering departments usually conduct quality assurance processes to ensure that products meet certain specifications and quality standards. These processes involve risk assessments to determine how and where a product is most likely to fail and examine which material characteristics are suitable for an application. **Technical and aesthetic issues arise when assessing whether recycled material can directly replace a virgin material for a product.** In many cases, the strength of a virgin material is greater than that of the same recycled material. To overcome structural issues, either the recycled materials feedstock must have minimal levels of contaminates and/or the industrial process that forms the material must be more advanced than currently available methods. Aesthetic characteristics such as color, appearance or texture can be difficult to replicate when using recycled material. To deal with aesthetic issues, a detailed understanding of the recycling process is required to achieve the desired aesthetic modification. Participants noted that technical issues were easier to overcome than aesthetic issues.

#### Perceived requirements

The perception of technical barriers creates an interesting dynamic between what is necessary and what is considered a necessary specification for recycled materials. As companies have internal discussions about technical specifications, **it can be difficult to discern whether a quality metric was in place for performance reasons, a customer requirement, or an industry standard**. Participants noted that not all the technical characteristics present in a product are required by the customer, nor is it fully understood internally where the requirement for a certain technical characteristic originated. This can lead to perceived specifications that a recycled material must meet that are in fact not necessary for product performance.

####  Quality standards barrier

Quality standards for a product are often determined by a trade-group standard or by a metric that achieves a desired technical or aesthetic characteristic. The trade-group standards and individual metrics typically have specific thresholds required for product quality. Standards and metrics need to adapt and be challenged if recycled material is intended to directly replace a virgin material. **Ranges of tolerance need to be established** to determine the suitability of a recycled material for a particular application.

#### Lack of end-of-life standards

There are no standards for product lifetimes or alignment on when a product should be returned to a manufacturer. This makes it difficult for manufacturers to appear impartial when declaring a product to be at end-of-life. Participants mentioned spending significant time reviewing international standards for how they apply to circularity. At best, this exercise resulted in a minimum of eight years for a product being mentioned more than once and at worst, standards contradicting one another. Without an industry standard, the manufacturer is left to self-determine a product’s lifetime and risk the timeframe being perceived as planned obsolescence. **The lack of standards and alignment for defining when a product reaches end-of-life make it challenging to determine if a product is ready for a take-back program.**

#### Reverse logistics barriers

In practice, reverse logistic programs are complex and create a barrier to starting a reuse or refurbishment program. Uncertainty in reverse logistics exists for both the end-customer and the equipment manufacturer. Registering the product, tracking the product, and enabling customers from other countries to send back a product are all barriers to post-consumer collection. In some instances, products cannot be returned in a country where the manufacturer does not have a factory. The import and export of waste or post-consumer material is governed by the Basel Convention and the OECD decision on waste shipment. Both regulations require prior informed consent procedures to ensure waste is managed in an environmentally sound manner between countriesxiv. While the intent of such regulations was to prevent the dumping of waste in less developed countries, the implementation has created additional barriers to establishing a reverse logistics program.

#### Recycled material supply-side barriers

The **lack of availability of recycled materials** creates a barrier to operating R-strategy programs. (R-strategies: refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, and recover) There is often not enough recycled material in the market to meet demand for advanced manufacturers. Suppliers of recycled materials are aware that a premium can be charged for sustainable products which makes achieving price parity with virgin materials a challenge. The number of supply chain risks and liabilities increases with a smaller number of recycled material suppliers compared to the number of suppliers available for virgin materials.

#### Employee education and perception barriers

The **lack of education** on circular economy concepts presents a barrier to progressing internal initiatives. The general perception of circularity is that it is the same as recycling. This line of reasoning leads employees to believe that recycling alone is sufficient to create a circular economy. Limiting the success of internal initiatives to reuse or refurbish products. Participants described employees as being “stuck” in this type of thinking making the transition to circular concepts challenging.

#### Consumer behaviour and perception due to inadequate residual value, convenience, and novelty

Consumer behaviours is currently aligned to a linear economy which makes it a barrier to implementing a circular economy. **Three main challenges of consumer behaviour were: perception of residual value of an item, the convenience of returning a product, and novelty or sentiment for an item.** Academic research on consumer behaviour as it relates to participating in a circular economy is still in the early stagesxiii. Research studies could help to explain challenges like low recycling rates in the United States or the reasoning for a customer not returning an item. Overall, there needs to be a better understanding of how consumer behaviour can be efficiently aligned to a circular economy, since it is a critical piece to creating a circular system.

## Life sciences and chemicals

Globally, approximately **400 million tonnes of hazardous wastes[[4]](#endnote-5) and 400 million tonnes of plastic waste are generated each year**[[5]](#endnote-6). Chemicals are present in more than 90% of manufactured goods[[6]](#endnote-7), therefore advancements in material science in this sector have the ripple effect to contribute to economy-wide circular transition. The life sciences and chemical industries typically occupy an early position in supply chains, positioned upstream of value chains, where they synthesise or transform materials into compounds of various properties.

#### Sourcing and partnerships

Costs of post-use feedstock is seen as a primary barrier to scale up circular economy solutions. **Post-use products are often scattered and contaminated, and their collection process is often decentralized, of small volume, and variable quality**. This makes it costly to consolidate these materials for further processing and further refining. Additionally, the insufficient amount and supply of feedstock does not meet companies' profitability requirements. Therefore, this lack of reliable supply at scale results in hesitancy for companies to invest and adopt these solutions, and the additional cost associated with the feedstock hinders the competitiveness of these offerings.

While companies need to establish relationships with new suppliers to transition to circular model, at times, partnerships in a new value chain beyond companies’ familiar territories are needed, especially for the collection of post-use materials. Companies, particularly in polymer producers, do not historically have the required recycling capabilities and need to identify and work with recycling partners. These new partnerships are critical to the success of circular economy offerings and finding a trusted partner and scaling up together can be seen as a major challenge for some.

#### Technological barriers

Recyclability is often not a consideration when materials are produced, except for single-use products. As a result, some materials are difficult to recycle, such as multi-layered packaging. **Technological innovations are still needed to recover traditionally hard-to-recycle products and develop appealing easier-to-recover alternatives that meet the same performance standards.** Additionally, contamination and waste management infrastructure lead to challenges in purifying the feedstock adding more technological difficulties, even for materials that are recyclable.

#### Knowledge barriers

Retailers and consumers may have negative perceptions of circular products on the demand side. Negative perceptions hinder the adoption of circular solutions in two ways: **a lack of demand of circular products, and a policy climate that is not conducive to circular transition.** The sentiments may be due to misinformation about the quality and life-cycle social and environmental impacts of chemical products. Stakeholders often believe that a lack of aligned strategy and messaging lead to limited influence over public sentiment and public policy. However, as companies in this sector are generally upstream suppliers and business-facing, they have limited capabilities in consumer education and awareness building to boost demand.

#### Policy barriers

Policy was a key concern raised by stakeholders when investigating the enabling environment. Current regulations may be seen as too **broad**, and thus limiting the potential of some circular solutions, especially for a sector that manufactures several products with diverse properties. A **lack of technical knowledge** among policy makers creates hurdles in formulating more granular and enabling legislations. For instance, trade policies to move the materials across jurisdictional borders requires support that is currently lacking. The current definitions of waste in the trade code broadly encompasses used products and do not account for the **granular value** in circular systems. As some countries apply **restrictions and prohibitions** on the import of waste, the trade policies hinder the effective movement of post-use material from end-users to reprocessing facilities, which is critical for the reconcentration of feedstock from sludge to used plastics. Policy updates could have a significant impact since the post-use materials and treatment facilities are often not located in the same jurisdiction, and that it may not be feasible for all jurisdictions to develop such infrastructure locally.

#### Financial barriers

From a financial perspective, R&D and upscaling of circular practices can be financially demanding and risky. As chemical and life science companies are driving the innovation, they look to share the risk and cost with value chain partners. The premium may need to be borne by brand owners or consumers. Some believe that upscaling of circular solutions can be accelerated when multiple stakeholders along the supply chain absorb the additional costs. Furthermore, specialised funding for circular initiatives could support the capital inflow. These risk-sharing mechanisms could incentivise investments towards R&D activities. Lastly, the transition to circular products requires leadership commitment and support, particularly as circular initiatives wouldn’t translate into profit in the short term. This makes new circular economy solutions vulnerable to shifting priorities within companies.

## Renewable energy

The International Renewable Energy Agency (IRENA) estimates that by 2050, between **60 and 78 million tonnes of material will be generated globally from solar panels** that will go through one of the three end-of-life routes: **recycling, reuse, or disposal**[[7]](#endnote-8). As much as 85% of a wind turbine and 90% of a solar panel can be recycled[[8]](#endnote-9). Interviews with key industry players reveal a shared sentiment of transition towards circular economy principles, while acknowledging significant challenges in sourcing materials through mining of essential resources.

#### Practical implementation of circular economy ambitions

There is a **significant gap** between setting circular economy goals and strategy and it’s execution. For example, an interviewee highlighted the case of a company's commitment to utilise recycled cobalt in their products without a comprehensive collection plan. Sourcing materials for renewable energy goods is a critical concern and the challenges are throughout the value chain and requires coordination with multiple stakeholders and industries.

#### Policy related barriers

#### The Basel Convention is a significant regulatory framework that governs the transboundary movement of hazardous waste and other materials, primarily focuses on the management and disposal of hazardous waste. Its **stringent regulations** can add complexities to cross-border movements of materials within the renewable energy sector hinder the smooth flow of materials essential to renewable energy production and distribution, creating additional complications for the sector's transition to a circular economy.

#### Financial challenges

While financial support for circular initiatives exist, accounting practices can be significant hurdles for the circular economy within the sector. Currently, financial practices and accounting are unable to accurately value and communicate the financial benefits of circular economy projects. For instance, consider a renewable energy company that invests in recycling and refurbishing its solar panels to extend their lifespan. While this circular approach reduces waste and benefits the environment, it may not be adequately reflected in traditional financial statements. The challenge lies in quantifying the long-term environmental and societal gains in a way that aligns with conventional financial reporting, making it difficult for companies to demonstrate the full economic value of their circular efforts. This underscores the need for innovative accounting methodologies and reporting frameworks that can better capture and communicate the holistic benefits of circular economy initiatives within the renewable energy sector.

#### Leadership buy-in

**Convincing clients and stakeholders** about the benefits of circular economy practices remains a challenge. Even with substantial investments in circular initiatives, scepticism and resistance persist. Additionally, **lack of standardisation** exacerbates the problem as overcoming resistance becomes more difficult when concerns need to be addressed on a case-to-case basis.

## Information technology

Implementing circularity in the sector will be crucial to addressing a global electronic waste problem. Transition to circular practices in IT has already led to a significant reduction in electronic waste generation, with some estimates suggesting a **30% decrease in e-waste production in developed countries that have embraced circular approaches**[[9]](#endnote-10). Interviews with key players within the IT sector reveal an optimistic outlook, underscored by the sector's potential for positive change. However, challenges persist, particularly in the interplay between developed and developing countries and Least Developed Countries (LDCs). The Basel Convention, designed to regulate the transboundary movement of hazardous waste, creates additional barriers to finding circular solutions. Developing countries often receive electronic waste from developed nations, where recycling and circular practices are more advanced. Balancing this global disparity and promoting circularity in all corners of the IT sector remains a complex challenge that requires international cooperation and innovative solutions to bridge the gap.

#### Consumer behaviour due to inconvenient and complex return logistics

Central to the challenges in the IT sector is **understanding of consumer behaviour and the inherent convenience mindset**. It was highlighted that currently the consumer preference is for convenience and new purchases over recycling and repurposing. Stakeholder interviews revealed consumers currently prioritise convenience and prefer new products over recycled and repurposed ones. This consumption preference, mostly driven by a lack of education and awareness provided to consumers about the benefits and often complex recycling and return processes, is a key barrier circular economy champions need to overcome within the industry.

#### Policy related barriers

The complexity of policies and regulations such as Extended Producer Responsibility (EPR) emerges as a significant hurdle. **Harmonising regulations to promote circularity while allowing for innovation presents a challenge.** The varying levels of understanding and complexity across regions compound the issue. Global coordination is deemed crucial for the IT sector's circular transformation, especially in a global supply chain enabled by aligned policies that prevent local or regional regulations from undermining circular initiatives. However, it is worth noting that navigating the diverse definitions and needs between domestic agencies can also add a layer of complexity, particularly during import and export processes. For instance, differing interpretations of what constitutes a used or remanufactured product by various domestic agencies can create challenges for businesses operating across borders. Additionally, the lack of distinguishing between high-value, low-volume B2B goods and low-value, high-volume B2C goods can further complicate compliance with regulations and hinder the growth of circular practices in the IT sector.

#### Information technology business cycle

Transitioning to new technological shifts in the IT sector presents challenges as providers rush to keep up with competitors and meet the demands of fast-paced innovation cycles. This often leads to a prioritisation of **speed and innovation** at the expense of designing products with circularity in mind. In the race to market, companies may overlook opportunities to create more sustainable and circular products. The competitive nature of the industry and the pressure to release new products quickly can clash with the long-term sustainability goals of circular product development. This challenge is further exacerbated by the need to **align technical standards, design demands, and revenue goals** with circular principles, creating a complex interplay of factors.

#### Geographical infrastructure barrier

Geographical variations influence post-consumer collection practices in the IT sector, leading to stark differences in collection rates across regions according to stakeholders. Well-established recycling infrastructure and stringent regulations tend to result in more effective collection in developed areas, driven by active consumer engagement. **In contrast, underdeveloped regions with limited recycling facilities face substantial challenges in collecting and managing electronic waste.** These geographical disparities highlight the need for tailored approaches to post-consumer collection, considering local regulations, consumer awareness, and the presence of recycling facilities. Achieving circularity goals requires addressing these variations, emphasising not only the improvement of recycling infrastructure but also fostering awareness and collaboration among stakeholders to overcome geographic challenges effectively.

#### Internal organizational barriers

Despite the huge potential, circular economy strategies are not widely adopted across organizations as getting **internal buy-in and rallying support** of employees are challenges companies continue to face. Furthermore, circular economy efforts seem to be given lower priority due to a lack of concrete targets and emphasis on driving innovation for circular products.

## Textile and retail

In the context of this study, textile and retail sector encompasses the brand owners, suppliers, manufacturers, and retailers of consumer goods. Primarily adhering to the linear “take-make-use-waste” model, many products and existing systems in the sector are not designed to facilitate repair, resale, reuse, or recycling. Taking textiles as an example, **an average person in the EU discards 11 kilograms of textiles annually**, **of which less than 50% is collected for reuse or recycling. Globally, resale, rental, repair, and remaking account for only 3.5% of the fashion market**[[10]](#endnote-11), **and less than 1% of clothing is being recycled into other clothing**[[11]](#endnote-12). Most textile recycling is downcycled, where it is mechanically shredded into shoddy that creates insulation or low-quality cleaning rags. The magnitude of materials currently being discarded or underutilised promises a significant environmental and social impact with the successful implementation of circular solutions.

#### Economic barriers

One of the main barriers is the potential **near-term impact on the bottom line** that would occur as the company transitions to circularity. Current market landscape **lacks an established infrastructure** for collection, recovery, and processing and establishing this infrastructure is perceived as **costly endeavour, with unclear responsibilities with regards to the private sector’s or government’s role.** Retail and textile products are scattered among consumers without a standard collection infrastructure to facilitate return. Due to these **limitations**, consumer behaviours are trained to facilitate linear processes, and throw items away or hold on to them despite no longer being used. Moreover, a wide range of retail products and textiles are petroleum-derived, anchoring the cost of virgin materials to oil prices. With comparatively low oil prices and without policy levers to create incentives for non-virgin material choices it remains the better financial decision for companies to maintain linear systems of production than opt for circular alternatives. Therefore, circular products face **profitability challenges** due to the higher costs of generating these products as compared to their virgin alternatives.

Additionally, investment towards the research and development of circular solutions, from prototyping design-for-disassembly to advanced recycling, is costly. Generally borne by the innovator, the **investment may be transferred and shared among all value chain partners or even consumers through pricing strategy**. The premium resulting from technology costs could be especially pronounced when the production volume remains low. Moreover, with the supply of recycled feedstock currently limited, there is competing demand from various sectors and stakeholders towards the same supply, catalysing competition, which further drives up the costs for adopting recycled materials.

#### Converting end-of-life to end-of-cycle

Converting a retail or textile product from end-of-life to end-of-cycle encounters two primary barriers to success: **consumers’ lack of access** to properly dispose products post-use and **lack of collection infrastructure** for further processing. Consumers’ lack of access encompasses both information and resources to extend the life of their clothing or products and effectively dispose their products, results in lower volume of post-consumer feedstock for effective upcycling into new products. Similarly, consumers are unable or unwilling to engage in circularity because of the inconsistency in access to a circular system, the difficulty of finding and engaging with a circular system, all based on the lack of infrastructure to collect and facilitate circularity of products. Additionally, improperly disposed end-of-life materials lead to **contamination that inhibits reprocessing**. Contaminations in waste streams make it technically more challenging and labour intensive to effectively recover value in post-use materials, which further translates into increased cost to enable circular loops. Unfortunately, companies running take-back programmes find misplaced items in the return stream which not only require extensive manual sorting, but also pose compliance challenges for processed post-use goods in specific subsectors such as children’s toys. On a macro level, there is also a geographic disconnect between where collection, reprocessing, and advanced recycling technologies are and where the waste is located. Both barriers **limit the volume** of post-use materials available for processing and thus the scalability, whereas the **quality of post-use material** streams due to misplacement by consumers hinders profitability of potential circular solutions.

#### Business model viability

Some companies encounter barriers in earlier stages of circular solution adoption. **Consumer perceptions, technological barriers**, and conflicts with internal strategies are some examples. For instance, consumers may perceive refurbished or resold pieces as **less desirable** or even unlucky, particularly for performance items like running shoes, or status products like phones, thereby lessening the business case for certain R-strategies in certain sectors, for certain buyer groups. **Proprietary design and performance criteria** on materials can pose challenges to brand-owners who strive to balance desired properties and circular design, such as design-for-repair, design-for-disassembly and adoption of alternative or recycled materials. Finally, **internal buy-in** can be a hurdle if the financial impact to change on existing, successful business models is significant, or if the transition brings along significant supply chain risks and costs. For instance, if a company specialises in the variations of one product line, then the entire ecosystem would need to adapt in circular implementation, which inevitably will generate sunk costs for the obsolete linear functions. On the other hand, if a company has a wide range of products, numerous technological partners and suppliers may need to be brought on to meet the specific needs for each product through circular solutions.

#### Harmonised regulations and policy

A lack of **harmonised policies and integrated circular economy frameworks** generate additional challenges. Specifically, current frameworks for circular progress measurement are not closely connected to other ESG frameworks such as the Greenhouse Gas Protocol. As a result, substitution of materials, like replacing plastic with paper, might be a trade-off against a company’s net-zero agenda and would result in inaction on circularity. Moreover, **data collection** could also be challenging, especially for end-of-life collection and processing, as the materials are scattered and market segmented. Insufficient data is an obstacle to companies to accurately monitor performance and plan for demand.

On the policy front, stakeholders identified three main pain points: **compliance to ever-evolving policies, broad-stroke regulations, and a trade system designed for a linear economy.** As country-specific circular policies like EPR schemes emerge, stakeholders face increasing administration costs to remain compliant to the nuanced regulations. A lack of standardization across jurisdictions also pose supply chain risks when companies rely on small- and medium-sized suppliers overseas, who may not have the resources to adhere to the regulations. Additionally, consultations during the policymaking process are often heavily politicised and thus focus on the products or materials that are most contended in public sentiments, such as single-use plastics. Consequently, durable goods are subject to the same set of regulations even though their durability inherently lends towards circularity, which would not be rewarded (but penalised) in the calculations. Lastly, trade regulations and current tariff codes have not been updated to cater to reverse logistics and circular lifecycles, which leads to uncertainty and increased administrative fees and costs for compliance for customs at each border. The current tariff codes are not designed for a circular economy and do not have a category for reused or end-of-cycle products or feedstock. This means that when goods are being shipped to be resold directly, or processed into new feedstock, the company conducting the import or export will have to pay the fees of a new product, since that is the closest item in the code available, despite not being able to charge the price of a new product. Therefore, companies can lose money when trying to resell used products by having to pay the new product fee when importing or exporting. This clearly disincentives companies from participating in the resell economy within circularity. In addition, guidelines around the value to be declared at customs are lacking for reusable goods, which may incur misaligned tariffs for the actual value of the materials, once again meaning a business may be spending more to enact circularity than it gains from participating.

Table - Circular economy barriers

| **Category** | **Barrier** | **AM&M** | **Chem** | **RE** | **IT** | **Retail** |
| --- | --- | --- | --- | --- | --- | --- |
| Political | Linear-economy-based codes and trade regulations, including the definition of waste |  |  |  |  |  |
| Complex and unharmonized regulations across geographies |  |  |  |  |  |
| Lack of harmonized accounting framework for CE metrics |  |  |  |  |  |
| Lack of connections between CE frameworks and other ESG frameworks |  |  |  |  |  |
| Broad-stroke policies that focus on specific products in an industry |  |  |  |  |  |
| Organizational | Heavy dependency on newly formed partnerships |  |  |  |  |  |
| Internal buy-in and coordination |  |  |  |  |  |
| Supply chain challenges |  |  |  |  |  |
| Social | Insufficient disposal of post-use materials by end-users |  |  |  |  |  |
| Consumption behaviours and misperception of circular goods |  |  |  |  |  |
| Lack of information for post-use return |  |  |  |  |  |
| Infrastructure | Lack of reverse logistic infrastructure |   |  |  |  |  |
| Financial | Premium associated with circular materials |  |  |  |  |  |
| Large and risky upfront investment required for R&D |  |  |  |  |  |
| Cross-value chain collaboration | Negative perceptions of CE products among value chain partners |  |  |  |  |  |
| Limited availability and quality of material flow data |  |  |  |  |  |
| Technological | Lack of technology for hard-to-recycle materials |  |  |  |  |  |
| Limitation of circular materials |  |  |  |  |  |

# Opportunities for policy interventions – recommendations

As highlighted in the previous sections, several barriers have hindered widespread adoption of circular economy business models. However, opportunities exist to alleviate the pressures of these barriers across sectors. Policies will play a vital role in paving the path for a circular economy and a sustainable future.

## Advanced manufacturing

#### Product innovation

Policies can enforce **penalties** on landfilling that can motivate companies to innovate and adopt R-strategies. However, policies limiting the use of certain materials and linear disposal may not be a long-term solution. Instead, they need to create meaningful shifts in the sector by driving **transparency** and **concrete measurement** of value delivered by circular products, which will make competition in the circular space visible and create opportunities to differentiate in the market by providing authenticity to product claims.

#### Infrastructure

Circular economy policies need to implement a **systems-thinking perspective**. Although it may be a challenging and long process to create such system level policies, these are necessary to transition to circular economy in the long term. An aspect where policies can help accelerate circular economy adoption is through **easing regulations for end-of-life infrastructure**. Waste sorting should be a mandatory policy, along with making public infrastructure ready to handle these changes. Regulations make it difficult to transport waste since current regulations do not value waste. For example, the European Union Waste Directive needs to be updated to allow for this. Goods need to be classified as products and waste needs to be handled by waste logistics companies.

#### Internal organizational barriers

Policy interventions can drive **internal awareness and buy-in at all levels**, from leadership to individual employees. This can potentially result in **training and re-/upskilling employees** to support agile product development for circular business transformation. For example, product-as-a-service offering requires influencing and inspiring the employees to challenge conventional thinking and create solutions that compete with conventional linear products. Additionally, policies can drive **innovation**, especially development of industry accepted tools to standardise R-strategy evaluation of solutions.

## Life sciences and chemicals

#### Sourcing and partnerships

As companies in this sector focus key capabilities on the technology and processes to convert raw materials into compounds, the volume and quality are key to the success of their circular offerings. Policy initiatives need to be conducive to lay a solid foundation for **end-of-life infrastructure** as well as support the feedstock ecosystem. Clarity in policy support paves ways to an increased number of suppliers and improved quality of recovered materials, which will help bolster the business case for life sciences and chemicals companies to further investments and commitments to circular solutions.

#### Technological barriers

Circular economy adoption can be accelerated by introducing policies that **incentivise innovation**. The incentive route could potentially work best as they are critical to promote R&D and scaling of circular products. Furthermore, policies can drive awareness and widespread sharing of success stories at scale to promote **internal buy-in** within the industry.

#### Knowledge barriers

Labelling policies will be a particularly effective means to support transitory mechanisms to help customers shift from a linear model to circular models. Additionally, educating the public about circular economy concepts beyond recycling is essential, with the aim to enhance understanding of the benefits and combat misconceptions.

#### Policy barriers

Incorporating additional **technical expertise** in policymaking would help result in more **targeted regulations** that are more conducive to business transformations. The sector is extremely technical and has legacy policies and laws that drive innovation. Therefore, new circular economy focused policies need to co-exist and harmoniously work with the existing nuanced policy landscape.

#### Financial barriers

There is immense scope to increase the sense of responsibility across the value chain by introducing policies such as **Extended Producer Responsibility**, with the expected effect of making the consumer-facing company responsible for the plastic residuals, products and packaging, such that the cost for transformation will be borne equitably. Policies can also help create demand for circular products by slowly **mandating alternate materials and conscious design decisions** to create long-term impact. For example, mandating a % of recycled materials in certain products could potentially help create the necessary traction among chemical companies to scale up technology and production. There is a pressing need for instruments to prepare industry to shift from a linear model to circular. Firstly, **incentives for innovation** and a market pool for circular products could encourage businesses to invest in circular economy practices. Addressing financial risks and providing incentives could facilitate scaling up circular initiatives. Secondly, **accounting and pricing of plastic residues** need to reflect and support circular business transformation. The sector needs frameworks that help stakeholders factor in the cost of reconcentration of plastic residues post-use in decision-making. Finally, there is a need to design and create mechanisms that help **bridge the gap** between different players (e.g., quantifying the contribution to partners’ sustainability targets) to incentivise participation throughout the value chain.

## Renewable energy

#### Financial challenges

The move towards **carbon accounting** and the evolving role of accounting as a service can be essential components for accurate evaluation and measurement of circular endeavours. These emerging trends have the potential to provide companies with the tools and methodologies needed to assess and report the environmental impact of their circular practices, going beyond traditional financial metrics. By integrating circularity metrics into accounting practices, organizations can gain a more comprehensive understanding of the sustainability and efficiency gains achieved through circular initiatives. This, in turn, enables better decision-making, improved transparency, and a clearer demonstration of the environmental benefits of circularity, ultimately driving the adoption of circular economy principles across various industries.

#### Consumer engagement

Effective consumer engagement emerges as a pivotal force in driving circular economy adoption within the sector. As consumer awareness **and demand for eco-friendly products** and services grow, businesses are incentivised to prioritise circular practices. The upcoming circular economy policy in India serves as an example of the need for adaptable, comprehensive policies that align with sustainable consumerism.

#### Leadership buy-in

Policies should strive to create partnerships for **closed-loop value chains**. Circular systems thrive on collaborations that encompass the entire lifecycle. Stakeholders emphasise the need for circular procurement strategy and incentives encouraging sustainable choices to bolster circular economy adoption.

#### Policy related barriers

There is an urgent need for standardisation and harmonisation of policies to pave the way for consistent progress in the circular economy. Furthermore, the role of local-level engagement and strategies is highlighted. Tailoring circular efforts to the specific nuances of each locality enhances the effectiveness of sustainability initiatives. By involving local communities and businesses in the development of circular policies and practices, it becomes possible to address region-specific challenges and opportunities, fostering greater buy-in and success in the transition toward circularity. Therefore, the combination of standardized policies and localized strategies, achieved through stakeholder consultation, holds the key to advancing the circular economy on a global scale.

## Information technology

#### Consumer behaviour and convenience

Policies that drive **consumer awareness** would be the crucial first step to create the demand for circular products in the industry. Furthermore, policies that help simplify the processes for recycling and repurposing products would be critical to drive higher consumer interest and participation within the sector.

#### Policy related barriers

**Global coordination** of policies is deemed crucial for the IT sector's circular transformation, particularly in a global supply chain. The stakeholders stress the need for aligned policies that prevent local or regional regulations from undermining circular initiatives. This coordination is integral to achieving meaningful progress on an international scale. To navigate the challenges and foster circular economy practices in the IT sector, stakeholders offer valuable learnings.

Promoting **consumer engagement** through awareness campaigns and financial incentives is pivotal. Stakeholders acknowledge that financial incentives can catalyse behavioural change, motivating consumers to choose circular options over linear alternatives. The power of procurement strategies and effective product/waste regulations is highlighted. These measures can shape market demand and direct industry practices toward circularity. Public procurement initiatives and stringent regulations can steer the IT sector towards more sustainable choices. The stakeholders emphasised the interconnectedness of circular economy principles with nature and biodiversity. Recognising this synergy is fundamental to achieving holistic sustainability outcomes within the IT sector. Policies driving global standardisation for used parts and remanufactured goods would be critical to drive success within the sector. Governments are urged to create distinct policies for business-to-business and business-to-consumer technologies, considering the unique dynamics of each.

#### Geographical infrastructure

Policies in the IT sector should be finely tuned to address its unique challenges. Facilitating collaboration across the IT value chain is crucial due to the industry's complex global supply chains and rapid technological changes. Additionally, policies must consider geographical variations, such as recycling infrastructure and regulations, which can differ widely across regions. Ultimately, tailored policies that support circularity while accounting for the IT sector's distinctive characteristics are vital to fostering sustainable practices within the industry.

#### Internal organizational barriers

Policies need to engage the entire company on the path to circularity, such as directives around aligning marketing language with circular concepts and addressing challenges in new product development. Additionally, there is scope to emphasise economic benefits to garner internal and external support for circular initiatives. Training marketing teams on circularity and eco-design language can drive alignment and buy-in. Also, having eco-design programs in place could prevent new product innovation efforts from neglecting circularity.

## Textiles and retail

#### Economic

There should be incentives provided to **promote innovation and adoption of circular economy solutions**, which help make a business case that bridge the investments to future profit. Policies can provide financial incentives and grants for textile and retail companies to incorporate circular design principles, such as modular and repairable designs, into their products. Low-interest loans, guarantee, equity, and tax incentives are examples of financial incentives that could be offered to circular SMEs, and retail companies that adopt circular practices and work with suppliers who do so as well. Public investment to further develop existing waste management system would also alleviate the economic barrier by reducing the costs of collection and processing of end-of-cycle products.

#### Converting EOL to end of cycle

Value chain for reverse logistics and processing should be set up in a way that take **transportation** into account, especially for high volume, low value goods. Policies can play a crucial role in the scaling of circular textile and retail through investment and development of recycling, waste management, collection, and sorting. To combat the widespread issue of exporting post-consumer textiles to other countries, local policymakers can help to regionalise a circular economy for textiles by creating incentives for local collection, regional sorting, reuse or recycling. This should start with setting definitions of textile waste and harmonising end-of-waste criteria at regional and national levels to secure constant flow of high quality secondary raw materials. Globally, it is a well-established problem that both mechanical and chemical textile recycling technologies are not mature enough to be cost-effective and economically viable. While these technologies show significant potential, their further development and scalability requires continued policy-driven and financial push from regional and national governments. Policies should establish guidelines restricting the use of non-recyclable blends and non-compliant labels to improve the quality of feedstock. Regarding sorting, there is a specific need for automated solutions to remove hardware and tags from textiles at efficient speed and cost. For example, processing should be set up in a way that take transportation into account, especially for high volume, low value goods. There is great potential in this space for public-private partnerships to leverage the innovation that has already been advanced by various stakeholders in the ecosystem.

#### Business model viability

#### To address the various underlying root causes of this barrier, a mix of policy instruments are needed. Informational campaigns will help engage and educate citizens on the importance of and best ways to extend the lives of consumer products and tackle the misinformation around the inferior quality of products designed for R-strategies or are remanufactured or recycled. Awareness building translate to potential willingness among consumers to switch to circular alternatives. Further, incentives for businesses to provide better access to consumers to be actionable on this information is crucial. Financial incentives can be provided in the form of investments in research and development in sustainable materials and manufacturing techniques, such that circularity is not achieved at the expense of significant compromise on quality or performance.

#### Harmonised regulations and policy

**Extended Producer Responsibility** system across geographies should be harmonised, making it easier for companies to comply with. There should be sensible, aligned, and harmonised policies across borders to address the global issue, such that all entities around the world have the same guiderail for smooth trade and compliance. Existing circular economy related regulations should be **depoliticised** to accelerate the transition. Updates to the **trade code** (HS code) to include more specific and granular definition around EOL products to facilitate and incentivise cross-border movement in the reverse logistics value chain, potentially with considerations of end-use as a criterion, or with the creation of specific category that exempts the declaration on certain information. Channels of communications also need to be established for all sub-sectors such that policies remain just and applicable across different types of products. On the retailer’s side, they can serve as an **information sharing platform** to help educate large numbers of vendors on compliance requirements. Finally, there should be more interconnected, **cohesive performance measurement system** so that CE solutions are not penalised and companies can better set targets and measure progress towards those targets.

# Annex

## Summary of literature review

This section summarizes the literature review on key challenges that companies encounter when striving to implement circular economy principles. The transition towards a circular economy offers numerous environmental and economic benefits, but it also presents companies with a series of complex challenges. By understanding and addressing these barriers, companies can navigate the path toward sustainable and circular practices more effectively. Some of these barriers include – **organizational, cross-value chain, financial, technological, political, social, infrastructure.**

#### Financial Barriers:

**High initial investment costs:** Transitioning to a circular economy demands substantial initial investments to establish collection and sorting infrastructure, in innovative technologies that enable repair, reuse, refill, or other circular loops. More specifically, there is a disconnect between who is responsible to own these costs and who is positioned to make the investment between government and private sector actors. These costs often pose a formidable barrier, particularly for companies operating under tight budgets or who focus exclusively on quarterly and immediate financial gains. While the upfront expenditures may seem daunting, it's crucial to recognize that these investments lay the foundation for circular enablement to be possible and provide long-term benefits for all of society including reduced resource consumption, reduced waste, and operational resilience which has bottom line implications for all parties once established.

**Longer Return on Investment (ROI) periods:** Circular initiatives often yield longer-term returns on investment (ROI) compared to traditional linear practices that focus on quarterly or annual performance metrics.

#### Technological Barriers:

**Inefficient recycling technologies:** Circular practices may necessitate innovative technologies for material recovery, recycling, and remanufacturing, which might not be readily available or feasible for some companies. Incorporating innovative technologies to enable circular practices is a critical challenge. Many existing recycling technologies are not advanced enough to efficiently process and recover materials from waste streams. This includes challenges in separating and purifying materials, especially complex or mixed-material products. Traditional mechanical recycling struggles with complex materials like multilayer plastics used in packaging, making it less effective in recovering high-value components.

**Limited technological innovation for new materials:** Developing new materials that are easily recyclable or biodegradable is a key challenge. This includes finding alternatives to conventional plastics and other materials that are currently challenging to recycle. For example, the development of fully biodegradable packaging materials that still maintain performance characteristics is an ongoing challenge in sustainable packaging solutions.

**Technological solutions for hazardous materials:** Hazardous materials, such as certain chemicals and electronic components, pose significant challenges for recycling. Developing safe and efficient methods for handling and recycling these materials is critical. For example, Recycling end-of-life electronics involves safely handling and recovering hazardous materials like lead, cadmium, and mercury, which require specialized processes.

#### Organizational Barriers:

**Risk aversion:** Companies are hesitant to adopt circular practices due to uncertainties or perceived risks associated with changing established business models. Implementing circular practices introduces a range of new risks that companies must effectively manage. For example, organizations may face the risks of lack of consumers acceptance of CE products and the uncertainties regarding the size of the market for innovative products. Other risk factors can vary from profitability, supply chain management, quality of circular economy products and etc.

**Fragmented supply chains:** A lack of integration and collaboration across the supply chain can hinder the efficient flow of materials, making it more challenging to close loops and prevent waste. In today's interconnected global landscape, adopting circular practices requires navigating intricate supply chains encompassing various suppliers, partners, and stakeholders. This complexity amplifies the challenge of ensuring seamless collaboration and communication throughout the circular product lifecycle.

**Material quality barrier:** Maintaining consistent quality of recycled materials is pivotal for the success of circular initiatives. Variability in recycled inputs can impact the performance and durability of circular products. Material quality barriers have several components: difficulty reclaiming materials without contamination due to lack of infrastructure to facilitate clean collection, sorting; lack of technology to make this infrastructure possible, and lack of volume in collecting back materials at a high enough volume to be economically viable as a feedstock for R-strategy loops.

#### Political Barriers:

**Regulatory and policy Barriers:** Eco-friendly waste management plays a pivotal role in the circular economy, starting with the grassroots level of an economy - local governance. Unsupportive regulatory systems and lack of policy coherence, particularly across waste management and recycling can hinder the implementation of circular economy. For example, existing regulations may not align with circular economy principles, and companies may face obstacles related to waste management, product design, and extended producer responsibility. Navigating the dynamic landscape of evolving waste management and sustainability regulations poses a considerable challenge for companies venturing into circular practices. The ambiguity surrounding future policies can hinder decision-making and strategic planning.

**Different environmental standards:** there are different environmental standards among the world and therefore it’s really hard for governments/ companies to differentiate between “good” and “bad” waste. Additionally, companies operating in regions with varying standards may struggle to manage resources efficiently. For example, materials that meet one region's standards may not be suitable for use in another, creating logistical and sourcing challenges.

#### Social Barriers:

**Consumer behavior:** Shifting consumer behavior from a linear consumption mindset to embracing circular products presents a multifaceted challenge. Consumers often prioritize low prices and convenience over sustainable options. Products designed for disposability tend to be cheaper and more readily available, making them more appealing to many consumers. This can deter the adoption of products or services that are more sustainable but may come with a higher initial cost or require additional effort to access or maintain. Moreover, there may be a cultural or social stigma associated with second-hand or refurbished products in some regions or communities. This perception can discourage individuals from embracing these options, even if they are economically and environmentally viable.

**Lack of awareness and understanding:** Many businesses may not fully comprehend the circular economy concept and its potential benefits, hindering their motivation to adopt new practices. Reuse, a cornerstone of the circular economy, has yet to be fully embraced in many industries. In sectors like fashion and textiles, consumers remain hesitant about reusing clothing due to lingering stereotypes about used materials being 'unclean.' The growth of the influencer industry has led to substantial expansion in the textile and fashion sectors, but the concept of clothing reusability has not been adequately communicated. Industries lag in conducting market analyses to identify new emerging trends and opportunities, as the old "profit-profit-profit" model becomes less viable. Considerable research is underway to develop compostable or biodegradable clothing materials. Companies must undertake comprehensive market analyses to grasp the evolving business models and consumer attitudes toward these changes.

#### Infrastructure Barriers:

**Availability of recycled Materials:** Companies reliant on recycled materials may face challenges in sourcing high-quality, consistent recycled inputs for their production processes. In regions where recycling rates are low, the volume of recycled materials available for use in manufacturing or production processes is limited. This can lead to a dependence on virgin materials, undermining the principles of a circular economy.

**Limited scalability:** Some circular practices might work well on a small scale but struggle to be scaled up to meet the demands of larger markets. As successful circular initiatives expand, companies encounter unique challenges during the scaling process. These may include maintaining product quality, ensuring consistent material supply, and accommodating increased demand.

**Lack of infrastructure:** Inadequate or outdated recycling facilities can impede the efficient processing and sorting of recyclable materials. This can result in lower recycling rates and hinder the closed-loop system essential to a circular economy. Effective collection systems are also crucial for gathering used products and materials for recycling or repurposing. In regions with inadequate collection infrastructure, valuable resources may end up in landfills or incineration facilities.

## Analysis - Commonalities across all sectors

Across the sectors, stakeholders are challenged with cross-value chain collaboration, financial, infrastructure, organizational, political, social, and technological barriers.

**Cross-value chain collaboration barriers:**

* **Perception:** In some industries, a wide acceptance of circular economy is lagging. Misperceptions persist among brand-owners that centre on the quality of circularity, especially remanufactured, or recycled products. From upstream stakeholders' perspective, a lack of supply of cost sharing from downstream buyers hinders the profitability of new circular product offerings.
* **Data:**Under the traditional linear model, companies do not have ownership over the materials once sold, and therefore have limited power to track the materials for reverse logistics. As post-sale products scatter, the decentralised, fragmented recovery system ceases to provide sufficient data for upstream designers and producers to efficiently plan for circular supplies. Value-chain wide efforts are needed to improve data availability and quality, enabling better integration of circular materials into the current supply chain management practice.

**Financial barriers:**

* **Premium:** Circular materials often come with a premium due to the high cost of reprocessing and limited supply while operating in a primarily linear model. Stakeholders shared examples where the cost of processing used products for resale surpass the cost of producing all-new products. For some specific materials that could be used in multiple sectors such as recycled PET, competition over the materials further drives up the price. The additional costs associated with circular materials disincentivise many from switching from linear models to circular alternatives.
* **Upfront investment:** Research and development (R&D) for circular technologies and processes often requires large up-front investment, which can be costly and risky. The investment hurdle limits circular innovation at-scale to large corporations with commitment and strategic priorities in circular economy. Stakeholders observe a lack of government incentives and dedicated circular funds, which could catalyse more investment towards circular innovations.

**Infrastructure barriers:**

* **Reverse logistics:** Capacity constraints exist throughout the reverse supply chain: from take-back collection points, to sorting, disassembly and remanufacturing and recycling facilities, limiting the supply of recycled materials.

**Organizational barriers:**

* **Internal buy-in and coordination:** As the transition to circular business models often requires various functions to work together, stakeholders sometimes come across internal difficulties that decelerate the process. Processes may need updates to cater to a circular system, which requires savvy liaisons to help execute from an idea to the realization of actual products or services.
* **Dependency on new partners:** For most companies tapping into recovered materials, they often look beyond the corporate boundary to seek partners with complimentary capabilities to implement the changes for capabilities. Circular solutions, as an emerging concept, is often led by small enterprises that spearhead innovations. Putting trust on a new partner in a strategic programme is seen as a challenge. Fortunately, many stakeholders have seen fruitful collaborations where they grew together with their new-found partners.
* **Supply chain challenges:** Supply chain management needs significant adjustments to accommodate current circular materials and products, which could be challenging when strict KPIs and targets are in place. For example, the number of circular material suppliers that meet the quantity and quality requirements may be much fewer than that of traditional material suppliers, which translates into higher supply chain risks. In addition, due to the limitation in supply, lead time and cost of transportation might increase, which is also against the conventional good practices.

**Political barriers:**

* **Accounting frameworks:** Unlike the more mature topics such as climate change and greenhouse gas accounting, there is a lack of harmonized accounting framework for circular economy metrics within some sectors or across sectors. This missing infrastructure limits stakeholders' ability to compare among peers and recognitions for leading practices.
* **Connection between frameworks:** The existing circular economy frameworks are not fully connected with the other commonly used ESG frameworks. For instance, substituting virgin plastics for paper packaging boosts some circularity indicators, but can have a negative impact on the company's GHG footprint. Trade-offs like this curtail the motivation for companies to introduce some circular solutions if other topics like nature and climate are of higher priority.
* **Broad policies:** Within sectors, some stakeholders believe most industry-specific regulations are still too broad. For example, in the IT sector, low-volume, high-value products and mass-market, low-value consumer products have very different considerations in design and end-of-life recovery. Plastics regulations, as another example, focus on the reduction of single-use plastics, which could disadvantage specialty products or other circular strategies like design-for-durability.
* **Trade codes and regulations:** The most cited challenge from a policy lens is the lack of updates in trade regulations to accommodate reverse logistics. Post-used materials can be treated as waste in jurisdictions in the existing code system and are thus often subject to bans for import/export. In addition to the classification issue, trade declarations also require data points such as value and origin. In the absence of formalized guidance and instructions for post-use materials, these declarations could lead to compliance risk for companies moving post-use materials across borders.
* **Unharmonized regulations:** For companies that conduct business internationally, another huge barrier is the complexity and heterogeneity of regulations around circularity across geographies. While many companies support EPR schemes, in many cases, they are designed differently from jurisdiction to jurisdiction, creating a fragmented regulatory landscape for companies to navigate. The lack of a harmonized approach in legislation poses challenges, resource, and cost burdens for companies' compliance functions. This can also introduce further supply chain risks if overseas enterprises are integral in the supplier network.

**Social barriers:**

* **Post-use disposal:** Effective recovery of post-use materials for resale, refurbishment, remanufacturing or recycling starts with design, but involves end-users. For existing channels such as municipal waste management systems and brand-driven take-back schemes, stakeholders observe contaminations in the stream as end-users do not sufficiently segregate at source, often due to a lack of access for effective participation. This leads to contaminated material streams that exacerbate the complexity and costliness of the recovery processes. When developing new reverse logistic channels such as collection points, there must be a focus on providing consumers with consistent, easy to access, and easy to use entry points to participate in the circular economy.
* **Information on post-use return:** Information on reverse logistics is not well provided to end-users. Consumers may not know how to properly dispose of materials post-use due to the lack of simple, informative, and practical instructions on the labels. Consumers may also be unaware of take-back programmes or collection points for drop-offs.
* **Consumption behaviours and perceptions:** A culture of consumerism still prevails. Consumers attach symbolism and sentiments to things and may be reluctant to forego ownership in the transition to circular business models. Misperceptions such as the quality concerns around refurbished or recycled goods and materials have a negative impact on the demand of circular offerings, whereas consumer activism and demand could be a catalyst in promoting the circular transition.

**Technological barriers:**

* **Hard-to-recycle materials:** Existing recycling facilities focus on a handful of materials. For traditionally hard-to-recycle materials, innovations are at different stages with varying potential for scaling. As such, many stakeholders are challenged with limited options in substituting with recycled materials without completely revamping their product offerings. Investment in technology innovation and upscaling is essential.
* **Material properties:** Some circular materials are economically viable to be produced at scale, however, they may be disadvantaged in terms of technical and esthetic properties. Design-for-circularity sometimes also entails trade-offs between functionality or durability against circularity. For example, recycled plastics often do not appear to be as clear as their virgin alternatives; limited dyes can be added if a product is designed to be recovered in a closed loop. Further technological advancements may help create circular materials or designs that do not require such trade-up, thus eliminating the barrier for designers and brand-owners to make the switch.

**Instructions:**

1. **Font style (all text) - Arial**
	1. Heading Level 1 – Font size – 14
	2. Heading Level 2 – Font size – 13
	3. Heading Level 3 – Font size – 12
	4. Normal text – Font size - 10
2. **Main text:**
	1. Only include information that needs to be in the document 90% probability
	2. If there is any additional information that needs confirmation, put it in the comment section and review it with lead sector managers
3. **References:**
	1. References to be added as endnote
4. **Survey results:**
	1. Survey results are due by August 18, we will review as a team and take the next steps
5. **Images:**
	1. Flag if there are any images that we need to include
6. **Timeline (Overall timeline – first draft to be completed by August 31)**
	1. Section 4.1 – completed by August 14 EOD, Managers will review by August 15 noon, and revisions incorporated by August 15 EOD
	2. Section 2,3, and 4.2 – completed by August 18 EOD, Managers will review by August 21 noon, and revisions incorporated by August 21 EOD
	3. Section 5 – completed by August 24 EOD, Managers will review by August 25 noon, and revisions incorporated by August 25 EOD
	4. Section 1 – completed by August 30 EOD, Managers will review by August 31 noon, and revisions incorporated by August 31 EOD
	5. Ready for leadership review by August 31
7. **Pointers:**
	1. It will be an iterative process
	2. Remember your Oxford commas!
	3. Reach out to me if you think brainstorming sessions will be helpful in certain sections
	4. Well-begun task is half done! 😊
8. **Risks:**

For team to discuss

# References

1. https://unfccc.int/blog/what-is-the-triple-planetary-crisis [↑](#endnote-ref-2)
2. <https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview> [↑](#endnote-ref-3)
3. https://greenly.earth/en-us/blog/company-guide/circular-economy-definition- and-principles [↑](#endnote-ref-4)
4. https://enb.iisd.org/articles/basel-convention [↑](#endnote-ref-5)
5. https://www.nature.com/articles/s41467-023-38613-3 [↑](#endnote-ref-6)
6. https://cefic.org/app/uploads/2022/01/FactsFigures\_Leaflet-1.pdf [↑](#endnote-ref-7)
7. [End-of-life management Solar Photovoltaic Panels (irena.org)](https://www.irena.org/publications/2016/Jun/End-of-life-management-Solar-Photovoltaic-Panels) [↑](#endnote-ref-8)
8. https://www.indystar.com/story/news/environment/2021/03/23/how-to-keep-solar-panels-and-wind-turbines-out-landfills/6875966002/ [↑](#endnote-ref-9)
9. [The world’s e-waste is a huge problem. It’s also a golden opportunity | World Economic Forum (weforum.org)](https://www.weforum.org/agenda/2019/01/how-a-circular-approach-can-turn-e-waste-into-a-golden-opportunity/)
https://www.indystar.com/story/news/environment/2021/03/23/how-to-keep-solar-panels-and-wind-turbines-out-landfills/6875966002/ [↑](#endnote-ref-10)
10. https://www.reuters.com/sustainability/climate-energy/resale-is-all-rage-fashion-brands-not-making-dent-unsustainable-levels-waste-2023-08-09/ [↑](#endnote-ref-11)
11. <https://www.europarl.europa.eu/news/en/headlines/society/20201208STO93327/the-impact-of-textile-production-and-waste-on-the-environment-infographics>

i [Hazard rate models for core return modeling in auto parts remanufacturing - ScienceDirect](https://www.sciencedirect.com/science/article/abs/pii/S0925527316301384)

Weavabel identifies consumer attitudes and trends, cost and lack of transparency as the key barriers to creating a CE – See blog 07/02/2022 [What Are the Drivers and Barriers to a Circular Economy? (weavabel.com)](https://www.weavabel.com/blog/what-are-the-drivers-and-barriers-to-a-circular-economy)

Jana Vrzel, How to Overcome the Most Common External and Internal Business Barriers to Circular Economy, 4 November 2022 - [How to Overcome the Most Common External and Internal Business Barriers to Circular Economy (circularinnovationlab.com)](https://www.circularinnovationlab.com/post/how-to-overcome-the-most-common-external-and-internal-business-barriers-to-circular-economy)

Xiii <https://doi.org/10.1016/j.jclepro.2022.135568>

XIV https://www.oecd-ilibrary.org/docserver/6ab6bb39-en.pdf?expires=1695666783&id=id&accname=guest&checksum=8BAD20E45AF9405E9B927CFEE7420521 [↑](#endnote-ref-12)