Putting the circular economy into motion

From barriers to opportunities

ICC

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1. Introduction

The circular economy imagines a world without waste in which resources circulate indefinitely, maximising resource efficiency and minimising environmental impact by promoting continuous use, reuse and recycling of materials and products.

While the circular economy has the potential to drive sustainability at scale and contribute significantly to turning the tide on the triple planetary crisis[1] that humanity is facing today, the transition to circular business models has been slow and not at the expected scale. Currently, the world is estimated to be only 7.2% circular – a decrease from 9.1% over the past five years, due primarily to increasing virgin material extraction.[2]

Yet there is growing interest in the circular economy among businesses across all sectors that recognise the social, economic and financial benefits of a circular approach. For companies manufacturing consumer-related goods, there is the added pressure of consumer expectations for "green" products. These companies see the tremendous opportunities of the circular economy but also a fundamental challenge: the growth of a circular economy for consumer-related goods depends on the creation of a market shift and demand for secondary sourced materials. Today, this shift is being impeded by many barriers, ranging from regulatory challenges to consumer behaviour.

This report looks at the policy and regulatory, technological, infrastructure, financial, organisational and social barriers that companies manufacturing consumer-related goods face when adopting or scaling circular economy approaches and presents actionable avenues for policymakers and businesses to overcome them.

Given the key role of international trade in enabling a circular economy, this report concludes with recommendations for actions that can be taken at the World Trade Organization.

The research methodology employed a combination of literature review, stakeholder interviews and surveys of industries, including manufacturing, renewables, information communication technology (ICT) or information technology (IT) or high-tech, chemicals and life sciences, and textiles *(detailed information in Annex)*.

1 What is the Triple Planetary Crisis? | UNFCCC

2 Circularity Gap Reporting Initiative. (2023). Circularity Gap Report 2023. Available at: www.circularity-gap.world/ (Accessed: 21 December 2023).

2. Background on the circular economy

There is currently no universal definition for the circular economy. However, in this report, circular economy is understood as an economic model that aims to maximise the economic value of materials by optimising resource efficiency and promoting longer use, reuse and recycling.

At the same time, the model minimises environmental impact by extending the lifespan of raw materials and products throughout their usable lifetime through different "R-strategies" including reuse, repair, refurbishment, remanufacturing, recycling, and reduction of materials and products. It is a systemic approach that transforms the way economies currently operate by decoupling economic activity from the consumption of finite resources.

Unlike the traditional linear economy, which follows a "take-make-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. The circular model creates value by simultaneously enabling economic growth and positive ecological impacts. Ultimately, the circular economy is a transformative process that reimagines and redesigns social and business interactions.

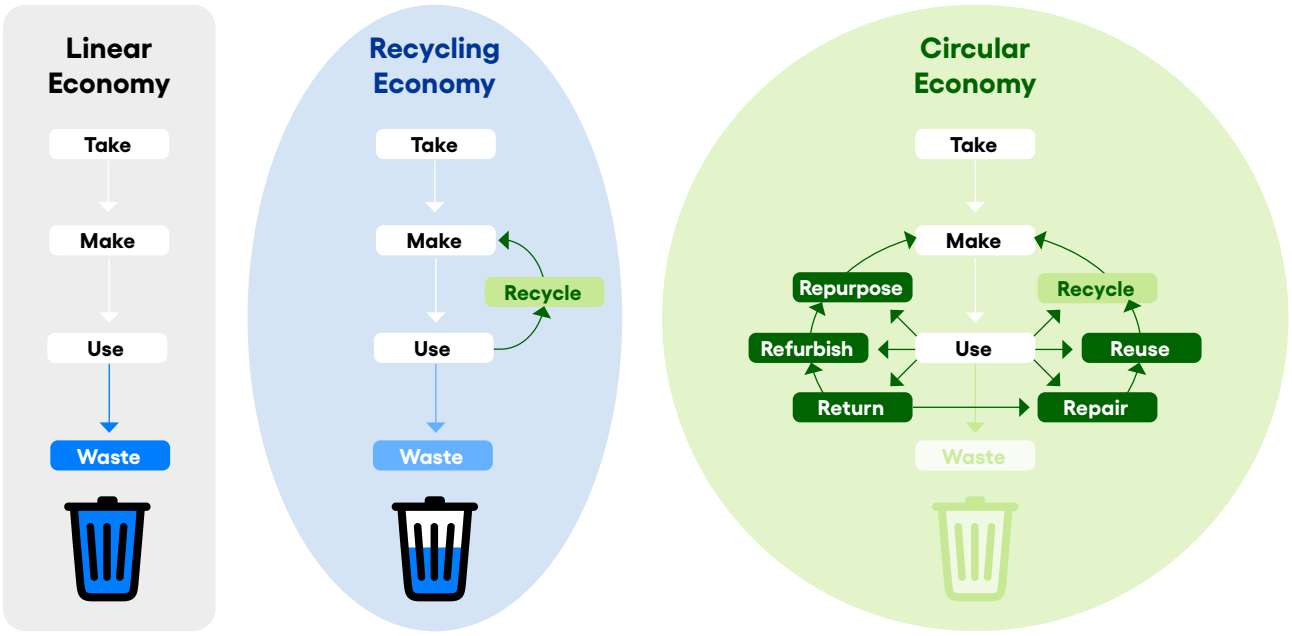


Figure 1:Transition from a linear to a circular economy (Source: ICC)

According to the Ellen MacArthur Foundation[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, raw materials are extracted or taken from Earth and products are made out of them. Eventually, these linear products and materials are thrown away as waste.

2. **Circulate products and materials at their highest value:** Circulating products and materials at their highest value means keeping materials in use, either as a product or, when they can no

3 Ellen MacArthur Foundation. (n.d.). What is a Circular Economy?. Available at: www.ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview (Accessed: 4 January 2024).

longer be used, as components or raw materials. This way, resources are kept in circulation, nothing becomes waste, and the intrinsic value of products and materials is retained.

3. **Regenerate nature:** By moving from a take-make-use-waste linear economy to a circular economy, natural processes are supported, and nature can thrive.

In academic circles, there are discussions and emerging scholarship regarding the need to also focus on resource efficiency and to include a detoxification step, both of which are seen as equally critical to the success of a circular economy.[4] Without these, the amount of unwanted substances in recirculated materials will continue to increase for decades. Advocates for a resource-efficient and detoxification approach have noted that a circular system requires materials and energy to drive the process and the more circularity is adopted, the more resources are needed. Moreover, 100% circularity is not realistic or feasible. For example, it is not possible to recover 100% of a car tire – parts of it become dust particles during use or are lost on the road. In short, this emerging approach is based on a recognition of the following considerations:

- **Resources for circular processes:** The circularity of products throughout their lifecycle from production through to reuse and recycling is resource-intensive, and requires material and energy inputs.
- **Resource losses:** The use of a product inevitably results in losses of materials and energy.
- **Practical challenges:** It is resource-intensive to collect and process every atom of materials, such as in the example of tires, making it impractical to achieve 100% reuse.
- **Optimisation:** The goal is to find an optimal point where the benefits of recycling and reuse outweigh the costs, aiming for the highest level of circularity that is practically achievable**.**
- **Business models:** Developing innovative business models is crucial for moving towards greater circularity. These models should incentivise the reduction of resource use and support the integration of circular principles into product lifecycles by making products easier to reuse and collect while optimising handling, reprocessing and transportation.

The diagram below shows how material flows would occur in a resource-efficient circular economy:

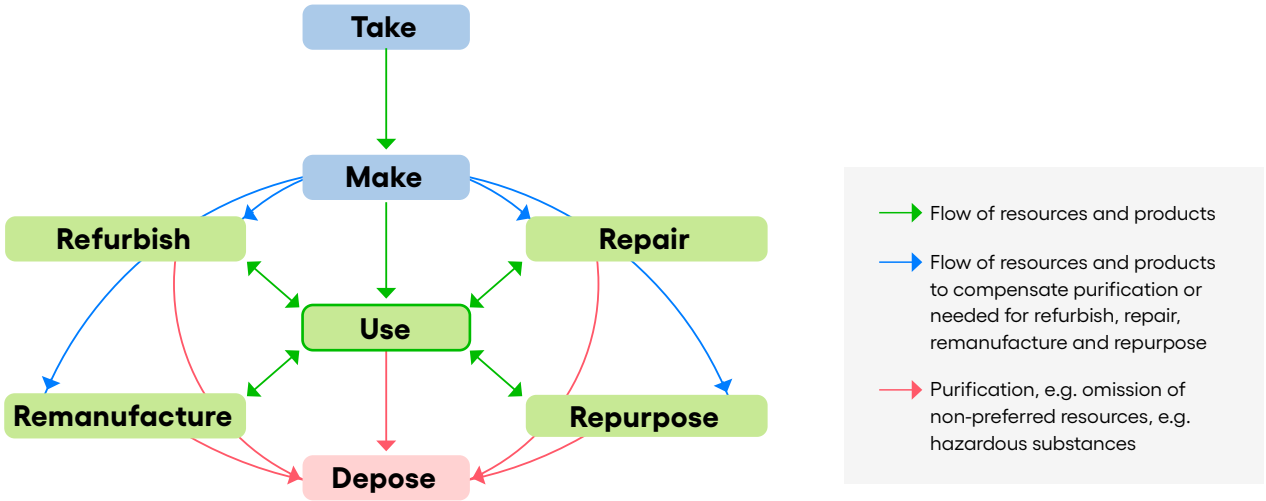


Figure 2: Resource flows in a circular economy[5] (Source: ICC)

4 Lindahl, M. and Dalhammar, C. (2022). The Circular Economy: towards a new business paradigm with support from public policy. Stockholm+50 background paper series. Stockholm Environment Institute.

5 Developed by Mattias Lindahl, Professor in EcoDesign and Ph.D. in Machine Design, Linköping University for the purposes of this report.

To become circular in practice, companies are currently employing different strategies to transform their current linear way of operating as set out in the following table:

Strategies	Explanation
Biomimicry and renewable energy	By emulating natural systems and using renewable energy sources, processes can be powered or improved, reducing their environmental impact.
Design for circularity	Products and packaging are designed with circular materials, including recycled, recovered, or renewable materials, and with durability, repairability, adaptability, reusability, and recirculation of inputs in mind. As a result, product lifespans are extended, fewer materials are used along supply chains, and environmental impacts are minimised.
Digitalisation	Digital technologies can be used to optimise processes, track materials, and create new business models that support circular practices.
Innovation	Adopting new ideas, approaches, and technologies to redesign products and processes can drive circular economy and enable new business models. Innovative technologies and methods are key to improve all "R-strategies" – repair, reuse, remanufacturing, refurbishment and recycling.
Recycling and recovery	Materials from products at the end of their life cycle are recovered and reused or recycled into products or materials, reducing the demand for virgin resources.
Remanufacturing	"End-of-life" products are returned to original quality and performance specifications using a combination of salvaged core and new parts in a manufacturing environment. During the remanufacturing process, a product is disassembled to its smallest individual components and then cleaned and inspected and remanufactured before being reassembled into a like new product. The remanufactured product meets Original Equipment Manufacturer (OEM) quality and performance specifications with an identical life-span expectation and is accompanied by the same warranty as a newly manufactured item.
Resource efficiency	Resource efficiency means minimising resource use and the use of virgin material at the source through more efficient and thoughtful product design and manufacturing processes, and optimising resource reuse and recycling. Through improved production processes, resources can be used more efficiently. The respective business model also impacts resource efficiency through the way an organisation creates, delivers, and captures value and how in case of products, how they are brought to the market. For example, improving the design of packaging to be as minimal as possible and/or with the option to be reused, results in improved resource efficiency.
Resource sharing	Collaborative consumption models enable multiple users to use the same resource over time, such as sharing services, renting, or leasing of products.
Reuse	Products (including products recovered from returns, take-back programmes or leases), parts and/or components are refurbished, repaired, remanufactured, or treated to be "as good as new" or "like-new", minimising waste, conserving resources and keeping products in use for longer.
Systemic change	A systemic change includes both structural and behavioural transformations for shifting from a linear to a circular business model. It requires collaboration among businesses, governments, consumers, and other stakeholders to reshape production, consumption, and waste management practices.

Figure 3: Key strategies for a circular economy (Source: ICC)

By applying the above-mentioned circular economy strategies, businesses have the potential to not only reduce "waste" and social and environmental harm but also to foster innovation and create new business opportunities, access new markets, and spur job creation and economic growth.

3. Barriers to circular economy

Across sectors, businesses seeking to put in place circular economy approaches face policy, regulatory, technology, infrastructure, financial, organisational, and social barriers. The main barriers are set out in the following table:

Policy and regulatory	Technology	Infrastructure	Financial	Organisational	Social
Lack of harmonised and standardised regulations	Lack of innovative recycling technology	Reverse logistics	Additional premium	Internal buy-in and coordination	Contamination of waste streams
Lack of updates to customs classifications and regulations	Lack of traceability and data	Trade system designed for linear economy	Upfront investment	Data availability	Lack of information on post-use return
Challenges due to the Basel Convention	Trade-offs between functionality or durability against circularity	Geographical infrastructure	Accounting practices	Employee education and perception	Consumer behaviour and perception
Broad policies	Quality standards and aesthetic barriers		Impact on near-term bottom line	Competition and quality trade-offs	
	Perceived requirements				

High impact
Medium impact
Low impact

Figure 4: Overview of barriers to transitioning to a circular economy (Source: ICC)

Source:

Note: Surveyed industries included manufacturing, renewables, information communication technology, chemicals and life sciences, retail including textiles. Big material streams such as construction sector or agriculture, forestry and other land use (AFOLU) are excluded.

3.1 Policy and regulatory barriers

Lack of harmonised and standardised regulations: Governments across the world have enacted different and often inconsistent environmental regulations. As a result, it can be difficult for both governments and companies to differentiate between resources that can be reused, recovered, repaired, repurposed, refurbished or remanufactured, and those that need to be recycled or otherwise disposed of. Illustrative examples include:

- Some countries view all used goods as waste and apply import prohibitions or varying restrictions on remanufactured, refurbished, like-new goods or their parts or assign ownership of the "used" product to the relevant municipality, limiting companies' ability to extend product lifecycles.

Trade barriers to imports: Cross-border shipping of remanufactured goods in the ICT sector

There are specific challenges when importing remanufactured ICT goods in many countries across the world.

Whilst many countries outright ban the import of remanufactured goods on the grounds that they are not new, those countries that do allow them often require an import license for ICT products. The process to obtain an import license can often be lengthy and complex. The first step is to figure out each country's process and regulatory requirements, which vary country by country. Once an import license application is submitted, usually to the department of trade or commerce, it can take many weeks for the application to be approved.

- Extended Producer Responsibility (EPR) schemes and Right to Repair schemes in many cases are designed differently from jurisdiction to jurisdiction.
- End-of-waste criteria determine what is needed for products and materials once classified as waste to re-enter the value chain. They are currently not harmonised across jurisdictions. For example, when materials are extracted from waste and are detoxified for further use, it can be "waste" in one country, while it is not considered "waste" in another country. This complicates their cross-border movement and limits the market demand from manufacturing companies for secondary materials. There is a need to harmonise the criteria across countries. It is particularly important when it comes to raw materials and natural resources that are otherwise extracted from (finite) virgin sources.

This fragmented regulatory landscape is difficult for companies to navigate and drives up compliance and operational costs. As a result, companies struggle to manage their resources efficiently and face logistical and sourcing challenges and impediments when moving circular goods across borders.

Most countries with restrictions on used goods do not reference "remanufactured" in their regulations. This gap is due in part to the lack of a global standard or universal definition of "remanufactured", which would allow regulators to determine the exact status of the goods and to provide provision for those in domestic regulations.

Currently, the term "used goods" is interpreted as "not new". As a result, remanufactured ICT products are treated by Customs authorities as used or end-of-life at the border even though they are like new.

The lack of a global standard definition affects the ability for businesses in the ICT sector and many other sectors to enable a circular economy. A global standard definition of "remanufactured" would let authorities in countries with restrictions reconsider and align their rules for allowing remanufactured goods to enter the country.

If this was achieved and by moving from a linear economy to a circular economy, industry could better achieve the maximum use of resources, reducing the need to use new raw materials, avoiding waste, and increasing the lifecycle of products. Enabling remanufactured goods to move across borders is a key component for a circular economy and will ease the ability of industry to reach economic and environmental sustainability targets.

Lack of common definitions for circular economy strategies: Because regulations and laws often only focus on a single circularity principle, such as repairability or recycled content, and these are enacted by government agencies working in silos, there are no clear definitions of key circular economy terms. Moreover, these vary from jurisdiction to jurisdiction. This piecemeal approach leads to inconsistent and unpredictable enforcement of circular economy principles by various government authorities. For example, the definition of "reuse" in one jurisdiction might solely focus on product parts, whereas in another regulations governing repair may not recognise reuse services that exist as part of end-of-life management regulations.

There are no global 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". Companies spend significant time reviewing the applicability of differing domestic standards to circularity. Without a global industry standard, the manufacturer is left to self-determine a product's lifetime and risk the timeframe being perceived as planned obsolescence.

Lack of updates to customs classification codes and regulations: Customs regulations have been drafted for a linear economy and have not yet been updated to accommodate reverse

logistics, which are key to a circular economy. Under current Customs regulations, materials that have completed their initial purpose and are ready for remanufacturing, refurbishment, or recycling, can only be classified as "waste" under the current version of the Harmonized System (HS) for the classification of goods and are thus often subject to bans or restrictions on import/export. This has a direct adverse and restrictive impact on many circular economy goods ranging from used clothing to components for conversion to recycle centres. Moreover, at the international six-digit HS level, the codes are not granular or expandable enough to add unique HS codes for each stage of a product's lifecycle. This means that when goods such as a used pair of shoes are being shipped to be resold directly or processed into new feedstock, domestic tariff rates will be assessed using the same tariff as for a new product since that is the closest item in the HS code available despite the company not being able to charge the price of a new product. Thus, companies may incur losses when selling used products due to being obliged to pay higher duties, which hinders their participation in the resale economy.

In addition, there are ongoing related technical discussions on customs valuation and origin determinations related to, for example, remanufactured, refurbished, or like-new goods. At this time, there is not sufficient formalised guidance and/or instructions regarding these aspects for post-use materials, exposing companies to compliance risks, increased costs, and subjective assessments by customs authorities. Indeed, current customs valuation guidelines do not adequately reflect that "waste" products often have no value or that the customer pays the company to take this "waste". The lack of guidelines on the customs value to be declared for reusable goods results in the application of customs duty rates that are not aligned with the actual value of the materials. In other words, a business may be charged more to enact circularity than it gains from participating.

Challenges due to the Basel Convention: The Basel Convention, established in 1989 as the pivotal international treaty governing the control of transboundary movements and disposal of hazardous wastes, aims to limit the cross-border movement of hazardous waste. It was specifically designed to prevent the transfer of hazardous waste from developed to less developed countries. However, while well-intentioned, the Basel Convention was not designed to take into account the evolution of circular economy policies and innovative developments in technology. It has created barriers to the development of reverse logistics programmes, impeding goods and recoverable materials from moving back to sellers and manufacturers, which is crucial to a circular economy. Key barriers include:

- **Absence of distinction between 'shipped for disposal' and 'shipped for recovery and/or recycling':** Disposal under the Basel Convention means any operation specified in Annex IV of the Convention without distinguishing between landfilling, recovery and recycling. The failure to differentiate between 'shipped for disposal' and 'shipped for recovery and/or recycling' waste under the Basel Convention has resulted in unnecessary restrictions on the transboundary movement of products and materials for recovery and/or recycling. As a result, companies have less access to secondary raw materials, which are necessary for circular economy systems to function. There is an ensuing debate among policymakers regarding whether the special characteristics of recyclable "waste" could justify the adoption of less stringent rules to facilitate their movement or if this would encourage fake recycling schemes.
- **Absence of classifying hazardous and non-hazardous waste characteristics:** The Basel Convention's system of classifying hazardous wastes and hazardous characteristics is

overly broad, covering a disproportionate range of substances. One of the key problems with the efficient implementation of the Basel Convention concerns the use of Annex III, which lists hazardous characteristics. Also, there is a lack of criteria to define some characteristics, especially for the last four classes in the list (H10–H13). For similar reasons, there are difficulties with the application of some of the categories of wastes listed in Annex I (e.g., Y18: 'residues arising from industrial waste disposal operations').

- **Inefficient procedures for authorising cross-border movement:** For materials classified as waste but that may be reused or recoverable, the Prior Informed Consent (PIC) procedure set out under the Basel Convention is often slow, cumbersome, and unpredictable. The costs and delays associated with PIC are a key factor contributing to the significant cost disparities of circular versus linear economy models.
- **Failure by the United States to ratify the Basel Convention:** Whilst a signatory, the United States has not ratified the Basel Convention because it does not have sufficient domestic statutory authority to implement all its provisions. This poses an additional challenge to the transboundary movement of waste since US companies, which amount to a large share of the market, do not always have easy access to secondary raw materials in the international market.

Broad policies: Policymakers often do not have access to the technical expertise required to draft more granular and enabling legislation. Current regulations are often overly broad, thus making them difficult to implement and limiting the potential of some circular solutions. For example, in the IT sector, the design and end-of-life recovery of low-volume, high-value products differ considerably from those of mass-market, low-value consumer products, but regulations often do not take these differences into account. Broad policymaking may also force companies to choose between durability and sustainability. For example, there are many different types and sources of plastic, but goods using circular plastic that are extremely durable, even almost indestructible, are treated the same way as goods made of lower quality and less durable plastic.

3.2 Technological barriers

Lack of innovative recycling technology capacity: Existing recycling facilities only treat a handful of materials. Significant investments are required to develop and increase their recycling capacity, but the lack of legal certainty and the regulatory complexity regarding the future use of recycled materials are limiting investments in recycling technologies. Currently, there is also insufficient demand for most recycled materials. For traditionally hard-to-recycle materials and materials with limited economic value, innovations are at different stages with varying potential for scaling up. Thus, many companies have limited options to use recycled materials without completely revising their product offerings. Further, recycling facilities for certain materials are highly specialised and are not available in all countries, particularly smaller ones, requiring the "waste" to move across borders, which as noted above, is hampered by current regulations.

Lack of traceability and data: The absence of traceability and data on certain product ingredients impedes many circular economy strategies, in particular recycling and refurbishing. The inability to fully determine the chemical and material composition of products results in them being incinerated rather than reused. Strive to balance desired output of the product and circular design, such as design-for-repair, design-for-disassembly, and the

ability to adopt alternative or recycled materials. Moreover, data collection is also challenging, especially for "end-of-life" collection and processing, as the materials are scattered and segmented across markets. Because of insufficient data quality, companies have difficulty accurately monitoring performance and forecasting demand for outputs incorporating circular design.

Trade-offs between functionality or durability against circularity: Some circular materials are economically viable to be produced at scale, but they may be at a competitive disadvantage compared to virgin materials in terms of their technical and aesthetic properties. Design-for-circularity sometimes can also entail trade-offs between functionality or durability against circularity. For example, it is a challenge to develop a shoe that can be easily disassembled, and its components recycled without negatively affecting its durability. Conversely, when a product is designed for durability by for example using an extremely strong material, it is difficult to disassemble it to reuse or recycle components.

Quality standards and aesthetic barriers: Technical and aesthetic barriers can arise due to exacting quality standards for products and lack of or limited access to available recycling technology. Engineering departments conduct quality assurance checks to ensure that products meet certain specifications and quality standards. Check processes involve risk assessments to determine how and where a product is most likely to fail and to determine which material characteristics are suitable for an application. Technical and aesthetic issues arise when assessing whether recycled materials 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. Aesthetic characteristics such as colour, appearance or texture can be difficult to replicate when using recycled material, in particular for plastics.

Perceived requirements: The perception of technical barriers creates a tension between what is actually necessary and what is presumed to be a necessary specification for recycled materials. Companies often have many internal discussions about technical specifications, which can make it difficult to discern whether a product specification metric was required for performance reasons, a customer requirement, or an industry standard. Consequently, there is a risk of applying perceived specifications to recycled materials that are in fact not necessary for product performance.

3.3 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. These constraints limit the supply of recycled materials. 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 or other established presence because of import/export regulations.

Lack of collection and sorting infrastructure: Currently there is limited infrastructure for collecting, sorting, recovering, and processing of "end-of-life" materials. Establishing such infrastructure is costly, and there can be unclear responsibilities between the private sector and the government. On a macro level, there is a geographic disconnect between where collection, sorting, reprocessing, and advanced recycling technologies are located and

where “waste” is located. These challenges limit the volume of post-use materials available for processing, consequently constraining scalability. Furthermore, the failure by consumers to return or sort products affects the quality of post-use material streams, hindering the profitability of potential circular solutions.

Lack of availability of raw materials: There is often not enough recycled material of sufficient quality and low contamination in the market to meet demand. The small number of recycled material suppliers compared to the number of suppliers available for virgin materials further increases supply chain risks and vulnerabilities. It makes it difficult to set recycled content targets if a reliable supply cannot be secured.

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-up process. These may include maintaining product quality, ensuring consistent material supply and accommodating increased demand. Many circular processes must be at a large scale to be able to have the correct output quality and be economically feasible.

3.4 Financial barriers

Additional premium: Circular materials often carry a premium due to the high cost of reprocessing and limited supply while operating in a primarily linear model. In some cases, the cost of processing used products for resale surpasses the cost of manufacturing all-new products. For some specific materials that are used in multiple sectors such as recycled PET, competition over the materials further drives up their price and jeopardises established circular material flows. The additional costs associated with circular materials disincentivise many companies from switching from linear models to circular alternatives

Upfront investment: Research and development (R&D) and upscaling of circular practices require substantial up-front investments, posing financial risks. This investment hurdle limits circular innovation to large corporations committed to circular principles, and the cost burden is borne by brand owners or consumers. The risk of investing in circularity can be perceived as high relative to other investment opportunities, limiting the availability of capital for circular economy investments.

Accounting practices: Accounting practices can be significant hurdles for the circular economy. Currently, financial practices and accounting are unable to accurately value 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 benefits the environment, it may not be adequately reflected in generally accepted financial statements. The challenge lies in quantifying the long-term environmental and societal gains in a way that aligns with conventional financial reporting. This discrepancy makes it difficult for companies to demonstrate the full economic value of their circular efforts, which in turn affects companies’ financing opportunities as well as need for long-term capital. This underscores the need for innovative accounting methodologies and reporting frameworks that can better capture and communicate the holistic short and long-term cost and benefits of circular economy initiatives.

Impact on near-term bottom line: One significant barrier is the immediate impact on a company's bottom line during the transition to circularity. For instance, 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 alternative material choices or the reuse of existing petroleum-based products, maintaining linear systems of production remains the better financial decision for companies. While circular products face profitability challenges due to their higher production costs, they often generate longer-term returns on investment (ROI) compared to products produced under traditional linear practices that focus on quarterly or annual performance metrics.

3.5 Organisational barriers

Internal buy-in and coordination: The shift to circular business models requires collaboration across multiple functions within an organisation. A lack of internal buy-in and coordination may slow this transition. Internal processes may need to be updated to accommodate a circular system, which require liaisons to shepherd concepts for circular products from ideation to market. Securing internal buy-in can be a challenge if the financial impact to change existing, successful business models is significant or if the transition introduces significant supply chain risks and costs. Convincing clients and internal stakeholders about the benefits of circular economy practices remains an ongoing challenge. Additional challenges include:

- **Dependency on new partners:** Most companies using recovered materials seek external partners with complementary capabilities to implement the changes required to become more circular. Putting trust in a new partner in a strategic programme is seen as risky, and it can be sometimes challenging to acquire the right partnerships for a variety of reasons. However, fruitful collaborations are possible, generating mutual growth within these newfound partnerships.
- **Supply chain challenges:** Supply chain management processes may require significant changes to accommodate 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 also goes against conventional good practices.
- **Measuring progress**: Current frameworks for circular progress measurement are not closely connected to other ESG frameworks such as the Greenhouse Gas Protocol, limiting companies' ability to accurately measure their circular performance. For instance, substituting a virgin material for a recycled material may boost some circularity indicators but can have a negative impact on a company's greenhouse gas footprint, compromising their nature and climate objectives. Adopting a holistic and scaled-up circular economy approach may reduce such trade-offs.

Data availability: In the traditional linear model, companies transfer ownership of materials to their buyers, limiting their ability to track 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 current supply chain management practices.

Employee education and perception barriers: A lack of understanding of circular economy concepts is a barrier to progressing initiatives within companies. There is a general misconception that circularity is the same as recycling. This misunderstanding 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. Employees stuck in this type of thinking make the transition to circular concepts challenging.

Competition and quality trade-offs: Transitioning to new technologies, especially in the IT sector, presents challenges as companies rush to keep up with competitors and meet the demands of fast-paced innovation cycles. The urgency for innovation and for products to reach the market can be at odds with the time needed for products to be designed with circularity in mind. In the race to market, companies may overlook opportunities to create more sustainable and circular products. The fiercely competitive nature of the IT 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.

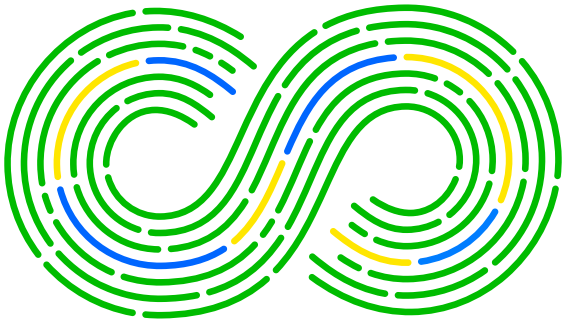
3.6 Social barriers

Lack of information on post-use return: Recovering post-use materials for resale, refurbishment, remanufacturing, or recycling starts with design but involves active participation from end-users. Currently, consumers lack information on reverse logistics and take-back processes – simple, informative, and practical instructions on labels are lacking. Consequently, they may be unaware of take-back programmes or collection points for drop-offs. This lack of awareness lowers consumer convenience, resulting in lower volumes of post-consumer feedstock available for effective upcycling into new products. While labelling can be an effective tool, it introduces traceability challenges – labels can be removed by consumers, making them an ineffective tool for subsequent product lives.

Contamination of materials streams: In relation to municipal materials management systems and brand-driven take-back schemes, there is often contamination in the "waste" stream. This is because end users generally do not follow return instructions. For example, instead of returning one component, they send the entire product back. This leads to contaminated material streams that exacerbate the complexity and costliness of the recovery processes. Also, improper disposal of end-of-life materials leads to contamination that inhibits reprocessing efforts. Contaminations in material streams make it technically more challenging and labour-intensive to effectively recover value in post-use materials and require an additional detoxification step to remove substances of high concern, such as per- and polyfluoroalkyl substances (PFAS), heavy metals, and asbestos. This further increases the cost of establishing circular loops. Companies running take-back programmes often find misplaced items in the return stream, requiring extensive manual sorting and posing compliance challenges, notably in subsectors such as children's toys. Apart from the contamination of material stream due to the inclusion of incorrect materials, there are sanitary concerns related to recycled base materials that are often worn or used and thus not sterile. Existing systems often require these materials to be washed and sterilised in advance of handling, further complicating the process.

Consumer behaviour and perception: Consumer behaviour is currently aligned to a linear economy, which presents four main challenges to implementing a circular economy:

- **Perception of value:** Misperceptions about the quality of remanufactured, refurbished, or recycled goods and materials negatively impact the demand for circular offerings. Consumers currently prioritise convenience and prefer new products over recycled and refurbished ones due to a lack of education and awareness about the benefits of refurbished devices. Complex recycling and return and/or take-back processes further contribute to this consumer preference.
- **Novelty or sentiment for an item:** Consumers often attach symbolism and sentiments to purchases and may be reluctant to forego ownership in the transition to circular business models. Consumers often assess a used product's value according to how they feel about it instead of its actual market value. Moreover, cultural or social stigma associated with secondhand or refurbished products in some regions or communities can discourage individuals from embracing circular options, despite their economic and environmental viability.
- **Prioritising cheaper disposable options:** Consumers typically favour 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 circular products or services which may be more expensive or require extra effort to access or maintain.
- **Aesthetic limitations:** Most consumers expect circular products or components to be aesthetically identical to their linear equivalent and are not ready to compromise on their expectations even though product performance is the same. For example, recycled plastics can be used in certain consumer products and fulfil the same performance requirements as the virgin material, but the colours may not be as flashy or catchy for the consumer. It is very challenging to replicate best-in-class plastic colours from recycled content.



4. Measures to support the transition to a circular economy

As discussed in Section 3, regulatory, technology, infrastructure, financial, organisational, and social as well as broader policies or barriers are hindering widespread adoption of circular economy business models. However, opportunities exist to alleviate the pressure of these barriers across sectors. These opportunities can play a vital role in paving the path for a circular economy and a sustainable future.

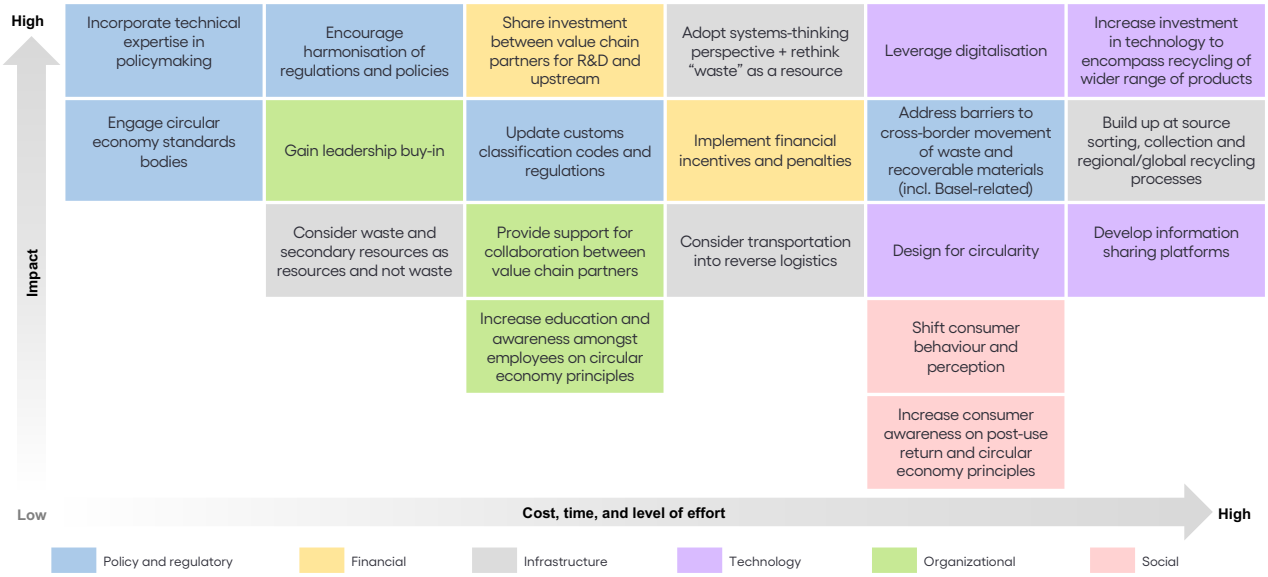


Figure 5: Overview of measures to advance circular economy approaches (Source: ICC)

4.1 Policy and regulatory opportunities

Harmonisation of regulations and policies: There is an urgent need for globally harmonised regulations and policies as well as guidance for their implementation on the national levels to pave the way for consistent progress in the circular economy. For example, harmonising Extended Producer Responsibility schemes across jurisdictions would simplify compliance and cut costs for companies. Sensible, aligned, and harmonised policies across borders are necessary to ensure that all entities worldwide follow the same guidelines for smooth trade and compliance. Most sectors consulted for purposes of this report are subject to complex technical and legacy policies and laws intended for a linear economy. Thus, new policies on the circular economy need to co-exist and harmoniously work with the existing policy landscape. Also, governments should apply a whole-of-government approach in assessing possible prohibitions or restrictions that apply to goods or their component parts as well as treatment of goods throughout their lifecycles. Thoughtful policy approaches must be taken to effectively manage the circular economy while not restricting innovation and the adoption of new practices. The combination of globally standardised policies and local initiatives, achieved through stakeholder consultation, holds the key to advancing the circular economy on a global scale.

Incorporate technical expertise in policymaking: Incorporating additional technical expertise in policymaking would lead to more targeted regulations. For example, given the lack of definitions of "recyclable" and "non-recyclable" and "hazardous" and "non-hazardous" "waste", integrating technical expertise into policymaking would help establish precise, transparent, and concrete definitions. This, in turn, would pave the way for efficient circular systems. Also, technical

expertise could help provide a more granular and hierarchical approach to define waste as refurbished, remanufactured, reused, and recycled, as well as help define end-of-waste criteria to allow waste or resources extracted from "waste" to be returned to the value chain.

Engage circular economy standards bodies: The lack of globally accepted definitions for even the most basic circular economy terms, including remanufactured, refurbished, like-new, repurposed, and used, creates regulatory uncertainty for businesses considering investments in circular economy. These terms need to be defined through an inclusive, multi-stakeholder, multilateral approach, so that objective criteria can be globally adopted to enable the identification and streamlined movement of physical goods needed for the circular economy across borders. The failure to define these critical terms leaves their use open to interpretation and possible misapplication and/or misinterpretation by both governments and businesses. More broadly, updates to existing regulations and frameworks must be done on an ongoing basis to keep pace with continuously emerging innovations, such as advancements in waste recovery technologies. Standards must evolve alongside these technologies and include business in their development.

Domestic inter-agency cooperation and whole of government approach: Domestic-level discussions involving all government agencies are necessary to tackle issues like restrictions and prohibitions on imports at all lifecycle stages and levels. Clear processes need to be established to facilitate and enable a circular economy for all stakeholders in one country and to enable a move towards more harmonisation across countries.

Penalties and incentives: Long-term solutions may include limitations on specific materials and linear disposal practices. By restricting certain materials and disposal methods, policies can propel industries towards circularity by creating demand in the market. Cross-border business models that support the efficient use of resources, such as cars and textiles, can be made attractive to businesses and consumers through market incentives. A crucial aspect lies in striking a balance between regulatory measures like restrictions, bans and taxes, and proactive support measures and incentives to circularity. Government-backed initiatives and dedicated circular funds stand as catalysts for increased investment in circular innovation, fostering a conducive environment for industry transformation. Any consideration of subsidies must be done in full compliance with the WTO Agreement on Subsidies and Countervailing Measures (SCM) to limit market distortions that may limit the trading of circular goods. Current policies lean heavily towards restrictions and a prescriptive approach, whereas the magnitude of changes and investments required call for supportive and enabling measures. A comprehensive policy framework, integrating penalties, incentives and support measures, is pivotal in steering industries towards circularity.

4.2 Technological opportunities

Investment in technologies to encompass recycling of wider range of products: Globally, both mechanical and chemical recycling technologies are not mature enough for most products to be cost-effective and economically viable. While these technologies show significant potential, their further development and scalability require continued policy-driven and financial push from regional and national governments. An enabling environment could help drive the significant investments needed to scale capacity and accelerate technological innovation. For example, mandating a percentage of recycled materials in certain products could potentially generate the demand needed to encourage chemical companies to scale up their technology and production capabilities.

Design for circularity: Technological advancements may help create circular materials or

designs at lower costs and with improved qualities, but contamination and inadequacy of "waste" management infrastructure pose significant challenges in purifying feedstock required for recycling or recovery processes. To address structural challenges, two primary avenues can be pursued: ensuring recycled materials feedstock maintains minimal levels of contaminates and advancing industrial processes beyond current methods. For recycled materials to seamlessly replace virgin material, standards and metrics must evolve and be scrutinised. Establishing ranges of tolerance is pivotal in assessing the suitability of recycled materials for particular applications. Decisions about materials should be based on a lifecycle analysis, as different materials have different environmental impacts over their entire lifecycle.

4.3 Infrastructure opportunities

Systems-thinking perspective: Resource efficiency and circular economy policies need to implement a systems-thinking approach across society in general. Systems thinking involves understanding how various systems influence one another within a larger system. As part of systems thinking, a mapping or understanding of how resources flow through society is crucial to be able to identify both business opportunities as well as needed policy measures. This would help identify root causes and help frame the conceptual understanding of a new circular business model, including infrastructure transitions.

At source sorting, collection and regional/global recycling processes: Mandatory "waste" sorting and collection at the source is crucial, coupled with instituting policies that enable the development of necessary infrastructure to support operation or process changes. Existing regulations hinder "waste" transportation and trade because they do not value "waste". Thus, "waste" needs to be reframed as a by-product. For instance, to address the pervasive challenge of exporting post-consumer textiles, local policymakers can help to regionalise a circular economy for textiles by creating incentives for local collection, regional sorting, reuse, or recycling.

Rethinking "waste" and secondary resources: To shift the perspective on waste and secondary resources, it is vital that "waste" is reframed as a resource. Narrowing the scope of what is considered waste will encourage more circular business models. On a practical level, secondary resources can be further optimised in a number of ways and by applying different strategies:

- Incorporating detoxification (i.e., the removal of harmful contaminates) into design lengthens the lifecycle of products by considering the impact of chemical compounds.
- Industrially processed material residues, like pomace, should be collected for further processing rather than being treated as "waste".
- Incentives and benefits should be offered to companies offering product innovations which turn "waste" materials as raw resource into new products.
- Investing in recycling infrastructure and collection systems tailored to new material types like bio composites and bio-based foams should be encouraged.
- Sorting and recycling facilities need to evolve with circular material innovations. This should start with setting definitions (e.g., for textile waste, and harmonising end-of-waste criteria at regional and national levels to secure the constant flow of high quality secondary raw materials).
- There also needs to be consideration for the significant amount of "waste" that needs to be transported in the piloting and development phase of innovative circular solutions.[6]

6 ICC. (2023). Circular material flows for research and innovation. Available at: www.iccwbo.org/news-publications/

Strategic material banks: Strategic material banks, acting as safe reserves for recoverable materials which are currently lost in landfills, could address the scarcity of certain materials. When coupled with effective detoxification processes, they could pave the way for a constant supply of strategic materials, ensuring their availability for future use.

Prior Informed Consent (PIC) procedures: The Basel Convention sets forth PIC procedures, documentation, financial assurance, and trade bans on certain shipments of hazardous and other wastes with the aim of ensuring the environmentally sound handling of waste traded internationally for recycling and recovery. However, for the Convention to achieve its objectives, it is paramount that the PIC procedures function consistently and efficiently, especially concerning "waste" destined for materials recovery or recycling. In practice, many countries lack the resources or capacity to fully operationalise the PIC procedures, and communication and logistical challenges have been well documented. As a result, businesses face significant shipping delays and operational uncertainties, undermining the objective of environmentally sound management and broader circularity goals. Modernising the PIC procedures through digitalisation and other trade facilitation measures will contribute to safe and efficient circular material flows.

Voluntary information sharing platforms: In addition to efforts that are or should be undertaken by governments, to increase awareness of circular economy strategies, companies across value chains can serve as voluntary information sharing hubs to educate large numbers of vendors on compliance requirements. Moreover, interconnected, cohesive performance measurement systems are essential. These systems prevent the penalisation of circular economy solutions and enable companies to better set targets and measure progress towards these goals.

4.4 Financial opportunities

Financial incentives: There is a pressing need for financial instruments to drive industry to shift from a linear to a circular model:

- Incentivising innovation and creating market demand for circular products can motivate businesses to invest in circular economy practices. Addressing financial risks and offering incentives can aid in scaling up circular initiatives. Introducing tax incentives can spur innovation in bio-based and circular materials. These financial incentives should help offset research and development (R&D) costs and scaling of sustainable materials. Also, funding, testing and piloting of circular materials can accelerate their adoption and facilitate de-risking and validation, bringing them to the market faster and making it as easy and profitable for businesses to internalise external costs and to embrace circularity as to have a linear business model. Investments should be supported by a stable and predictable regulatory framework.
- Lower tariffs on circular goods, materials and services would help make circular economy business models more financially viable, while also lowering consumer prices on secondary products.
- Mandatory eco-modulated Extended Producer Responsibility (EPR) fees and mandatory recycled content targets for certain products would help level the playing field, in particular by internalising external costs for the production of virgin material.[7]

policies-reports/circular-material-flows-for-research-and-innovation/ (Accessed 18 December 2023).

7 Internalisation of externalities refers to all measures (public or private) which guarantee that unpaid benefits or costs are taken into account in the composition of prices of goods and services. See Ding, H., He, M., and Deng, C. (2014). Lifecycle approach to assessing environmental friendly product project with internalizing environmental externality. Journal of Cleaner Production, 66, pp. 128-138.

Carbon accounting: The move towards carbon accounting can be an essential component for accurate evaluation and measurement of circular practices. This emerging trend has the potential to provide companies with the tools and methodologies needed to assess and report the environmental impact of their circular practices, surpassing traditional financial metrics. Integrating circularity metrics into accounting practices allows organisations to have a more comprehensive understanding of the sustainability and efficiency gains achieved through circular initiatives. With increasing costs for carbon emissions, circular economy approaches are becoming more attractive as they have lower carbon emissions than virgin material extraction. Ultimately, this may drive the adoption of circular economy principles across various industries.

Shared investment between value chain partners for R&D and upscaling: Investment in research and development of circular solutions, spanning from prototype design-for-disassembly to advanced recycling, is costly. Generally borne by the innovator, the cost may be shared among value chain partners. The premium due to technology costs is especially pronounced when production volumes remain low. To alleviate this, specialised funding for circular initiatives could support capital inflows, encouraging investments towards R&D activities. Introducing policies such as EPR across the value chain can make consumer-facing companies accountable for plastic residuals, products and packaging, such that the transformation cost will be borne equitably.

Financial institutions can facilitate the transition towards a circular economy in several ways[8]:

- The bankability of circular business models in many cases requires the acceptance of "contractual comfort" instead of the right of legal ownership over assets in case things go wrong. Secondly, it requires a more cash flow-based approach to finance rather than an approach based on collateral values.
- Banks can enable the circular economy by developing valuation and risk models that suit the characteristics of circular business models. For example, assets are often written down to zero or a small scrap value over their economic lifecycle. Capturing higher values in circular supply chains through upscaling or through second hand markets is pivotal to the circular economy, but currently this value is not fully captured in financial business cases.
- Banks can explore and develop leasing arrangements for products with circular potential.
- Banks can explore and develop new and innovative finance solutions for supply chains that go beyond the currently available working capital solutions.
- Banks can advise clients on the financial incentives that make the end user choose for circular products and services over standard products. Currently, many business models are financially sound for the client, but they lack a strong financial incentive for the end user. If the financial benefits are not clear to the end user, circular business models are bound to face limited demand.
- Banks can develop knowledge on and gain experience with new pricing tools that incorporate environmental and social costs and benefits into the financial business case.
- Banks can partner with equity providers if the risk return profile of the circular business case does not match debt finance criteria

8 ING Economics Department. (2015). Rethinking finance in a circular economy. p. 8.

4.5 Social and organisational opportunities

Leadership buy-in: The transition to circular products requires strong commitment and support from leadership, particularly as circular initiatives are usually not profitable in the short term, making them vulnerable to shifting company priorities. Leadership buy-in can enable companies to adopt a holistic approach to circular economy across the whole company. It can also have a positive impact on internal sustainability and circularity efforts if the value of circular economy is recognised across the company since it will empower employees and teams to innovate.

Effective consumer awareness and engagement: Consumers of all ages, including children, must be educated about circular economy concepts that extend beyond recycling. The aim is to shift perceptions towards maximising the use of existing resources, emphasising the benefits, and dispelling misconceptions. As consumer awareness and demand for eco-friendly products and services grow, businesses are encouraged to prioritise circular practices. Policies aimed at consumer education are crucial in stimulating demand for circular products. Promoting awareness through campaigns and offering financial incentives, such as rebates on future purchases for returning products, may help overcome convenience-based obstacles, thus increasing consumer interest and participation in circular practices.

Labelling policies: Labelling policies are a particularly effective means to provide customers with information to facilitate their understanding of products' circularity, encouraging prolonged use and contributing to a more circular economy. However, it is critical to consider a circular product's anticipated multiple uses before it reaches the final stage of recycling.

Consumer behaviour and perception: Academic research on consumer behaviour within a circular economy is still in the early stages. Research studies could help to explain challenges like low recycling rates, the factors influencing a customer's decision not to return an item, or adoption of resource efficient rental or sharing business models. Overall, there needs to be a better understanding of how consumer behaviour can be efficiently aligned to a circular economy, since it is critical to creating a circular system. When developing new reverse logistic channels such as collection points, consumers must be provided with consistent, easy to access, and easy to use entry points to participate in the circular economy.

5. Conclusion

As the previous sections have shown, there are significant policy and regulatory, technological, infrastructure, financial, organisational and social barriers that impede a meaningful adoption and scaling of circular economy by companies manufacturing consumer-related goods.

While many of the barriers described in this report require the private sector to take action, notably in setting global industry standards, governments also need to work on creating a more enabling environment in which it makes business sense to shift to a circular economy. There are four key areas that will need to underpin all efforts toward a circular economy.

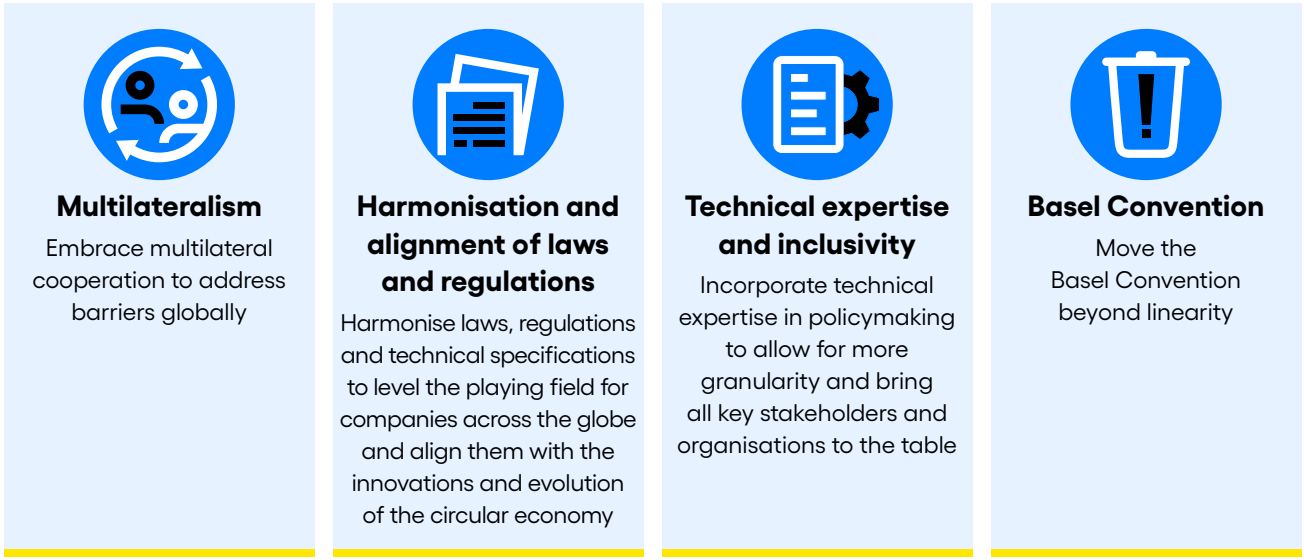


Figure 6: Key recommendations for a circular economy

First, the facilitation of cross-border movement of products, materials or services to improve resource efficiency and extend the lifecycle of a product or material are critical for a circular economy, but it requires governments to work together to harmonise regulations. Coordination between governments to address barriers to the circular economy is critical and requires a multilateral approach given the global nature of the challenge, in such fora as the World Trade Organization and the World Customs Organization.

Second, laws, regulations and technical regulations must be aligned to allow for a circular economy across borders and to create the required market shift away from a linear economy. The extension of the lifecycle of a product or material needs to be prioritised rather than prohibited through restrictive measures that have not kept up-to-date with the evolution of circular economy.

Spotlight on multilateral cooperation

During the WTO's 13th Ministerial Conference in Abu Dhabi held in February 2024, participants of the Trade and Environmental Sustainability Structured Discussions committed to continuing their work on the trade-related aspects of the circular economy beyond the current mapping exercise which has been undertaken since 2020. The work on circular economy should be prioritised and accelerated – sharing best practices from around the world and incorporating technical expertise to lead to improved cooperation and coordination between governments to address trade-related barriers to achieving the circular economy.

Third, critical to policymaking is the need to include all stakeholders and incorporate technical expertise into discussions to ensure rules and regulations truly enable a circular economy.

Regulations and policies have not kept up with the possibilities of a circular economy and the deployment of various R-strategies that extend the lifecycle of materials and products and improve resource efficiency. In many cases, companies are at the forefront of the circular economy and have the technical knowledge and expertise that should be considered when designing policies. The inclusivity of the policy-making process that systematically includes all key stakeholders can help ensure the effective implementation of policies and regulations – and deliver the intended impact in the real world.

Finally, the Basel Convention was designed to address the catastrophic consequences of the linear economy in which developing countries have become "dumping" places for hazardous waste from across the world. Unfortunately, in recent years, as companies have tried to implement and scale circular economy approaches, the Basel Convention has become a major barrier for such circular approaches, due to both a lack of effective implementation of the PIC procedure but also an outdated approach. With the Basel Convention expanding to more waste categories in the near future, it is critical to ensure that the PIC procedures are implemented effectively and more efficiently, for example through digitalisation, and that provisions of the Convention be updated to ensure the facilitation of waste for recovery and recycling purposes is possible.

Circular economy is a systemic approach that will have the biggest impact if it is adopted by all stakeholders – including the final consumers – within an enabling regulatory framework that will help companies adopt and scale solutions. It represents a pivotal opportunity for collective progress, but as shown in the report, it requires the concerted efforts of all stakeholders to drive meaningful change. This approach is not only a strategic imperative but also a shared responsibility, vital for fostering sustainable economic growth, development and resilience for future generations.

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7. Annex

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 manufacturing, life sciences and chemicals, renewable energy, information technology (IT) or high-tech or information communication technology (ICT), and textile and retail sectors. Interviewees were selected based on experiences of 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, obligations and challenges faced, and recommendations for implementing circular initiatives. The qualitative data obtained from interviews offers nuanced perspectives and real-world examples that contribute to a deeper understanding of the subject.

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 they encountered when 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.

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