



Resource Recovery Playbook

Expectations for the circular economy
of 2030 and the steps required to achieve
a sustainable future.

Executive Summary

It's time to rethink the take-make-waste systems of the linear economy and navigate through the headwinds impeding the transition to a circular economy. Based on principles to design out waste, dramatically reduce pollution, keep products and materials in use, the circular economy redefines growth by focusing on positive societal and environmental development. A circular future is vital for a healthier, more equal and more sustainable planet for generations to come.

As an impact leader and global frontrunner in the revolution of circularity, TOMRA has extensively explored, analyzed and collaborated to rethink the ever-increasing waste problem. Our vision for the future goes beyond reduce, reuse and recycle – it perceives an entirely new generation of society, economy and behavior.

The ReSociety is an initiative to re-think, re-act and re-start our world for a more sustainable future. It is a place for industry, policymakers, companies and consumers to share ideas, increase awareness, collaborate with solution enablers and drive impactful change. It is also a hub in which TOMRA proactively shares its vast research and multi-national studies on holistic waste management systems, which have been indispensable in developing the circular value chains.

As the first white paper in a series of multi-national studies and reports on holistic waste management systems commissioned by TOMRA, this document presents the challenges, projections and opportunities along the way towards the circular economy.



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scaling the circular economy:

the epoch of sustainability and its challenges

From the start of the industrial revolution until recently, the world's leading economies were powered by human ingenuity and a seemingly inexhaustible supply of raw materials. As the markets and global supply chains evolved, the rapid growth of the take-make-waste system resulted in proliferating signs of resource depletion and the progressive destruction of habitats. Because the use of materials involves energy expenditure, the increase in consumption and extraction of raw materials has propelled the rise in greenhouse gas emissions (GHG) responsible for anthropogenic climate change. Since the turn of the millennium, the rising urgency to take action has impacted governments, businesses and individuals that the buy-and-consume-and-dispose economy has reached its growth limits and is fueling an environmental crisis.

Waste management and improving material resource streams offer impressive potential in climate mitigation. Reports often account recycling offsets to industrial production as opposed to GHG savings being attributed to holistic waste management.

Globally, most waste is currently dumped or disposed of in some form of landfill.¹ Lower-income countries generally rely on open dumping since waste management systems are often non-existent outside major cities. The informal sector plays a major role in recycling in developing countries, where waste pickers primarily focus on items which can be easily sold to provide an income for themselves and their families. Less valuable materials, and those with no viable end market, are left uncollected.

There are known economic benefits associated with recycling and public outcry over the environmental damages created by dealing with waste through dumping, landfills and incineration. Yet few countries are fully addressing the challenges, enabling the costs and benefits to be reflected in market prices, and properly seizing the opportunities presented by poor waste management. For all items where the collection, sorting and recycling costs outweigh the market value of material streams that could otherwise be recycled, no obvious recycling solution can be expected without some alternative interventions. Public policy, consumer engagement and collaboration across the value chain are necessary to create a closed-loop circular economy. Making the shift from a linear to a circular economy to build thriving economies requires radically reducing the use of primary resources, designing waste-free products, harnessing materials to keep them in use and implementing technologies to ensure the system is regenerative.

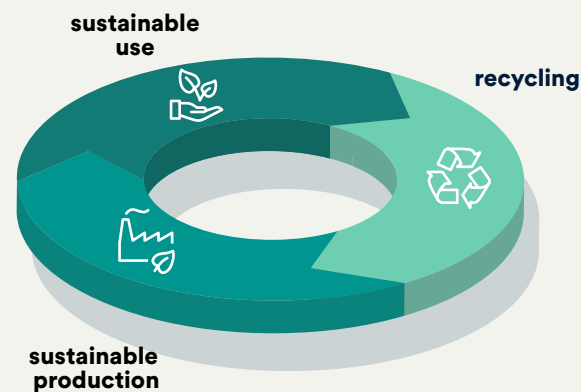
Furthermore, a viable funding mechanism needs to be developed to support the rapid diffusion of waste collection services to those parts of the world where no such facilities currently exist. As long as consumption keeps rising in places where there are no comprehensive waste collection services, we can expect a continuation of the build-up of waste in rivers and oceans. The issue of waste collection and management is at the heart of solving the problem of ocean pollution.

Environmental pressures such as climate change and ocean plastic pollution are incredibly complex challenges that are also influenced by social and economic factors. Building a new framework that balances these interdependent systems is a global challenge that involves everyone and every aspect of economic, societal and environmental structures. By bringing the challenges of these structures to light, we can identify what levers we have at our disposal and determine a viable action plan.

linear economy



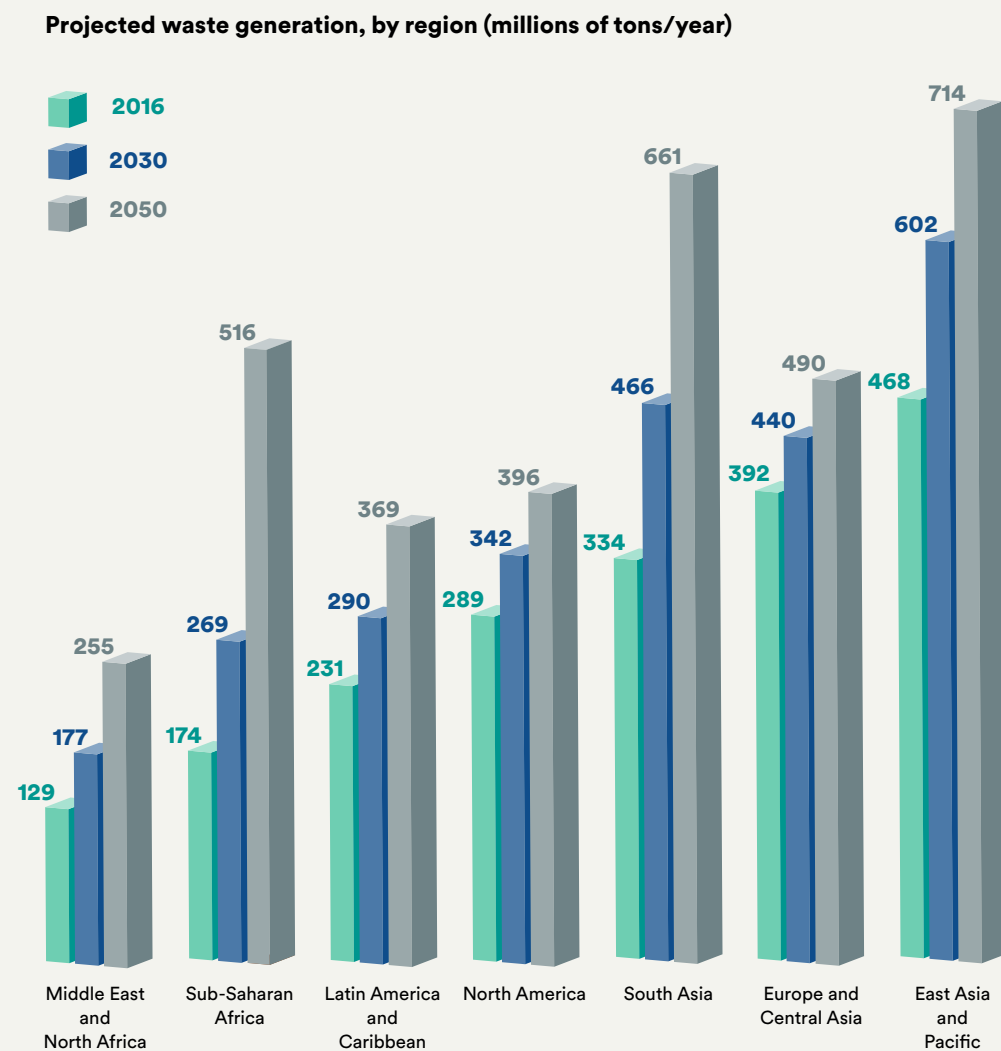
circular economy



The world generates 2.01 billion tons of municipal solid waste annually,

with at least 33 % of that not managed in an environmentally safe manner.

The consequences of the take-make-waste system shown in the estimated data below have raised consumer awareness and shaped societal engagement. Actual data from waste management systems, however, tell a very different and more dramatic story concerning global waste quantities and its potential growth.



Source: World Bank. "Trends in Solid Waste Management." Retrieved 22 July 2020 from https://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html

Rapid urbanization and busier, on-the-go life-styles have propelled consumers towards products that simplify their lives and save them time but should these trends continue at such an enormous cost to the environment? According to a special report by the United Nations, the material footprint per capita has increased considerably: in 1990 some 8.1 tons of natural resources were used to satisfy a person's needs, while in 2015, almost 12 tons of resources were extracted per person.²

People are increasingly demanding that something be done about problems caused by linear production and consumption models,³ and they are especially sensitive to the issues associated with plastics. But strong measures must be taken to advance the cause even in countries with more developed waste management systems. Advanced waste management systems are still developing, consumers often choose convenience or other needs above those of sustainability. In these regions, the circular economy competes with other urgent problems such as extreme poverty, ecosystem crises, water and sanitary issues.

The volume of plastics has been increasing at a rate higher than economic growth, thus impacting greenhouse gases and ocean plastic. Annually, about 8 million metric tons of macro-plastics are discarded from land-based sources into the ocean. When adding another 4 million metric tons of microplastics and plastics cast-off directly from sea activities such as shipping, fishing and aquaculture, the total plastic entering the marine environment comes to 12.2 million tons per annum.⁴ According to an Ellen MacArthur Foundation study in 2019, recycling 1 ton of plastics could reduce emissions by 1.1–3.0 tons of CO₂e compared to producing the same ton of plastics from virgin fossil feedstock.

Overcoming environmental pollution by transitioning to a circular economy is one of the central challenges of the 21st century. The implementation of waste collection and facilities that enable recycling of materials are essential for every region of the world, regardless of location or complexity. Beyond waste management infrastructure, it is also necessary to curtail excessive consumption and ensure products are designed to be reused, repaired, and once at the end of life, easily recycled.

Constructing Ecological Geopolitics Through Public Policy

Currently, there are still many countries throughout the world where waste is not regulated or collected, resulting in toxic emissions from open burning, uncontrolled dump sites and massive plastic pollution. To enable the fundamental shift towards the circular economy, well-designed policy frameworks and regulatory instruments are necessary. Decoupling economic growth from resource extraction is one of the most critical challenges for regulators today. Creating a conducive environment to change markets, infrastructure and society also depends on policies that profoundly transform business practices and value chains.

**Food waste
accounts
for nearly
50%
of emissions.**

In 2015, the 2030 Agenda for Sustainable Development was adopted by all United Nations Member States. Goal 12: Responsible Consumption and Production of the Sustainable Development Goals (SDGs) aims to halve per capita global food waste at the retail and consumer levels and substantially reduce waste generation through prevention, reduction, recycling and reuse. Food packaging, when designed for recycling and reuse as opposed to single use, can help prevent unnecessary food spoilage and reduce the carbon footprint of the food supply chain.

Some consumer brands have set clear targets for the recyclability of packaging plastics. The metrics, however, are more often defined by the individual companies as opposed to independent bodies. The monitoring of progress towards the objectives is also not always transparent. In Europe, regulations require 55 percent recycling of plastic packaging by 2030, and there are also plans to call for all plastic packaging to be recyclable in the same timeframe. Taking the concept of circularity to heart, Germany requires 63 percent of plastic packaging to be capable of being recycled and reprocessed into new, high-quality products from 2022 onwards.⁵



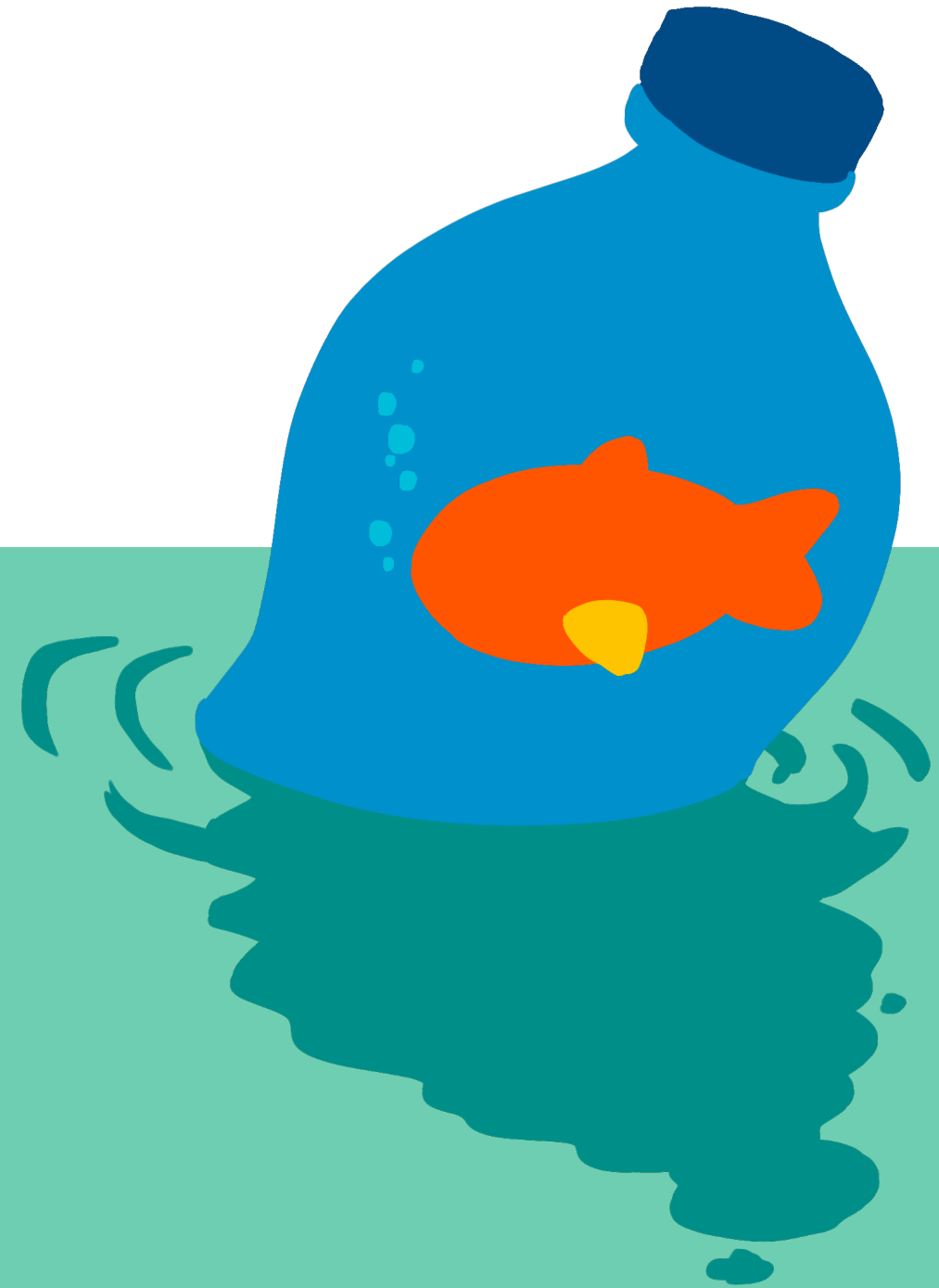
In 2019, more than 180 nations agreed to landmark ratification making waste trade more transparent while ensuring human health and environmental safety.⁶ Now global waste exporters must first obtain consent from the governments of receiving nations before shipping the most contaminated, mixed or unrecyclable plastic waste. The amendment under the Basel Convention will have a significant impact on extended producer responsibility and national financing systems for environmentally-sound waste management systems, which in turn creates opportunity for problem-solving solutions.

The Economic Paradox of Corporate Responsibility

Consumers are calling for brands to take more responsibility for the environment, and frontrunning companies are responding by voluntarily joining various Plastic Pacts and Global Commitments. The noble effort of making products 100 percent recyclable, however, is meaningless in developing countries lacking formal waste management, where plastics are often burned or discarded into the environment. In a new report from Systemiq and The Pew Charitable Trusts, the authors estimate that the world would see a reduction in annual rates of plastic pollution flowing into the ocean of only 7 percent if the existing commitments on plastic are met.⁷

For companies to maintain financial stability and meet the demand for environmental impact transparency, they will need to make more relevant commitments. By robustly investing in new technologies, recycled content, collection systems and circularity management practices, companies can help stop plastic pollution and lead the way to a sustainable future.

Conglomerates and start-ups alike see the potential of sustainable opportunities and are developing new business models to meet future market trends.



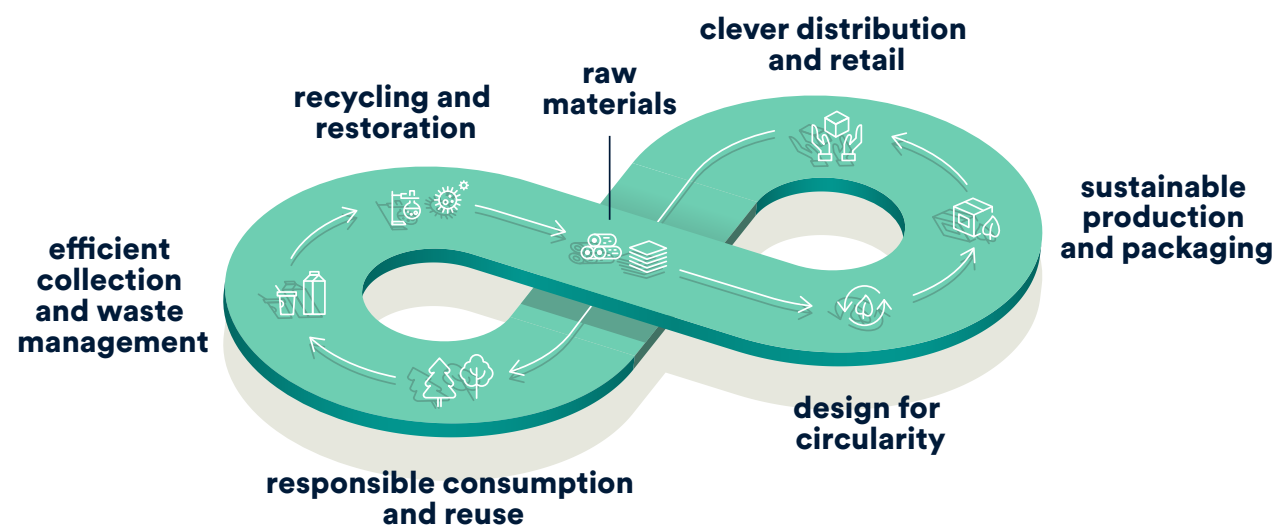
Wasting the Resources of Waste

Waste is a universal issue that affects the environment, economic development and the health of every human in the world. With over 90 percent of waste openly dumped or burned in low-income countries, establishing alternative models of funding waste collection and management would prevent plastic pollution. Possible funding sources could include revenues from producer responsibility schemes and the application of taxes on single-use items.

Of course, once waste is collected, a myriad of options become available to transform end-of-life materials into valuable resources. For example, recovered ocean-bound plastics have recently begun to be integrated into several viable packagings and products. From a holistic perspective, scaling up the quality collection and mechanical recycling should be prioritized over and above building waste-to-energy incineration plants. In some cases, electricity generated by waste incineration has proven to have significantly higher greenhouse emissions than electricity obtained by conventional means such as fossil fuels.⁸ By harnessing valuable materials that can be recycled or composted, the introduction of targeted mechanical sorting before incineration can result in carbon savings and other environmental benefits.

According to a 2019 study by the World Wildlife Fund (WWF), plastic waste in lower middle to low-income countries is expected to grow upwards from 11 kilograms generated per person toward the 118 kilograms per person typical in high-income countries. As lower-income countries continue to develop, their waste management systems evolve but so does the amount and composition of waste. The informal waste sector continues to play a crucial role around the world, and enabling integration with the formal ecosystem would help identify existing gaps and access its environmental impact.

There is an urgent need for more advanced systems to monitor, verify, track and analyze waste to understand the intrinsic value of waste. The dangers of politicizing the reporting of waste generation, collection and management have profound implications on the environment, consumers and business. Artificial intelligence and neural networks in sensor-based sorting technologies offer access to unbiased, evidence-based insights to shape holistic waste management systems.



40% of today's global plastic waste ends up in the environment.⁹

Preparing for the Great Unknown

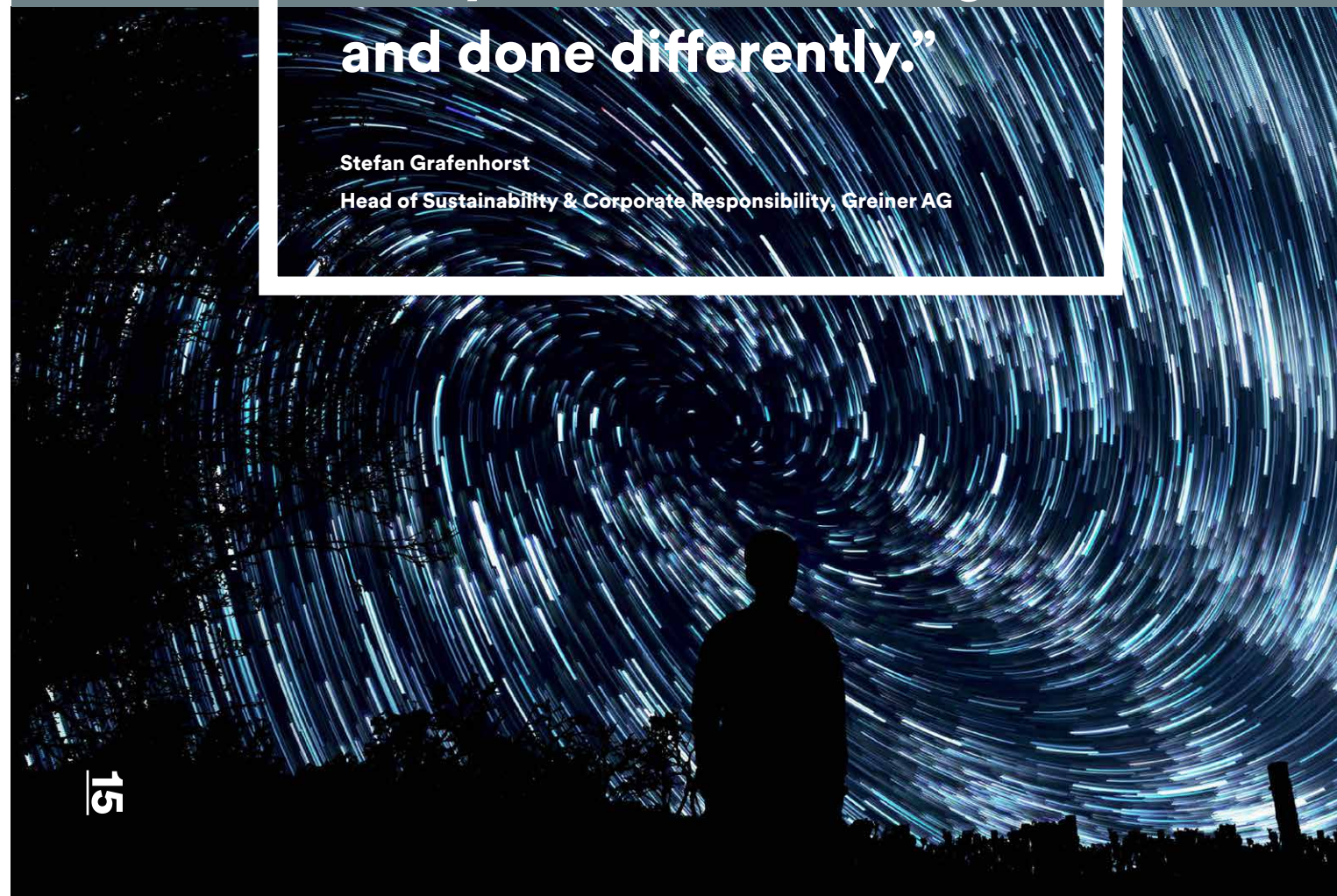
The COVID-19 pandemic has proven that ‘business-as-normal’ can change overnight. Social distancing and strict measures to curb the spread of the disease have given societies the chance to rethink primary needs, the interconnectedness of value chains, and the overall impact on the environment. From waste collection to recyclers, the pandemic has already proven to have tremendous implications on the waste management value chain with the upsurge of both hazardous and non-hazardous medical waste.

Cultural paradigm shifts and global events always pose challenges which make adapting necessary. As priorities and value systems change, rapid restructuring of economic policies and orientation towards ecological sustainability can bring about deposit return systems for the recycling of beverage containers or the banning of materials, such as specific polymers. While some companies have used the pandemic to lobby the reinstatement of single-use items, scientists suggest that reusables present no problems, and indeed, there are simple and hygienic ways to avoid throwaways. Environmental and global health security also drive the world’s ‘green recovery’ plans to jump-start economies, find options to reach net zero carbon emissions and promote more sustainable consumption.



“The COVID-19 pandemic could advance the movement towards circularity because of the sudden realization that the economy has to be rethought and done differently.”

Stefan Grafenhorst
Head of Sustainability & Corporate Responsibility, Greiner AG





waste as a resource:

projections and potential for 2030

Fast-forward to 2030 – let's imagine a society that has integrated sustainable practices into daily living. We can still recall Greta Thunberg sailing across the ocean to avoid airplane emissions, movements against single-use plastics, and the widespread health concerns of the pandemic. These anchored memories continue to propel innovations, regulations and finding new ways of reducing our impact on the environment as individuals and as a collective.

Increased media attention on the global waste issue has significantly influenced society, and for this reason, eco-impact apps are more widely adopted. The previously hidden carbon costs of products are now made transparent, and consumers increasingly consider global versus local production, recyclability and repair rates. In developing countries, educational programs teach communities about improved management of waste in a united effort to reduce greenhouse gases. Society, as a whole, is moving closer to a circular economy.

ReView 2030 – Circular Economy Survey

Moving resolutely towards the circular economy has the potential to deliver considerable benefits for both developed and developing countries. Concrete measures are needed to achieve this vision; making it a reality requires commitment from all players in global value chains. Societies and their governments have the decisive power to make a difference and bring about positive change.

The European Commission launched the world's first Circular Economy Action Plan in 2015, with 54 actions implemented to ensure less waste, make sustainable products the norm, harness resources and empower consumers. The plan was updated in March 2020, and the Commission will explore setting an EU-wide, harmonized model for separate collection of waste and labelling. Global efforts in recent years have produced a tidal wave of new agendas and collaboration focused on sustainable growth, while environmental activism, especially among younger generations, has accelerated this agenda.

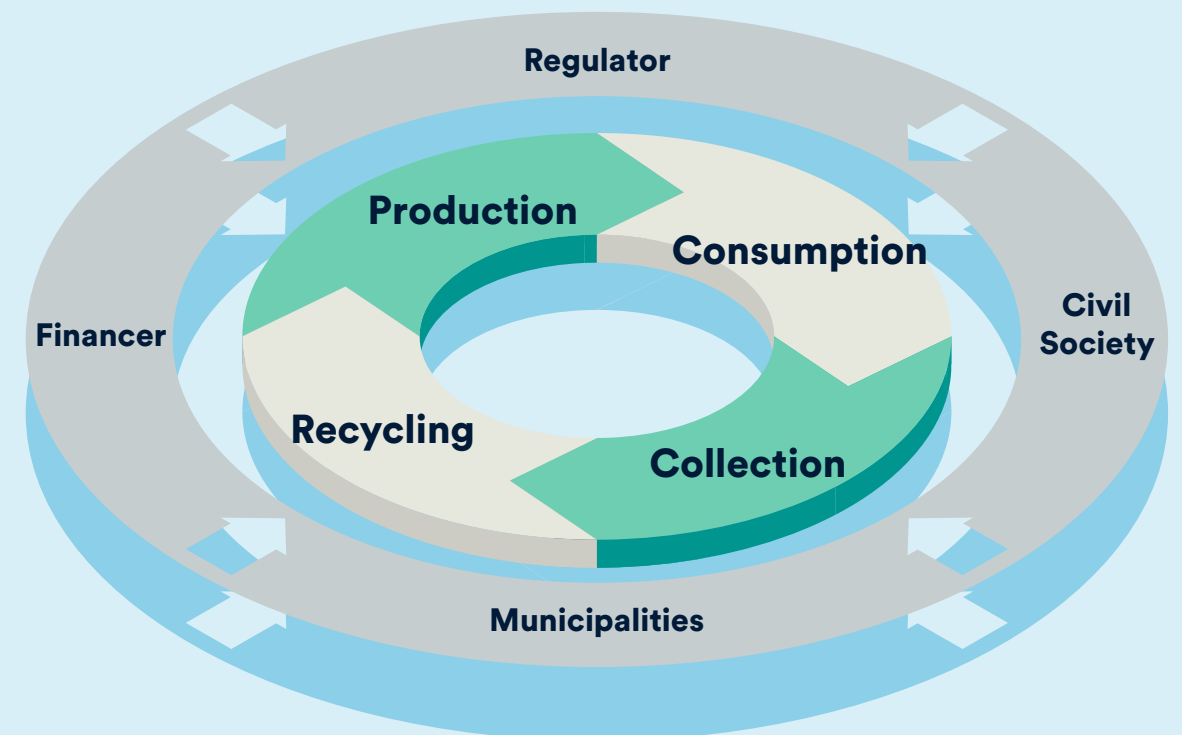
“A shift to a greener economy could create 24 million new jobs globally by 2030 if the right policies are put in place.”

To project how the circular economy could play out until 2030, TOMRA Circular Economy Division enlisted the expertise of FutureManagementGroup AG to conjointly develop scenarios based on

stakeholders' knowledge and diligent research. A survey polling a total of 53 representatives, including TOMRA experts and representatives from key value chains, were asked a series of multiple-choice questions to gain insight on post-consumer packaging waste and their perceptions of the circular economy in 2030. In-depth interviews were also conducted to facilitate a better understanding of the complex interdependencies of the value and supply chains and created an abridged system map of the circular economy. The circular economy is also seen as an opportunity to generate jobs and economic value creation over the long term. As the climate crisis continues, entrepreneurs look to harness business opportunities to prevent waste by creating products that offer more sustainable consumption. According to a United Nations Environment study, untapped trade opportunities and export markets for green and sustainable food, products, services and energy are expected to grow rapidly.¹¹

In some countries, waste disposal is informal and results in no costs to municipalities. Today, more than 15 million people globally earn a living informally as waste pickers. The informal sector in developing countries diverts a significant amount of waste and puts it to productive use. When supported and organized, the informal waste sector can reduce poverty, strengthen the value chain and create new job opportunities in the circular economy. Furthermore, significant investment in digital and material innovations, as well as the embedding of sustainable production and consumption in local economies, could potentially give developing countries the chance to leapfrog countries with advanced waste systems. Emerging cashless economies via smartphone payments offer opportunities for novel ways of transacting across the supply chain.

System map circular economy



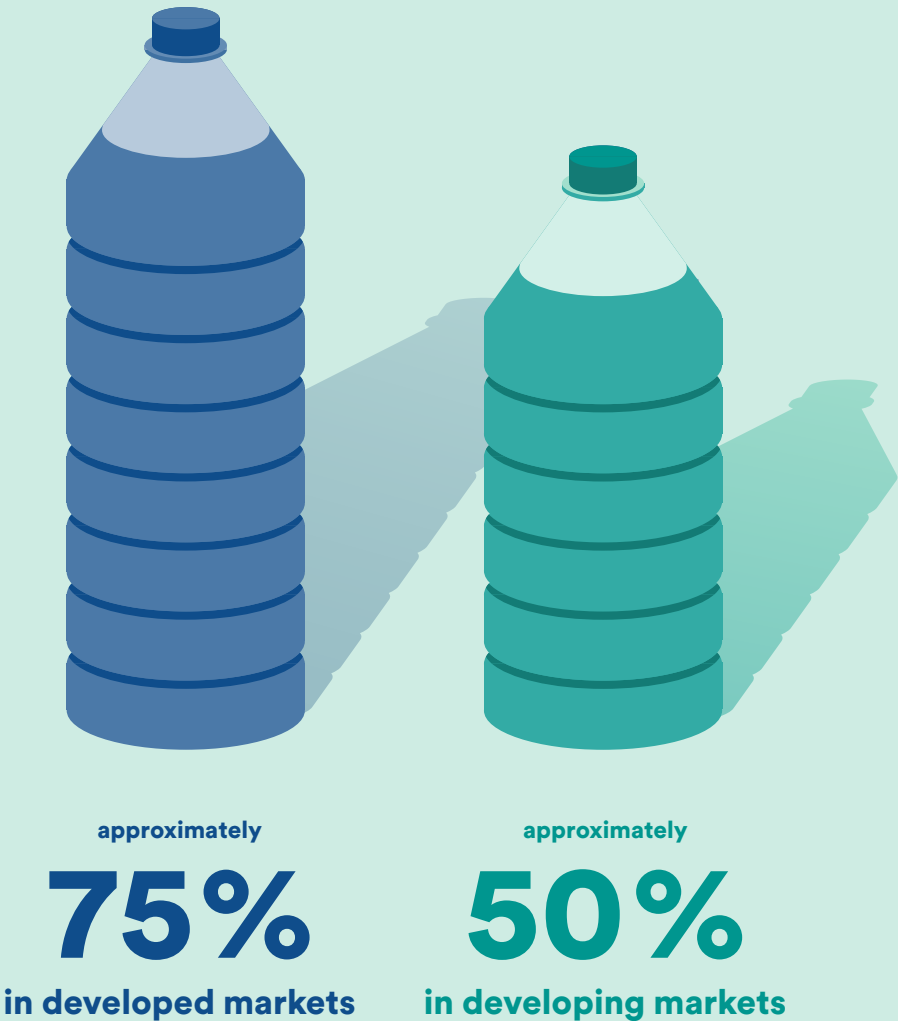
ReDesigning Production – Made for Recycling

Production has a substantial impact on the environment, resources and waste. By improving product design and optimizing production processes, companies can help save precious resources and boost innovation. Moving towards simplified design that makes products more durable, easier to repair and to recycle is a first step in preparing for extended producer responsibility (EPR) schemes based on a product’s end-of-life costs. To reduce resource consumption and waste generation, innovative processes such as industrial symbiosis, where the waste of one company becomes the resource of another, could be commonplace.

Over 450 signatories including consumer businesses such as L’Oréal, MARS, Nestlé, PepsiCo, The Coca-Cola Company, Unilever and Werner & Mertz have pledged to use 100% reusable, recyclable or compostable packaging by 2025 in collaboration with the New Plastics Economy Initiative.

As companies make commitments for products to include recycled content, significant investments are made in renewable sources. The demand for recyclates in plastic packaging will be significantly stronger than in 2020. In developed countries, approximately 75 percent of plastics packaging will be designed to be recycled, whereas estimations for emerging markets gravitate towards 50 percent.

2030 Expectation:
Percentage of plastic packaging
designed for recycling



ReThinking Consumption –
Prioritizing Circularity over Convenience

While increased environmental awareness directly correlates with consumer involvement, many consumers are unaware of the broader relevance of the circular economy in their lives. Consumers around the world will continue to ask for more protection and safety when it comes to food, which is often only achieved through plastic packaging. This consumer trend will drive food-grade post-consumer recycled (PCR) plastic or alternative material innovations.

“As consumers continue the pressure on brand owners, new apps and technologies will appear and enable an increased and easier engagement for end consumers.”

Thomas Hascoet
Director of Strategy and Development, Veolia

In developed markets, new infrastructure and higher awareness has led to consumers making only slight efforts to enable recycling through their time and money. Despite consumers’ reluctance to make a greater effort, society will demand – even more so than in 2020 – the waste problem be solved. For this reason, many apps and technologies that exist today will be even more widely adopted by consumers moving forward. These tools offer accessibility to sustainability figures,

which empower consumers to stop buying items because of their environmental impact. Government involvement in these markets will especially drive consumers’ reduction, reuse and recycling of plastic packaging.

Almost two thirds (62%) of young consumers in the UK admit they would stop using a brand if it was found to be detrimental to the environment, according to new research.¹⁰

As environmental awareness increases in developing markets, values and consumer behavior will evolve, but more urgent priorities will take precedence. Pressing needs, such as clean water, sanitary issues and extreme weather conditions, play a superseding role in everyday life. The waste issue often remains a secondary or even tertiary concern.

Consumers in 2030 are expected to consider environmental impact, especially when buying apparel and food. While convenience and cost are vital in achieving consumer participation in a green economy, the majority of consumers will not likely be willing to expend significant effort or pay premium prices for circular solutions.

2030 Expectation:
Consumer engagement and
the reuse of plastic packaging



Developed markets:
Slight efforts in spending
time and money

Developing markets:
Focus on convenience and
issues more urgent than waste

approximately
10%
reuse plastic packaging

ReOrganizing Waste Collection – Keeping Things Simple and Separate

Waste collection is unquestionably needed in every region of the world to transition to a circular economy, and it also plays the leading role in reducing plastic in oceans. Improper waste disposal is the leading cause of soil contamination but also adversely affects air and groundwater quality. Therefore, waste collection is an integral part of human health and building a thriving economy. By establishing policy instruments for waste collection, and designing collecting and sorting systems to maximize capture for recycling at the lowest cost, the management of residual waste becomes a pivotal contributor to greenhouse gas reduction targets.

with simplified packaging design, will make the collection and sorting solid municipal waste in developed markets less burdensome and improve the quality of resource recovery.

Not all deposit return systems are created equal. The performance of such systems depends heavily on the local culture, industry structure and public policy.

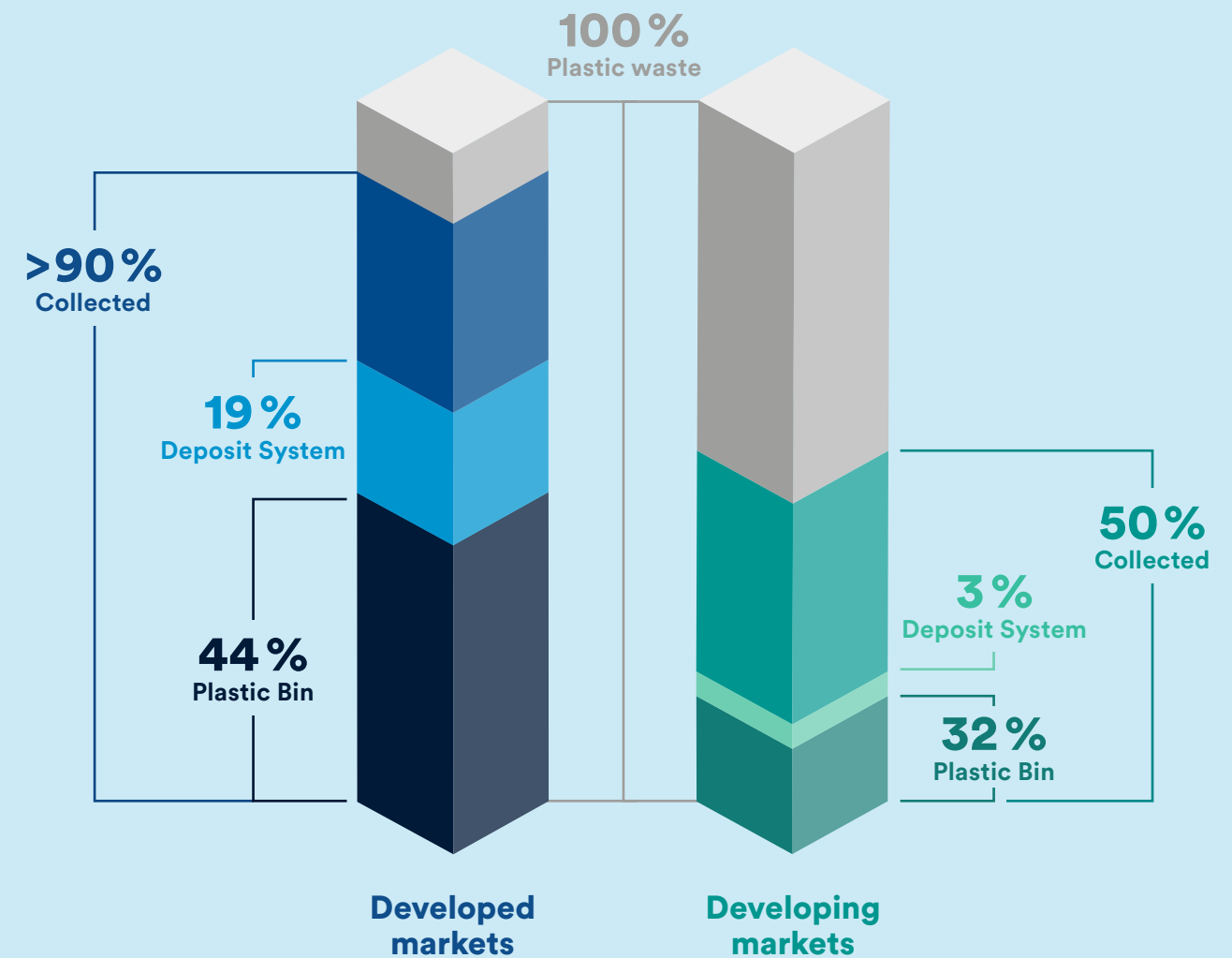
In regions with public policy that introduces deposit return systems (DRS), monetary incentives bring about higher consumer participation and thus higher return rates of plastic bottles and drink containers. Technologies such as reverse vending machines (RVMs) enable DRSs by making the return of containers more efficient and convenient. System changes like DRS complement the informal sector and can create green jobs. Non-regulatory measures such as NGOs and philanthropic organizations, for-profit investments and the push from developed markets will advance circularity globally. Educational campaigns will play an ever-increasing role in supporting waste collection in developing countries.

“The means of separating and sorting are consistently improving as new technologies develop. Furthermore, stakeholders are awakening to the need for simpler design. Combined, these actions will make it easier to recycle and reduce contamination.”

Robert Flores
VP of Sustainability, Berry Global

Separate collection of waste is essential for high-quality recycling and reuse strategies. While separate collection is often not established in developing markets, with only 30 percent of waste being separated, governments with advanced waste management are focusing on legislative measures to harmonize methods for separate collection. These enhancements, along

2030 Expectation: Percentage of plastic packaging waste collected and which collection systems will prevail



ReStructuring Recycling – Collaborative Transformation

While waste management and recycling companies are the primary drivers of resource recovery today, investments made by converters and chemical companies will be influential in the transition to the circular economy. Legislation continues to propel the reduction in material complexity and improvement in waste streams, thereby enabling higher-quality recycling.

Large-scale consolidation of converters and chemical companies will take place across the entire industry with an even more substantial impact in developing countries. Mergers of converters and chemical companies with recyclers will enable greater transparency and command over the whole value chain, while also providing the significant capital for expensive massive infrastructure investment. Joint ventures will also become more prevalent in certain aspects of the value chain. Where substantial challenges are faced, joint ventures offer a way to mobilize knowledge and resources to tackle these issues more effectively.

The stakes are also high for chemical companies, where reusing plastic waste can be an opportunity for new business. Chemical companies are making the pivotal move into recycling through numerous acquisitions and intense research and development. Chemical companies will continue to be at the forefront of investment, which could enable a quantum leap in closed-loop recycling worldwide.

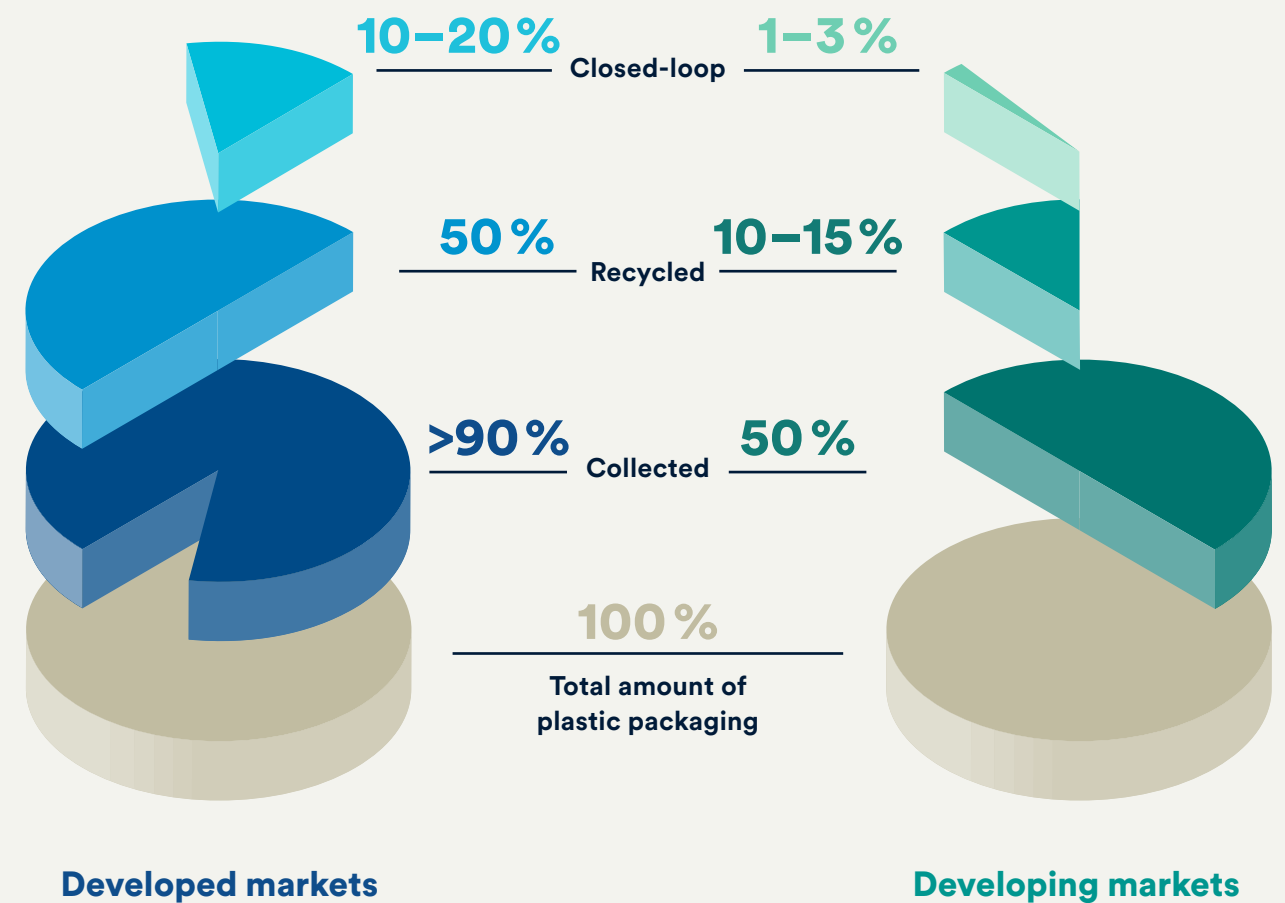
Chemical recycling could be a complementary solution to mechanical recycling where the latter proves to be unsuited to materially recover plastic because it is too degraded, contaminated or too complex.

**Zero Waste Europe
August 2019 Study**

Innovations in sorting technology, advanced mechanical recycling and packaging will determine the future of developed markets, as recycling is the primary circularity strategy rather than reduction or reuse. Mechanical recycling capacity will grow substantially but focus on ‘mainstream’ plastics, and the quality of sorting will be improved by NIR (Near Infrared) technology. Innovations in materials and additives, as well as chemical recycling, will enable recycling across industries globally.

“We aim to increase the global collection of recyclable plastic from 14 % to 40 %, as well as increase the recycling of plastics in closed loops from 2 % to 30 % by 2030.”

2030 Expectation: Percentage of plastic waste recycled and how much will be retained in a closed-loop system



ReFraming Regulation – A Holistic Approach

As societies demand more action to solve the waste problem, the primary focus will be recycling. Reducing the complexity of recycling, bans, and regulatory measures is needed for consumers to embrace a circular lifestyle and ensure policy success. Developing markets will create educational campaigns in high leakage areas as well as introduce extended producer responsibility (EPR), fees and bans, while more advanced markets will focus on recycling and reuse quotas, plastic taxes, EPR fees and deposit return systems.

As regulatory measures are enacted, business activity will intensify especially in areas where no policies exist. International cooperation and promoting synergies between policies to minimize incoherencies are vital. For instance, for developed countries to create a sound policy, they must consider any possible effects it could have on developing countries. After all, the transition towards a resource-efficient and circular economy goes hand in hand with climate neutrality for all.

Identifying regulatory barriers that inhibit circular economy development and removing those obstacles through innovations or regulation modifications could revolutionize the circular economy. Limiting legislative burdens while creating regulation to promote the reuse of resources and reduction of waste have proven successful in multi-stakeholder networks.

There are increasing calls around the world to address the alarming growth in plastic pollution, increase recycling, and reduce the use of virgin resources. Single-use plastics have particularly drawn focus, with the European Union's Single-Use Plastics Directive featuring bans on several plastic products and targets for member states to collect 90% of all plastic bottles by 2029.

2030 Expectation: Regulatory measures



Developed markets:

- Plastic taxes
- Recycling quotas
- Reuse quotas
- EPR fees
- Deposits

Developing markets:

- Bans
- EPR fees

creating synergies for holistic system solutions

TOMRA's roadmap to a circular economy

The future undoubtedly holds many challenges for humanity and the planet – and it's clear we have work to do. By addressing waste and how it is managed, we can mitigate the climate and ecological crises confronting us. In regions without effective systems in place to collect materials that the informal sector does not recycle, there is an urgent need to provide collection services. Limiting the sales of certain types of products and their respective packaging by specific regions could be an alternative way to eliminate all problematic and unnecessary waste. Despite numerous corporate sustainability initiatives, unsalable plastic packaging is still widely used in countries where waste collection services only serve a minority of its total population. In such circumstances, all plastic packaging has the potential to be problematic.

In regions without effective systems in place, there is an urgent need to provide collection services.

Wherever plastics cannot be reliably intercepted through some form of collection mechanism, especially when they regularly find their ways to rivers, beaches and oceans, their use will need to be restricted. When developing countries attributed plastic bags to blocking drains, exacerbating the risk of flooding and increasing the associated threat to life during monsoon rains, plastic bag bans were implemented. Similarly, in developed countries, bans were implemented to mitigate specific items often found littered, especially those which posed a threat to nature. Increasingly, producers will need to consider the diverse methods of waste collection service as an indication of the extent of their social license to operate. The development of collection services will be crucial in developing countries, along with creating more appropriate delivery models for what is consumed, and substitutions for widely littered products.



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Growing urban populations will also give rise to large and ever-increasing quantities of recyclable materials and food waste. Collection services need to go beyond ‘sanitary disposal’, which is often incineration. Such interim steps are commonplace in most developed countries, in which multilateral donors emphasize a single asset, high capital outlay solution, only prolongs the path to a circular economy. Leapfrogging to provide high-performance collection services which keep materials in use should integrate informal waste-pickers, and ensure their livelihoods are, as far as possible, maintained and improved. Such systems protect the health of those directly managing waste by minimizing the incidence of vector-borne diseases, such as dengue fever.

Developing countries have the opportunity to bypass traditional stages of development through the uptake of digital technologies. In many developed countries, moving to more advanced data capture is partially hindered by the legacy systems and the old way of doing things. These obstacles are less evident in systems that are in the early phase of development, where moving to a more sophisticated system of data capture and performance management can be implemented quickly. At the same time, the basic facility operations must be seamless. Whether manufacturing factories, recycling facilities, incinerators or sanitary landfills, it is essential to prevent mismanagement of materials and waste to stop the flow of plastics into the environment. Therefore, the basic regulation of these key installations will be imperative, and countries will also need to have regulatory oversight in place to ensure facilities are adequately funded and staffed. After all, poor management of waste only gives rise to the problems.

Developed countries have notably taken an ‘out of sight, out of mind’ mentality to recycling. There are long-standing trade patterns of secondary materials, such as the transfer of paper from developed to developing countries. With developed countries striving to meet rising recycling targets, the physical distance between the recycling claims and the reality in the receiving countries has conveniently allowed low-quality ‘recyclables’ to be exported to destinations ill-equipped to deal with waste. It would not be necessary to cease such trade completely, at least not when received by major manufacturing nations. So that both exporting and receiving countries mutually benefit, a better system for regulating the flow of secondary raw materials is needed.



Developing countries have the opportunity to leapfrog their developed country counterparts.

There is no sensible target for plastics entering the ocean other than zero.

Producers will need to think carefully and longer-term when specifying products and packaging, including the potential for retaining the selected materials once its end of life is reached. The term recyclability is defined in different ways by different actors, but what ultimately matters is what is actually recycled. Ideally, the design of packaging and products takes this into account. This is a major challenge for more global producers, who are either under economic pressure or simply prefer to produce at scale for a large market. Since different recycling systems might be in place in various parts of that market, the use of minimum service standards combined with extended producer responsibility offers a promising way to ensure appropriate systems and funding across markets.

Progressive approaches to waste collection and product bans must be rapidly implemented to manage materials at the end of their life for them to make their proper contribution and address the environmental crises.

Today, the best-performing systems in developed countries ensure the collection, sorting and recycling of well over 50 percent of all materials. However, in general, the quality of performance measurement is patchy. Waste data is impracticable to compare since measurement methods of recycled materials vary from country to country, and recent attempts by the EU to address this issue are welcomed. There are lessons that can be learned from high-performing systems, and the underlying principles should be applied across the developed world, adapted for local climatic conditions, patterns of housing, and other key variables to increase overall performance. There is also the need to improve the reporting of waste management performance. The concept of product traceability to help facilitate the sorting of waste streams would further enable their repair and reuse.

There is no sensible target for plastics entering the ocean other than zero. There is not enough action taking place, and it is not happening quickly enough. This problem cannot be resolved by global corporations signing up to commitments – it will only be solved by actions occurring on the ground, worldwide, with active participation from national and local governments, businesses and consumers. Many municipalities and public figures across the world are declaring their acknowledgement of a climate emergency. These municipalities can strongly influence society's contribution to reducing emissions by providing high-performance waste management services. Consumers use their purchasing power to buy more durable products, avoid single-use items through refill options, and select items made with recycled content. Together, these actions will reduce the embodied carbon and energy content of what is consumed while providing the raw materials that enable that transition to a circular economy.

To reduce greenhouse gas emissions from production, which is severely needed, we need to lessen the primary resources used and ensure recycled content is significantly increased. Meeting a percentage figure for recycling targets is not doing enough if the pursuit of better environmental outcomes is not achieved. Significant progress is already being made in many countries to decarbonize electricity generation, and over time, we expect this to become mainstream. However, the pace of decarbonization will be slowed down as long as consumption patterns continue to increase the energy demand, whatever its origin. All decarbonization pathways have highlighted the need to switch to low-carbon energy sources as well as the reduce the demand for energy. By increasing the use of recycled content, we will reduce the demand for energy associated with what we consume, and that reduction in energy consumption should quicken the decarbonization of the energy system. This is why it is so important to collect, sort and process materials for recycling in such a way that their quality enables their reintegration into productive use within the framework of a circular economy.

Meaningful progress is being made regarding optimizing business models for various products, reuse systems are gaining ground, new approaches to packaging design are being tried, and excellent initiatives are tackling the problem of food waste. However, the projections previously outlined and best estimates available still tell us that we have a massive problem of uncollected and mismanaged waste. The world has become somewhat of a living laboratory, testing the materials that we consume, and right now, it looks like it's going badly wrong. The lab is providing us with evidence of what does and does not work, and we cannot afford to repeat mistakes. We need systems that are designed to meet the enormous challenges of the 21st century.

The experts at TOMRA strongly believe that we need to immediately step up improvements in waste management on a global scale, and we will continue to contribute our extensive knowledge and proven field experience to this discussion along with that of various partners. Therefore, we have initiated a range of studies, both internal and external, to explore how we can deliver the best outcomes in the future, based on what we currently know, and what we believe may happen going forward. The aim is to help provide the know-how and a clear path to those who are looking to make positive changes.



To meet the enormous challenges of the 21st century, we need holistic system solutions.

A systems perspective must be adopted to address the myriad of problematic waste effectively. Studies show that household behavior can be influenced by features of the overall waste management system rather than targeting of specific materials, such as plastic. In the UK, for example, statistical analysis of household waste collection services showed that collection service for food waste was a key factor of the dry recyclables stream. Likewise, the amount of space available for unrecycled waste also affected the separation of waste. Even if the principle intention is to address plastics, entire systems need to address the broader problem of waste, as well as people's attitudes and behaviors towards it.

The nature of the current problems suggests different priorities for varying geographies, but all countries need to move towards similar objectives, albeit divergent trajectories. Systems tend to have a linear path-dependent logic with a menu of options available at a given point in time, shaped by decisions made in the past. But the truth remains: Few countries can claim to have an ideal waste management system, and there is a yawning chasm between what needs to be done and the current reality.

Why should waste management differ around the world?

Which performance indicators are best suited to my region?

What actions can policy makers and businesses take to make a bigger impact?

Which system is best when starting from scratch?

What can further enhance a system short-term?

What could hold back high performance?

What are the key components of a system, and why?

TOMRA is confident that collectively, we have the knowledge and ingenuity to bridge that chasm so we can all tread more lightly on the planet. We have developed a Holistic System Solutions (HSS) program to highlight issues and chart a path towards the way we manage materials at the end of their life to meet the challenges of the twenty-first century head-on. Waste management plays an important role, but the solution also focuses on redesigning models of consumption, increasing the longevity of products through design or making them more suitable for reuse, in addition to finding ways to repair and remanufacture products.

TOMRA will publish the finding and results over the coming months, and we invite interested parties to engage with us actively. We have challenged our thinking, debated internally and passionately deliberated the intricacies and merits of Holistic System Solutions, and what they might look like in different geographies.

Conclusion

The challenges, projections and opportunities presented in this paper outline the necessary steps in shifting from a linear to a circular economy. Recreating our world for a more sustainable future requires a holistic approach to managing waste, recognizing its key role in helping address the environmental crises that the world is facing, and fostering a more circular economy. Developing the framework for improving collection services and introducing deposit return systems is a starting block. Through collaboration and partnerships to pilot new projects, together we can radically reduce the use of primary resources, design out waste, contribute to greenhouse reduction targets, harness materials to keep them in use and redefine growth through regeneration.

Developing circular value chains that balance interdependent systems begins with a holistic approach to change: one system alone will not provide the ultimate result. By integrating models that give value to the collection and recycling of waste, the circular economy has the potential to deliver considerable benefits for both developed and developing countries. While emerging technologies and innovations in material, additive and chemical recycling present exciting opportunities, there are a number of economically feasible solutions available today that can accelerate the path towards circularity. And the perfect time to start is now – with the technologies and proven strategies to make our future more sustainable.

“Our commitment to the circular economy is unequivocal. Until recently, it was unheard of having players from the entire value chain at one table. From chemical companies to converters, retailers and brand owners, waste management companies and recyclers – there’s true dedication in finding solutions. We take pride in doing our part: sharing our know-how, developing new solutions and striving to make our planet more sustainable every day.”



Dr Volker Rehrmann

Head of Circular Economy, TOMRA

Additional reports and best practices will be made available through tomra.com and the ReSociety – an initiative and resource to reimagine and recreate our world for a more sustainable future.

About TOMRA

TOMRA is a global impact leader in the resource revolution by creating and providing sensor-based solutions for optimal resource productivity. Founded in 1972 on an innovation that began with the design, manufacturing and sale of reverse vending machines (RVMs) for automated collection of used beverage containers. Today TOMRA provides technology-led solutions that enable the circular economy with advanced collection and sorting systems that optimize resource recovery and minimize waste in the food, recycling and mining industries.

TOMRA Circular Economy

TOMRA Circular Economy (TCE) was established in January 2019 to capitalize on market opportunities emerging from a circular economy framework. As the only company that can offer a holistic solution for waste management, TOMRA is excellently positioned for this fast growing and future-proof market, as the world transitions to a circular economy. TCE will shape the market and thus change the competitive landscape. With its leading position in collection and sorting product technology and recognized process knowledge, TCE will work to position TOMRA as an essential strategic partner by collaborating with key business players across the entire plastics recycling value chain. Our target is to develop new methods, processes, technologies and business models, aiming at accelerating the transition to a truly circular economy and thus driving new growth for the two business divisions. TCE’s long-term focus will lead to new business opportunities beyond today’s business through exploration of disruptive technologies and digitalization of the value chain.

TOMRA Group employs approximately 4,000 people globally and is publicly listed on the Oslo Stock Exchange (OSE: TOM).

www.tomra.com

About ReSociety

ReSociety is a global collaborative initiative promoting and accelerating the transition to the circular economy. Initiated by TOMRA Circular Economy Division in early 2020, ReSociety invites industries, policymakers, enterprises, journalists, NGOs, educators and consumers from all over the world to share best practices and knowledge, establish new and rewarding partnerships and co-create solutions.

www.resociety.net

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