THE CIRCULARITY GAP REPORT

2020

When circularity goes from bad to worse:
The power of countries to change the game

CIRCLE ECONOMY

WHO WE ARE

We work to accelerate the transition to a circular economy. As an impact organisation, we identify opportunities to turn circular economy principles into practical reality.

With nature as our mentor, we combine practical insights with scalable responses to humanity's greatest challenges.

Our vision is economic, social and environmental prosperity, without compromising the future of our planet.

Our mission is to connect and empower a global community in business, cities and governments to create the conditions for systemic transformation.

The Platform for Accelerating the Circular Economy (PACE) This report is published as part of the Platform for Accelerating the Circular Economy (PACE). PACE is a public-private collaboration mechanism and project accelerator dedicated to bringing about the circular economy at speed and scale. It brings together a coalition of more than 70 leaders and is co chaired by the heads of Royal Philips and the Global Environment Facility. It was initiated at the World Economic Forum and is currently hosted by the World Resources Institute.

IN SUPPORT OF THE CIRCULARITY GAP REPORT

CAROLINA SCHMIDT
Minister for the Environment at the Government of Chile

"The circular economy is a fundamental means to achieving sustainability and carbon neutrality. Yet to know if we're getting there, we need to measure circularity. The series of Circularity Gap reports have been illuminating, as they're showing us the –distressing– tendency of the past years. This third report sparks an alarm for all governments; we need to deploy all the array of policies to really catalyze this transformation."

GINO VAN BEGIN
Secretary General at ICLEI - Local Governments for Sustainability

"The circularity gap is widening, and with it, the climate and biodiversity impacts of our extractive economies. To confront environmental challenges and deliver socio-economic benefits, we must rethink how we consume and dispose of materials. This report offers essential metrics to track progress and underlines the key role played by cities and regions in bridging the gap."

FRANS VAN HOUTEN
CEO at Royal Philips

"Despite two years of concentrated efforts and pockets of success, circularity's global impact is not big enough. This report provides a clear roadmap for action. Countries, cities and businesses can step up as change agents to accelerate circularity locally and globally. But, governments and businesses alike must engage in far-reaching, cross-border collaborations for circular value chains and climate neutrality."

CRISTIANNE CLOSE
Leader at World Wildlife Fund Markets Practice

"Our current economic and financial systems are driving unsustainable consumption and degrading the natural environment. The circular economy provides a tangible framework for reducing our impacts, protecting ecosystems and living within the means of one planet. Collaborating with business and civil society, governments can play an invaluable role in delivering positive change by implementing policies that encourage circularity and systems change."

DAVID B. MCGINTY
Global Director at Platform for Accelerating the Circular Economy

"The transition to a global circular economy will continue requiring new data and metrics to enable public and private sector leaders to make the best decisions. This Circular Gap Report is another step forward, providing leaders with data and insights on how to understand national-level circularity and possible ways to cluster, learn from similarly-situated countries, and better understand their individual and collective transitions."

RACHNA ARORA
Deputy Team Leader & Coordinator at the European Union - Resource Efficiency Initiative (EU - REI) at, the Government of India

"The Circularity Gap Report conveys a compelling need for redesigning economic models. The North-South dilemma will not lead to the needed transition, businesses and policy makers need to create an opportunity for the scale up. Although many thought leaders and countries have initiated action in terms of rising social inequity, declining resources and national frameworks but further increase in the CE gap from 2018 to 2020 by 0.5% is threatening. We need accelerated action by investors, designers, businesses, researchers, consumers and policy makers to create an economic opportunity for CE, worldwide."

JANEZ POTOČNIK
Former European Commissioner for the Environment and Co-chair at the UNEP International Resource Panel

"Circular economy is becoming a widely recognised and accepted concept. But to make it real, as the report shows, will request many efforts and a system change also in our understanding of the circular economy. We need to embrace dematerialisation, rethink ownership concept and move from resource efficiency to resource sufficiency."

NAOKO ISHII
CEO and Chair at the Global Environment Facility

"The Circularity Gap Report has quickly become the annual go-to report for understanding the status of the world's circularity. This year's report has revealed that the world has regressed from 9.1% circularity reported two years ago to 8.6% this year. This finding underscores the urgent need for collective action. With clear articulation of the challenges and opportunities, problems and solutions, the Report provides critical insight to companies as they define their road maps toward circularity."

PETER BAKKER
CEO at WBCSD

"Business as usual is dead. We must commit to taking action at scale to make the circular economy reality. Measuring our individual and collective performance in the circular economy is fundamental in knowing whether we're decoupling resource consumption and financial performance at the rate which our planet is demanding of us."

MUKHISA KITUYI
Secretary General at the United Nations Conference on Trade and Development

"Broad awareness of the need to transition to a circular economy is now driving governments, companies and consumers to use resources more efficiently and minimize waste. But how far have we come and how much further do we need to go? And beyond plastics and CO_2 that make the headlines, what other waste streams require our attention? The Circularity Gap Report 2020 answers these important questions for us. It is required reading for all of us working to advance a circular economy."

FEIKE SIJBESMA
CEO at DSM

"This report recognizes the critical role that countries play in closing the widening circularity gap, and underlines the urgent need for close collaboration. Companies that have a global footprint also have a responsibility to embed circular thinking into their business models and processes. We must join forces to enable the transition to a circular economy."

ANDERS WIJKMAN
Chairman of the Governing Board at Climate-KIC and Former Co-president at the Club of Rome

"The way we measure circularity is still not good enough. Circularity goes way beyond recycling. But the Circularity Gap Report conveys a strong message that we are still stuck in the linear production model. This has to change. The focus in the Report on developing countries is spot on. We have to help them avoid repeating the linear production mistakes of the rich countries. If we succeed in that there is hope for the world."

EXECUTIVE **SUMMARY**

Today, the global economy is only 8.6% circular — just two years ago it was 9.1%. The global circularity gap is widening. There are reasons for this negative trend, but the result remains the same: the news is not just bad, it is worse. The negative trend overall can be explained by three related, underlying trends: high rates of extraction; ongoing stock build-up; plus, low levels of end-of-use processing and cycling. These trends are embedded deep within the 'take-make-waste' tradition of the linear economy — the problems are hardwired. As such, the outlook to close the circularity gap looks bleak under the dead hand of business as usual. We desperately need transformative and correctional solutions; change is a must.

Countries are critical facilitators of the circular economy. This is not because of what they have achieved in the past, but what they could deliver in the future. An initial cohort of countries have engaged with the circular agenda, ranging from individual nation states in Europe, to the giant economy of China. Yet recent years have witnessed a steady stream of new players adopting circular economy policies and roadmaps.

The opportunity is real. The *Circularity Gap Report* will provide on the ground examples across the globe to illustrate how the practical implementation of circular economy strategies and solutions is an everyday reality — right now. This global groundswell of positive action is happening bottom-up: from waste processing in Nigeria, to a digital solution that empowers informal trash collectors in Brazil. Today, we see entrepreneurs, businesses and communities coming together with city officials leading the way, followed by an increasing number of countries and national governments that are shaping their strategies to support investment towards sustainable and specific circular economy agendas.

We are all developing countries now. Closing the circularity gap serves the higher objective of preventing further and accelerated environmental degradation and social inequality. The end goal is to establish an *ecologically safe* and *socially just* operating space for mankind.[1] As laid out in the Sustainable Development Goals and the Paris Agreement, countries have an important and pivotal role to play.

Some countries operate well within the ecological boundaries of our planet, but without satisfying certain basic social needs. Conversely, other countries increasingly provide basic levels, but do so by overshooting the sustainable means of the planet. Effectively, therefore, all countries are developing now: each starts from a different point on the map; many share commonalities in their journey; but, all have a distance to go.

Different countries, common needs. In principle, all countries are unique when it comes to their ecological footprint and ability to provide for their people. In practice, some face similar barriers and many are confronted with the same global trends. So, zooming in from the global footprint to look at satisfying national, regional and local societal needs, this *Circularity Gap Report* examines and extrapolates common challenges and opportunities experienced by distinct country groups. When circularity goes from bad to worse, we explore the power of countries to change the global game.

3 STEPS TO BRIDGE THE CIRCULARITY GAP THROUGH LEADERSHIP AND ACTION:

1. **Foster global collaboration to collect and share data.** This will enable identification of key data needed to measure and track circular performance, plus provide the necessary infrastructure and alliances to collect, retrieve and share data.

2. **Translate global trends into national pathways.** This will enable countries to set goals, peer review, measure and benchmark performance, plus track progress against their ambitions; while still allowing them to formulate practical pathways that are aligned to local context, incentives, and mandates.

3. **Build a global coalition for action that is both diverse and inclusive.** This will bring together front-running businesses, governments, NGOs and academics to collectively boost capacity and capability to better serve societal needs more sustainably.

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1. INTRODUCTION

In a world where the only news seems to be bad, it would be nice to report that things are getting better in terms of global circularity. Sadly, they are not. The circularity gap is getting wider and resources more scarce. As consumption spirals upwards, the carrying capacity of the planet falls and sustainability suffers. We desperately need transformative and correctional solutions. So, what the 2020 Circularity Gap Report aims to do is set out the critical role to be played by one of the key potential agents of positive change: Countries.

ENGINE STUCK IN REVERSE

Up until the relatively recent past, our world economy had been operating in a broadly circular manner. It was only around 200 years ago that things really took a turn for the worse: this was when the Industrial Revolution pressed the ignition button on global growth. The upside of what followed was improved prosperity for some people, in some parts of the world, for some time; the downside was that the twin forces of accelerated resource extraction and consumer demand were unleashed worldwide, driving forward a new model of take-make-waste. Ever since, we have been headed in the wrong direction on circularity. As a result, the global engine of change is stuck in reverse.

So, what's new? Well, it is not so much the message, as the evidence. Evidence of environmental impacts is building; revealing the true extent to which our linear tradition is embedded deep within our society. In 2017, for example, our material resource use breached the 100 billion tonnes mark for the first time in history. Advances in scientific study are also painting a more detailed, but bleaker picture of where we are headed. In 2019, for instance, we received fresh reports of Greenland's ice sheet melting seven times faster than in 1990.[2]

A FALTERING RESPONSE

In response, policymakers, business and communities worldwide have largely pinned their hopes for a turnaround on two landmark pillars of strategic and ambitious international collaboration: The United Nations Sustainable Development Goals (SDGs) and the Paris Agreement.

The aspirational and holistic nature of these two frameworks is both inspiring and inclusive. Whilst the thinking is positively joined-up, the doing is typically not. Particularly on Paris targets, policy implementation is proving incrementally slow and collective action plainly inadequate. Symptomatic of this legislative lethargy, the UN COP25 climate gathering, held in Madrid, in December, saw 2019 end with a whimper not a bang. Bogged down in technicalities and fogged by compromise and fudge, the talks proved the longest on record, yet achieved little or no progress, or agreement.

The irony is that the sense of urgency and appetite for change amongst the general public has never been stronger, or greater worldwide. From Extinction Rebellion and the Climate Emergency, to teenage activist Greta Thunberg and the Friday school strikes, momentum is building fast — especially amongst millennials who are literally taking to the streets to protest against perceived political apathy, corporate irresponsibility and social injustice.

A 1.5˚C WORLD IS CIRCULAR

There is good news in all of this, though; and it comes in the form of the largely untapped potential of the circular economy, as a means to an end that is both demonstrable and doable. The pathway to a low-carbon future is circular. In fact, the goal of the Paris Agreement to limit global warming to 1.5°C above pre-industrial levels can only be achieved by way of a circular economy. The circular and low-carbon agendas are complementary and mutually supportive.

THE POWER OF COUNTRIES

Critical facilitators and core enablers of this circular economy are countries — not because of what they have achieved in the past, but what they could deliver in the future. After an initial cohort of countries was seen engaging with the circular agenda — ranging from 13[3] individual nation states in Europe to the giant economy of China — recent years have witnessed a steady stream of new players adopting circular economy policies and roadmaps. In 2019, for instance, Colombia launched its National Circular Economy Strategy,[4] the first of its kind in Latin America.

These emerging national agendas can also provide insights into why joint action is needed, as well — with shared experiences helping build consensus. For example, when the European Commission's Green Deal launched in December 2019 with the ambition of creating the first climate-neutral continent by 2050, it was promptly adopted by almost all countries within the European Union. In short, countries have circular potential; and potential is power.

THE OPPORTUNITY IS REAL

What the report will show is how examples on the ground and right across the globe illustrate that practical implementation of circular economy strategies and solutions is an everyday reality, right now. Moreover, it is just as much a positive reality as the one-step-forward-two-steps-back UN climate see-saw appears a negative one.

Furthermore, this global groundswell of positive action is happening bottom-up. Ranging from start-ups to cities, multiple innovators and disruptors are driving the circular transition — and a growing number of countries are responding and rising to the challenge with bold vision and incentives to stimulate and support the emerging market. From waste processing in Nigeria, to a courageous plastic ban in Rwanda, we see entrepreneurs, businesses and communities coming together with city officials leading the way; followed by an increasing number of countries and national governments that are shaping their strategies to support investment towards sustainable and specific circular economy agendas.

NEED TO SCALE, NOW

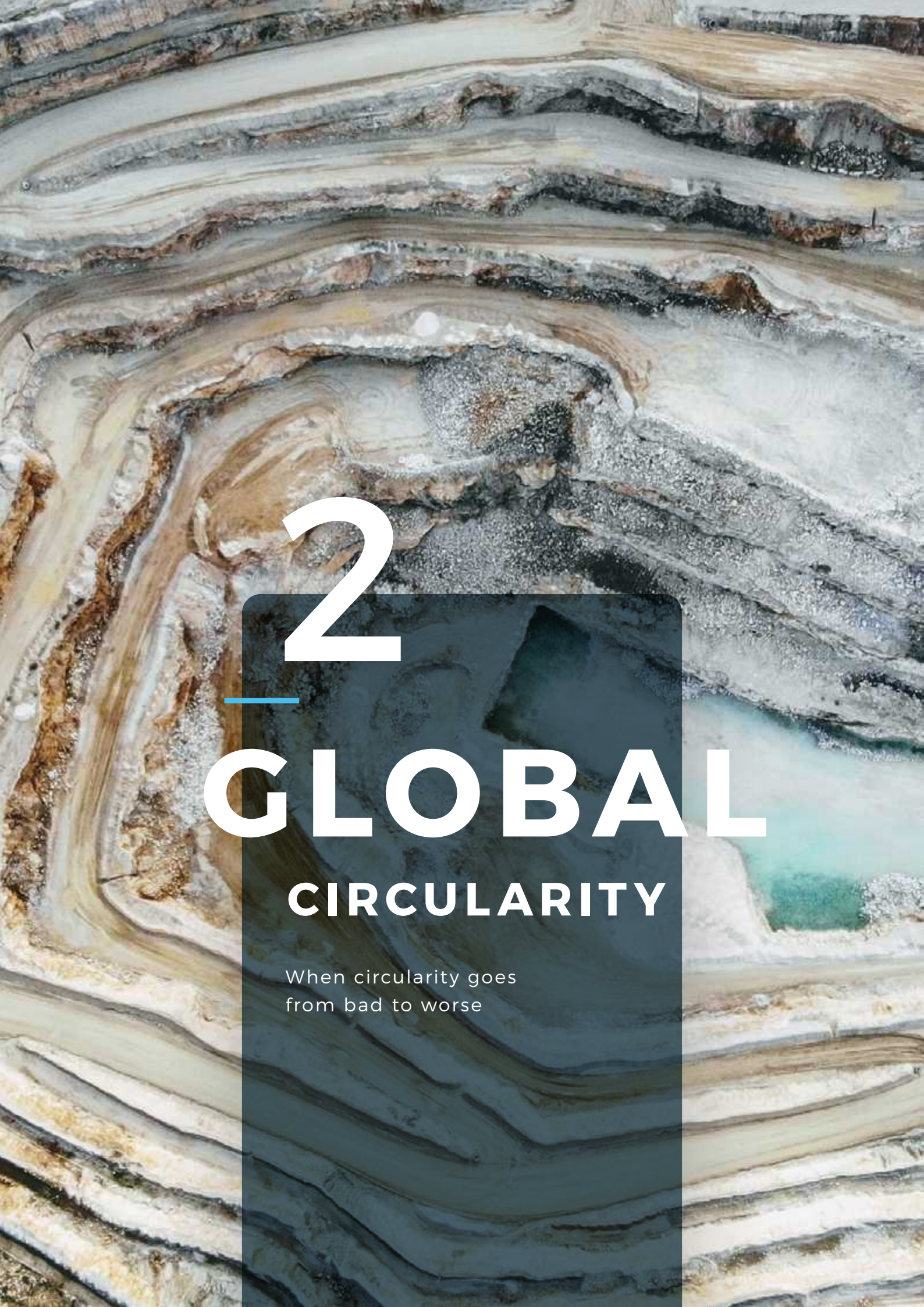
So, whilst the practical examples of circular economy are real and springing up all around the world, there remains an urgent need to scale. What we have is more than mere proof of concept, it is a bona fide business case and blueprint for action on every continent. However, it is also still only a drop in the ocean; it is simply not enough. Linear dependency is a great leveller: no country currently inhabits *the safe and just* space; everyone must do more, fast. We live in a world that is only 8.6% circular and nowhere near 1.5°C degrees. We are all developing countries, now. For countries, this truly is their time.

AIMS OF THE 2020 CIRCULARITY GAP REPORT

1. Report on the progress of global circularity and the gap by applying the Circularity Gap Metric to new data.
2. Based on the above, identify key trends and possible levers for transitioning to circularity at a global level by mid-21st century.
3. Also, identify hardwired habits and business-as-usual behaviours with potential to form systemic blockages.
4. Analyse how 176 countries perform on their Social Progress and Ecological Footprint to determine their distance to the *safe and just* operating space for humankind.
5. Identify key pathways for three distinct country groups to transition towards the *safe and just* space.

ABOUT THE CIRCULARITY GAP REPORT

The first Circularity Gap Report presented the alarming statistic that our world economy was only 9.1% circular, leaving a massive circularity gap. The Report, launched in January 2018 during the World Economic Forum Annual Meeting in Davos, has since been updated and published every year, with this being the third edition. It aims to contribute to the emerging evidence base that supports decision-makers in business, politics and civil society with key insights and metrics to guide their action in the most impactful way. In particular, it seeks to move thinking on global circularity in the direction of better measurement, so as to be able to set targets uniformly and track progress consistently year-on-year. From 2020, the Circularity Gap Reporting initiative (CGRi) will also explore how data to inform stakeholder decision-making can best be collected, consolidated and made available globally. For updates and contact details we encourage you to visit our website: *circularity-gap.world*



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GLOBAL CIRCULARITY

When circularity goes from bad to worse

Today, the global economy is only 8.6% circular — just two years ago it was 9.1%. There are reasons for this negative trend, but the result remains the same: the news is not just bad, it is worse. This negative trend can be explained by three key related, underlying trends: high rates of extraction; ongoing stock build-up; and, increasing (but still low) levels of end-of-use processing and cycling. These underlying trends are deeply embedded within the 'take-make-waste' tradition of the linear economy — the problems are hardwired. As such, the outlook for closing the circularity gap looks bleak under the dead hand of business as usual. We desperately need transformative and correctional solutions; change is a must.

For the first time in history, more than 100 billion tonnes of materials are entering the global economy every year. The reasons for this are threefold. Firstly, it is because we rely predominantly on extracting virgin materials, rather than making better use of existing resources, to fuel growth. Data suggests that the rate at which extraction of resources increases, outpaces improvements in the recovery at end-of-use by a factor of two to three. The second reason is that we are adding more materials to build up our global housing stock, infrastructure and heavy machinery — together being supplied to service the needs of a growing global population. Thirdly, our lack of end-of-life processing and cycling, as well as poor design of products, contributes to a self-perpetuating linearity that only exacerbates demand for virgin materials, thereby starting the whole unsustainable sequence all over again.

MATERIAL EXTRACTION

Material extraction has fuelled prosperity growth since the Industrial Revolution. In fact, over the last five decades, the global use of materials has more than tripled — increasing by a factor of 3.5, from 26.7 billion tonnes in 1970, to 92.0 billion tonnes in 2017. The International Resource Panel (IRP) forecasts that by 2050 material use will amount to between 170 and 184 billion tonnes.[5] A proportion of these billions of tonnes extracted comprises inherently non-circular and non-regenerative materials — for example, oil derivatives such as petrol, burned in combustion engines of vehicles.

STOCK BUILD-UP

Urbanisation, as a global phenomenon, is increasing and accelerating demand for housing, so driving the stock build-up dynamic worldwide. Additionally, the build-up of physical assets in utility infrastructure is on the increase — improving the provision of services such as energy, water, sanitation, communication and mobility. Of the materials entering the global economy every year the majority (52.6 billion tonnes) are being used by society as short-lived *Products that Flow*,[6] such as an apple or a pair or a pair of jeans, reaching their end-of-use typically within a year. The other 48.0 billion tonnes of materials enter into long-term stock,[7] referred to as *Products that Last*.[8] These come mainly in the form of buildings, infrastructure and capital equipment.

When materials, mostly minerals and ores, are invested into stock in the form of buildings, infrastructure and heavy machinery, they become embedded and unavailable as secondary feedstock for as long as they remain stored and in use. It is, therefore, paramount that these buildings, roads and machines are designed, produced, maintained and reused in a circular manner. The *2019 Circularity Gap Report* assessed in detail how such assets can move to circularity.[9] While hard numbers are lacking, we need to count on the circular design of current stock build-up, thereby locking-in future opportunities for the maintenance, repairability and reusability of these assets.

PROCESSING AND CYCLING

On a positive note, we do see that, in parts of the world, recovery rates are on the increase. This is steered by comprehensive government policy and technical innovation and investment directed at increasing material efficiency, extending and intensifying use and enabling end-of-life recovery. By way of illustration, solid waste recovery in Europe between 2011 and 2016 increased by an average of 11%, with countries such as Sweden, Austria and Luxembourg leading the way with recovery rates above 80%. Recycling rates have also been improving over the years, representing a growing proportion of solid waste (excluding emissions and water) that gets recycled. The ever-increasing rate of material extraction, however, means that these modest improvements in waste recycling are being overtaken by the sheer volume of virgin materials being sourced and used to fuel our growth. The yield of secondary materials is, therefore, simply not sufficient to feed our hungry economy on its own.

7 SOCIETAL NEEDS & WANTS

HOUSING AND INFRASTRUCTURE

The need that represents the largest resource footprint, with 38.8 billion tonnes, is for construction and maintenance of houses, offices, roads and other infrastructure, especially in the developing world.

SERVICES

The delivery of services to society ranges from education and public services, to commercial services like banking and insurance. The material footprint is modest in total and typically involves the use of professional equipment, office furniture, computers and other infrastructure.

NUTRITION

The second biggest category in terms of resource use is the need for nutrition. Agricultural products such as crops and livestock require 21.3 billion tonnes per year. Food products have short lifecycles in our economy, being consumed quickly after production.

HEALTHCARE

With an expanding, aging and, on average, more prosperous population, healthcare services are increasing globally. Buildings aside, typical resource groups include use of capital equipment such as X-ray machines, pharmaceuticals, hospital outfittings (beds), disposables and homecare equipment.

MOBILITY

A considerable resource footprint is taken up by our need for mobility. In particular, two resource types are used: the materials to build transport technologies and vehicles like cars, trains and airplanes; plus, predominantly, the fossil fuels burned to power them.

COMMUNICATION

Communication is becoming an ever-more important aspect of today's society, provided by a mix of equipment and technology ranging from personal mobile devices, to data centres. Increased connectivity is also an enabler of the circular economy, where digitisation can make physical products obsolete, or enable far better use of existing assets, including consumables, building stock or infrastructure.

CONSUMABLES

Consumables are a diverse and complex group of products - such as refrigerators, clothing, cleaning agents, personal-care products and paints - that generally have short to medium lifetimes in society. Textiles including clothing also consume many different kinds of resources such as cotton, synthetic materials like polyester, dye pigments, and chemicals.

THE GLOBAL MATERIAL FOOTPRINT BEHIND SATISFYING KEY SOCIETAL NEEDS

Newly updated, Figure 1 shows the volume of globally extracted resources per year, which amounted to 92.0 billion tonnes in 2017.[10] These extracted resources are complemented by 8.65 billion tonnes of cycled resources, bringing total material inputs to 100.6 billion tonnes. Apart from looking at how resource groups satisfy societal needs, the figure also presents insights into what happens to resources after use (*End-of-use*).

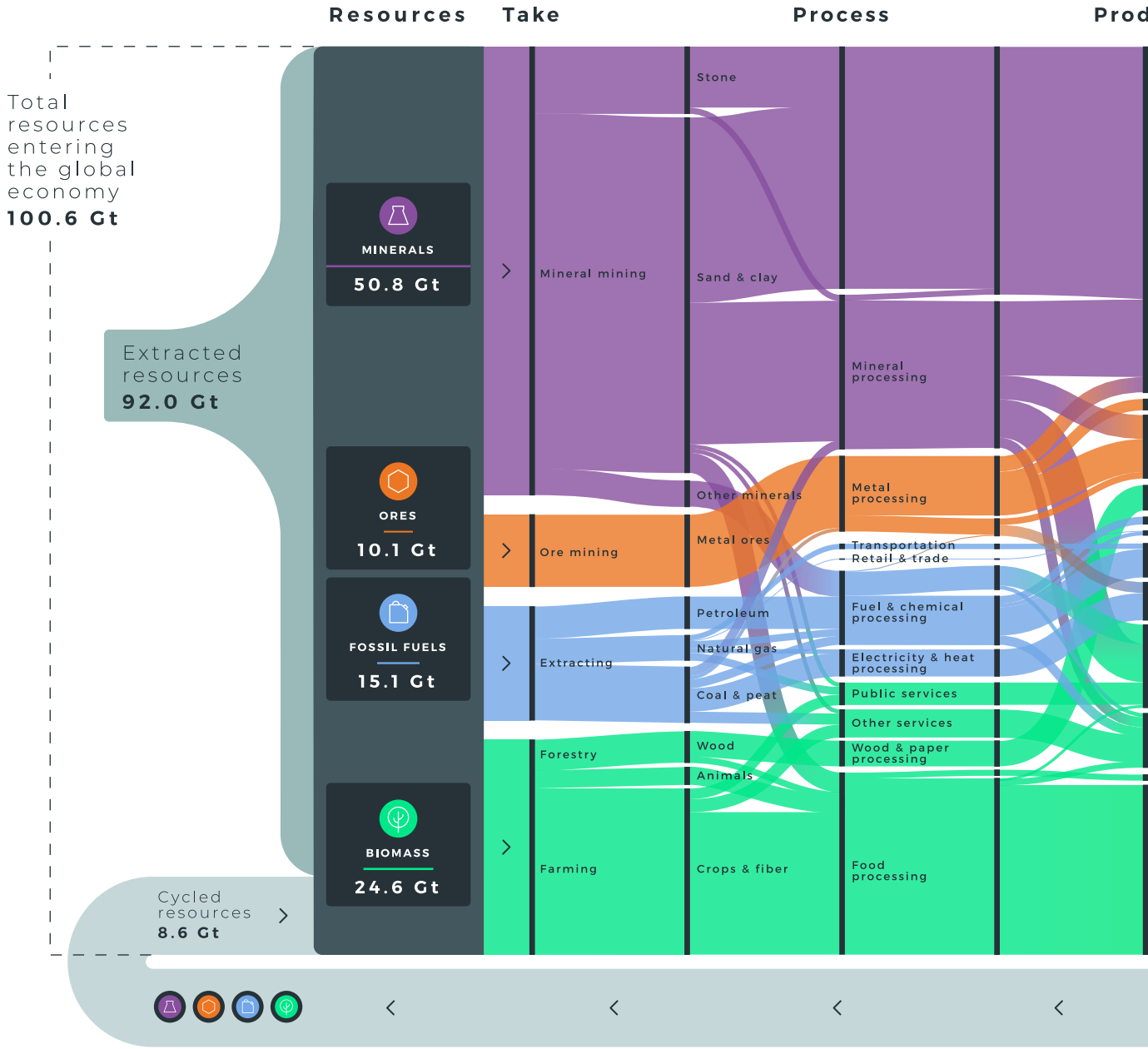
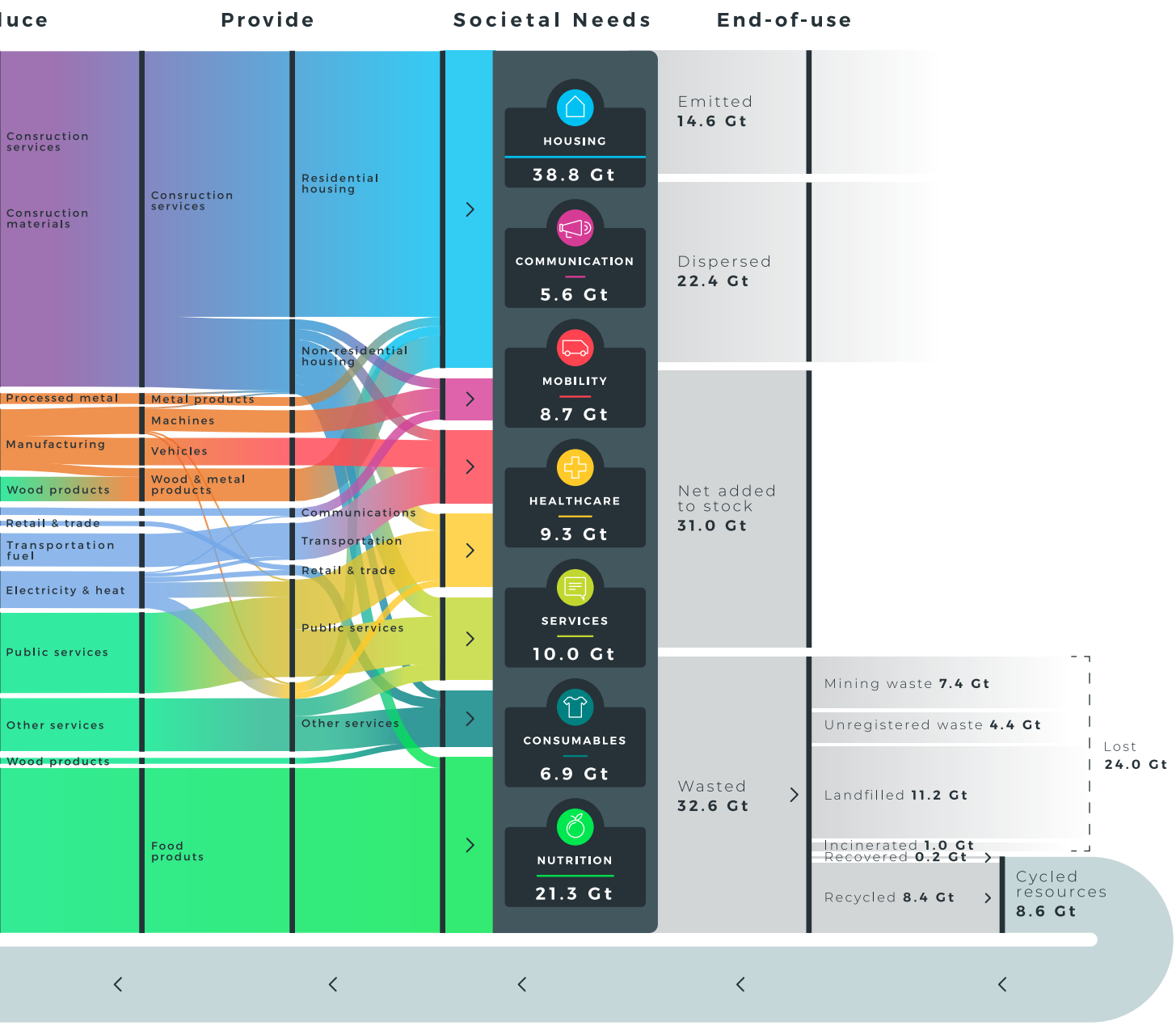


Figure 1 The global resource footprint behind meeting key societal needs showing the numbers that indicate our global economy is only 8.6% circular.

Of the total material inputs of 100.6 billion tonnes, 48.0 billion tonnes were put into long-term stock. From that same stock, 17 billion tonnes of materials were removed, leaving a net addition of 31 billion tonnes in the year. In terms of the short-lived products that were consumed by the global economy, a large share remains unaccounted for and is assumed to be dispersed into the environment as unrecoverable wastes.

In total, 32.6 billion tonnes of materials are collected as waste. The majority of this stream, 23.9 billion tonnes, is lost; being landfilled, incinerated, wasted at mining operations or being unregistered waste fractions. Of the materials classified as waste, only 8.65 billion tonnes or 8.6% of total material use of society is cycled.

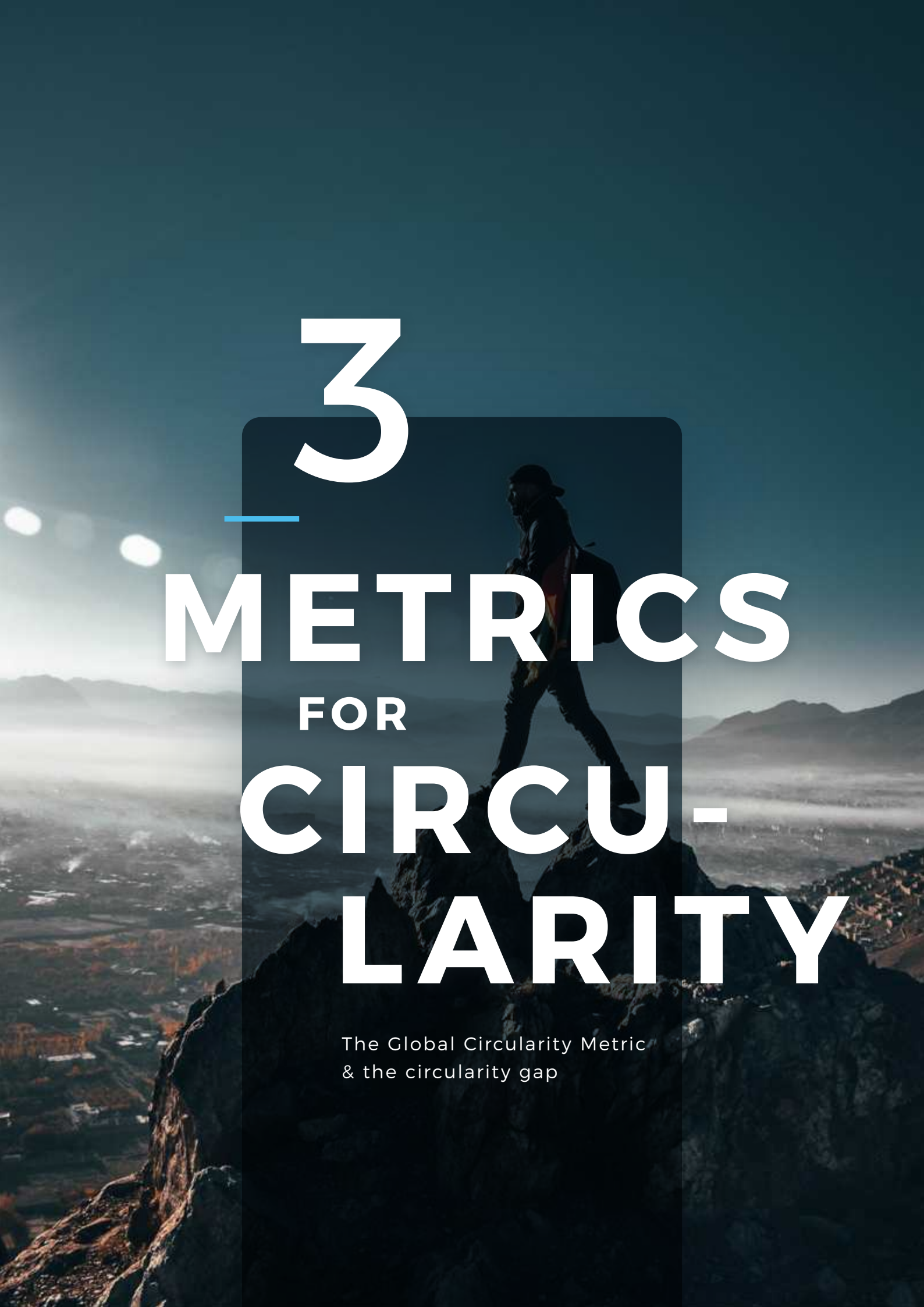


RECOVERED

- **Waste-to-Energy** more than 65% efficient
- **Biogasification**
- **Component recovery**

RECYCLED

- **Recycling/Reclamation**
- **Backfilling**
- **Composting**
- **Regeneration**



3 METRICS FOR CIRCU-LARITY

The Global Circularity Metric
& the circularity gap

This section presents a measurement framework and metrics for circularity. In the first edition of the Circularity Gap Report we launched the Global Circularity Metric (CGM). In last year's 2nd edition we built on that work by applying the Circularity Metric to specific sectors and product groups. In this 3rd edition, for the first time since the launch, we update the Global Circularity Metric. This shows the real value of the Circularity Metric; being able to track changes over time, measure progress and put trends into context. Ultimately, consistent measurement frameworks should inform governments and businesses alike to engage in uniform goal-setting and guide future action in the most impactful way.

CONCEPTUALISING GLOBAL MATERIAL FLOWS AND STOCKS

As pointed out in the first chapter, a truly circular economy is more than just a closed-loop system. This report introduces a strongly simplified conceptual representation of the global metabolism — namely, the materials flowing through and in (long-term) use by the economy. The approach adopted here builds on and is inspired by, amongst others, the work of Haas et al.[11] Then, taking material metabolism as our starting point, we explore and suggest a metric for global circularity. When we consider the four fundamentals page 20, it becomes apparent that the last one, the cycling of materials, is the key factor. To capture this essential dynamic, we therefore suggest that the circularity metric should measure the share of cycled materials as a proportion of the total material inputs into the global economy every year.

As presented on page 16 and 17, the total resources entering the economy account for some 100.6 billion tonnes. These annual material inputs into our economy are composed of extracted resources, complemented by cycled resources. In 2017, 8.6 billion tonnes of resources were cycled back into the global economy and extracted material inputs amounted to 92 billion tonnes. Applying the definition to these numbers results in a Global Circularity Metric of 8.6% for 2017.

GLOBAL CIRCULARITY FALLS FROM 9.1% TO 8.6%

Since the launch of the Circularity Gap Report back in 2018, we have seen a significant body of new scientific publications and data sources updated. This allows for the use of more accurate data, in some cases.

In other areas, it supports making different choices as to which data to include — for example, when deciding which residual resource streams to account for in calculating global circularity. On our website, *www.circularity-gap.world/methodology*, you can find more exhaustive background information, but, below, we present the most profound changes and updates:

- Globally **extracted resources** have increased by 9% between 2015 and 2017, from 84.4 to 92.0 billion tonnes.[10]
- The **end-of-use stage** underwent a re-categorisation of its main outflows: For instance, this year we introduced a clear distinction between **emitted** and **dispersed** materials, showing how greenhouse gas emissions — measured in carbon dioxide equivalent emissions — went up from 50.6 billion tonnes in 2015, to 53.3 billion tonnes in 2017.[12] In pure carbon content this amounts to 14.6 billion tonnes in 2017. The amount of material dispersed into the environment (as a result of undefined dissipative uses) amounted to 22.4 billion tonnes.
- The total amount **wasted** went from 19.4 billion tonnes in 2015 to 32.6 billion tonnes in 2017. This increase is again explained by a re-categorisation. In the previous report a lot of waste was reported as being dispersed where in the current report we shed more light on how it ends up. For example, we make explicit the **mining waste, unregistered waste** and see a sizeable share of **landfilled** waste.
- Resources that are **net added to stock** have increased significantly from 21.5 billion tonnes in 2015, to 31 billion tonnes in 2017. The net stock addition is calculated by deducting the figure for resources that are **wasted from stock** (17 billion tonnes, up from 14.5 billion tonnes previously) from the total for resources **added to stock**, or *Products that Last* (which rose from 36.0[13] billion tonnes to 48 billion tonnes).[7] It should be noted that these large changes are mostly related to improvements in the underlying datasets and do not reflect actual trends. Fully referring to the new data available, net added stock was actually 1 billion tonnes larger in 2015. In fact, materials being added to stock seem to have peaked in 2016 and entered a downward phase, whereas the flow of materials wasted from stock is still on the rise. Overall this means that while the total size of the stock continues to grow, its rate may have started to decline as more and more countries reach higher levels of industrialisation.

- **Cycled resources** went up from 8.4 billion tonnes to 8.65 billion tonnes — however, with new recovery rates applied globally for waste coming from stock (2014) and to the EU only for waste from short-lived products (2016), this might prove a slight underestimate (with the actual figure probably closer to 9 billion tonnes).

  Some 2.16 billion tonnes represent recovered waste from short-lived products, while 6.47 billion tonnes was recovered from stock depletion.

- In summary, the amount of **total resources entering the global economy** increased by 8.4% from 92.8 billion tonnes to 100.6 billion tonnes.

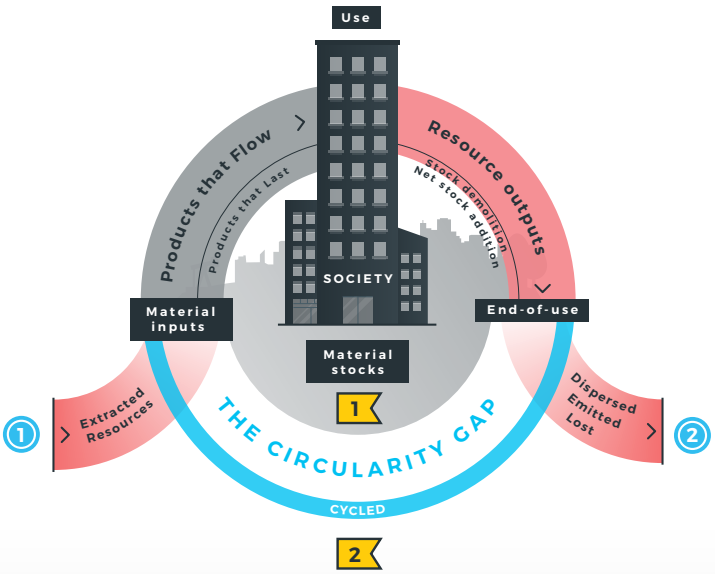


Figure 2 The Circularity Gap

OBJECTIVES & STRATEGIES

Based on this analysis and conceptual representation, four fundamental dynamics of a circular economy can be identified. The first two describe the objectives, whereas the latter two suggest the means to improvement:

1 OBJECTIVE 1

Resource extraction from the lithosphere is minimised and biomass production and extraction is regenerative.

2 OBJECTIVE 2

The dispersion and loss of materials is minimised, meaning all technical materials have high recovery opportunities, ideally without degradation and quality loss; and with emissions to air and dispersion to water or land prevented.

1 STRATEGY 1

Utilisation of stocks is optimised, which means current stocks in use such as buildings and machinery are employed to their full potential, with most material in active use. This approach also entails limiting the stocks temporarily not in use (hibernating), or mobilising materials to re-enter the economy (urban mining).

2 STRATEGY 2

Material cycling for reuse is optimised, requiring improved collection infrastructure and wide-scale adoption of best-available technologies for (re)processing of resources.

PRACTICAL CHALLENGES IN CALCULATING AND INTERPRETING CIRCULARITY

Back in 2018, with the launch of the first *Circularity Gap Report*, we wanted to introduce a year-zero baseline measurement for the circularity of the global economy. Now, for the first time, we can report how we are progressing, or not. In fact, circularity has gone down from 9.1% to 8.6% over the course of just two years. To be able to interpret these numbers and associated trends, it is helpful to provide some context for how the metric might best be understood and used in guiding action. The Global Circularity Metric is a strongly simplified measurement for a very complex system. Calculating and interpreting the GCM has one core strength (1) and at least four practical challenges (2-5):

1. **Monitoring progress.** The real advantage of the GCM is its ability to consistently monitor progress over time for the globe. It remains the ambition to report on its value and underlying fundamentals every year.
2. **Ignorance of core traits.** A circular economy is not the same as a system that optimises the recycling of materials. On the contrary, it is about retaining value and complexity of products as highly as possible, for as long as possible — ideally, without any degradation, or fallout. The GCM does not, however, explicitly consider individual strategies that are core to building a circular economy — such as asset sharing, lifetime extension or remanufacturing. These strategies extend the functional lifetime of products, whereby waste creation is prevented, thus 'slowing down' flows and lowering waste volumes. At the same time, they also reduce the requirement for new inputs to produce new products for replacement.
3. **Data quality.** For the quantification of global material flows and stocks, data quality is variable. Data on material extraction and use are relatively robust. What happens to materials after they are discarded is generally less certain, because waste is heterogeneous in nature, geographically spread-out and its categorisations differ between statistical sources.
4. **Quality loss and degradation.** The metric focuses on the end-of-use cycling of materials that re-enter the economic system. The GCM measures how much (in mass) materials are cycled, but does not consider in what composition, or to what level of quality. As such, any quality loss and degradation in processing goes unconsidered.
5. **Relative compared to absolute numbers.** The GCM considers the relative size of cycled materials as a share of the total material input. This means that as long as the amount of cycled materials improves relative to the extraction of new materials, we see the statistic improving, while more and more virgin resources are being extracted. The statistic in this case would show progress, despite a key objective of the circular economy not being met.

4

THE POWER OF COUN-TRIES

The equaliser: we are all developing countries now

In this chapter, we explore how countries are increasingly recognising the transformative power of setting targets for circularity and developing nationwide roadmaps. The precise starting point for each country to move to circularity will be different: some countries operate well within the ecological boundaries of our planet, but without being able to satisfy certain basic human needs; others are getting much closer to providing basic levels, but doing so by overshooting the sustainable means of the planet. Ultimately, the real challenge is to enable and equip all countries to reside sustainably within the ecologically safe and socially just space.[1] At present, some countries are close, others are far away; each starts from a different point on the map; but, all have a distance to go — all countries are developing now.

HOW COUNTRIES ADOPT AND DRIVE CIRCULARITY

As comprehensively laid out in the SDGs and the Paris Agreement, countries have a pivotal role to play in the dynamic triple-charged forcefield of government, business and civil society. As such, countries are leading change agents for the circular transition.

First and foremost, countries have the mandate to develop national legislation and create the enabling environment and incentives which drive the transition. Alongside this, as lead investors in infrastructure, government buildings and assets, their procurement strategy can kick-start circularity at scale. They are also the leading actors in supranational and multilateral coordination, via alliances such as the United Nations, the African Union and the European Union.

Individually, the motivations for countries to establish national roadmaps for circularity vary considerably, but drivers may include: creating a more competitive national economy; tackling resource scarcity and ensuring supply security; complying with emission reduction targets; or meeting the needs of a growing population, to drive better social outcomes. In response, certain countries are taking a more adversarial stance, for example by imposing trade restrictions on secondary resource flows to protect their markets.

MOVING TO A SAFE AND JUST SPACE: WHERE COUNTRIES ARE ON THE MAP

Overall, closing the circularity gap serves the higher objective of preventing further and accelerated environmental degradation and social inequality. The transition towards circularity is, therefore, a means to an end. The end goal is to establish an *ecologically safe and socially just* operating space for humanity.[1] In essence, then, the challenge faced is one of achieving a high quality of life for close to 10 billion people by mid 21st century, without destabilising critical planetary processes. In order to steer action towards this *safe and just space* in which all of humanity has the chance to thrive, deep transformations will inevitably be needed.[14]

As regards development progress to date, analysis by O'Neil et al.[15] has scored where over 150 countries stand in terms of operating in the *safe and just* space. Taking this study as inspiration — but applying different proxies for the *ecological safe and socially just* dimensions — we have now created an overview for 176 countries. In this, the Social Performance of a country is indicated by its score on the United Nations Human Development Index (HDI). The HDI is a measure of achievement in key dimensions of human development: a long and healthy life, being knowledgeable and having a decent standard of living.[16] The other axis assesses a country's performance on its Ecological Footprint (EF), an indicator that accounts for human demand of global biological resources.[17] To reside within the *ecologically safe* space, is defined by countries with an average EF score per person of less than the world's biocapacity available for each global citizen.[18] For a country to be in the *socially just* space an HDI above 0.8 out of 1 is needed, which indicates very high human development. Scoring all countries on both aspects allows us to determine how far they stand from the *safe and just* space.

One observation is already striking: no country resides within the *safe and just* space today. Some countries are close, others are far away; each starts from a different point on the map; but, all have a distance to go — all countries are developing now.

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MEANS TO AN END: THE CIRCULAR ECONOMY AS GAMECHANGER

Closing the circularity gap serves the higher ambition of moving to an *ecologically safe and socially just* space. Exactly how the circular transition can deliver more beneficial social outcomes is not a question with just one right answer: There is no simple straight-line solution and the feedback loops in the system run in all directions.[15]

Therefore, to systemise the transition dynamics, we need to think in three dimensions: how *resource use* links to *social outcomes* via *provisioning systems*. Provisioning systems comprise both physical and social systems; the former include networks of infrastructure, technologies, and their efficiencies,[19] while the latter encompass government institutions, communities, and markets.[20] Provisioning systems are the essential link between biophysical resource use and social outcomes. For example, different forms of transportation infrastructure (railways versus highways) generate similar social outcomes at very different levels of resource use.[15]

In the following chapters, we will sketch out how we see different provisioning systems driving similar social outcomes and satisfying certain societal needs, but with (significantly) different resource-use profiles (based on on-the-ground projects).

These scenarios may, for example, relate to how the energy infrastructure is designed (centralised fossil fuel generation, versus distributed renewable); or, how advances in urban planning and construction support moving to adaptable, modular build methods, rather than retaining a traditional brick-and-block approach.

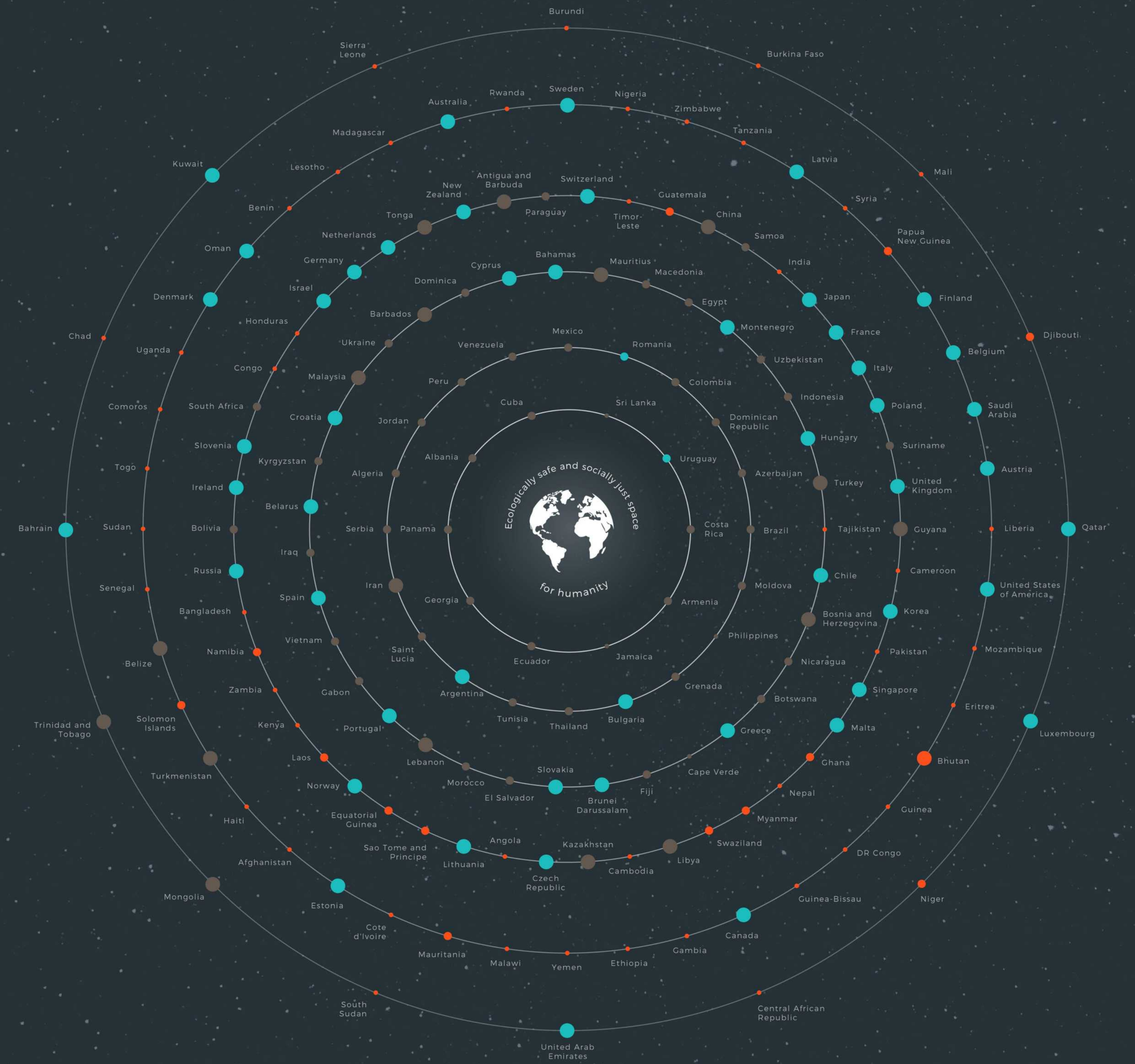
So, in summary, having established the material-flow linkages between resource use and societal needs, plus having explored how countries as a whole are progressing (or not) on their journey towards the *safe and just space*, the remainder of this Report will focus on identifying common country profiles, highlighting individual examples and gathering actionable insights around the creation and adoption of practical transition pathways. These transition pathways can help move countries towards an achievable circular economy in a complex and challenging global context.

Figure 3 Shows how 176 countries score on the Human Development Index (HDI) and the Ecological Footprint (EF) combined; three country profiles emerge with different distances to a safe and just operating space for humanity (the rectangular box bottom right).

MAPPING COUNTRIES' DISTANCE FROM THE SAFE & JUST SPACE

Showing how 176 countries perform on the basis of both Social Performance and Ecological Footprint, and thereby how far they are from operating in an *ecologically safe* and *socially just* space for humanity: meeting basic human needs while staying within the Earth's biophysical boundaries. Some countries are close, others are far away: each starts from a different point on the map; but all have a distance to go — all countries are developing.

CIRCLE ECONOMY



Ecological Footprint

Measured in average Global Hectares (GHa) per person in relation to the earth's biocapacity

Smaller = preferable

within 1 planet

1 to 2 planets

more than 2 planets

Social Performance

Measured by the United Nations' Human Development Index (HDI)

Higher = preferable

0.8 to 1

0.65 to 0.79

0 to 0.649

Distance to Safe and Just space

Each orbit clusters countries that share a similar distance to the safe and just space.

Closer to center = preferable

5

NOT THE SAME BUT SIMI-LAR

Different countries,
common needs

In principle, all countries are unique, when it comes to their ecological footprint and ability to provide for their people. In practice, though, it is possible to identify signs of commonalities and evidence of megatrends that are shared both within and between these unique country profiles. Zooming in from the global footprint to focus on satisfying national, regional and local societal needs, this chapter explores some of the common challenges and opportunities experienced by distinct country groups. It then seeks to illustrate such patterns and parallels by providing individual country examples. Common problems and shared solutions help place unique profiles and individual issues in context. Whilst recognising that no single country can ever be a perfect match for all the criteria of any one group, it is important to join the dots of our understanding. This understanding then helps inform the development of comprehensive and custom implementation blueprints for the circular economy strategies of each and every country.

DIFFERENT COUNTRIES

The Map of Countries and scatter plot (Figure 3) in the previous chapter positions countries in terms of where they are on the map, in terms of both their Social Progress and Ecological Footprint. In part, their various starting points explain the differences in emphasis being placed on their development priorities. For instance, a country with a severe deficit in terms of its Human Development Index (HDI) will prioritise the satisfaction of all its citizens' societal needs — with the recipe for this usually centred around economic growth. The circular challenge in this context is to design a pathway for inclusive growth that enables the economy to flourish, whilst staying within the planet's ecological capacity. By contrast, countries that are already achieving strong levels of citizen satisfaction, but doing so at a high ecological cost, are faced with an immediate need to decarbonise their economies, reduce pollution of soil and water, consume resources more efficiently, plus reconsider their consumption habits altogether.

COMMON NEEDS

Whilst no two countries are the same, there are still obvious similarities between some of them, with discernible development patterns and parallels in evidence. Common problems and shared solutions help place unique country identities and individual issues in context.

Based on the two dimensions of Social Progress and Ecological Footprint, therefore, we have been able to distinguish between countries falling into one of three broad profiles: namely, the *Build*, *Grow,* and *Shift* country groups.

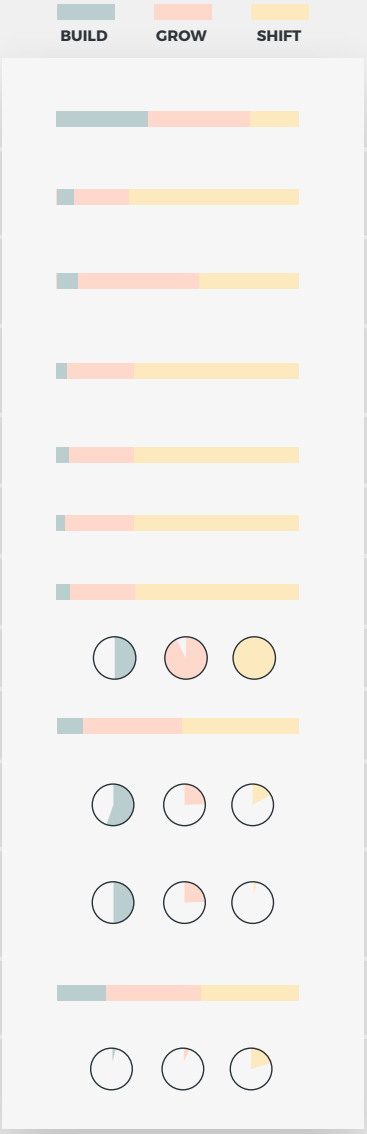
Whilst this classification is far from clear-cut and exhibits some overlap, it does underline how the discourse on transitioning to a circular economy needs to account for both differences and commonalities, if we are to arrive at a more strategic and instructive analysis. It also allows us to highlight a set of key themes that are likely to be central to the countries that fall under the respective profiles.

The first group comprises countries where large parts of society lack the means to satisfy their basic needs and are therefore motivated to *Build* an economic system that is both inclusive and futureproof. The second pathway relates to emerging economies that will need to continue to grow in a manner that satisfies societal needs, but do so within planetary boundaries. Lastly, there are the countries that are typically home to advanced, post-industrial economies, which are under pressure to *shift* away from over-consuming the planet's resources, in servicing their relatively affluent and comfortable lifestyles.

SNAPSHOTS

To demonstrate how the *Build, Grow* and *Shift* countries perform, we present a non-exhaustive list of statistics to help illustrate the orders of magnitude between the country groups. For example, looking at indicators such as material consumption shows that *Shift* countries consume roughly 10 times more resources per person than *Build* countries. Zooming in on social indicators, for example, the share of workers employed in agriculture shows that in *Build* countries 1 in every 2 people is employed in agriculture, whereas for *Grow* countries the figure is only 1 in 4 and for *Shift*, it is as low as 1 in 25. Access to infrastructure is another indicator that demonstrated differences between profiles: in *Build* countries approximately half of all people have access to electricity; in *Grow* countries the proportion jumps to more than 90% whereas in *Shift* countries, access has become a commodity.

COUNTRY PROFILES
PHYSICAL, SOCIAL & ECONOMIC DIMENSIONS



POPULATION[22]	**7.6** billion people worldwide
MATERIAL CONSUMPTION[22]	**11.3** tonnes per capita/ year (worldwide average)
STOCK BUILDING[10]	**28.7** billion tonnes of construction materials used worldwide
TRADE VOLUME[22]	**33.7** trillion € aggregated imports and exports worldwide
IMPORTS[22]	**17.0** trillion € imports for all countries worldwide
EXPORTS[22]	**16.7** trillion € exports for all countries worldwide
GROSS DOMESTIC PRODUCT[22]	**60.3** trillion € gross world product (Constant 2010 €)
ELECTRICITY ACCESS[22]	**77.9** percent of population with access to electricity
ENERGY USAGE[22]	**13.1** billion tonnes of oil equivalent/ year
RENEWABLE ENERGY CONSUMPTION[22]	**25.0** percent renewables in worldwide energy consumption
EMPLOYMENT IN AGRICULTURE[22]	**30** percent of worldwide employment
WASTE GENERATION[23]	**2,010** million tonnes of worldwide municipal solid waste/ year
RECYCLING RATE[23]	**10.7** percent of waste recycled (worldwide average)

Figure 4 Presents key statistics for physical, social and economic dimensions, to illustrate the orders of magnitude on these topics across the three Build, Grow and Shift country groups.

MATERIAL FOOTPRINT: GLOBAL TO COUNTRY (PROFILES)

Having introduced the idea of the global material footprint behind satisfying key societal needs in Chapter 2, here, we take a closer look at how this applies across the *Build, Grow* and *Shift* country groups. Doing so helps to highlight some of the commonalities in the way the different groups of countries extract, process, produce, consume and treat materials at the end-of-use stage. Ultimately, the way an economy functions, also in relation to material handling, forms the point of departure for countries in their trajectory towards reaching a circular economy. At the same time, it is worth mentioning that most countries are by no means starting their journey from scratch — rather, the point of departure refers to their baseline as of now.

Compared to the globe, performing a material footprint analysis for a country (profile) means that the system is not closed. Raw materials, semi-finished and finished products are traded between countries. To account for the material footprint of raw materials is straightforward. With finished goods this can be very different. Take a laptop computer for example. When imported into a country it may be that the actual laptop only weighs one kilogram. All the materials that were needed to produce and transport the same laptop can be as much as 3 to 5 kilograms. To represent actual material footprints in the dynamic of trade — imports and exports — we have applied so called raw material equivalents (RMEs). This follows the reasoning that Circle Economy also applied in its first ever analysis performed for a country. The Circularity Gap Report Austria was launched in spring of 2019.[24]

MATERIAL FOOTPRINTS

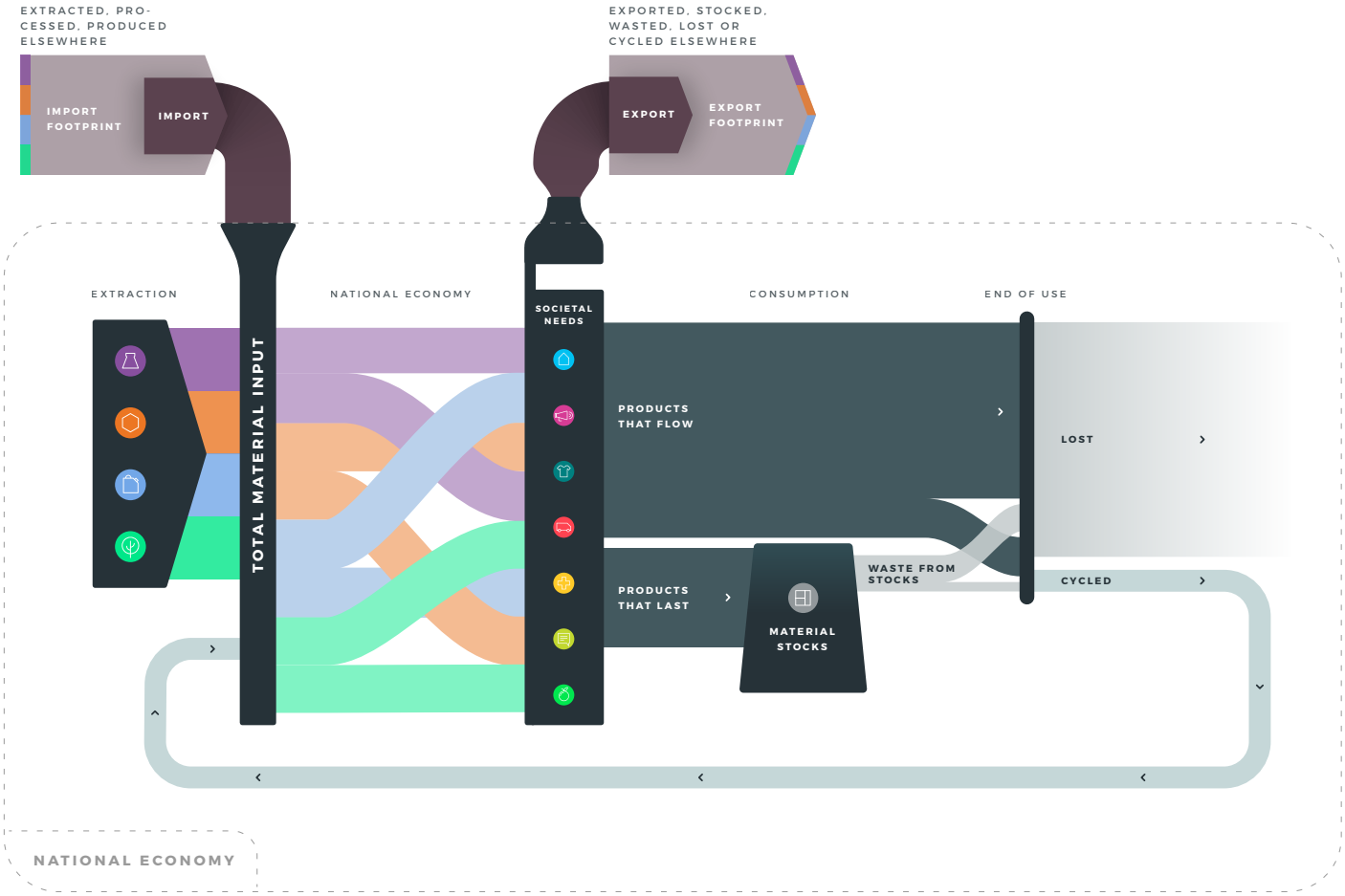


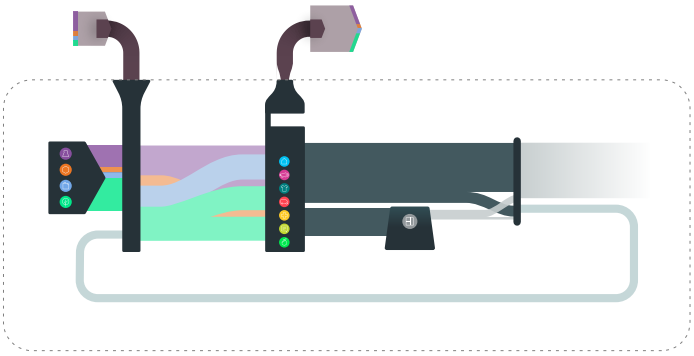
Figure 5 (Above and right page) The resource footprint overviews for the Build, Grow and Shift countries[10] based on 2017 data from the WU Global Material Flow Database. Note: material stock and cycled material flows are not scaled to proportion.

The figure above shows a schematic overview of the material footprint of a country or group of countries. The left side shows four resource groups (minerals, ores, fossil fuels and biomass) that are the result of domestic **extraction**. The top section shows how many resources enter the national economy through **import**. Because the imported volumes are manufactured and transported to the country, the actual material **import footprint** is shown in the shaded colour. Together the domestic extraction and the import comprise the **total material input** into the **national economy**.

The materials are in turn processed and either applied to satisfy **societal needs** such as nutrition, housing and mobility, or they are **exported.** Of these materials entering the national economy every year, the majority are utilized by society as short-lived **Products that Flow** — reaching their end-of-use within a year. The end-of-use resources of these products are either **lost** or **cycled** back into the economy. The remaining aforesaid materials enter into long-term stock — referred to as **Products that Last**. These products are namely capital equipment, buildings and infrastructure.

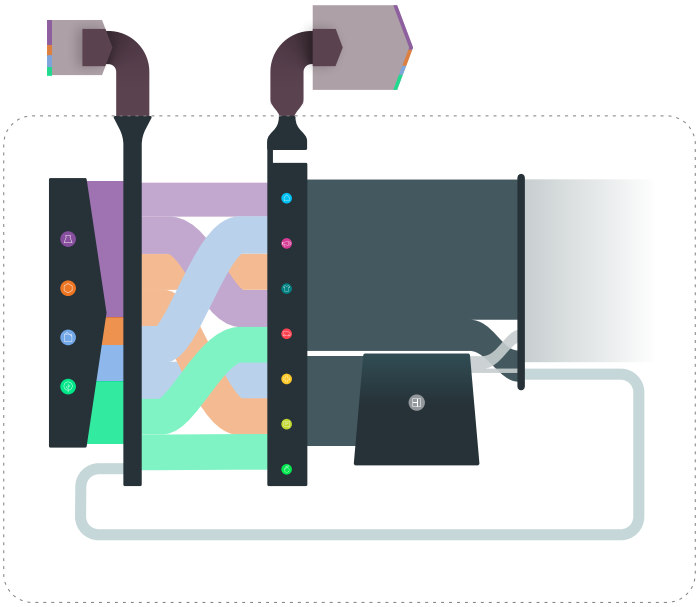
BUILD

The *Build* countries are characterised by an overall modest per capita material footprint when compared with the *Grow* and *Shift* countries. Biomass extraction is the dominant resource group. Due to a largely informal waste sector, material cycling is low but assumed to be underreported.



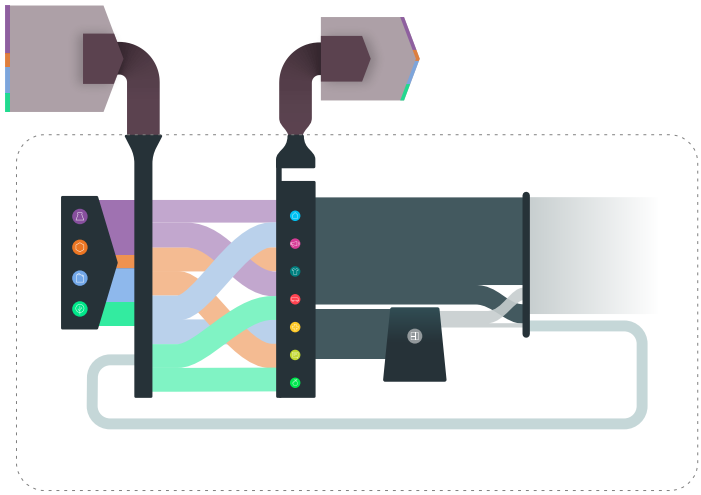
GROW

Grow countries are manufacturing hubs, hosting an expanding industrial sector and leading the way when it comes to building. They extract and import a large array of resources which are then processed and flow into manufacturing, before being exported again. Nearly half of all domestically extracted resources in *Grow* nations are construction minerals. This large export volume of domestically extracted resources continues to fuel the high consumption rates of imported resources in *Shift* countries.



SHIFT

The *Shift* countries show high imports of finished products with a high resource footprint elsewhere. *Shift* countries effectively outsource resource intensive production. Their extraction of fossil fuels is relatively high.



DISRUPT: 7 KEY ELEMENTS
OF THE CIRCULAR ECONOMY

The circular economy assumes dynamic systems, meaning there is no specific end-point, but it is rather a process of transformation. The DISRUPT model describes 7 key elements that give direction to this transformative process, with the aim of slowing the flow of resources, closing the loop and narrowing resource flows, while switching to regenerative resources and clean energy. The 7 elements describe the full breadth of relevant circular strategies and will be used throughout the report.

D 

Design For the Future: Adopt a systemic perspective during the design process, to employ the right materials for appropriate lifetime and extended future use and optimal recovery.

I 

Incorporate Digital Technology: Track and optimise resource use and strengthen connections between supply-chain actors through digital, online platforms and technologies.

S 

Sustain & Preserve What's Already There: Maintain, repair and upgrade resources in use to maximise their lifetime and give them a second life through take-back strategies, where applicable.

R 

Rethink the Business Model: Consider opportunities to create greater value and align incentives through business models that build on the interaction between products and services.

U 

Use Waste as a Resource: Utilise waste streams as a source of secondary resources and recover waste for reuse and recycling.

P 

Prioritise Regenerative Resources: Ensure renewable, reusable, non-toxic resources are utilised as materials and energy in an efficient way.

T 

Team Up to Create Joint Value: Work together throughout the supply chain, internally within organisations and with the public sector to increase transparency and create shared value.

6 BUILD COUNTRIES

Small impact,
big opportunity

Build countries have a low material footprint per capita. As a result, the impact of their economic activities often falls within the regenerative capacity of the planet. On the downside, however, they are struggling to meet all basic needs, not least in relation to HDI indicators such as education and healthcare. Natural capital, rather than human capital, is their dominant source of wealth, which means that the focus is on extraction and sale of raw materials, while investment in education and skills is insufficient.[25] The good news is their potential: as Build countries are still building-up their basic infrastructure for public services, hospitals and transport, they have an opportunity to apply circular strategies such as modular, passive and flexible design. In construction they can also prioritise the use of regenerative resources in buildings and avoid, by design, the operational inefficiencies which characterise infrastructure in Shift countries. Furthermore, the decentralised nature of the informal economy prevalent in Build countries provides a platform on which to develop distributed professional services that allow welfare to grow, while providing decent health and safety conditions.

BUILD COUNTRIES: WHERE ARE THEY NOW?

The Build profile is most relevant to countries in Sub-Saharan Africa, plus some small island states and Asian countries. The larger countries by population to which the profile may apply are India, Bangladesh, Ethiopia, Nigeria, Pakistan and the Philippines.

Given that the rate of material consumption per capita is low, *Build* countries currently transgress few planetary boundaries, if any at all. To continue avoiding excessive degradation of natural assets, their programmes of much-needed development, both present and planned, should be designed and managed in a sustainable and circular manner.

As current stock is insufficient (such as in transport infrastructure and buildings) and markets are unsaturated, the figure for stock in use per capita is 10 times lower than in *Shift* countries, but stock growth rates are higher.[26] Stock building dynamics are effectively a defining characteristic of *Build* countries. *Build* countries are already working to build up their distribution networks and physical assets in infrastructure and buildings for instance, delivering services for energy, water, sanitation, communication and mobility, where access is currently lacking for a large proportion of the population.

The cycling of resources in *Build* countries is a labour-intensive process, distinguished by its comparative efficiency. Waste production per capita is low, but recycling rates are relatively high. An area of concern, though, lies in the associated social impacts and risks to worker welfare and wellbeing. In the informal economy. The waste sector provides a valuable source of revenue, but is associated with poor labour conditions and high health and safety risks.

Used for nutrition and as a source of energy, biomass is a major consumption factor, with agriculture and forestry making up a large share of the economy. In fact, agriculture is the biggest sector (by employment) in many of the *Build* countries.[27] The tendency for biomass to make up a high share of the energy mix is problematic, as is the expansion of agricultural areas, since these are often causes of deforestation and forest degradation. When it comes to footprints for international trade, import volumes are low, but the relatively high share of secondary products and even waste imported by some *Build* countries results in a high domestic environmental impact.By contrast, resource rents in the *Build* countries are relatively high. The export of raw materials with low value-added often represents foreign capitalisation of domestic natural resources, which comes at a high domestic environmental and socio-economic price.

BUILD COUNTRIES: WHERE ARE THEY HEADED?

These countries are effectively "facing a youth bulge, meaning that young people comprise the highest proportion of the population". [28] Africa is the only region in the world where youth population (up to 24 years old) is increasing, and expected to rise to 51% by 2050.[29] In Sub-Saharan Africa, in particular, this is coupled with a vast overall growth in population, predicted for the coming decades. The population of Nigeria, for example, is forecast to double in the next 25 years.[30] As a consequence, a fast-emerging and growing middle class of young people will inevitably want to enjoy greater consumption. When it comes to stock growth, the reality for a *Build* country such as India[27] is that as much as 70% of the buildings needed in 2030 are yet to be built. Not surprisingly, the construction industry there is already the second largest sector, providing significant employment.[27]

The economies of *Build* countries typically feature a relatively high share of contribution from bio-based primary sectors (agriculture, forestry and fisheries). They are also experiencing the fastest growth rate in annual crop production, with forecasts indicating this will be highest in Africa. Yield increases are an important driver of this growth, but they risk being compromised in the long run by soil depletion and unsustainable farming, as well as consequences of climate change.[31] Alongside this, deforestation rates continue rising, despite commitments to stop deforestation.[32]

TRANSITION PATHWAYS: SO HOW CAN BUILD COUNTRIES GO CIRCULAR?

Build countries are showing impressive progress in reducing poverty.[33] As they move forward on improving the quality of life for their populations, three pathways in particular can aid the transition to a circular future. Not surprisingly, given the stock build-up dynamic, the first transition pathway targets the construction sector.

DESIGN CIRCULARITY INTO NEW STOCKS

Stock build-up is essential for future sustainability, as many *Build* countries have stock levels which do not allow for a minimum living standard. High relative accumulation of materials in long-term stock, such as buildings and infrastructure, constitutes an opportunity to transition towards an asset base that is both flexible, robust and cost effective in the long run. There is also evidence of associated market demand, with surveys showing expectations of growth in green construction across all countries.[34] Ultimately, though, future stock levels will still likely be lower than those in *Shift* countries.[35] Overall, this transition will only be successful if circularity is designed-into any such stock build-up from the start.

Successful stock build-up must therefore be seen first and foremost as a design issue. **Design for the future** determines material usage during construction and throughout the whole lifetime of stock, plus flexibility for different use cycles; as well as lifetime energy consumption and material value at end-of-life. A bank building in Mauritius, for example, contributes more sustainably to the future asset base by being designed from the outset to meet the international BREEAM standard for construction.[36]

Offsite, modular manufacturing can also drastically improve material efficiency during construction, cut costs, enhance site management and reduce nuisance — especially on projects in dense urban areas. It also allows for innovative construction techniques, such as prefabricated buildings and 3D printing, which offer potential for fast, cheap and eco-friendly development.[37]

As well as modular technologies and design-for-disassembly, building methods that **prioritise regenerative resources** (such as renewable construction materials), plus planning for flexibility, represent circular design strategies that form the basis of sustainable stock build-up with high value retention. However, global forest cover and aboveground biomass stock are still declining and sourcing renewable construction materials such as wood, bamboo or other fibres can aggravate deforestation drivers. This limits the potential for responsible sources of woody biomass to countries which have stringent and well-enforced environmental legislation in place to ensure sustainable forest management.[9]

New technologies that **use waste as resource** also allow for upgrading secondary materials into construction products — such as process plastics into tiles[38] — and for recovering cement from concrete in demolition waste.[39] When combined with 3D printing, or additive manufacturing, these technologies open up a whole new range of material-efficient design opportunities.[40]

The government can also play a key part in the adoption of circular design solutions, as well as efficient use of materials and new approaches to modular and adaptable building components, by way of public procurement. In addition, governments can impose strict requirements on foreign investors, especially where there is increasing interest from multinationals in the construction sector. Whilst multinational corporations operating in *Build* countries are slowly starting to be more responsive to pressures around sustainability, they tend to make commitments only beyond the necessary compliance where it serves their existing business case — hence the importance of regulatory rigour.

CIRCULAR AND PASSIVE BUILDING DESIGN IN NAMIBIA, ZIMBABWE AND SOUTH AFRICA

Local, renewable and recycled construction materials were prioritised during the construction of the Habitat Research and Development Center in Katutura, Namibia. The use of these materials makes the building fit within cultural preferences and retain a distinguished Namibian signature. The thick walls of the building are made of compressed earth and brick, which are also the materials used in traditional houses. Low-grade sheep's wool is used to insulate the ceilings. The building is cooled and ventilated by means of passive design principles, such as its orientation on the dominant wind direction, shade from the large roof overhangs and by spraying harvested rainwater to freshen the air; while lavender is used to keep insects away.[41] In Zimbabwe, the Eastgate Centre has been applying passive heating and cooling principles in Harare since 1996, employing biomimicry solutions inspired by airflows in termite mounds. Deep eaves keep direct sunlight out in summer and are a modern application of a building principle common in Zimbabwe.[42] Another example is the Tebogo Home in Orange Farm, South Africa, where similar passive design principles keep indoor temperatures within the 18 to 26 °C range, whereas, in conventional buildings, they can span from 2 to 45 °C.[41]

EMPOWER THE INFORMAL ECONOMY

The decentralised, informal economy makes up a large part of the total world economy, providing jobs for an estimated 61% of all workers.[43] In fact, when including agriculture, the informal sector makes up over 90% of total employment in a number of African and Asian countries.[43]

Whilst the low-cost labour that is characteristic for the informal sector can operate highly effective material sorting and last-mile reverse logistics, the downsides include poor working conditions, insufficient income, plus both directly and indirectly related health issues. The decentralised, distributed nature of the informal economy, however, makes it a very organic and resilient economic structure.

Important to any notion of economic empowerment as a driver of social equity, therefore, is the requirement to upskill and organise informal workers, ensuring that their labour conditions improve. Education is needed too, to facilitate some of the processes and tasks in the informal economy — as there is also a requirement for tools and frameworks to help explain and communicate the circularity concept in a way that is both practical and relates to specific waste streams. Education can teach young entrepreneurs, designers and engineers about technical specifications of circularity and communities about turning waste into new products.[44,45] In addition, the youth 'bulge' needs to be educated to both create and fill the circular jobs of the future.[44] In this, it helps that working in sustainability is socially very well received — especially in respect of those entrepreneurs who both solve visible environmental problems and provide jobs to as many people as possible.[44] Such strong interest augurs well for ongoing growth in the fields of social and sustainable entrepreneurship.

In tandem with this cultural upswing, support to **incorporate digital technology** throughout the informal economy can also help bring supply and demand together, **rethink the business model** and encourage consumer confidence. Digital access and engagement can boost markets not only for new products, but also services, underused assets, secondary materials and human capital. As such, digitalisation is potentially a democratising and empowering force for social inclusion and economic mobility. However, to take full advantage of these benefits, countries need to be proactive in developing guidelines, specific permitting regimes and accreditation for products as a service.[46,47,48] Overall, it pays to **team up to create joint value**. Working together with local government and ensuring adequate institutional representation of the informal sector in local and national policy making via associations, chambers of commerce and unions are key ways of achieving this, as well as improving working conditions.

HOW DIGITAL TECHNOLOGY IS ENABLING NEW BUSINESS MODELS

For small-scale farmers in Africa, tractors are simply unaffordable. So, while preparing a field for planting might take only 8 hours with a tractor, it could take up to 40 days by hand. Added to this, the labour costs are higher than the costs associated with using a tractor. In response, Hello Tractor, which operates in Kenya, Mozambique, Senegal, Tanzania and Bangladesh, sells tractors to contractors who rent them out to farmers in need. The farmers can request a tractor with a text message through the Hello Tractor platform. The tractors are monitored with GPS, allowing owners to check the location of their assets, route travelled, fuel consumed and even maintenance required.[49] [47]

Local agents are also in place to support farmers who are not used to making business transactions via phone. Founded in 2014, Hello Tractor reached 240,000 smallholder farmers within just a few years of operating. Their technology is installed in 75% of commercial tractors entering Nigeria and they ventured into other countries through strategic partnerships.[50] [51] Also active in Nigeria, Jolancer provides a platform for freelancers, connecting them with global demand for skilled labour. Skills offered range from graphic design and software building, to editing films, text and audio recordings.[52]

BUILD UP A SIZEABLE, SUSTAINABLE BIOECONOMY

Developing an increasingly sizeable and sustainable bioeconomy is vital for most *Build* countries, with the substantial residues from agriculture, forestry and fisheries able to provide a basis for significant recovery and cascading activity.[53] Alongside this, closed-loop agricultural models can also help preserve the future productive capacity of economically critical natural capital.

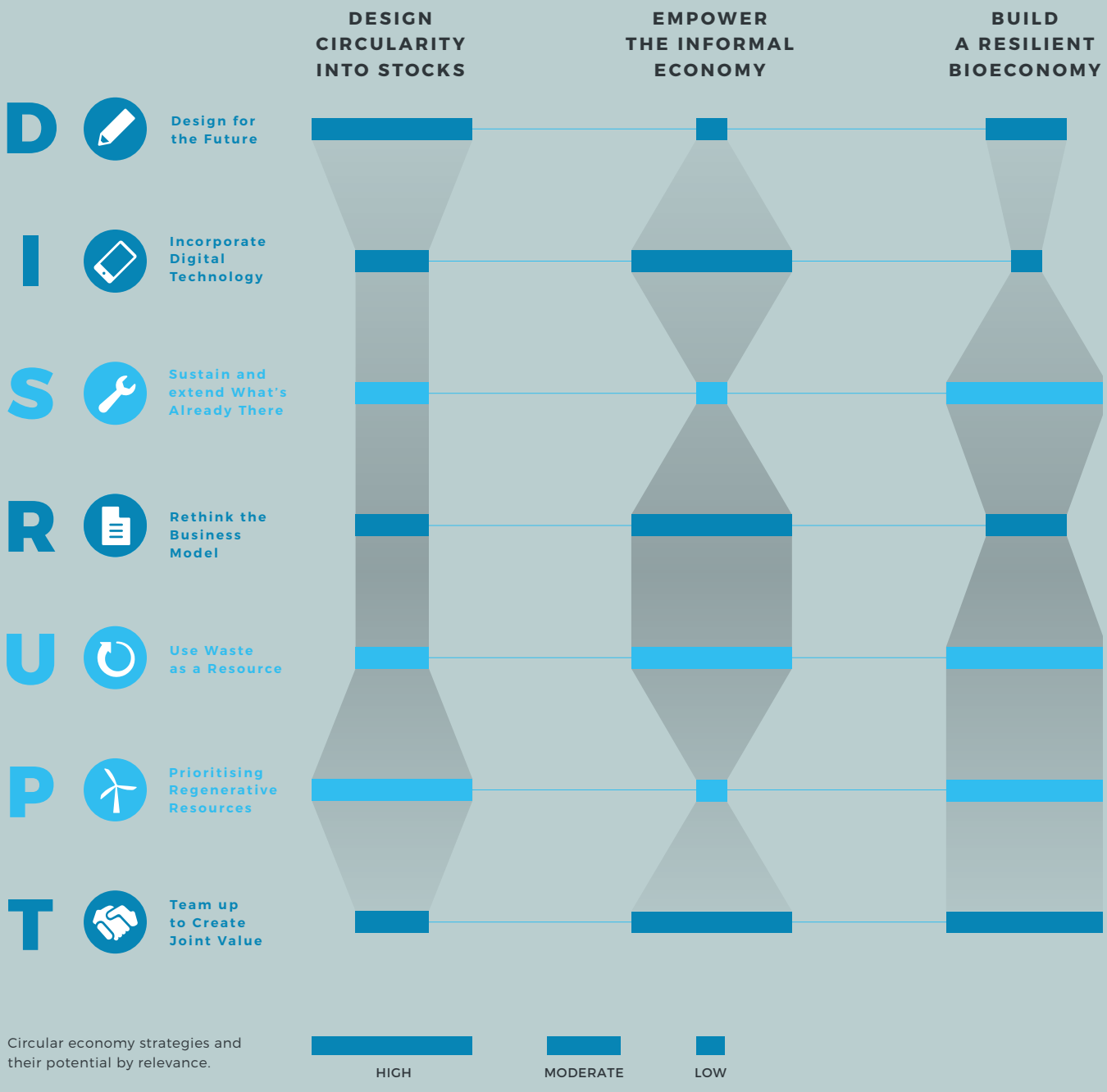
To actively **sustain and preserve what is already there** in this way, particularly in the face of extractive industries, serves to avoid eroding the future production capacity of renewable resources. In addition, due to inadequate road infrastructure and lack of other transport options, many fruits and vegetables are damaged before reaching markets, not to mention the final consumer. In India, for instance, a significant rise in the installation of cold storage facilities in a potato-producing region was enabled by a combination of private sector investments and supportive policy adjustments by the government.[54]

In a bid to stimulate markets and encourage incumbents to **rethink the business model**, it can also help to professionalise the bioeconomy and increase added value by attracting an influx of processing industries for agricultural commodities within any given *Build* country.[55 56 57]

RECLAIMING DEGRADED LAND AND ORGANIC CERTIFICATION

The scale of bioeconomic endeavours can be impressive: Niger, for example, has been able to support some 2.5 million people by reclaiming degraded land for crop production under a Farmer-Managed Natural Regeneration programme. Investment in recognised accreditation programmes is another potential springboard for growth in the bioeconomy. Uganda, for instance, set up certification schemes and labels for organic production systems, encouraging farmers to lower the use of synthetic fertilisers and pesticides.[58 59] Between 2002-2007, the number of certified organic farmers increased by 359% and acreage under organic agricultural production rose by 60%. As a result, certified organic exports skyrocketed from just US$3.7 million in 2003/4 to US$22.8 million in 2007/8. The farm-gate price of organic produce felt the benefit too, with the likes of certified pineapple, ginger, and vanilla up 300%, 185%, and 150%, respectively, on conventional alternatives. Organic uptake also brought about welcome reductions in environmental impacts associated with agriculture, including cuts in both greenhouse gas emissions and chemical runoff into local water bodies.

BUILD



Circular economy strategies and their potential by relevance.

Figure 6 Summary of circular economy elements that shape the key transition pathways for Build countries.

7 GROW COUNTRIES

Rising impact,
huge potential

Most Grow countries have already experienced a degree of economic growth and industrialisation, broadly expected to continue due to a combination of rising standards of living and population increase. As a result, resource use in these countries is characterised by fast economic growth and associated material consumption, rapid stock build-up and an expanding industrial sector (also responding to demand from Shift countries). In part, therefore, sustainable growth is about more efficient use of natural capital — investing earnings from the likes of minerals into infrastructure and education, thereby developing human capital. Such investment results in growth of total wealth.[25] Designing new infrastructure, buildings and consumer goods in a circular manner, simultaneously considering both enhanced durability for lifetime optimisation and end-of-life scenarios, are key strategies for these countries to become more circular. Alongside this, professionalising and improving the labour conditions in the informal parts of waste management in these countries also bears potential to reduce the environmental impact of both industrial and consumer waste.

GROW COUNTRIES: WHERE ARE THEY NOW?

The Grow profile is most relevant to countries in Latin America and Northern Africa, as well as those with an economy in transition in Eastern Europe, the Caucasus and Central Asia, plus the larger Asian countries. The largest countries falling under the Grow profile are China, Indonesia, Brazil, Mexico, Vietnam and Egypt.

Grow countries are, increasingly, the manufacturers of the world and the only group with a positive trade balance overall. The economic growth of their manufacturing industries has far outpaced that in *Shift* countries over the past decade. Leading the pack, the Chinese value-added from manufacturing as part of GDP had risen to 31% by 2017, while it declined to 14% in Europe over the same period.[60] Faced with a natural resource base eroded by rapid industrialisation (mostly in the service of the export market), some *Grow* countries have started implementing policies to move away from a linear growth model. In all of this, trade is a key driver of growth — with comparatively low labour costs and favourable trade conditions (albeit, disputed at times),[61] these countries are manufacturing and processing goods for markets around the world.

Both imports and exports reflect this, whilst being moderated by the relatively low levels of domestic consumption compared to *Shift* countries.

The majority of material use relates to non-metallic minerals and ores used to fuel the rapid build-up of stock in construction of housing and infrastructure, as well as the industrial assets powering the resource extraction, processing and manufacturing industries. For instance, China is forecast to more than double its existing stock of buildings and infrastructure by 2050.[24] At the same time , it is worth mentioning that, since 2003, China has already poured more cement every two years than the US did in the entire 20th century and, despite a dip of late, still uses almost half the world's concrete.[62]

Whilst the national metabolisms in many of these countries are characterised by growing material consumption, the figures rank below the per capita consumption levels of Organisation for Economic Co-operation and Development (OECD) countries in Europe or North America. In terms of livelihoods and earnings, agriculture and forestry provide for a relatively large share of employment in some of these countries, despite the economic contribution of these sectors declining.[63] However, *Grow* countries have made considerable headway in lifting vast parts of society out of poverty and providing access to essential means.

GROW COUNTRIES: WHERE ARE THEY HEADED?

Grow countries often have a high demographic share of young people, as a result of recent population growth. The potential of this human capital to contribute to growing welfare necessarily calls for investment in infrastructure and education, as well as effective, sustainable management of the natural asset base in the long run.[25]

Trends in increased consumption cannot simply be attributed to population growth, however, which will only account for a quarter of the rise forecast by 2030. The remaining three quarters will come from rising wealth per capita,[64] with the rapidly growing middle class being the key driver. The rate of change can be dramatic — for example, disposable income per household in China more than doubled in the last ten years.[65]

Since economic growth remains a primary lever for poverty alleviation in many *Grow* countries,[66] it is important that this growth is decoupled from primary resource extraction and environmental degradation; and that all citizens benefit. It should be noted, too, that countries in the *Grow* profile further exhibit the steepest urbanisation curves. For instance, Brazil's urban population has increased from 40% in 1960 to more than 86% in 2018.[21]

As wealth grows, the proportion of domestic extraction of materials tends to go down, due to increases in international trade; whereas the overall mass of material consumption generally goes up.[67] This trade-off is already happening in *Grow* countries, who, in anticipation, are joining their *Shift* counterparts in positioning themselves strategically around access to scarce resources from elsewhere.[68 69]

Services also make up an increasing part of global consumption, particularly in *Grow* countries. As income rises, the share of spending on necessities, such as food decreases; spending on services such as restaurants, hotels, recreation, and culture increases.[64] This change in spending can also involve reconsidering historic development pathways with a large impact on resource use and even quality of life. For example, China had cycling ambitions already in its first 5-year plan. So, after years of accommodating an ever-growing car fleet — with rates of annual increase in Chengdu, for instance, reaching 17% — modal *shift* away from private car use has become a top priority again.[70 71 72]

Waste management and recycling activities that used to be performed by the informal economy are increasingly integrated into a more formal waste management system. Nonetheless, the informal economy is still responsible for a large share of waste collection and processing in the majority of *Grow* countries.[73]
A major opportunity, therefore, lies in integrating the decentralised steps of the informal sector's reverse value chain into and alongside the efficiency of centralised processing and recovery of materials.

TRANSITION PATHWAYS: SO, HOW CAN GROW COUTRIES GO CIRCULAR?

In many *Grow* countries, circular economy initiatives have already been launched to design closed-loop value chains, redesign products and processes and use natural resources more sustainably.

Often, these are not referred to as 'circular' initiatives even if the programme is of European origin — as in the case of Switch Asia.[74]

FOSTER SMART CONSUMPTION

Improving the utility of products and resources through new service-based business and shared-use models can help reduce the total number of goods needed to satisfy consumer demand. To **rethink the business model** in this way requires increased durability and product mobility, as well as closed material cycles that allow for an overall reduction in the need for new materials. In principle, it should be possible to encourage product-service models, whilst also meeting minimum socio-economic and environmental standards — Dichung, for example, is a ride sharing platform and social enterprise in Vietnam[75]; and Gojek offers a range of mobility, nutrition, payment and cleaning services via its application in Indonesia.[76]

Regulatory measures which discourage the use of toxic materials, or production of items which are difficult to recycle, can be powerful ways to drive a transition and behavioral change top-down. In order to gain momentum and public support to **use waste as a resource**, however, it is imperative to be transparent in the motivations for certain bans and to carry consumers along through communication and education.

EFFECTS OF CHINA'S BAN ON WASTE IMPORTS

Announced in 2017, China de facto stopped the import of 24 types of waste, effective as of start 2018. The 24 waste categories included plastics, paper and textiles. In 2019 the trade restrictions were expanded to 32 waste types. The trade restrictions were introduced to protect domestic environmental interests and the health of the population, as recycling processes can be energy intensive and create a lot of garbage if the material is of low quality. The impact was huge. Since 1992, an estimated two thirds of global plastics had been going to China. In 2016, the United States alone exported an estimated $5.6 billion of scrap commodities there.[77] China's drastic measures also served to focus a lot of attention on the international trade of waste. This helped stimulate the search for solutions at source and even accelerated the development of circular economy agendas in countries which had previously exported their waste there, such as Australia.[78]

The recent and ongoing rise of the middle class in many *Grow* countries has seen consumers stepping away from more conscious patterns of consumption. Confronted with the impact of recent developments on wellbeing and environment, though, support has emerged in some quarters for a critical reflection on recent choices, as illustrated by the reemergence of bicycles in China. In addition, multinational enterprises selling to both *Grow* and *Build* countries need to ensure their products are fit for both for patterns of local consumption and end-of-life handling.[44] Where the environment is not the main driver, then demand for economic diversification, domestic job opportunities and an improved balance of trade, can motivate instead.[44] Across *Grow* countries, social enterprises are also starting up, committed to solving issues such as traffic congestion, waste, poverty and access to products. Support will be needed for example via 'light touch' regulation[47] and open-source data access, in bringing the most promising solutions to scale. Education is also important to raise consumers' awareness of their direct impacts and responsibilities.[79] To truly change consumption patterns, such education is needed across all societal groups. Behavioural aspects such as consumers feeling responsible for their own waste are key.

DESIGN CIRCULARITY INTO NEW STOCKS

Stocks being built now need to **be designed for the future**. This means they need to be fit for purpose, durable, adaptable and upgradable to allow for optimal use. The same holds for consumer goods, which should be affordable and designed to last, easy to maintain and built with end-of-life disassembly or recycling in mind. In most *Grow* countries the focus of circular initiatives is to alleviate the pollution and ecosystem damage caused by vast waste volumes. However, such a focus frequently leaves the upstream value chain and particularly product design and use models, untouched.

This opens up the potential to take a design approach to the circular economy, targeting the incentives under which the system operates and improving product design. Given the population pressures and industrial drivers acting upon *Grow* countries, applying strategies of circular design for newly built stock and export products will not only help to alleviate resource scarcity and reduce waste volumes, but it also represents an opportunity for these countries to gain a competitive edge and position themselves at the innovation frontier.

As a lot of infrastructure is developed and operated under government authority, public procurement can be another key driver of the transition. By setting ambitious targets for material efficiency, secondary materials and circular design in tenders, public procurement can drive demand for circular solutions. Simultaneously, when using secondary materials and implementing new design, it is Important to consider health aspects.[80] This design-centric approach also applies to industrial development. As many *Grow* countries are still setting up much of their industrial capacity, they are uniquely positioned to form industrial systems where businesses operate mutually reinforcing processes that **use waste as a resource** and enable shared innovation. China has been spearheading this for decades with its development of eco-industrial parks, which revolve around the concept of *industrial symbiosis* — the exchange of waste streams within a local industrial cluster.[82]

To **prioritise regenerative resources** when it comes to construction materials actually resonates with some conventional building methods, with the environmental and health benefits of wood-based construction receiving renewed appreciation.[83] Renewable construction materials, such as wood, frequently offer benefits in terms of energy and resource efficiency but also in relation to thermal comfort in hot climates.[84] Advances in architectural and engineering applications for wooden materials allow for broader use of locally sourced and affordable timber, even in high-rise buildings.[85]

MODULAR CONSTRUCTION WITH REGENERATIVE MATERIALS

Engineered solutions can offer some additional versatility around sustainable construction materials. Companies like HWZ International[86] and XLAM, for example, are actively promoting Cross Laminated Timber as a lightweight but strong structural product in South Africa, where timber-frame buildings are already commonplace in higher market segments.[87] As part of a drive to rethink the business model, offsite construction also allows for major efficiency improvements. Such modern methods of construction are already at 6% market share in China,[88] where the process is referred to as industrialised building. Other countries such as Tanzania and India, where Modulex[89] operates, confirm that it can reduce construction time by up to 50%. Bandar Sunway, a township and entertainment area in Malaysia, that was formerly a tin-mine wasteland has received international recognition for its sustainable approach to construction and land restoration.[90] [91] Initiatives to encourage the use of renewable materials in the bioeconomy can also start bottom-up, as exemplified by Biomimicry South Africa, which promotes nature-inspired solutions through education and consultancy.[92]

TRANSFORM THE INFORMAL ECONOMY

Even though many countries in the *Grow* profile are implementing formal waste management infrastructure, their longstanding history of informal waste handling for recovering valuable materials still plays an important role — especially where centralised solutions fall short. It can also prove beneficial to **team up to create shared value**. So, setting up legal entities and stimulating collaboration with and between informal workers can help improve environmental, health and safety standards, while aiming to create a higher added value and income. Delivering educational programmes that enable an integration of the informal sector both improves working conditions in the informal economy and at the same time facilitates better waste valorisation.

Over the years, many of the informal recyclers have built up considerable expertise in the recovery, recycling and repurposing of e-waste and scrap metals. The decentralised nature of the informal sector can therefore be turned into a key advantage to increase collection rates and sorting quality to levels that are sometimes even higher than those in formalised, industrial processing.[44] At times, the effective processing of complex, diverse waste types simply requires a lot of labour.

In Ghana, Accra is developing as the recycling and remanufacturing hub of West Africa. The Agbogbloshie scrapyard, for example, provides employment to an estimated 6,000 to 10,000 persons working in the scrap trade, dismantling anything from toasters and irons, to aircraft and mining equipment. The Agbogbloshie Makerspace Platform (AMP) is supporting these recyclers to become designers and manufacturers and obtain a higher added value from their work.

The German government is also investing in professionalising e-waste processing in Agbogbloshie — targeting the likes of mechanical stripping of electric cables, which avoids scenarios where recyclers burn the plastic off and are exposed to toxic fumes. By looking to **incorporate digital technology** the connection between informal waste collection, sorting, processing and redistribution of materials can be made relatively easily.

A MOBILE PHONE APPLICATION TO CONNECT WASTE SUPPLY AND DEMAND IN BRAZIL

The estimated 400,000 informal waste collectors in Brazil are known as 'Catadores'. They collect waste and recyclable materials and sell them to scrap centres. The work is physically demanding and many catadores live on or near the poverty line. So, a new application called Cataki has now been launched to inform Brazilians about the importance of catadores. The catadores can create a profile on the app and become contactable by residents to organise the collection of their recyclable materials. Although the app remains an unaffordable luxury for catadores without a phone, it helps organise and create visibility for their work, while the contact between suppliers and collectors make the individual catadores less anonymous.[95] The Cataki application started off with an initiative to 'pimp up' the handmade carts which most catadores use, mobilising 1,600 volunteers in 42 cities. After that, the initiative ventured into ways to help the catadores themselves find their trash. That became Cataki. The initiative won a UNESCO digital innovation award in 2018.[96]

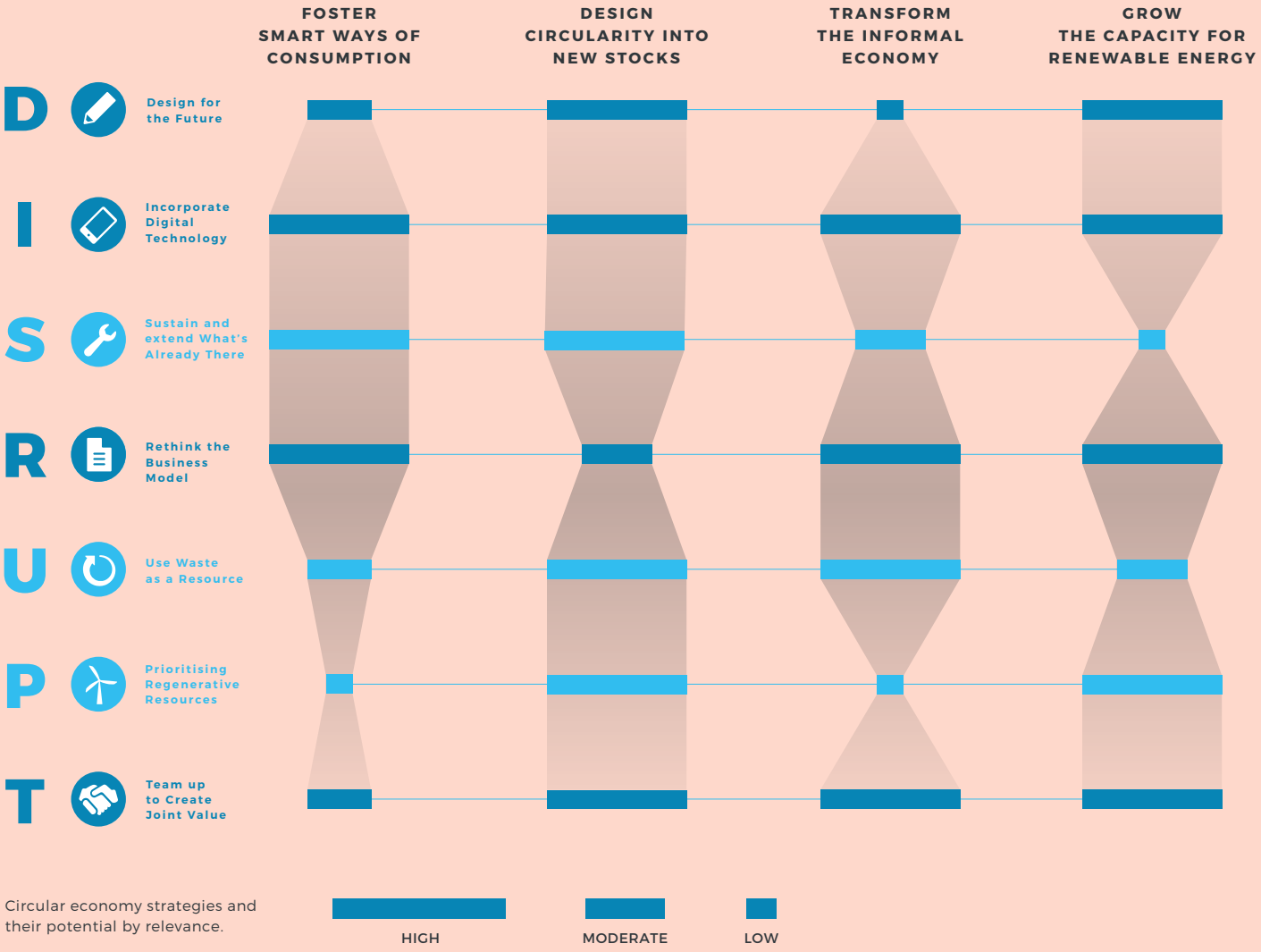
GROW THE CAPACITY FOR RENEWABLE ENERGY:

In some *Grow* countries, electricity from the grid is expensive and security of supply can be unpredictable. In response, certain industries rely on fossil-fuel-powered back-up generators.[44] Along with investments in other infrastructure, these countries are putting money into expanding their power generation capacity. Investments in power generation that **prioritise regenerative resources** can help decarbonise these economies without leaving them with the stranded assets more typical of *Shift* countries.

RENEWABLE ENERGY TRANSITIONS IN CHINA AND COSTA RICA

China is leading the clean power transition globally with an investment of more than US $758bn in renewable energy capacity in the last decade — and thanks to this investment, the price of electricity from renewables keeps on dropping.[97] Over 2018, China's renewable energy capacity grew 12% across all renewable sources, reaching 728 GW installed capacity by the end of 2018, equal to 38% of total installed capacity.[98] In terms of *Grow* profile sustainability, Costa Rica also features in the vanguard of country ambition with a target of becoming carbon neutral by 2050 — chiefly by electrifying transport and lowering private car usage, whilst its power production is already largely renewable and deforestation has been stopped. The Environment Minister is on record as saying that under the national policy plan, his grandchildren in 2035 will have the same carbon footprint as his grandparents had back in the 1940s — and by 2050, none at all.[99]

GROW



Circular economy strategies and their potential by relevance.

Figure 7 Summary of circular economy elements that shape the key transition pathways for Grow countries.

8 SHIFT COUNTRIES

High impact,
getting smart

Shift countries maintain the highest proportion of services as part of their GDP. Yet, their material consumption is 10 times greater than that of the Build countries. They also produce high volumes of waste, although what they process in-country themselves is usually managed relatively efficiently. With consumption levels exceeding several planetary boundaries, however, the true impact of Shift countries extends far beyond their national borders, with much of the environmental and social costs incurred elsewhere. Ultimately, Shift countries need to stop passing the buck and take responsibility for these impacts, regardless of where they occur. To that end, they can start incentivising the dematerialisation of consumption by aligning their tax regimes with sustainability ambitions. One other characteristic of Shift countries is their distinctive demographic: the population tends to be relatively small and ageing; although, when it comes to sustainability matters, most notably and recently climate, it is the younger generation that have adopted a clear position, taken to the streets and made a stand on the global stage. Their activism is an increasingly influential factor in social change.

SHIFT COUNTRIES: WHERE ARE THEY NOW?

The Shift profile fits best with the higher income countries in the global North, in the Middle East and on the Australian continent. The larger ones are the United States of America, Japan, Argentina and member countries of the European Union.

Shift countries are high impact: they produce 66% of GDP, while having only 20% of global population; plus their material consumption per capita is 10 times that of the *Build* countries and 2.5 times that of *Grow*. The material impact of the *Shift* countries is, however, cushioned somewhat by the comparatively high proportion of services employed. Services make up 71% of the GDP of the European Union and 80% of that of the United States of America. By contrast, agriculture provides only 4% of employment in *Shift* countries — whereas, in *Build* countries like Pakistan the figure is 25% and in India 18%. Import and export values represent 68% of global trade volume, illustrating the degree to which *Shift* countries are major world traders.

Waste generation per capita is close to that in *Grow* countries — indicating that efficient waste avoidance and management in *Shift* countries is compensating for the disproportionately large amounts of incoming materials. *Shift* countries have built up the highest fixed and mobile stock volumes in the world, to the extent that some markets are effectively saturated — as evidenced by the fact that car scrappage rates in Germany, for instance, are on a par with sales. This stock concentration gives *Shift* countries a sound and valuable asset base, but also locks them into a certain efficiency mindset, out of necessity. It also presents them with difficult choices and, in some cases, obliges costly corrective action. In the energy transition, for example, *Shift* countries are facing stranded assets, requiring them to mothball coal-fired or nuclear power plants which no longer havea societal licence to operate.

On the other hand, some responsibilities still get shirked and impacts offloaded. With high levels of material consumption, much of which is imported, this can ultimately lead to a large displacement of environmental and health impacts from *Shift* countries to *Build* and *Grow*.[100] The tide of public opinion is turning, though — and recycling policy is changing with it, here and there. Trade restrictions imposed by *Grow* countries have spurred some *Shift* countries to take control of their own recyclable waste. China's de facto import restrictions on certain waste types, followed by similar measures imposed by other countries in the region, accelerated the development of a national circular economy programme in Australia, for example.[78]

SHIFT COUNTRIES: WHERE ARE THEY HEADED?

Rates of GDP and population growth are expected to remain far lower in *Shift* countries than in their *Grow* and *Build* counterparts.[102] An ageing population is another distinguishing feature of *Shift* profiles, as the over-60s will account for nearly 60% of consumption growth in the likes of Western Europe and Northeast Asia.[64]

As wealth grows, *Shift* countries therefore tend to reduce their domestic portion of materials extraction through international trade, whereas the overall mass of material consumption ge nerally remains on the rise.[67] This typically comes as a result of *Shift* countries outsourcing the most material- and energy-intensive production stages to *Grow* countries, who in turn are beginning to experience some of the same issues themselves.[101]

In essence, *Shift* countries are affected by a global move away from labour being the limiting factor in production, to a world where natural resources and environmental impacts have become critical to productivity, instead. This also affects sustainability ambitions, which are compromised by a lack of resources, when they fail to address material overconsumption. For example, the electrification of the car fleet in the Netherlands would require a disproportionate amount of scarce resources, none of which is found in Europe. Such a transition would only be possible if the electrification were combined with far more efficient fleet mobility, plus higher vehicle utility rates.[103] That whole package calls for changes in car ownership models and usage behaviours — embracing such initiatives as ride-sharing services and car pools.

TRANSITION PATHWAYS: SO, HOW CAN SHIFT COUNTRIES GO CIRCULAR?

In a resource-constrained world, heavy consumers are a problem both for themselves and for others. With *Shift* countries already in the spotlight regarding their climate responsibilities and post-industrial legacy, they are under increasing pressure to get smart.

SHIFT TO A SMARTER WAY OF CONSUMPTION

Fundamentally, the ways for *Shift* countries to consume smarter are threefold: firstly, cut consumption of goods through product lifetime extension; secondly, increase material efficiency through new technology and design; and, thirdly, reduce the total number and volume of goods needed through promotion and adoption of sharing business models.

Since *Shift* countries consume a disproportionate amount of global resources, the onus is on them to lead the pack in circular design. Circular **design for the future** allows for stock build-up to **prioritise regenerative resources** during construction or production, optimise utility during the in-use phase (perhaps in combination with approaches that **rethink the business model**) and, towards end-of-life, **sustain and preserve** what's already there through re-use, recycling and lifetime extension.

DESIGN WORKSHOPS, A MODULAR SMARTPHONE AND REMOVING LEGAL BARRIERS

The Dutch CIRCO programme targets specific industries or material flows with circular design classes. Subsidised by government to reduce prices by around 75%[104], these workshops often have a regional focus to allow for synergies across industries, whilst targeting specifics such as bike manufacturing, horticulture, or organic fibres. Also operating out of Holland comes Fairphone. An example of extending product lifetimes through circular design, this social enterprise company has developed a modular phone, comprised of individual parts that can easily be replaced by the user. In addition, Fairphone invests in tracing the component materials back to their origins, sourcing the ones which are most ethically produced and paying a living wage to the workers who assemble the phone.[105] Sometimes, however, design options can end up being limited by prohibitive legislation. In a bid to remove these roadblocks, the Dutch government has opened a portal for citizens to report such barriers, allowing for a solution to be found jointly with stakeholders.[106]

Encouragement to **rethink the business model** can enable companies to provide a service level similar to product ownership, but at far lower levels of material consumption. In dense urban centres, these new business models gain ground by offering solutions to limitations of public and private space.
Certain sectors face particularly stiff challenges: fashion-as-a-service, for example, will only reduce wardrobe sizes through reuse and recycling,[107] if the rate of adoption can successfully get ahead of the accelerating curve of fast fashion.[108] Still, sharing and service models are here to stay. For instance, membership of car-sharing schemes globally is growing at an annual rate of 65% — relative success, nonetheless, however, policies are urgently needed to accelerate their uptake[109] still further in *Shift* countries, as a crucial means to lower material footprints.

Adopting many such innovative approaches, *Shift* countries already generate a large share of their GDP through services, with recycling rates also on the rise.[110] However, several *Shift* countries have recently been confronted with disrupted exports of recyclables, which were rejected by the receiving countries.
By further investing to **sustain and preserve what's already there**, the impact and risk of such trade disruptions can be reduced and potentially avoided in the future.

TAKE CONTROL OF IMPACTS

Due to the disproportionate burden placed on other countries through excessive material consumption, there is an urgent need for *Shift* countries to take control of the impact of their imports and exports. This requires all countries involved **team up to create joint value**, whereby shared standards for health, safety and environment are applied along the full value chain, regardless of the geographies which they cover. After the use phase, the international trade of secondary materials and products is particularly controversial. At the country of destination, waste may not be processed under safe and sound conditions, while the import of secondary products may hinder the transition towards an energy efficient and low-carbon economy in the importing country.

An example of an innovative effort to **use waste as a resource** and make production more sustainable is the Net Effect initiative being pioneered by Interface, a global commercial flooring company and leading manufacturer of carpet tiles.

With its new Net Effect Collection, Interface is investing in plastics recycling technology and collaborating with villages in the Philippines to collect used fishing nets from their shores. The waste nylon in the nets is then used to provide recycled content for Interface carpet tiles.[118] [119] [120]

FROM COFFEE MACHINES, JEANS AND PACKAGING, TO TAX REGIMES

Netherlands-based Bundles offers a range of products as a service, including coffee machines, beds, washing machines, laundry dryers and dishwashers. Payment can be made per washing cycle, or even per cup of coffee — effectively per unit of use — and the subscription model can even include additional service benefits, such as the delivery of coffee beans. Furthermore, the manufacturer is incentivised to prioritise product lifetime extension to optimise return on assets, for example, by building appliances that last well and can easily be maintained.[114] Mud Jeans applies the same business model to denim, actually offering jeans you can lease,[115] whereas RePack provides a circular packaging service that employs delivery materials which can be returned to them by retailers and consumers for re-use.[116] In Sweden, for example, reduced tax on repair, maintenance and rebuilding of private dwellings aims to boost employment, whilst shrinking the volume of undeclared work, at the same time.[117] [118] [119] In general, lowering labour tax and increasing environmental taxation is an attractive budget-neutral way to encourage circular design and repair, plus discourage disposal and consumption of single-use products — be they plastics or fossil fuels. Studies show that such alignment of the tax regime with sustainable development ambitions pays off, according to economic models developed by the NGO Ex'tax.[120]

INTERNATIONAL COOPERATION ON THE CIRCULAR ECONOMY

Since 2007, the European Union has been running the Switch Asia programme to support sustainable consumption and production (SCP) in South East and Central Asia. So far, close to half a billion Euros has been invested in 106 projects. Switch Asia aims to accelerate the uptake of SCP practices by disseminating knowledge and tools plus fostering the sharing of learnings and experience within the region.[74] Operating globally and officially launched in 2018, the international Platform for Accelerating the Circular Economy (PACE)[121] convenes private and public entities around a joint circular economy ambition. It spearheads international initiatives on topics such as circular electronics, plastics recovery and closing the loop on capital equipment.[122] Working alongside all of the above, the role of international treaties to ban the use of harmful substances should not be underestimated. The Montreal protocol, for example, has already successfully phased out 98% of the production and consumption of ozone depleting substances, compared to 1990 levels. Since some of these materials are greenhouse gasses, the Montreal Protocol also avoids an estimated 0.5°C climate change.[123]

DRIVE THE RENEWABLE ENERGY TRANSITION

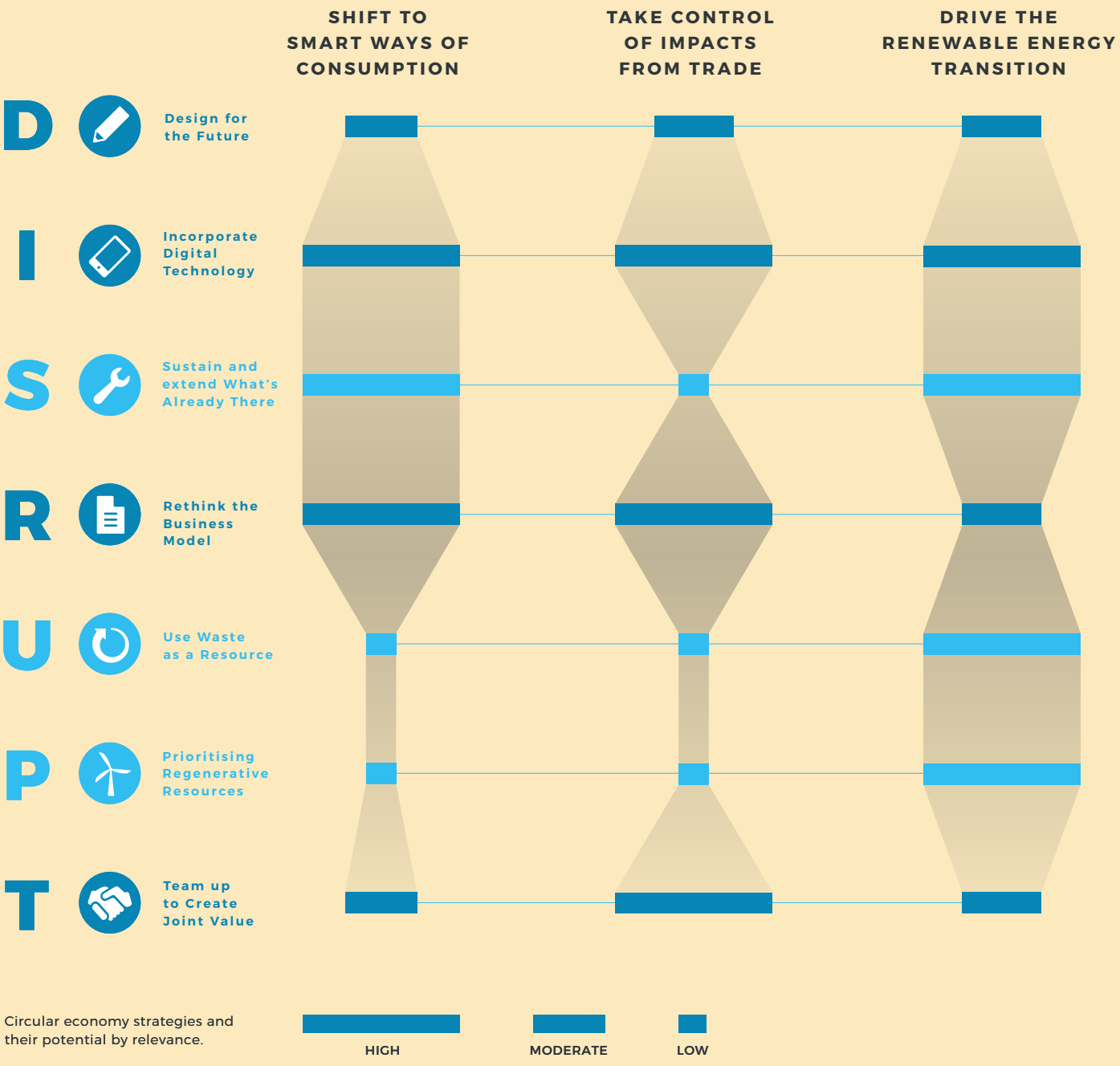
Shift countries are facing strong calls to ramp up regulatory and financial support for the infrastructural transformation required to secure abundant capacity for renewable energy generation (as well as associated storage and connecting networks), so **prioritising regenerative resources**. In both the build-up of renewable energy capacity and use of renewable materials, *Shift* countries should though be mindful of trade-offs and rebounds. Sourcing wood from sustainable sources is perfectly possible, for example, but requires diligence. Also, the energy transition will inevitably increase demand for rare earth metals, which should be distributed in a way which grants all countries access. On the positive side, research indicates that the transition will create ample jobs. Already, the renewable energy sector employs 1.2 million people in Europe and 0.8 million in the United States. China is way out in front, though, with 3.8 million people driving the energy transition.[124]

Research on the New Green Deals proposed to move the United States energy system[125] onto 100% renewables has shown that it is possible. Even at 100% wind, water and solar energy, the grid can be kept stable. The transition would save the United States $ 600 billion on healthcare costs from fossil fuel-related pollution, whilst saving the world $ 3.3 trillion on climate costs, at the same time. The cost of operating a fossil fuel-based energy system is six times that of a renewable energy system. So, whilst the technology is there and the economics work, scientists point to social and political issues as being the barriers to uptake in the United States, for instance.

DENMARK LEADS THE PACK ON ENERGY TRANSITION, OR 'GRØN OMSTILLING'

When talking about the energy transition in Europe, most attention ends up focused on the German Energiewende. However, while Germany went from 6% to 29% renewables in its power mix, nearby Denmark increased from 15% to 66%. In 2011, Denmark adopted an integrated Energy Strategy 2050, which addressed all types of energy generation and consumption. It includes separate targets for wind power, coal phase-out and intermediate greenhouse-gas emission reductions, as well as the aim to become carbon neutral by 2050. Alongside the massive deployment of renewable energy capacity, the country is also reducing its absolute energy consumption through energy efficiency measures. Decentralisation has been an important part of the country strategy. The Danish electricity mix was dominated by large central cogeneration plants back in 1980. Since then, the number of power production units has increased to 6,000, with 16 power stations still active, but also 1,000 decentralised cogeneration units, 5,200 wind turbines and 92,000 solar power installations.[126]

SHIFT



Circular economy strategies and their potential by relevance.

Figure 8 Summary of circular economy elements that shape the key transition pathways for Shift countries.

9. THE WAY FORWARD

Countries are critical to the circular economy. They operate, however, in a world that is only 8.6% circular and bears witness to the corrosive impacts and negative trends of the 'take-make-waste' tradition. The linear economy and its legacy are embedded deep within our society. The problems are hardwired, as underlined by a widening circularity gap. Against this backdrop of bad news and slow progress, however, we are seeing a global groundswell of positive action emerging bottom-up. This is driven by entrepreneurs, businesses and communities coming together with city officials leading the way. So, sensing both the urgency and the opportunity, an increasing number of countries and national governments are now beginning to shape their strategies in order to support investment towards sustainable and specific circular economy agendas.

Apart from facilitating national and local action, country governments are also key influencers and organisers of global coordination; together, they effectively set the 'rules of the game'. In turn, the dynamics of this world trade reverberate right back through national, regional and local markets. This can be seen in the way global supply chains often criss-cross continents — leaving footprints everywhere they go, in terms of resource and material extraction, processing, production, consumption and end-of-use management. The domino effect of recent trade bans and restrictions on waste imports, whilst controversial,[127] has illustrated this global interconnectedness almost perfectly — shining the spotlight on the one-way buck-passing of *Shift* countries to other places on the planet. This has prompted some *Shift* countries to start questioning the intrinsic sustainability of their consumption habits.[79] It has also highlighted the value of circular design.

In response, we can identify important ways in which countries can play a role in international collaboration to (re)write the rules in favour of positive action: for example, by aligning taxes with SDG objectives and climate mitigation. Commoditising secondary resources to smooth cross-border trade represents another lever countries together can pull, along with the development of global environmental standards that regulate the design of products to allow for easy end-of-use processing.

Until such shared control systems are in place, countries will remain tempted to regulate the quality of imports and exports themselves, acting unilaterally to shirk their environmental and social responsibilities. The global reality is clear: when circularity goes from bad to worse, countries have the power to change the game. The question is will they?

3 STEPS TO BRIDGE THE CIRCULARITY GAP THROUGH LEADERSHIP AND ACTION:

1. **Foster global collaboration to collect and share data.** This will enable identification of key data needed to measure and track circular performance, plus provide the necessary infrastructure and alliances to collect, retrieve and share data.

2. **Translate global trends into national pathways.** This will enable countries to set goals, peer review, measure and benchmark performance, plus track progress against their ambitions; while still allowing them to to formulate practical pathways that are aligned to local context, incentives, and mandates.

3. **Build a global coalition for action that is both diverse and inclusive.** This will bring together front-running businesses, governments, NGOs and academics to collectively boost capacity and capability to better serve societal needs more sustainably.

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