Number 26

MakingIt

Industry for Development

Time to go circular

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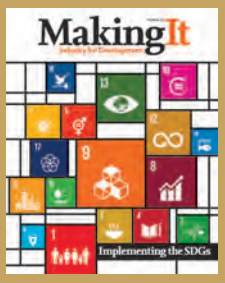

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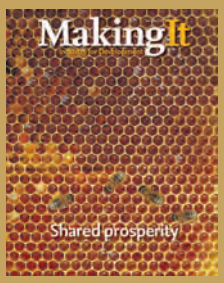

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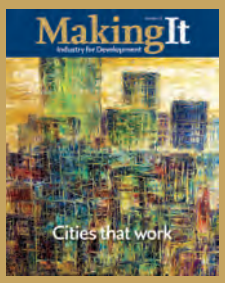

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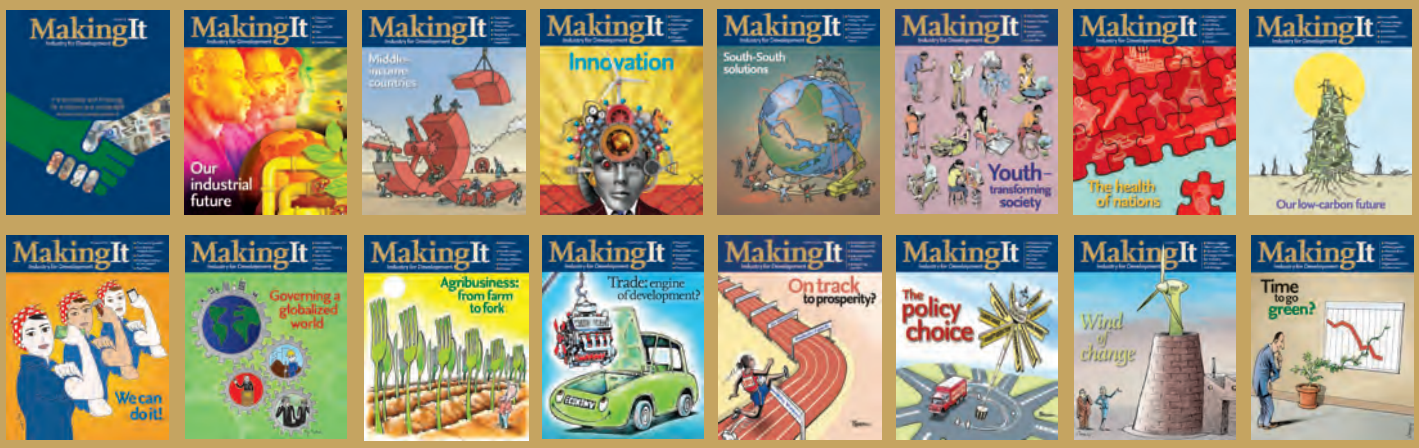

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Editorial

In her book, *Doughnut Economics*, Kate Raworth writes that "the last two hundred years of industrial activity have been based upon a linear industrial system whose design is inherently degenerative." She describes the essence of this industrial system as "the cradle-to-grave manufacturing supply chain of take, make, use, lose…"

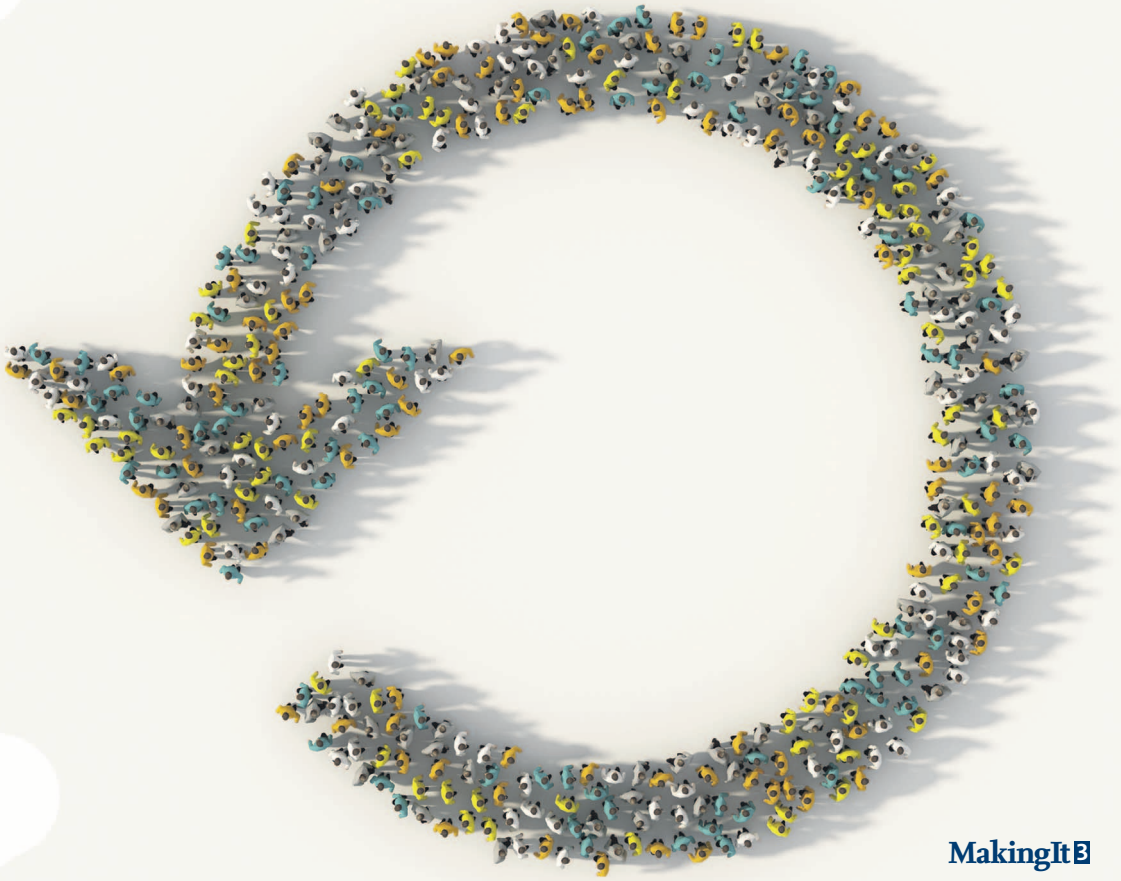
Raworth goes on to describe how industrial manufacturing is beginning a metamorphosis from degenerative to regenerative design through the circular economy. It is regenerative by design, she writes, "because it harnesses the endless flow of the sun's energy to continually transform materials into useful products and services".

The circular economy is a set of processes that create more value, and are designed to do away with waste. Value is maintained for as long as possible. Products are designed to last, their components to be re-used.

In this issue of *Making It* our contributors look at the circular economy from a variety of angles, from Ken Webster's introduction to systems thinking to Ewa Lewandowska's argument for social equality to be included in the design of the new circular economy.

Alexandre Lemille rails against the focus on recycling, claiming that we should instead understand the circular economy as the way to prevent waste from being created in the first place.

We also take a look at the design and re-design aspects of circularity, and introduce the Rizhao industrial park, one of the best examples of the impact of Chinese government policies that encourage industrial symbiosis as part of its circular economy drive.



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Industry for Development

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editor@makingitmagazine.net
Chair of editorial committee:
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GLOBAL FORUM

The Global Forum section of *Making It* is a space for interaction and discussion, and we welcome reactions and responses from readers about any of the issues raised in the magazine. Letters for publication in *Making It* should be marked 'For publication', and sent either by email to: editor@makingitmagazine.net or by post to: The Editor, *Making It*, Room D2150, UNIDO, PO Box 300, 1400 Vienna, Austria. (Letters/emails may be edited for reasons of space).

LETTERS

The new asbestos?

By chance I came across a copy of the very first issue of *Making It* (ten years ago now – back in 2009) and noticed an article by Gareth Leather titled "Why we need to green the global automotive industry", about the production of more environmentally-friendly vehicles.

Gareth wrote: "In the short-term, hybrids in the United States will face increasing competition from diesel-powered vehicles, which are 20-30 per cent more efficient than petrol vehicles, particularly with the advent of cleaner (reduced NOx) diesel and higher-performance diesel engines."

I had forgotten how far we have moved on in such a short space of time. Back then, governments, alarmed by rising carbon emissions, urged us to switch to diesel fuel, which was thought to emit less CO2 than petrol.

Three years after Gareth's article came the first major evidence of some truly dreadful health impacts and the World Health Organisation declared diesel exhaust a carcinogenic, a cause of lung cancer in the same category as asbestos and mustard gas.

Then in 2015 Volkswagen, which had been running its own marketing campaign in favour of "clean diesel", admitted that it had cheated on its emission tests. We had trusted the car industry when it said the fuel was clean. In fact emissions analytics found that 97% of the diesel cars made since 2011 exceeded NOx safety limits.

In fact diesel never did make huge inroads into the US, where gasoline remained cheap, and where American automakers focused their efforts on hybrid and electric vehicles. But in Europe, diesel passenger cars still remain a major part of the auto industry: astonishingly, they accounted for nearly half of all new cars sold across the continent in 2016.

It is unlikely that governments will want to face the ire of their motorists and tell them to 'forget what we said, do differently and oh you will have to pay for it as well'.

But I've noticed a lot of big cities are thankfully taking a stand. Paris, Madrid, Athens and Mexico City have now agreed to completely outlaw diesel vehicles from the centre of their cities by 2025 and the C40 group of global megacities are all taking steps to crack down on diesel vehicles and reduce smog.

Look at Germany. Berlin has already banned the oldest, highest-polluting diesel cars from its centre, while Munich is developing a clean air programme that will bring in some form of diesel ban this year.

Now, I must find an article in *Making It* extolling the virtues of plastic containers…

Nic Claesen, Brussels

Good nukes?

Roberta Bliss (Letters, *Making It* number 23) asks whether a "resource-efficient, low-carbon global economy" can include nuclear power?

I would argue it could. Nuclear power is one of the cleanest sources of energy because it emits little carbon dioxide.

It can be a more prominent part of a diverse, energy supply alongside renewables, in the face of dwindling fossil fuel reserves and skyrocketing electricity demand.

Despite successful deployments and falling prices for solar and wind power, renewable energy alone will not be sufficient to bring about the deep, rapid reductions in carbon emissions that are urgently needed.

By their very nature, sunshine and wind are not constant and there can sometimes be too little renewable power available on days when there is heavy demand, and too much on days when demand is lower. There is currently no economical way to store commercial-scale quantities of surplus electricity from solar or wind for days or even months at a time.

No energy system is risk free. But as environmental campaigner and journalist George Monbiot says, "atomic energy is far less dangerous to human beings and the living world than fossil fuels."

As he points out: "The Fukushima disaster, a level 7 nuclear accident (the highest category), caused by a massive earthquake and tidal wave hitting an antiquated reactor, has so far killed no one as a result of radioactive discharge, and is unlikely to

For further discussion of the issues raised in *Making It*, please visit the magazine website at *www.makingitmagazine.net* and our Twitter page, *@makingitmag*. Readers are encouraged to surf on over to these sites to join in the online discussion and debate about industry for development.

do so in the future. Fossil fuel burning, by contrast, kills hundreds of thousands of people every year through air pollution, and presents a possibly existential threat to civilisation through climate change."

The engineering challenges of running a modern society entirely on renewable energy are enormous, requiring not only cheaper storage technologies but also a reconfiguration of the electricity grid. Nuclear power is able to supply a consistent supply and could expand faster than renewable energy by building new reactors. Monbiot has championed the building of smaller modular reactors that use nuclear waste as fuel.

Four countries already get at least 50 percent of their electricity from nuclear, and 13 countries get at least 25 percent. If every country built reactors at the same rate that France did in the 1980s the world could reach its de-carbonization goal by 2050.

Tony Marchi, Iowa, USA

Daylight robbery

Excellent issue on the Belt and Road Initiative (*Making It* number 24) about China underwriting billions of dollars of infrastructure investment along the old Silk Road routes.

Given the scope of the BRI you could easily miss another road initiative, a project that China is saying is the world's first photovoltaic highway.

In Jinan, in the north eastern Shandong province, traffic is now rolling over a one-kilometre stretch of expressway that's also generating electricity from the sun.

It is made of three layers: transparent concrete on the top, photovoltaic panels in the middle, and insulation on the bottom and could handle 10 times more pressure than the normal asphalt variety. In a year it is due to generate one million kilowatt hours of electricity, which will be used to power streetlights and a snow-melting system on the road. It's also designed to supply power to charging stations for electric vehicles, should those be added in the future.

A week after it opened in December 2017, it was discovered that thieves had stolen a 1.8 metre section. It is suspected it was pinched in an attempt to duplicate the technology. They must be onto something!

China is now the world's top solar-energy producer – it boosted its photovoltaic capacity to around 78 gigawatts in 2016, almost twice that of second-placed Japan, and it's aiming for 105 by 2020.

Together with its scope of investment across the globe China really is showing the way.

Tom Mitchell, by email

Food for thought

Kate Raworth ("Change the mindset", *Making It* number 25) is so right when she says that "economists have fixated on GDP as the first measure of economic progress..." If policymakers considered GDP only as a measure of raw market economic activity in conjunction with many other metrics, the flaws in it would be less important. If poverty rates, inequality levels, natural capital accounts, and other metrics were taken into account as heavily as GDP, then different policies and priorities would begin to emerge. As Kate went on to say: "GDP is a false goal waiting to be ousted".

Melissa Aleksic, by email

Raworth's reference to the "doughnut" is all about the dilemma currently facing global industrial development.

The dough provides a "safe and just space for humanity". The hole in its centre represents "critical human deprivation" while "critical planetary degradation" lies in the space beyond the outer crust.

The dilemma is how to eradicate the former without exacerbating the latter. Unless a more intelligent growth model is adopted, involving a shift from GDP to broader measures of well-being, the world will face severe crises.

Stephanie Carr, website comment

Does everyone know what GDP covers and what it doesn't and therefore how reliable is it? For example, GDP also does not capture the value added by volunteer work, and does not capture the value of caring for one's own children. For example, if a family hires someone for childcare, that counts in GDP accounting. If a parent stays home to care for their child, however, the value is not counted in GDP.

Roberta Bliss, Lyon, France, by email

Photo: www.istock.com/FS-floor

Working women transforming the Muslim world

SAADIA ZAHIDI explains how a new generation of educated, tech-savvy women are shaking up the labour market

Debate in the West about technology and work often centres on the risks the rise of robots and algorithms will pose to job security. In other parts of the world, though, the same advances are bringing about a cultural and economic revolution.

This is certainly the case in much of the Muslim world. These countries, which account for 20% of the world's population and 12% of its gross domestic product, are undergoing one of the largest labour market transformations in history, and it is being driven by women.

Just over a decade ago, only 100m women were working in the 30 largest Muslim-majority economies. Today it is 155m. While this is still a small proportion of the overall working-age population, it is an extraordinary shift. And, while investment in education, changing social norms and economic

need have all played a part, the real driving force has been the rise of technology as an enabler of work.

One reason for this is the rise of the female tech entrepreneur. Rather than the stereotypical young man in a hoodie we associate with the entrepreneurs of Silicon Valley, in the Muslim world you are more likely to encounter a young woman in a headscarf. Their businesses are often built on the disposable income of other working women. Whether online platforms for childcare and safe transport, food or clothing, these digital bazaars are aimed at a new generation of educated, tech-savvy women. It is a lucrative and untapped market: the combined income of working women in the Muslim world is nearly US$1tn.

Gig economy: a chance to bypass cultural constraints

Not all working Muslim women are turning to large-scale entrepreneurship. A second factor behind their mass migration into the labour force is the gig economy. In advanced economies, it has become synonymous with the rise of the precariat but there are important differences between an Uber driver in London, a Lyft driver in San Francisco, a Careem driver in Jeddah or a Ladyjek driver in Jakarta.

In emerging markets, including those in the Muslim world, micro-entrepreneurs who have never had access to social safety nets are embracing digital gig work as an upgrade in terms of pay, security and the potential for social mobility. For women, in particular, the gig economy is liberating. It provides an unprecedented opportunity to bypass cultural constraints on their time and mobility. Women are finding new opportunities to share their skills, from driving to cooking to coding. Suddenly they have the kind of level playing field that is missing in a traditional office.

> "While investment in education, changing social norms and economic need have all played a part [in the extraordinary rise in the number of women working in the 30 largest Muslim-majority economies], the real driving force has been the rise of technology as an enabler of work."

This situation is partly made possible by the choices women make about their education. There are only five countries in the world where women make up a larger proportion than men of students enrolled in science, technology and engineering subjects. Of these, Brunei and Kuwait are Muslim-majority economies.

In another 18 countries, women make up 40% or more of those enrolled in those courses – more than half are Muslim-majority countries: Algeria, Azerbaijan, Bahrain, Jordan, Malaysia, Oman, Qatar, Syria, Tunisia and the United Arab Emirates. In Saudi Arabia 38% and in Iran 34% of students in those fields are women. The percentage in the United States is only 30% and in the United Kingdom 36%.

Nothing seems off-limits

As more women enter higher education in the Muslim world, the lack of role models has turned out to be a blessing in disguise. It has left them free to choose what they want to study rather than being influenced by stereotypes. Because everything was off-limits for most of their mothers and grandmothers, nothing seems off-limits for them.

Hungry for talent, companies have filled roles from IT to engineering with the best they could find, often from this pipeline of educated women. This has created a digital labour force with the potential to become much more gender-equal than many in the west.

There are barriers when it comes to converting degrees into jobs, and biases around career progression and promotion. As in the West, some women drop out to start families, but many also have support systems that enable them to keep working – extended families where grandparents provide childcare and low-skilled, cheap workers to do the household chores.

An even greater migration of young women into the workplace will occur in coming years. Multinationals and local businesses are waking up to this trend. Governments must do likewise. Helping a generation of digitally savvy future employers, consumers and taxpayers to flourish may well turn out to be the highest return on financial and social investment they could make.

SAADIA ZAHIDI is a member of the Managing Board and Head of the Centre for the New Economy and Society at the World Economic Forum. She is the author of *Fifty Million Rising: The New Generation of Working Women Transforming the Muslim World.*

World Economic Forum / Greg Beadle

Solving the plastic pollution crisis requires focus on another 'R' – responsibility

TOM DOWDALL argues that by emphasizing recyclability and recycling over reduction and elimination of plastic waste, major companies are still ducking their responsibility to tackle plastic pollution

Plastic pollution covering a beach in Accra, Ghana.

TOM DOWDALL is a sustainability consultant specializing in corporate action and advocacy. Previously he was responsible for Greenpeace's successful campaigns to transform the electronics and IT sectors and pushing major companies to effectively advocate for climate solutions.

The problem with plastic is not new. For decades, the plastics and packaging industry has combined with food and beverages companies to frame it as a "litter" problem. Individuals littering are the problem, and it's the responsibility of individuals to fix it. Public concern is effectively funneled to "clean-up" events, while industry lobbyists successfully weaken and postpone any policies that effectively would limit the growth of plastic. As a textbook example of how to effectively avoid responsibility for the ever-increasing amounts of single-use plastic, it has been a huge success. But it has been a disaster for the planet, resulting in a plastic pollution crisis.

What's new is that this slow-burning crisis has leapt beyond environmental concerns to hit the headlines in many countries. Despite the flurry of negative stories, the playbook suggested by those really responsible remains the same: "more recyclable packaging," "more recycling" and "voluntary targets." Despite all the evidence that recycling is not the answer, it's still pushed as the first priority. Only 9% of all the plastic ever made has been recycled. Most of that is downcycling to low-grade plastics. Even when effectively collected, a high portion of plastic packaging is impossible to recycle. Like the convenience of plastic packaging, pushing recycling first is convenient for avoiding responsibility.

Who is responsible?

In order to find out where the plastic packaging actually comes from, I started by looking at the contents of my own plastic recycling bin for two weeks. I live in the Netherlands, which has a long-established bottle deposit scheme, plastic bag tax and plastics recycling scheme for most homes, partially funded by a producer-responsibility levy.

Despite these measures, I still had 147 items of single-use plastic in my recycling bin. Forty came from supermarkets and 52 from named companies; the rest were unbranded plastics. That means of the roughly 3,800 pieces of plastic entering my home each year, over 60% comes from consumer goods companies and supermarkets.

The *#breakfreefromplastic* campaign has done this on a global scale with global audits of plastic pollution. For the last two years, volunteers have organized hundreds of plastic pollution cleanup events and audited what they collect, to create a unique insight into exactly which companies are most responsible. Of 147,000 pieces of plastic collected in 2018, the biggest polluters are Coca-Cola, ➤

➤ PepsiCo, Nestlé, Danone, Mondelez International, P&G, Unilever, Perfetti van Melle, Mars and Colgate-Palmolive, according to the organization.

Prioritize reduction and reuse over recycling

Tackling plastic pollution requires dramatic reductions in quantities of single-use packaging, and focusing product design and changing business models to increase reuse. Any company skipping straight to recycling as the solution is ignoring proven waste reduction strategies in favour of failed non-solutions. Fixing the broken take-make-waste consumption model will require much more than incremental increases in recycling.

Major multinationals have played a major role in creating this crisis. Chasing market expansion and maximizing profits with single-use plastics as the go-to solution. In developing countries, Nestle, P&G and Unilever created the sachet economy using packaging they knew was impossible to recycle, inevitably creating a new type of waste. Small sachets of soap, coffee and instant noodles are the biggest type of plastic pollution in many developing countries.

Unilever is at least belatedly starting to address the problem of sachets, but again the focus is on recycling only, not on expanding proven existing business models such as dispensers and reusable containers. This pattern of aggressively expanding new markets without having solutions for waste is repeating itself with Tetra Paks in Viet Nam. Over eight billion Tetra Paks are sold annually in Viet Nam, but only a tiny portion is recycled, as the recycling infrastructure has been overwhelmed by growth.

Avoiding regulation

In developed countries, food and drinks companies and the plastic industry have funded industry associations to continually lobby against regulation that requires full producer responsibility for packaging and to prevent solutions such as deposit bottle schemes being implemented or expanded.

Here in the Netherlands, a successful and popular bottle deposit scheme for large PET bottles has been consistently attacked for decades by industry lobby groups. These groups always push for voluntary waste reduction targets that are subsequently never met. The scheme has survived, but reusable hard PET bottles have been replaced by companies in favour of single-use PET deposit bottles, which are mostly destined for downcycling.

In 2018, a Dutch proposal for expanding deposit-return schemes to small plastic bottles and cans was defeated by intensive lobbying from the corporate sector and supermarkets on cost grounds. This is the standard industry lobby playbook in many countries: delays and promises of voluntary improvement bury the inevitable failure. Rinse and repeat for the next political cycle.

The first part of being a solution to a problem is taking responsibility for your part of the problem.

The problem and who is responsible is clear. Here are the new 4 Rs of how companies and the plastics industry can take responsibility to really be part of the solution:

1. Radical transparency: Exactly how much plastic packaging is your organization responsible for?

2. Reduce single-use plastic: State clear absolute reduction goals combined with regular progress reports.

3. Redesign business models to promote reuse: How exactly are you promoting reuse and driving fast progress towards circular economy packaging?

4. Responsible policy support: Show clear support for regulation to reduce plastic packaging and withdraw from industry groups that continue to delay, weaken or undermine required regulation.

Start with transparency

The first part of being a solution to a problem is taking responsibility for your part of the problem. For huge companies that sell billions of single-use plastic packaging that means being transparent about how much plastic they use, how much they sell and what happens to their plastic waste.

Unfortunately, none have fully disclosed in detail what plastics they consume, how much and where. Only Unilever publishes a partial plastics footprint. Nestlé, Coca-Cola and PepsiCo don't even disclose how many plastic bottles they sell each year. Without dramatically improved transparency, it's impossible to assess how seriously companies are taking the problem.

Reduction as top priority

Any credible waste strategy has to start with reducing the amount of waste.

Currently, the global plastics industry is building hundreds of new plants to increase global plastic production by 40%, all based on fossil fuels. Only if major customers get serious about reducing demand will these expansion plans be stopped.

Any company serious about tackling climate change also has to get serious

"Only 9% of all the plastic ever made has been recycled."

Picture: Thomas Kirschner / Flickr.com

Huge companies that sell billions of single-use plastic packaging need to be transparent about how much plastic they use, how much they sell and what happens to their plastic waste.

about reducing its own use of fossil fuel-based plastics. Despite the plethora of corporate announcements in response to increased media scrutiny, hardly any even mention actual reductions, let alone put reduction first.

New business models

The recently announced New Plastics Economy Global Commitment finally marks the start of a response that's actually addressing the core of the problem.

Getting producers, packagers and big consumer goods companies to commit to hard reduction goals and introduce reusable packaging is a good start. However, the pace and scale of change needs to be faster and solutions that already exist need to be implemented at scale.

Any company serious about tackling climate change also has to get serious about reducing its own use of fossil fuel-based plastics.

Why are problematic multi-colored PET bottles still being used? Supermarkets right now can encourage reusable packaging by offering discounts to customers bringing reusable containers. That fast change only happens when companies are shamed into action by focused campaigns; it does not exactly inspire confidence that the biggest corporate producers of plastic waste are actually prioritizing real solutions.

British supermarket chain Iceland's move to ban all single-use plastic from its own branded products by 2023 shows that big change is possible, and it represents the level of ambition that other retailers and consumer goods companies need to follow.

Support responsible policy and regulation

There are almost too many examples to count of industry pledges, voluntary reduction promises and alike being used successfully to prevent effective waste reduction regulation, only for these promises and pledges to be broken.

As well as supporting initiatives, such as the voluntary New Plastics Economy, major companies must show clear and unconditional support for ambitious regulation to reduce plastic pollution. That also requires cutting funding or membership ties to industry lobby groups aiming to weaken regulation.

Unfortunately, this does not appear to be happening. A recent leaked lobby letter reveals that even a simple measure to require drinks bottle caps to be attached to bottles in the European Union was opposed by Coca-Cola, Nestlé, PepsiCo and Danone. Ironically, the lobby letter proposes bottle deposit schemes as a better solution, which these companies also have lobbied to prevent being implemented in Belgium, France and Spain.

Coke, Nestle and Pepsi are all core partners of the New Plastics Economy. Unless these companies lead by example and stop opposing mandatory regulation to reduce plastic pollution, they remain part of the problem.

Tackling the plastic pollution crisis will require a complete switch away from the last 50 years of framing, funding and lobbying that created this crisis. Only companies clearly accepting their responsibility to radically reduce consumption of single-use plastic can be considered real leaders.

● This article originally appeared on GreenBiz.com and is republished with permission.

trends

Global trade disputes, tariffs and trade barriers, political instability and even the potential onset of a recession are topping a long list of threats for companies that make complex engineered products and equipment for manufacturing operations and earth-moving projects.

PwC's *Industrial manufacturing trends 2019* asserts that in the United States, steel and aluminium tariffs and levies placed on more than US$200bn-worth of Chinese goods – which, in turn, led to retaliatory actions from China – have increased industrial manufacturing materials costs and squeezed margins. The sector's supply chains also are feeling the tariff pinch, which makes it more challenging to determine locations for factories and sources of supply. In Europe, the uncertainty of Brexit negotiations is having a similar effect.

The PwC report states that decades of stable supply chains have meant that industrial manufacturing companies have had no real sense of urgency to seriously invest in significant internal operational improvements that would, for instance, fully modernize their factories and create a seamless network that includes product design, procurement, production, warehousing and shipping.

Consequently, many industrial manufacturing companies have not implemented digital tools across their business lines that would give them a low-cost and lean operating environment, flexible enough to respond quickly to geopolitical and global economic challenges.

Now, the report suggests, the series of external challenges ultimately may be catalysts for action that the industrial manufacturing sector has avoided for many years. Growing uncertainty about global conditions is prompting industrial manufacturing CEOs to plan to rely on operational efficiencies to bolster growth via enhanced competitiveness. PwC suggests that "in today's world, operational efficiency is essentially a proxy for digitizing internal operations, creating scale and value from advances such as artificial intelligence, robotics and connectivity technology through all facets of the industrial manufacturing ecosystem."

BUSINESS MATTERS

Transitions in the age of automation

The world of work is undergoing a radical transformation as automation – and, on the near horizon, artificial intelligence (AI) technologies – begins to sweep through sectors and businesses search for productivity gains. Automation promises a new productivity revolution as robots and computers take over many routine physical tasks and are increasingly capable of accomplishing work that requires cognitive abilities.

The McKinsey Global Institute's *The future of women at work* focuses on how the growing adoption and diffusion of automation and artificial intelligence technologies is likely to affect women in the workforce.

According to the report, men and women could experience significant improvements in their working lives, spending less time on repetitive routine tasks such as data processing and physical manual labor, thus freeing up time to use social, emotional, and higher cognitive skills instead. In a partially automated emergency room, for instance, health workers could spend less time on paperwork and more time interacting with patients. Many more women (and men) will work alongside

> "To make these transitions successfully, women will need different skills and more education, mobility to switch jobs easily, and access to technological capabilities"

Grant Thornton's *Women in business report 2019* indicates that, globally, progress on gender diversity in business is being made. 2019 sees the highest percentage of women in senior management on record, at 29%. This year also marks the biggest increase in the proportion of women in executive roles around the world, rising five percentage points from 24% in 2018, and making it the first time the proportion of women in senior leadership has exceeded one in four.

Encouragingly, over the last five years, the proportion of global businesses employing at least one woman in senior management has risen by 20 percentage points – 12 points in the last year alone. However, globally the proportion of women in senior roles is still lying short of the 30% tipping point that is expected to open the gates to gender parity.

The findings in the report are drawn from 4,900 interviews and surveys conducted in late 2018 with chief executive officers, managing directors, chairs, and other senior decision-makers from all industry sectors in mid-market businesses in 35 countries. In mainland China, mid-market businesses are those with 100 to 1,000 employees; in the United States, those with US$0m to US$D2b in annual revenues; in Europe, those with 50 to 499 employees.

The 2019 research reveals marked regional differences in gender diversity among senior leadership, often rooted in country-specific cultural, economic and political factors.

Leading the way is Eastern Europe with almost a third (32%) of senior management in the region made up of women, outperforming the global figure by three percentage points. Conversely, Latin America has the lowest figure, with just 25% of senior managers being women.

Modern Eastern Europe has offered opportunities for women to gain technical skills and move into male-dominated industries, with many women leading in the workplace. Government policies aimed at full employment and entrepreneurialism have also inspired and supported women.

machines and will have more fulfilling and productive working lives as a result. However, automation will undoubtedly be disruptive for many.

The spread of automation could potentially displace millions of female workers from their current jobs, and many others will need to make radical changes in the way they work. At the same time, shifting population dynamics and growing incomes will drive increased demand for certain jobs.

Globally, between 40 million and 160 million women may need to transition between occupations by 2030, often into higher-skilled roles. Navigating these transitions successfully could mean that many women would be well-positioned for more productive, better-paid work, allowing them to maintain or even improve on their current share of employment.

However, this positive outcome could be challenging for many women to secure. To make these transitions successfully, women will need different skills and more education, mobility to switch jobs easily, and access to technological capabilities that will not only be in demand, but can also open up new ways of working and new sources of economic opportunity.

Women face persistent challenges on these three dimensions that will be needed to thrive in the automation era; these challenges have already slowed women's progress toward gender equality in work.

Leaders in the private, public, and social sectors will need to be bold, putting in place concerted measures – many of them designed with women specifically in mind – to enable women to develop the skills, the flexibility and mobility, and the tech access and expertise that will be needed. The stakes are high. If women fail to make the necessary transitions, they could face a wider wage gap relative to men or even drop out of the workforce altogether, falling further behind in their share of employment.

Concerted measures and creative new solutions by governments, companies and individuals are needed in three areas to enable the necessary transitions and overcome long-established barriers

1. Invest in training programs and platforms to enable women to develop necessary skills.
2. Enable women to balance unpaid and paid work, and develop infrastructure and networks, to boost their labor mobility.
3. Raise women's access to technology, their skills to use it, and their share of tech jobs and leadership roles.

'Thinking in systems' has been identified as integral to the transition to the circular economy. As a concept, systems thinking is often positioned as a way of understanding the complex world around us.

In this interview, **Ken Webster** gets to grips with systems thinking.

What is systems thinking?

Photo: www.flickr.com/photos/nlireland/6199795865/National Library of Ireland on The Commons

How can we apply systems thinking and what is its relevance to the circular economy?

We've always had systems – a steam engine is a system, in that it's a connection of interacting components with a purpose. The aim of the steam engine is to turn the wheels and, with that, pull the carriages. This is a narrow example of a mechanical and predictable system – where one pulls the levers, feeds the engine and gets the result. Train drivers will tell you there is an art to this, which gives us a hint about other systems that are not under our control. Coal burns in the steam engine's fire, and the intensity varies. It depends on the quality of the coal, the amount put in, and the speed at which the train is travelling. These systems are much harder to manage, that is why we call it an art.

For a long time, and ever since Newton described the universe as being like clockwork, we assumed the world was a bit like a machine. We have assumed that, in principle, we can understand, predict, control and literally engineer the result we want. This was very useful. It took us to the Moon. But, almost all real world systems are nothing like machine systems. We need to understand the context much better.

The economy is often thought of as a machine to process resources. It is thought that the more efficient we make the machine, the better off everyone will be. Some people even think that X marks the spot: a supply and demand diagram tells us where the most efficient position will be. However, this is very simplistic.

Not worrying about where resources come from, because the machine is efficient, is only looking at part of the picture. The big picture is that feedback from too much resource extraction and feedback from too much waste, do impact the economy in very damaging ways. We know this now. The circular economy uses understanding the system to give a better overall result. You can't ignore the feedback, it's real. Just because it is not in your model or idea – doesn't take away the issue. So, systems thinking really is understanding bigger contexts over longer periods and looking at the connections, not the parts, for insights.

We are looking for patterns, not certainty, because certainty does not exist, but the pattern gives us insight about which direction to move in. A circular economy reflects this more contemporary scientific understanding of how the world works.

"A steam engine is a system... a connection of interacting components with a purpose."

How can we use this methodology to solve problems in the economy effectively?

The challenge of systems thinking is that our habit of thought is always to look for an immediate cause and effect.

"He crashed the car because he didn't brake."

But why didn't he brake? What were the other factors? Did he have a row with his partner? Was his blood sugar low? Does he have eyesight problems? Was there a bumble bee in the car?

The point is that the most obvious, proximate cause of a problem may not be the one that is the most effective one to solve.

Waste might be better solved by designing out the use of the product. For example, an iPhone carries at least ten or more regularly used products inside. There may be end of (first) life issues with an iPhone, but when is the last time you saw someone carrying a camera, compass, calculator, or torch? Replacing something with nothing is a great solution for the system as a whole. These products have been designed out along with the waste that comes with them.

Intervening in a system is one of the hardest questions to answer, as you have to look at all the indirect causes. A report from Alfred Rosenfeld of Berkeley Labs – a world expert on energy efficiency – noted long ago that if the Chinese had issued instructions to manufacturers of pumps and refrigeration units to up their energy efficiency to best practice , then the Three Gorges Dam need not have been built. So, a seemingly mundane solution, sending a few hundred letters, could have been more effective, and would have avoided arguments over a large dam construction and the displacement of people.

So how can people know where to start when it comes to systems thinking? How do we break free from habitual thinking and take things forward?

This indirect causation makes it difficult to know where to intervene in the system, because people expect visible action. They are used to reacting to cause and effect. Having a different perspective on how the world works doesn't sound like taking action – but, as John Maynard Keynes once famously said, the difficulty lies not so much in developing new ideas as in escaping from old ones.

So we have to get used to a new idea, but more importantly, we have to be convinced that it is worth letting go of the old one. In that way, thinking is action – and the circular economy is busy exploring the rationale for us to abandon the habits of thought with which we have grown up. ➤

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John Maynard Keynes

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Are there examples of where systems thinking has already proven successful?

As mentioned earlier, the iPhone – although it's trivial in a way. And we must not forget autonomous and electric vehicles that, thanks to smartphones, give the promise to combine mobility with an integrated accessible public transport system, e.g. buses, bikes, trams etc, making cities far more accessible.

It isn't about giving everyone a car and building roads to match that assumption (which proved to be the very opposite of intelligent systems thinking).

The problem was people needed effective mobility to get from A to B. In the 1950s and 60s, we were told, "Get a car. We'll give you roads!" We assumed that the idea was brilliant, and all we had to do was make the system better for the individual car. But the problem really lay in mobility and access. This is why cities are being revived so successfully, because we have the promise of living densely, in walkable connected communities, without sacrificing urban space to cars and the inevitable pollution.

We are now designing for mobility, NOT around the car. The renowned entrepreneur, Elon Musk, of Tesla Motors (amongst others), has seen the potential and is developing autonomous driving and emission-free vehicles. This is a long way from selling a car to an individual as an aim in itself. He has pointed towards more effective mobility. He started with a car, but has always had his sights on the bigger system and he is one of the poster children for systems thinking in the tech-orientated field.

● **KEN WEBSTER** (left) is Senior Lecturer in Circular Economy at the UK's University of Exeter and former Head of Innovation at the Ellen MacArthur Foundation.

● Interview by **LOU WALDEGRAVE**, the Ellen MacArthur Foundation.

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Moving away from a waste-based model

Alexandre Lemille argues that the circular economy is about entering a post-recycling era, not advancing it.

Too often the circular economy is muddled up with some kind of advanced recycling process that would mean keeping our industrial system as it is and preserving a growing consumption model. This idea is based on a belief that recycling will take care of everything.

One of the most startling examples of this is the part of the European Union's Circular Economy Action Plan which aims at increasing recycling rates: up to 70% of all packaging waste by 2030 and 65% of all municipal waste by 2035. In a properly built circular economy, one should rather focus on avoiding the recycling stage at all costs. It may sound straightforward, but preventing waste from being created in the first place is the only realistic strategy.

While we obviously need to continue recycling for quite some time, putting the emphasis on genuine circular innovations – moving us away from a waste-based model – should be our sole objective. Investing in them today would result in leadership tomorrow. ➤

➤ Recycling is linear

In a linear economy, we do not account for the side-effects generated by a product once sold to an end customer. The aim here is to sell a maximum number of products at minimal cost. Continuous pressure to reduce costs leads to the creation of many of these side-effects – called externalities by economists. The higher a company's rate of production and the higher its efficiency, the more successful it will be at selling its goods in a fiercely competitive environment.

This worked well in the twentieth century, when resources were easily available and raw material prices kept decreasing. Waste, as an economic externality, was not the producers' responsibility. Managing waste cycles, dumping it out of sight or, at best, recycling it – but only when it was cost effective – were under the control of our national institutions.

Visionary manufacturers, who understand the upcoming challenges of increasing their economic resilience, know better: a product that is returned for repair will cost less to fix and sell again, than manufacturing it from scratch.

In our current model, we extract resources, transform them into products, and consume or use them, prior to disposing of them. Recycling only starts at the throwing-away stage: this is a process that is not made to preserve or increase value nor to enhance materials.

Recycling is the second material stream of a linear economy. Recycling has to cope with huge volumes, and complex polymers and materials. Often these cannot be extracted or end up in mashed-up fragments that – once again – require lots of energy to create a new product from scratch. Recycling has to deal with products that often are not meant to be sold with a feedback loop strategy, so there is a loss of energy, a loss of manpower hours, and a loss of research and development capacity, as all these investments have been made for a one-time production.

Finally, we need to understand that recycling is not an effective strategy for dealing with unused resource volumes in a growth model, be it strong or weak, linear or even falsely circular. We will find ourselves in a never-ending race in pursuit of continuously generated waste, rather than seeing the avoidance of waste as a path to beneficial innovations on many levels.

Of course, it is easier to think about recycling. This avoids changing the whole of our volume-based production mode. But in a world where we have to shift our consumption patterns and choose alternatives that make more moderate use of energy, recycling is no longer up to expectations.

Recycling is 'business-as-usual'

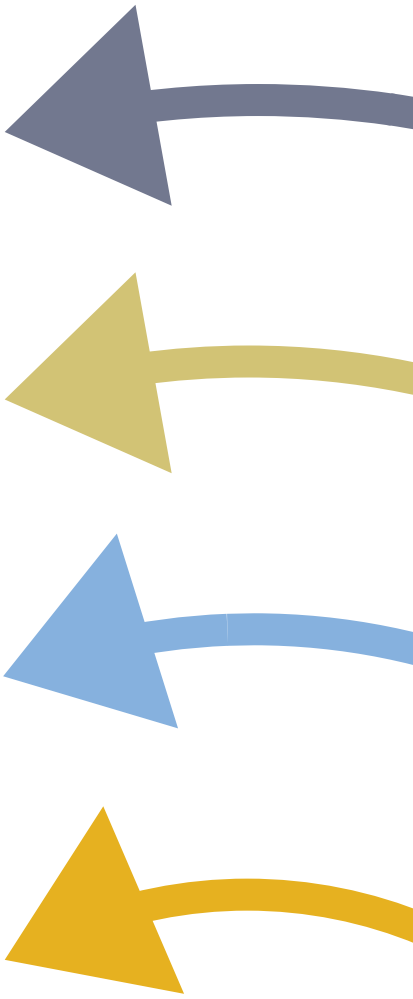
Since we cannot stop the volume of waste overnight, investments in the recycling industry are needed. But really meaningful investment in the development of a circular economy takes place outside of the recycling space. Indeed, the more we recycle and the more we finance recycling factories, the more we stay "linear". We mistakenly believe this is the best route to solve our problems but, by staying in a recycling-based economy, we will delay the need to shift gears into an advanced circular economy scenario.

In a circular economy, resources do not end up as recyclables since products are made for several life cycles to come. Products lifespans are extended via maintain, repair, redistribute, refurbishment and/or re-manufacture loops, thus never ending up in the low-value, high-need-for-energy loop: the recycling one.

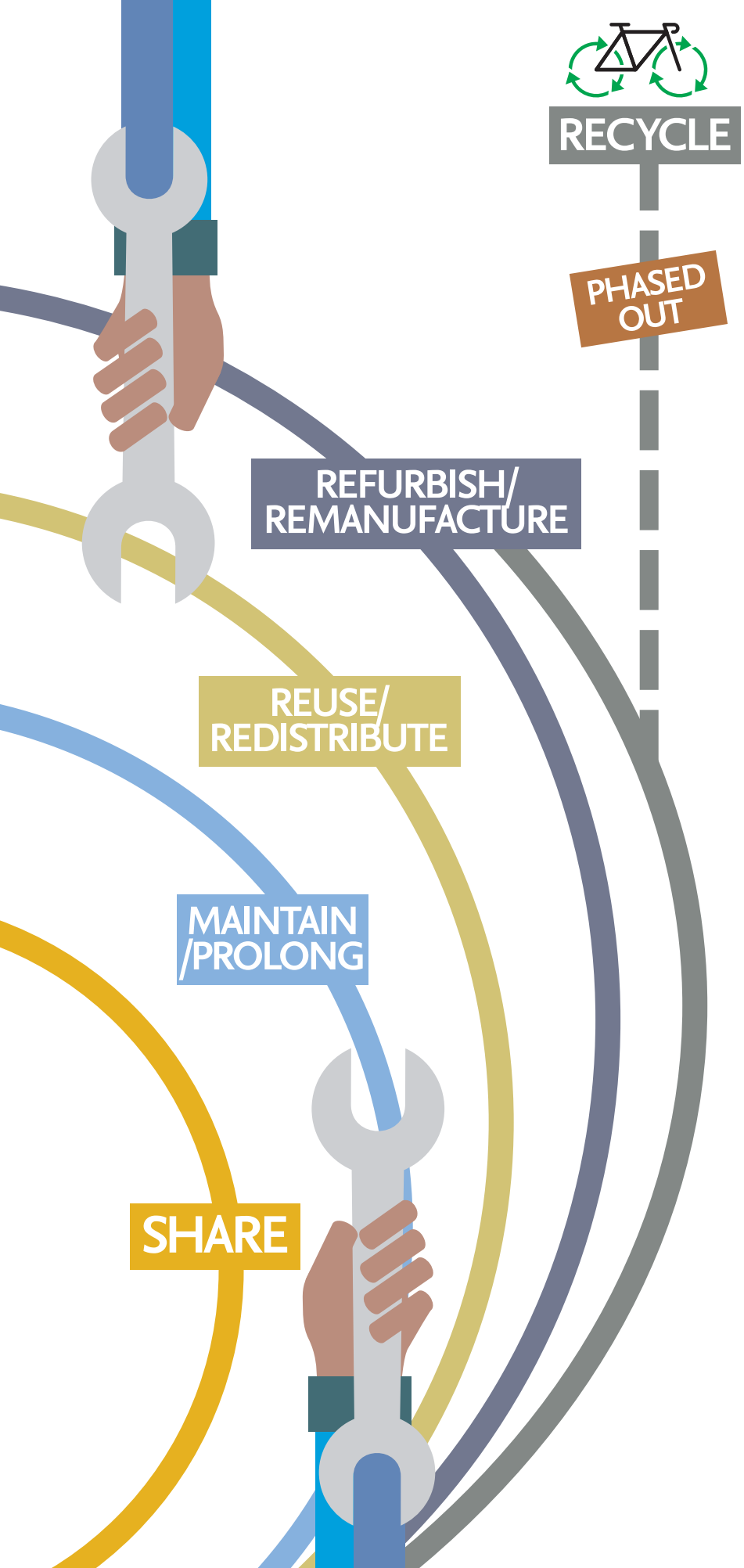
We live in a world in dire need of disruptive innovations. Closing loops next to where customers live, while avoiding the creation of waste, is a short and longer-term win-win for any leading re-manufacturer. Short-term because you are in direct contact with your customers, and taking back a product that needs maintenance is an opportunity to better understand their needs and help them with additional services. Long-term because you will lower your exposure to future financial risks. Any of the feedback loops that come prior to the recycling loop are an opportunity to take back control over your stock of resources – taking control away from the raw material markets, which may become highly volatile. Increased interactions with your customers, both commercial and financial, and an in-depth understanding of their needs, would definitely increase loyalty rates and a business' overall resilience.

> **"A product that is returned for repair will cost less to fix and sell again, than manufacturing it from scratch."**

Re-using, re-distributing and/or remanufacturing strategies are the preferred approaches in a circular economy, as they are based on parts durability. Caring and preserving the value of product components increases corporate economic resilience, while diminishing external market risks. And, whether you are acting in a highly-advanced economy or an economy reaching out to its maturity level, these strategies make crystal-clear sense: they are less costly in the long-run because repairing a product made to last is always less expensive than producing it from scratch.



● **ALEXANDRE LEMILLE** lectures in inclusive circular economy at Sciences Po, Paris, and at the University of Cape Town. He is also the co-founder and General-Secretary of the African Circular Economy Network.



Leapfrogging into valued supply chains

Whether your production units are based in a developed or an emerging market, the vision remains the same, but the strategy differs. The vision is about addressing the needs of your customers, shifting from a product to a service-based model, lowering your production costs thanks to the re-use of or ease of remanufacture of a product sold or leased with the guarantee that it will be returned at some point to your plant to be prepared for its next economic life.

Following this approach, we must move away from activities that devalue the material, such as recycling, or even destroying it by incineration, and instead invest in those activities that preserve it: reuse and remanufacture. The two are especially important since they create many more secure jobs. Walter R. Stahel, the godfather of the modern circular economy, introduced the metric of labour input-per-weight ratio (man-hour-per-kg) to measure job creation in relation to resource consumption. He found that the ratio man/hour per kilo (mh/kg) of used resources for a remanufactured engine compared to the mh/kg for the manufacture of the same engine from virgin materials is 270:1. The impact on employment is huge. In an economy of maintenance, repair and remanufacture, employment becomes central to the effectiveness of such a model.

The re-localization and the re-sizing of activities closer to the customers become critical. Production sites should migrate from a highly centralized global hub to units designed to fulfill local needs. In developed markets, a possible plan could be to develop strategic partnerships, with local service providers providing the infrastructure. In emerging markets, often with a dire need for jobs, leapfrogging straight into a national re-manufacturing strategy is the way forward. Becoming the next "world factory" hub is a very obsolete vision today.

One way to start thinking like a leader in the next economy, while creating jobs, could be, in order of priority:

- Reuse by repairing (goods) through re-hiring (people), while sharing the radical benefits (awareness) of such model;
- Redistribute by promoting access (goods) through collaboration (people), while sharing information (awareness) about this model;
- Remanufacture via the ease of disassembly (goods) by training (people), while sharing the acquired knowledge (awareness) through this model;
- Migration of recycling activities by diverting (goods) to service models, transferring skills (people) to remanufacturing processes (awareness);

All of the above make sense in a world where planetary limits have already hit most economies.

Adopting a circular strategy by avoiding reliance on recycling is the way forward.

This is about genuine innovation derived from genuine leadership.

KEYNOTE

Photo: www.istockphoto.com/kozmoat98

A question of design

Kai Bethke and **Stephan Sicars** on the circular economy answer to looming resource scarcity and an overwhelming production of waste ➤

Our current linear "take, make, dispose" economic system depends on a permanent throughput of materials that are extracted, traded and processed into goods, then sold and used, and finally disposed of as waste or emissions.

According to the latest report of the International Resources Panel, between 1970 and 2017, the annual global extraction of materials tripled, growing from 27 billion tonnes to 92 billion tonnes.

The use of metal ores has grown on average by 2.7% per year since 1970, while the use of non-metallic minerals, mainly sand, gravel and clay, has increased from nine billion tonnes in 1970 to 44 billion tonnes in 2017.

It is the same story for fossil fuels: the use of coal, petroleum and natural gas increased from six billion tonnes in 1970 to 15 billion tonnes in 2017; and for water: from 1970 to 2010, the growth rate of water withdrawals grew from 2,500 km3 per year to 3,900 km3 per year; and for biomass (organic matter) with demand increasing from 9 billion tonnes in 1970 to 24 billion tonnes in 2017.

According to the OECD's *Global Material Resources Outlook to 2060*, in the absence of new policies, global materials use is projected to rise to 167 billion tonnes in 2060.

But it is not just a matter of the world eating into a finite supply of resources. The current pattern of resource use is having negative impacts on the environment and on human health. Resource extraction and the processing of these resources into biomass, fossil fuels, metals and non-metallic minerals make a massive contribution to the global greenhouse emissions that are over-heating our climate. They are also driving global biodiversity loss and water scarcity. The OECD reports that reducing greenhouse gas emissions is strongly linked to materials use policies. Materials extraction and production, the OECD says, contribute to a significant share of total environmental impacts.

The extraction and processing of resources and the distribution and use of products all contribute considerably to environmental pollution and especially to air pollution. Soot, smoke, methane and carbon dioxide are a just few common air pollutants. The 2017 report of the Lancet Commission on health and pollution found that air, water and soil pollution is the largest environmental cause of disease and

"The current system is no longer working for businesses, for people or for the environment. The take-make-use-dispose economic system cannot go on."

death in the world today, responsible for an estimated nine million premature deaths in the year 2015.

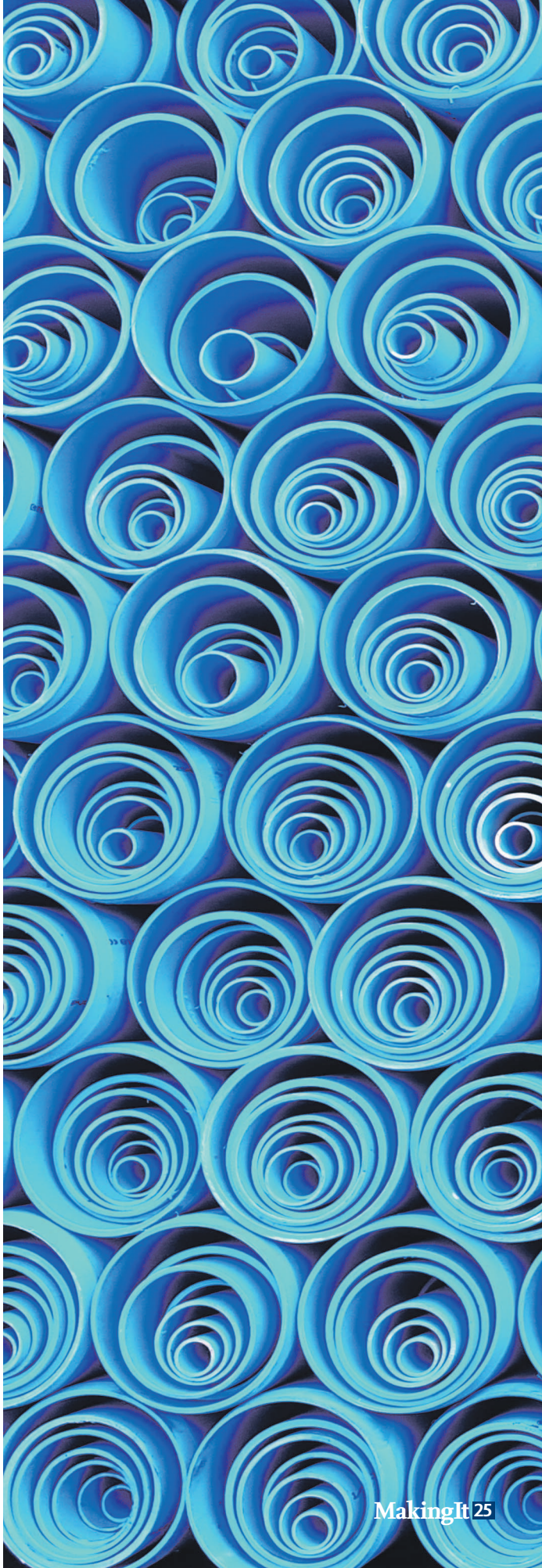
How to dispose of the ever-increasing amounts of used, broken or unwanted products is another seemingly insurmountable challenge created by the linear economy. Municipal solid waste is reaching levels that traditional waste management approaches are struggling to deal with. The substantial challenges created for in particular waste management in Western countries by China's recent decision to end imports of plastic and paper waste is one recent example of the magnitude of the world's solid waste problem.

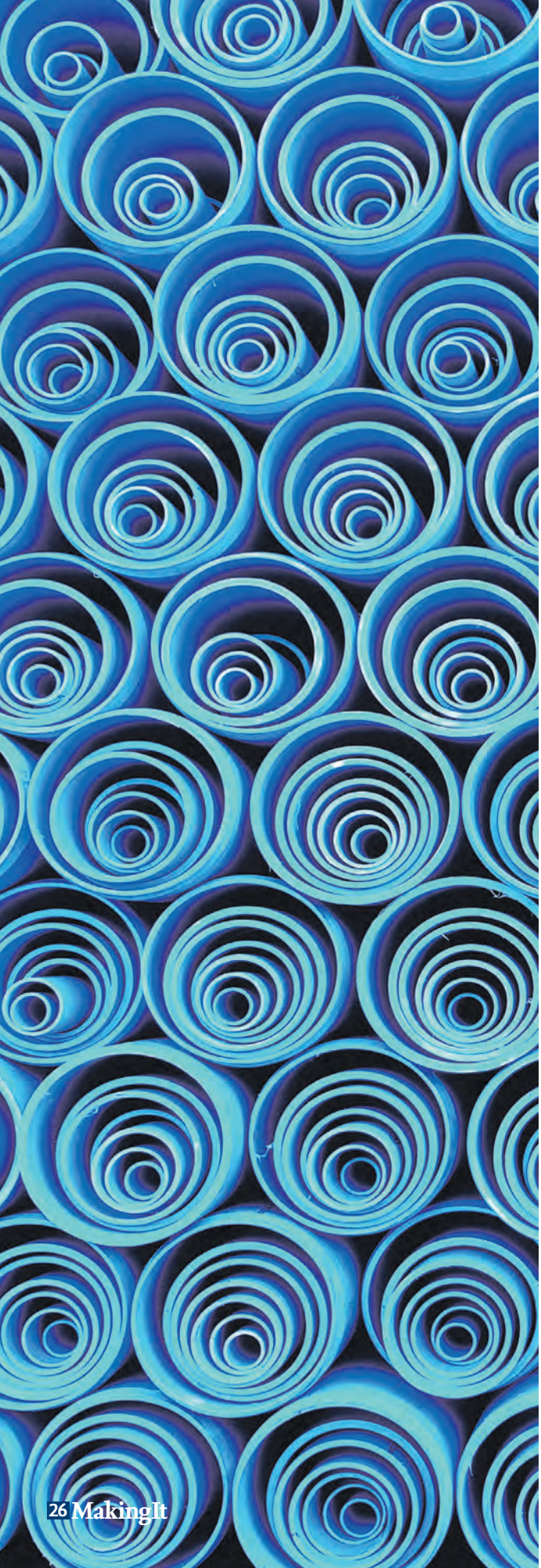
Looming resource scarcity and an overwhelming production of waste show that the current system is no longer working for businesses, for people or for the environment. The take-make-use-dispose economic system cannot go on.

To create a thriving economy that can benefit everyone within the limits of our planet, we need to transform the way we manage resources, the way we make and use products, and the way we deal with products when they break or wear out.

A circular economy

The Ellen MacArthur Foundation describes the circular economy as "an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems and, within this, business models". ➤





Here, the circular economy is an ideal, not reached in the near future; however, moving towards this ideal creates substantial benefits in terms of resource availability, profitability, new economic activity and, last but not least, an improved environment.

One of the basic principles at the foundation of the circular economy is a focus on optimized design. For any product, decisions made at the design stage will influence what will happen to that product – how it is made, used and disposed of, and whether it will end up in an incinerator, landfill or in the sea. The essential ideas here are to view waste and pollution as design flaws, to rethink product design and production processes, and to harness existing and new materials and new technology to ensure that waste and pollution are not created in the first place.

Design choices also come into play in determining whether a product can be repaired, recovered, remanufactured or composted. Such design choices include: the type of materials a product is made of; the application of a modular design approach; the way a product is assembled and the ease of disassembly, so that it can be maintained or so that its parts can be replaced and/or reused; and the capacity for a product to be upgraded or improved in the future.

Keeping products and materials in use is another of the basic principles of the circular economy. In terms of industrial production, if products are designed so that they can be reused, repaired or remanufactured, the amount of resources needed would be greatly reduced.

Remanufacturing

Remanufacturing is an industrial process involving the dismantling of a product that has already been used, restoring and replacing components, and then testing the individual parts and the whole product to ensure that it is within its original design specifications. Instead of destroying or landfilling products at the end of their life, remanufacturing gives them another one. Today, this is typically applied to high-value equipment or components, such as engines and motors, transmission assemblies and gearboxes, complex medical equipment, heavy transport equipment, etc.

Today's digital technologies offer a way to expand the scale of remanufacturing by allowing remanufacturers to know much more about the way products are used, their location and the actual functioning of the product in terms of wear and tear. This information will enable them to maintain and upgrade products more easily.

Circular business models

Extending beyond the product itself, design decisions relating to the business model play a crucial role. The essential idea here is to shift from simply selling a product to providing a service. Customers access what they need, rather than owning things outright. The service provider or manufacturer will take care of maintenance and repairs because it's in their interest to keep that item in circulation.

A great example of a circular business model in the industrial sphere is chemical leasing, which has been pioneered by the United Nations Industrial Development Organization (UNIDO) since 2005. Chemical leasing is a product-as-service business model that shifts the focus from increasing the sales volume of chemicals, towards a value-added approach. A producer sells the functions performed by the chemical, and functional units are the main basis for payment. The conventional approach is turned upside-down: economic success no longer depends on the volume of chemicals sold, but on the service that is linked with the chemicals. ➤

"Remanufacturing is an industrial process involving the dismantling of a product that has already been used, restoring and replacing components."

➤UNIDO places great importance on applying innovative concepts to the real world through our mandate of inclusive and sustainable industrial development. To this end, we are working to introduce circular practices into production processes, guided by the conviction that systems can be regenerative and underpinned by design principles that view final disposal as the very last option after a long life of continued use and reuse of products, material and resources. These principles extend from the extraction of raw materials to production, distribution, use and end of first life, which are transformed – to the greatest extent possible – into a continuous, cyclical process.

The circular economy is not just about a few manufacturers changing some of their products. It requires all the interconnecting companies that form our infrastructure and economy to come together to rethink the way they collectively operate.

Circular economy for developing countries

The circular economy offers a promising alternative strategy for industrial development and job creation in developing countries. Keeping in mind that the circular economy is an ideal to move towards, developing countries can facilitate change by setting priorities in types of products, sectors or at different parts of the product life cycle, depending on their specific situation. The circular economy provides new opportunities for economic diversification, value creation and skills development.

Developing countries are in a strong position to take advantage of these new economic opportunities. The strong tendency to value products and their components leads to a wider application of circular economy principles. The related capabilities, e.g. for repair or recycling, are often wider spread, and having products repaired and reusing them are more socially acceptable. Many developing countries have large informal sectors that already practice circular activities – for example, in areas such as electronic waste (e-waste) and refrigerator repairs – and they could improve their value generation and engage in higher-value circular economy supply chains; in the case of refrigerators, UNIDO already supports thousands of repair/refurbish technicians every year. With sufficient priority accorded to related investments,

“The circular economy requires all the interconnecting companies that form our infrastructure and economy to come together to rethink the way they collectively operate.”

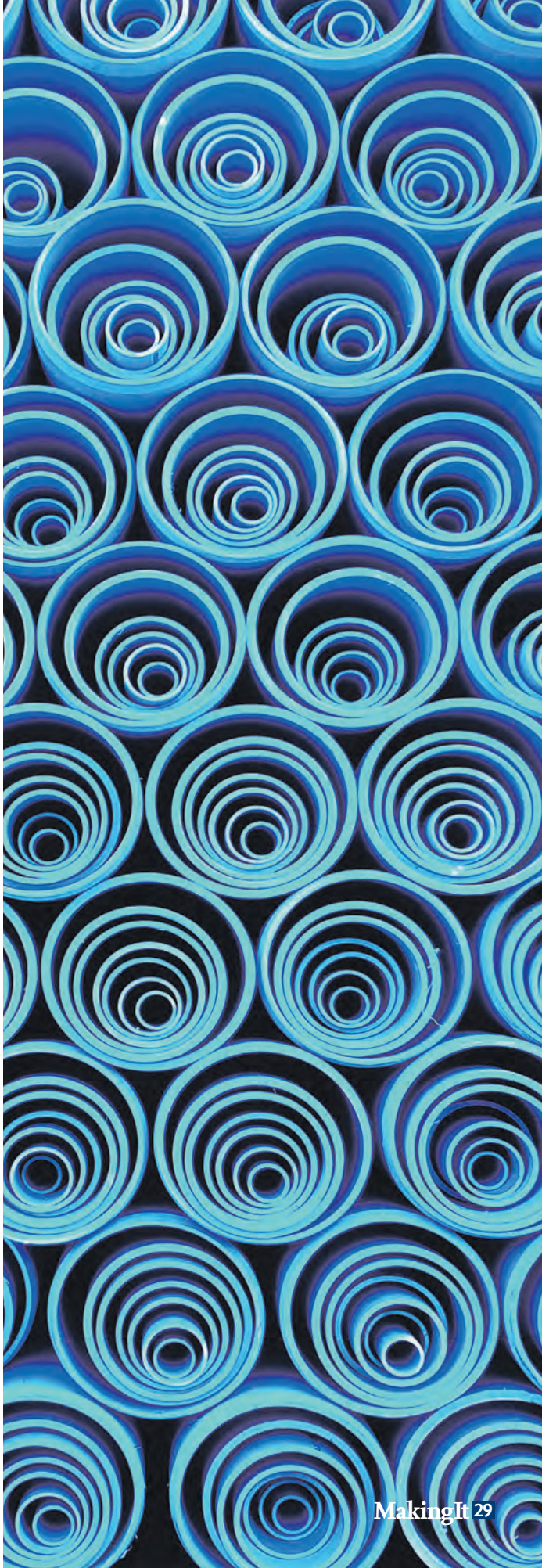
developing countries could 'leapfrog' developed countries in digital and materials innovation, and embed circular economy principles at the heart of their economies.

Success now in embedding circular principles in industrial development strategies can address the needs of growing, urban populations, while mitigating against a continued rise in primary resource use, and associated greenhouse gas emissions and environmental pollution.

We need to widen the global circular economy conversation to greatly increase the involvement of developing countries, and we need to invest political and financial capital in promoting the development of inclusive circular economy approaches globally. Developed country governments have an important role to play in piloting approaches and facilitating a dialogue on how the international dynamics of circular economy policies can be managed better. Support from international agencies, in particular UNIDO, will be critical to the piloting of circular economy solutions among small and medium-sized enterprises in developing countries and along international value chains in order to demonstrate the viability of cross-border circular value chains at scale. ■

KAI BETHKE
is Director of UNIDO's Department of External Relations.

STEPHAN SICARS
is Director of UNIDO's Department of Environment.



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Just seven Asian countries will contribute an estimated 45% of global GDP by 2050. Already with more than half the world's population, **Adrienna Zsakay** believes that the Asian region will make or break efforts to create a sustainable and circular world.

PT Komatsu Remanufacturing Asia – Indonesia.

Photo: www.http://kra.co.id

Achieving the circular economy in Asia

We have no choice. This goal of a sustainable and circular world must be accomplished. The real question then is not 'is it achievable?" but rather 'how will it be achieved?' Here are some suggestions:

Language

In 2017, a research paper was published stating there are 114 different definitions of the circular economy in use. Language is the single most important starting point for all circular economy practitioners, government agencies, NGOs, businesses and civic society when working together.

The core values and principles are the key foundations. However, as the circular economy gains traction, the range of core values appears to be ever-expanding.

When we were simply recycling, we had the 3Rs: reduce, reuse, recycle. Then, these expanded to 6Rs: rethink, refuse, reduce, reuse, repair, recycle, and even the 12Rs: reduce, reuse, recycle/reclaim, repair, refurbish/recondition, repurpose (upcycle or downcycle), re-design/eco-design, remanufacturing, R&D (new materials, processes, technologies and innovation), re-skill (policymakers, business and civil society), reverse logistics/supply chain management, re-vision (green industrial revolution and ecological civilization).

Legal language

When we agree on a defined circular economy language, the next step is to establish the legal parameters for both businesses and consumers. This need not be fixed, as businesses must remain competitive and offer a range of services according to their capabilities. For example, not all repair businesses may be able to test the strength of any repairs or include a warranty.

Yet the legal language, particularly for repair, refurbish and remanufacture, provides the opportunity for both business and consumer choice. Without this framework, circular economy practitioners run the risk of working within an undefined grey area, leaving it up to businesses to make their own rules. This will have a detrimental effect on consumer uptake and may even damage perceptions of the circular economy.

Reality check

Looking at one of the core principles of the circular economy within the Asian context – the remanufacturing industry – Indonesia provides the classic scenario of the challenges circular practitioners will face. Manufacturing industry contributes approximately 22% of Indonesia's GDP. A vast number

of small and medium-sized enterprises (SMEs) – 3.27 million companies – represent 99% of the total number of manufacturing industries in the country.

Remanufacturing, defined as a series of manufacturing steps acting on an end-of-life part or product in order to return it to like-new or better performance, with warranty to match, appears to be the most appropriate strategy to attain sustainable manufacturing in Indonesia. Remanufacturing is economically viable by maximizing the use of old components or product, and it is environmentally friendly by reducing the size of landfill and minimizing energy usage, and it is socially viable by providing employment opportunities and developing prosperity flows.

However, SMEs, which are undoubtedly the engine of Indonesia's manufacturing industry, do not have adequate experience, skill, resource, technology or financial support in the remanufacturing area. Only a few large companies, like PT Sanggar Sarana Baja and PT Komatsu Remanufacturing Asia, have recognized the value of remanufacturing strategies.

For the more than three million manufacturing SMEs spread out across the 922 permanently inhabited islands of the Indonesian archipelago, will there be a trickle-down effect from big remanufacturing businesses or do we tackle this from the bottom up?

One solution should be an industry association, much like US Remanufacturing Industries Council and the European Remanufacturing Council, that can lobby, provide guidance and case studies for mid-size manufacturers to comprehend how to manage a remanufacturing industry. We also need to ignite the interest of entrepreneurs or start-ups in the massive opportunity provided by reverse logistics – the operations related to the return of products from the end consumer back to the manufacturer.

Are there other support industries that we need to build first to make it easy for SMEs to include remanufacturing in their business model? Anyone can sell or rent a product. The key is getting it back for reutilization.

A global strategy

In a recent article in *Nature*, 'How to Globalize the Circular Economy', the authors suggested five ideas for a global strategy for the circular economy:
(a) A global database to capture links between resource uses, run by the UN. In a recent report by the World Economic Forum, a new term emerged, The Internet of Materials (IoM): "a decentralized data system connecting data on different products and materials through standardized communication protocols. Data should be supplied by producers as products are sold, tying in data on material provenance and product design. Ensuring data confidentiality and anonymity are key here to avoid competitive and anti-trust challenges."

The report focuses on consumer electronics and plastic packaging. As the circular economy progresses, this must expand to include all materials. The only question remaining is the financial mechanisms that incentivise SMEs to participate. If it was structured innovatively, an entrepreneur could hold the license for a particular area or native language, thus removing the burden of governments to translate and maintain the database and reduce costs for SMEs.

Existing circular economy platforms such as FLOOW2 could also pay to access the IoM database, thus strengthening their business model.
(b) A global platform should be established for sharing knowledge about the circular economy.
(c) International alliances are needed to promote large-scale experimentation. Circular Economy Asia launched the Asian Plastics and Packaging Agreement, based around a certifiable plastics supply chain, global definitions for recycling, and the basic requirement for each country in Asia to establish their own sustainable plastics and packaging industry within a global alliance.
(d) Standards for performance measurement, reporting, accounting and future products need to be developed and harmonized. The European Commission's ecodesign directive will push the boundaries on this. The downside is that more and more Asian exporters are now finding it easier to export within Asia because there are far less regulatory barriers. It is unclear how many Asian governments are ready to support a similar initiative.
(e) Policymakers should develop ways to enforce regulations, settle disputes and implement sanctions on a global scale. Few countries in Asia can enforce the laws they enact, and naming and shaming seems a little draconian. ➤

FLOOW2 world's reset button

"Existing circular economy platforms could pay to access an Internet of Materials database, thus strengthening their business model."

ADRIENNA ZSAKAY is founder of Circular Economy Asia, an organization leading the discussion on circular economy values in the region, with a particular emphasis on resource recovery, education and training, and the voluntary Asia Plastics and Packaging Agreement.

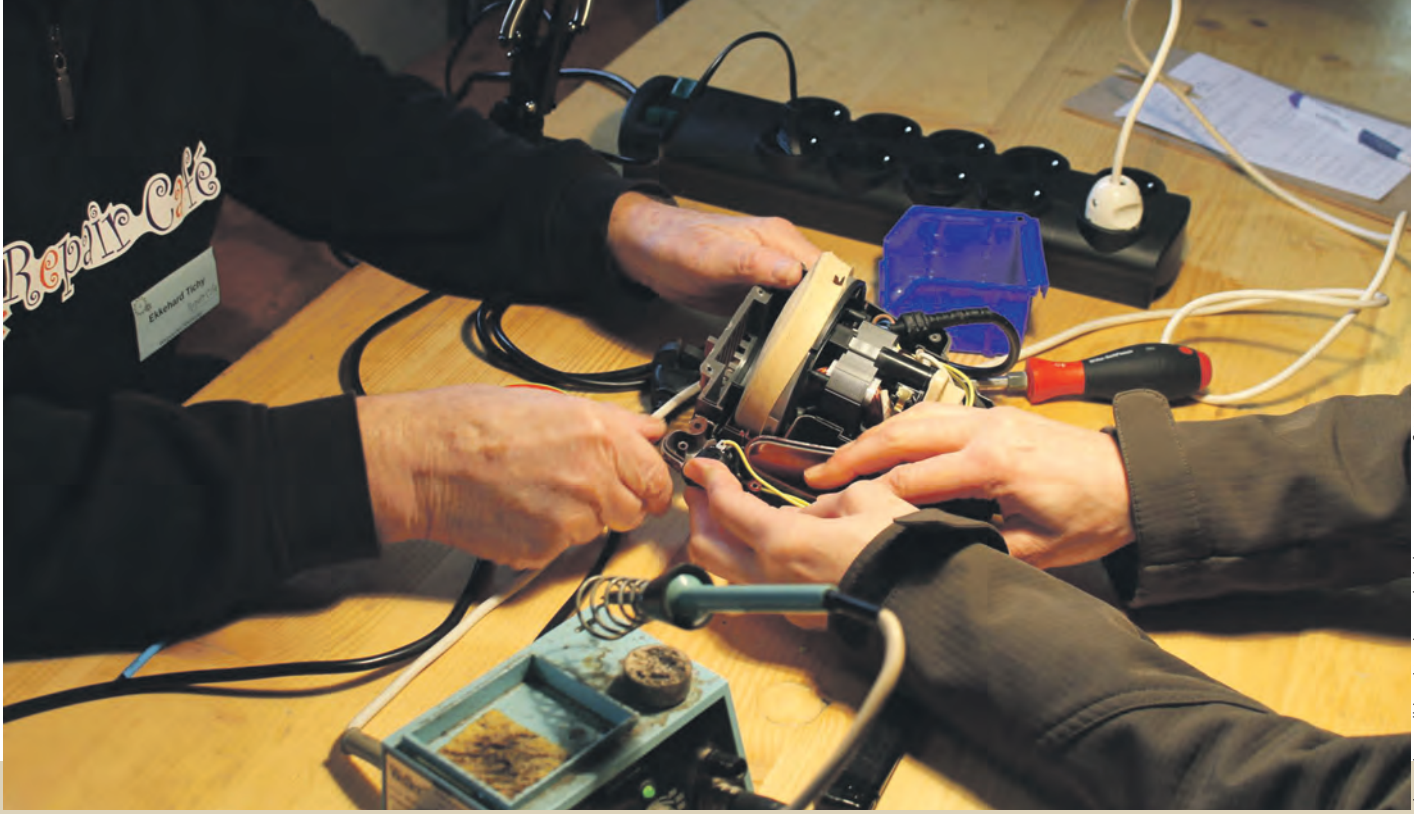

Photo: https://de.wikipedia.org/wiki/Datei:Repair_Caf%C3%A9_Trier_Reparatur.jpg

“There are now around 1,750 repair cafés worldwide... we need to encourage more up-take.”

➤ Diversity and economic disparities

Many people who have travelled through or worked in Asia are acutely aware of the diversity and the economic disparities between countries. If we are to globalize ideas, initiatives or alliances, then we will need industry associations, such as a remanufacturing industry association, in each country, linked regionally and internationally for information, networking and particularly events on best practices.

Another idea is the repair café, an international network started by Martine Postma in the Netherlands. There are now approximately 1,750 repair cafés worldwide. We need to advertise them to encourage more up-take, potentially by social entrepreneurs.

Skills and training

While there are a growing number of people beginning to work in the circular economy, we must cast our eyes into the future by identifying the training and skills for this new workforce. Again referring to remanufacturing as an example, the essential skills are forecasting, planning and inventory management. In addition, staff and professionals can cross-train and transfer between forward supply chain, sales, operations planning and scheduling, which are also highly transferable to new product manufacturing. A range of skills and training in technology will also enhance employment prospects.

Circular economy practitioners cannot sit idle, believing this is someone else’s task. We must contribute to this discussion in meaningful ways that guide students, schools, colleges and universities towards circular employment prospects.

Academia

We ignore academia and the students who dig deep and ask the questions businesses and governments do not have the resources to address. We have not even scratched the surface on the research and development that the world will need to undertake to transition from a linear to a circular system. Asian universities lag very far behind and it will take some time before they realize the value of offering new courses.

In conclusion, implementing the circular economy in any emerging market is not for the faint-hearted. It requires a dedication and commitment that must rise above the usual terms of ‘passion’ and ‘love your job’. It requires an unwavering conviction that there is no other choice. With a combined effort, over many years, it will come to fruition.

Illustration: vickykatzman.com

Another first for China

Making It editor **Charles Arthur** traces the development of a pioneering eco-industrial park

The need to reduce carbon emissions is not the only challenge facing Chinese industry. Demand for raw materials used in industrial production is continuing to grow, driven by population growth and the rapid rise of the middle class. At the same time, the supply of a wide range of natural resources and their derivatives face increasing constraints. The long-term imbalance of supply and demand threatens business performance across the board.

The growing scarcity of natural resources requires increased resource efficiency, including improved reuse rates. China has been taking bold steps to tackle the issue. For around 15 years, the country's government has been a frontrunner in devising and implementing circular economy policies for industrial production.

China's Five-Year Plans are a series of social and economic development initiatives issued by the government since 1953. They map strategies for economic development, set growth targets and launch reforms. The 11th Five Year Plan (2006–10) was the first to accord strategic importance to the development of a circular economy. The plan suggested the practical implementation of the circular economy at three levels: enterprises, industrial parks, and cities and regions.

A legislative first

It resulted in the Circular Economy Promotion Law, issued in 2008, which was one of the first pieces of circular economy legislation in the world. The Law demanded that factories – particularly those involved in resource-heavy sectors such as cement and aluminum – embed themselves in a network to make further use of industrial by-products.

The Rizhao Economic and Technology Development Area (REDA) is one of the best examples of the impact of the huge effort made by the Chinese government – through incentives, regulations and policies – to enhance Industrial symbiosis as central part of the implementation of a circular economy.

REDA is an industrial park located near Rizhao, a port city in Shandong province, eastern China. It was founded in 1991, and was part of the first wave of Chinese industrial parks that incorporated the exchange of by-products and the sharing of infrastructure into the core business model of the companies operating in the park.

Initially, the companies in the park began exchanging by-products in response to the environmental impact improvements required by new national, regional and municipal policies and regulations. They wanted to avoid the costs of mandatory waste treatment and to benefit from tax cuts and refunds offered in return for reduced ➤

environmental impact. In addition, symbiotic exchanges were seen as a means to substitute for expensive raw materials and to cut transportation costs.

By the time of the Circular Economy Promotion Law, REDA had expanded to include a large number of different businesses, including cereal oil and food producers, breweries and distilleries, chemical companies, pulp and paper factories, machine makers, construction and textile companies, and cement factories.

REDA was identified as a demonstration industrial park for the implementation of the circular economy in the Rizhao area. A management committee was created to pre-assess the environmental impacts and resource-efficiency capabilities of companies setting up in the area and to encourage by-product exchanges, among other efficiency practices.

In 2010, the government upgraded it to a national economic and technology development zone, and the management committee began to work with the companies in the park on the planning and financing of symbiotic exchanges.

A complex network

Subsequently, a dynamic and complex network of material and energy flows developed. For example, a beer brewery provides vinasse, a by-product of sugar, to a fertilizer factory. Excess CO2 captured during the fermentation process is used by a beverage company to carbonate soft drinks and soda water.

And then there is a paper and pulp plant that receives scrap wood from a lumber yard as input, while providing sludge for fertilizer, green mud for building materials, white sludge for a citric acid factory and a cement plant, wood chips for a charcoal producer, fly ash for a cement plant, and waste hot water for an aquaculture feed mill.

A 2015 article in *The Journal of Cleaner Production* details huge material savings at REDA. In 2011 alone, 71,446 tons of white sludge from the paper and pulp plant were used as a substitute for calcium carbonate in the citric acid and cement factories. In that same year, the cement and building material factories were supplied with over 66,000 tons of fly ash and 20,000 tons of green mud as raw materials.

Such is the effectiveness of the material flow management, REDA does not need a waste treatment plant. Through a combination of symbiosis and cleaner production practices, an astonishing 98% of the industrial solid waste in the park is reused.

> "Such is the effectiveness of the material flow management, REDA does not need a waste treatment plant."

Today, China is building on the example provided by REDA and other early implementers of industrial symbiosis as a stepping-stone to a circular economy. The current 13th Five

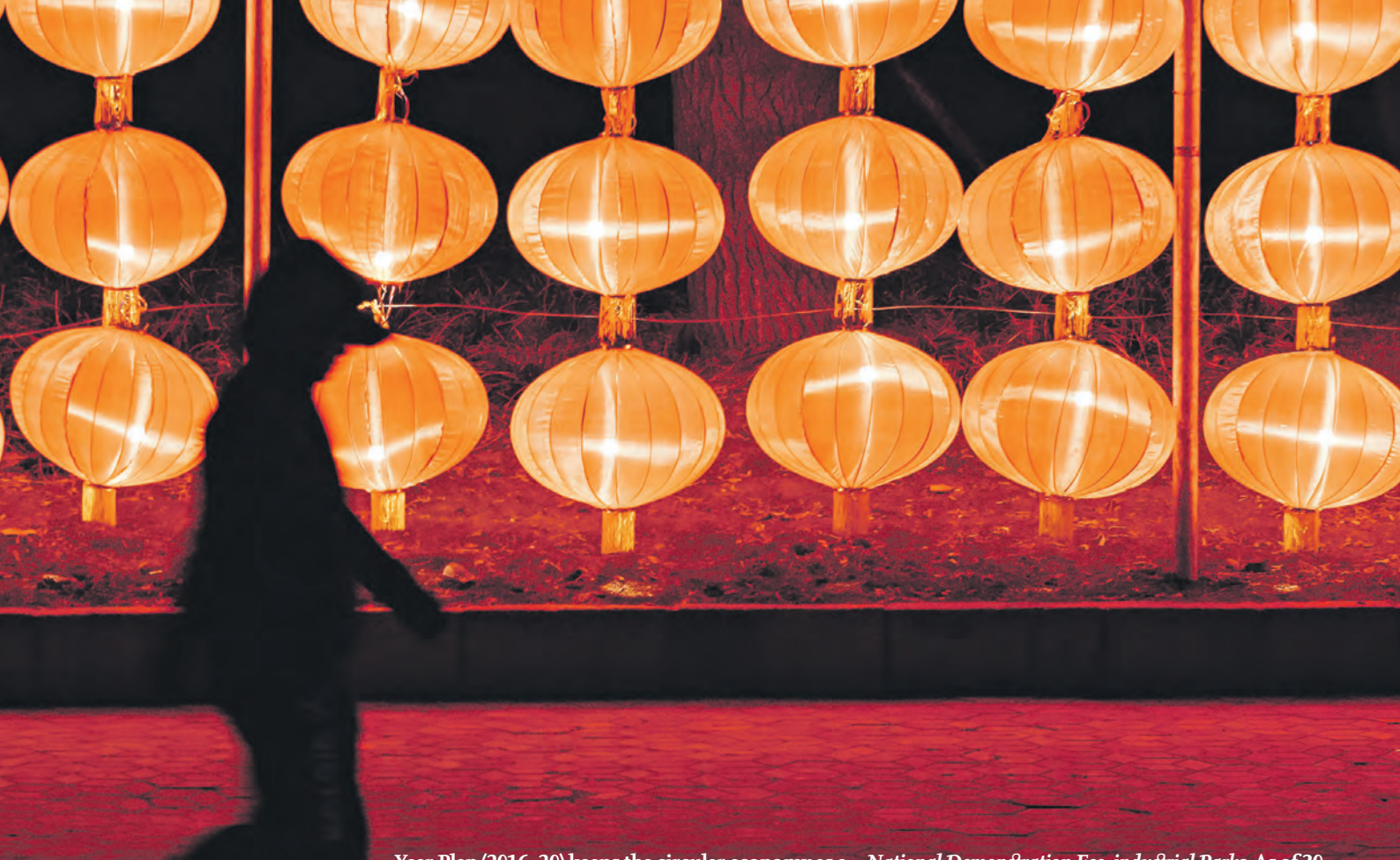

Photo: Dominik Vanyi on Unsplash

Year Plan (2016–20) keeps the circular economy as a key focus area for policy. It introduces binding targets relevant for the circular economy, emphasizes the importance of an extended producer responsibility framework, and proposes to further strengthen municipal waste management and the remanufacturing sector.

Specifically, it requires 75% of the country's more than 500 national-level industrial parks to undertake a circular transformation i.e. depart from the traditional linear production model at the industrial park level and, instead, make efficient and circular use of resources.

Eco-industrial parks

Starting in 2001, the Chinese authorities have initiated a number of programmes to widen the uptake of the approach demonstrated by REDA and other parks, and to promote the development of eco-industrial parks, designed and operated according to the principles of clean production, circular economy and industrial ecology.

Most recently, in 2015, the Ministry of Environmental Protection, the Ministry of Commerce and the Ministry of Science and Technology issued the *Measures for the Administration of National Demonstration Eco-Industrial Parks and the Standard for National Demonstration Eco-industrial Parks*. As of 30 March 2018, the development plans for 93 national demonstration eco-industrial parks had been approved, and 51 of these had been officially accredited.

A recent report by the UN Partnership for Action on Green Economy (PAGE) defines China's eco-industrial parks as ones that "link up factories or enterprises through logistics and energy flows to form industrial symbiosis where resources are shared and by-products/wastes exchanged, thereby minimizing waste and facilitating tiered use of energy and closed-loop circularity".

In 2016, the government conducted a comprehensive assessment of industrial parks, including five areas: economic competitiveness, technology innovation, regional development impact, eco efficiency and environmental protection, and administrative efficiency. Only about 10% of China's industrial parks are eco-industrial parks, but 23 of them made it into the ranking of the top 30 best performing industrial zones, and among the top 10, all but one were eco-industrial parks.

"Eco-industrial parks are based on the principles of clean production, circular economy and industrial ecology."

Eco-industrial parks are becoming a central element in China's strategy to combine industrial development with minimized environmental impacts and improved resource efficiency. ■

Ewa Lewandowska argues for an inclusive, social, circular economy.

The next big OPPORTUNITY for gender equality?

The movement for a circular economy has focused on the environmental and business impacts of circularity, with far less interest (from researchers and policymakers) dedicated to its social implications. However, as we attempt to break away from unsustainable, linear models, we must not overlook this opportunity to use a global paradigm shift to build a more equitable society for everyone.

Nearly three decades ago, 1992 Rio Conference final document recognized women as key actors for environmental protection and poverty alleviation. In the 1990s, there was a broad consensus that ecology and sustainability are not gender neutral and that the study of gender relations is essential for understanding the relationship between nature and society, as well as for resource management and overcoming environmental emergencies. However, as noted in *The Future We Want: A Feminist Perspective*, published in 2012 by the Heinrich Boll Stiftung, despite the apparent agreement that, "without gender justice, there will be no environmental justice, no sustainability, and no good life for all", the United Nations' Green Economy approach did not reflect gender mainstreaming and continued to ignore a feminist perspective.

Women have been the group that's the most heavily impacted by the "take, make, waste" economy. The disadvantage is felt in both developing and more prosperous countries. The increasing demand for steel, plastic, aluminium and cement produced using the linear model has not only placed a heavy burden on the planetary limits of natural resource use, but has also driven global greenhouse gas emissions.

Women left behind

Lake Chad in West Africa has shrunk by 90% since the 1960s as a result of climate change and irrigation. Traditionally, the lake was the source of water for millions of people in Nigeria, Niger, Chad and Cameroon. Now, men have had to leave the area to seek employment in cities, and women have been left behind, working harder than ever to care for their families – for example, having to walk much further to collect water.

Severe weather events caused by climate change linked to the linear economy routinely impact women more dramatically than men. For instance, after Hurricane Katrina hit the US states of Florida and Louisiana in 2005, 83% of single mothers were unable to return home for two full years after the storm, and two-thirds of the jobs lost after the hurricane devastation were lost by women. Additionally, post-disaster rebuilding efforts provided jobs in traditionally male-dominated fields, i.e. construction.

There's a general understanding – or an assumption – that through a transition to a circular economy, "everybody wins". But circularity is not always more inclusive by design. As a 2017 article in the *Journal of Business Ethics* points out, "key social equality aspects such as gender, racial and financial equality, inter- and intra-generational equity and equality of social opportunities are often absent in the existing conceptualizations of the circular economy."

A kind of blindness

As an example, the circular economy would champion a business model that uses a robot to repair mobile phones slightly cheaper than the current business model, where they are sent straight to landfill or undergo only partial recycling. It would still be an advocate for this labour to be performed by a robot if it was 1% cheaper than hiring five refugee women to perform the repairs, even if they would have had the means to support themselves and their families and gain purchasing power in the local economy.

This striking example illustrates the danger of introducing a new economic paradigm that leaves people out of the equation. This kind of blindness would mean that women who currently hold low-value-added, low-skilled jobs in informal sectors of the economy (due to not having equal ➤

➤education and/or professional opportunities) end up more vulnerable yet again, as they're more likely than men to be replaced by robots.

Can a circular economy bring about progress in creating a more equitable society? The potential is immense, but only with a *social* circular economy. The social circular economy model unites the circular economy and social enterprise concepts to deliver benefits for people, planet and profit.

Circular, social enterprises

One notable example of a social circular economy can be found in India, where a non-governmental organization uses circular social innovation to reduce pollution in the River Ganges. Over eight million tonnes of fresh flowers are thrown directly to the river by pilgrims every year, polluting it with toxic arsenic, lead and cadmium from the fertilizers and pesticides used when growing the flowers. Combined with other pollutants, the river becomes a carrier of waterborne diseases such as dysentery, cholera, hepatitis, and diarrhoea – the major causes of child mortality across India.

In the state of Uttar Pradesh, HelpUsGreen's circular model has the discarded flowers collected by local women, and then sprayed with a patented biological culture which includes activated carbon from the seed of Indian

Photos: www.helpusgreen.com

"A social circular for-profit, HelpUsGreen employs over 150 women from lower social and economic strata to collect flowers daily from temples and mosques."

black plum. The spray detoxifies all the major organophosphate insecticides/pesticides, leaving a purplish residue that is then washed off. The flowers are then used to make incense and soaps, and the water is stored and used to make vermicompost, a process in which earthworms digest most of the residue in the wastewater. As a social circular for-profit, the company employs over 150 women from the lower social and economic strata to collect flowers daily from more than 30 temples and mosques.

In another example, Retalhar, a São Paulo-based company, uses circular principles to repurpose used corporate uniforms into new products and return them to the organization that used them in the first place. In this process, Retalhar employs ex-offenders to triage the items and works with women's seamstress collectives to perform the refurbishing or repurposing. As these people come from disadvantaged backgrounds and have little access to the labour market, Retalhar steps in, ensuring a good, regular income for the workers.

Passive to active

Some might say that just the fact women can be employed in circular processes doesn't mean that a circular economy more equitable, as women can be employed in linear processes as well. That's true, but, being employed in a linear economy, they're effectively a passive participant of a system that oppresses many (as well as the environment itself) and benefits a selected few. Moreover, they might even be contributing to the deterioration of their immediate environment (for example, working at a factory that's polluting a river close to their homes).

Through being employed in a circular economy, women have an opportunity to go from "oppressed" to "empowered", and actively co-create a positive change in their environment.

Additionally, there are some ways in which circular economy can be considered more equal by design. For example, women-led businesses are notoriously discriminated against when pursuing venture capital. In a circular economy-based business, low or zero cost of model "input" materials can potentially make it easier to start up a business with little resources – no investors required.

Still, only a conscious and purposeful circular innovation can ensure that while the paradigm shift happens, women won't be left out again, as it happened in the linear economy. As noted by Seigo Robinson in the *Social Circular Economy* report, the narrow circular economy model alone would only meet one of the UN Sustainable Development Goals (SDG12 on responsible consumption and production), while the social circular economy approach would help accomplish three more (SDG5 on gender equality, SDG8 on decent work and SDG10 on reduced inequalities).

To meet our most ambitious UN Sustainable Development Goals, including gender equality, women (and other disadvantaged social groups) cannot be left out of the equation when designing the new, circular economy.

EWA LEWANDOWSKA is a writer, digital business strategist and environmental advocate, currently based in Lisbon, Portugal. She sees sustainable entrepreneurship as a tool for environmental and social change, and advancing equality.

Diamonds are not for ever

Diamonds have transformed Botswana since they were discovered in the country in 1967, just one year after independence from Britain. Botswana has been one of the world's fastest growing economies, moving from one of the poorest countries to one of the wealthiest on the African continent.

The diamond industry – in partnership with De Beers, the world's largest supplier – currently contributes around 20% to the southern African nation's Gross Domestic Product (GDP) and employs around 20% of the workforce.

Diamond wealth, combined with good governance, prudent economic management and a relatively small population of slightly more than two million, have made Botswana an upper middle-income country. It is ranked 5th out of 54 countries in the *Ibrahim Index of African Governance* and is rated as the least corrupt country in Africa in the Corruption Perceptions Index by Transparency International.

Vulnerable

Although in many respects Botswana's economy is considered a model for countries in the region, its heavy reliance on commodities renders it vulnerable to international market fluctuations. The model has also generated strong state-dependence and limited private sector job creation. Unemployment remains high, with youth unemployment posing a critical challenge.

The World Bank notes that while the economic model has delivered important results, poverty and high levels of income inequality persist. "Poverty has come down to approximately 16%, but some 30% of the population remains just above the poverty line and thus vulnerable to a range of shocks. Botswana's level of income inequality, while declining, remains one of the world's highest."

Pictured: Jwaneng Diamond Mine on a dust-disturbed day in Botswana.

Picture: https://commons.wikimedia.org Cretep

Looking to diversify

The diamond mines have long provided economic stability but, with a view to the long term, the land-locked nation is now looking to diversify its economy to help maintain its high standard of living. A 2017 report in *The Economist* predicts that the diamonds that propelled Botswana's exceptional growth and paid for impressive infrastructure could be exhausted before 2050. As Tshekedi Khama, the country's Minister of Youth Empowerment, told FRANCE 24, "We have to go from relying on diamonds to diversifying the economy."

In February 2016, an economic stimulus package came into force with an emphasis on non-mining industries, job creation and import-substitution. The transport and tourism sectors received a boost, with the latter eclipsing copper and nickel, which were once Botswana's second largest source of export revenue. For manufacturing, emphasis was put on developing export-oriented businesses and providing complimentary infrastructure.

The *Economist Intelligence Unit* (EIU) reports that this is not the first intensive attempt to spur on manufacturing. Botswana offers a range of strong incentives, including giving businesses the possibility of applying for a special and globally competitive corporate tax rate of 15%, compared with a rate of 22% for all other sectors. In addition, manufacturers have long enjoyed concessional funding and other incentives provided through quasi-state organizations such as the National Development Bank, the Botswana Development Corporation, and the Citizen Entrepreneurial Development Agency.

Ranked third

The *Competitive Industrial Performance Index*, published by the United Nations Industrial Development Organization (UNIDO), benchmarks the ability of countries to increase their presence in international and domestic markets whilst developing industrial sectors and activities with a higher value added and technological content. In 2016 (the most recent year covered by the Index), Botswana ranked 85th in the global table but was third in the ranking of 29 sub-Saharan African countries (behind South Africa and Swaziland).

The country's 11th National Development Programme (2017-23) focuses on three key areas: tackling poverty, inclusive growth, and job creation. The EIU notes that specific training and skills enhancement for manufacturing, and addressing high labour costs are largely omitted from the programme. According to the EIU, the government will continue with its existing approach to helping manufacturing: "intervene when necessary to prop up struggling businesses; invest (some US$9.6bn) in industry-supportive infrastructure over the next six years, such as telecommunications; and develop export-led special economic zones for manufacturers".

At a glance

Capital: Gaborone

Population: 2.3 million (50% under age of 24)

Human Development Index position in list of African countries: 5th

Climate breakdown impacts: Food and water shortages

Principal export: Diamonds – 79%

Composition of manufacturing (2015): Jewellery and related articles – 55%, Food and beverages – 24%

Rank in Press Freedom Index: 48th

Profile of **Bogolo Joy Kenewendo**, *Minister of Investment, Trade and Industry of Botswana*

"It is not just about creating jobs. It's about creating sustainable jobs, jobs that give good wages."

In April 2018, at the age of 31, Bogolo Joy Kenewendo was appointed Minister of Investment, Trade and Industry. When *Forbes Africa* asked her how it felt to be Africa's youngest minister, she replied, "It's been a great surprise and an honour. I was so humbled by all the good wishes and cheers from around the world. I, however, say youth leadership was the flagship of political independence and revolution, and so it should be for the economic independence revolution that I believe our generation should lead."

She continued, "Most of the revolutionary leaders who brought Africa its independence were younger and some the same age as me. Patrice Lumumba was 29 when he was, unfortunately, assassinated as Prime Minister. Kwame Nkrumah, Sir Seretse Khama and Julius Nyerere were in their late 30s, early 40s. Graça Machel was 30 years old when she became Minister of Education in Mozambique."

She told *New African Woman* magazine, "I have often been asked, 'What are the disadvantages of being a young woman leader?' Why should being me be a disadvantage? It is ridiculous. Nobody has asked what the disadvantages of being an old male are. And this is asked as if to imply that I do not belong in this space, and I strongly beg to differ."

Kenewendo holds a BA Degree in Economics from the University of Botswana and an MSc in International Economics from the University of Sussex in the United Kingdom which she obtained after landing a Chevening Scholarship. After her postgraduate studies, she worked as a trade economist in Ghana's Ministry of Trade and Industry, and also served as an economic consultant at Econsult Botswana, a Gaborone-based think tank.

In 2018, in her capacity as minister, Kenewendo was appointed by United

Photos: Eva Manasieva (UNIDO)

Nations Secretary General, António Guterres, to the High-level Panel on Digital Cooperation, co-chaired by Melinda Gates and Jack Ma.

Since taking office as the Minister of Investment, Trade and Industry, Kenewendo has focused on reducing Botwana's heavy dependence on mineral wealth.

She told *Forbes Africa*, "My team and I have plans to make Botswana the start-up capital of the region and we are repositioning Botswana as a gateway into the rest of southern Africa. We are doing so by working on our business reforms, to enable doing business in Botswana and working on a one-stop border post services with our neighbouring countries. We are also investing in transport and ICT infrastructure and of course, providing incentives, including a competitive corporate tax rate of 5% in designated and reserved areas, as well as, government off-take agreements with manufacturers who meet government needs most importantly."

In an interview with *Bloomberg* in November 2018, she said, "We are rebranding ourselves as the investment destination of choice. We recognize that there are a lot of doing business reforms that we need to undertake. We have a doing business reform roadmap and in the last session of Parliament we passed some nine (pieces of) doing business reform legislation that will be implemented in the next financial year. We are looking at online business registration, and we are looking at overhauling our immigration system in order to make it easier for those that are skilled to come in, and we have very relaxed exchange controls. We are focused on boosting our competitiveness and ensuring that it is not difficult to register and do business in Botswana. We see a lot of opportunities in the global value chain space, in light manufacturing, component manufacturing, as well as in the services sector."

"When we talk about development, we are not just talking about GDP growth. We are talking about livelihoods."

"Unemployment is high in Botswana particularly for graduates and there is a rising cost of living. So it is not just about creating jobs. It's about creating sustainable jobs, jobs that give good wages. So, if you are a young person and you want to start a business here, we will help you," she stressed in a BBC interview. "When we talk about development, we are not just talking about GDP growth. We are talking about livelihoods."

During a visit to the United Nations Industrial Development Organization (UNIDO) shortly after her appointment, Kenewendo spoke about the importance of inclusive and sustainable industrial development for Botswana. "We think the best way to achieve our development goals and ensuring that there is wealth creation is through an inclusive industrialization plan, by ensuring that small and medium enterprises are given the space in order for them to grow, in order for them to create sustainable jobs and then create incomes that create wealth. Some of the measures that are important in doing that include focusing on lifting women up and lifting youth up, because that is where high unemployment is and those are our vulnerable groups. If we focus on fixing the enabling environment, making it easier, and supporting incubation hubs, we will be able to reach the target."

African (de)industrialization and the AfCFTA

by **Ioana Lungu**, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Justin Lin's 2011 article, *From flying geese to leading dragons*, observed "that dramatic acceleration in growth rates came about with the rapid technological innovation after the Industrial Revolution and the transformation of agrarian economies into modern industrialized societies. This intriguing trend has led us to recognize that continuous structural change prompted by industrialization, technological innovation, and industrial upgrading and diversification are essential features of rapid, sustained growth".

Although economies in sub-Saharan Africa are some of the fastest-growing in the world, this growth has failed to materialize into economic diversification or an adequate expansion of the employment base. Indeed, the growth-poverty elasticity in Central and East Africa is the lowest in the world, with economic growth failing to translate into significant poverty reduction. Exports remain concentrated in the area of primary commodities, with very little diversification occurring over time. Even in areas where growth has occurred in high productivity sectors, such as resource extraction, these are often capital-intensive and have little spillovers for human capital and employment creation.

Against this backdrop, the role of trade can be crucial. Historically, certain proponents of neoclassical schools of thought have pushed for trade liberalization and non-state interventionism under the assumption that markets are inherently efficient and would lead to an optimal allocation of resources. Under this logic, economic development would follow naturally from a process of market opening and free trade. The role of the state should be limited to ensuring a

good business environment and providing essential infrastructure.

Nevertheless, this model has come to be contested, due to its suboptimal results in recent decades and limited applicability to developing countries whose markets are often non-existent or insufficiently developed and characterized by information asymmetries and negative externalities. Thus, free trade by itself is not enough to ensure industrialization.

Industrialization challenge

In the African context, the industrialization challenge is twofold. First, trade liberalization is far from achieved. African countries trade more with partners outside Africa than among themselves, which inherently leads to a fragmented continental market and the impossibility to make full use of regional value chains and economies of scale. Second, there is a lack of a coherent industrial strategy to be actively pursued and implemented by African Member States within a continental framework.

The African Continental Free Trade Area (AfCFTA) aims to address the first issue. By liberalizing trade in goods and services, it aims to unlock the potential for enhanced regional and continental economic integration. Actors on the production side on the continent should thus be in a better position to access economies of scale, expand operations cross-border and develop regional value chains that increasingly embed African inputs. Furthermore, by accessing a unified continental market, different stages of industrial production along the value chain can be outsourced to various countries within the free trade area depending on their respective comparative advantages. The resulting intermediate products can then easily be reimported into the country of origin for further intermediate and final processing.

"By liberalizing trade in goods and services, AfCFTA aims to unlock the potential for enhanced economic integration."

Industrial policy

In terms of existing frameworks for industrial policy, the African Union's Agenda 2063 aims to generate a 10% growth increase of the manufacturing sector by 2050. Similarly, the Action Plan for Accelerating Industrial Development in Africa has been designed to promote industrial development, including by facilitating the means for supporting small and medium-sized enterprises to integrate in regional and global value chains.

On the Member State level, countries such as Djibouti, Egypt, Eritrea, Ethiopia, Gabon, Kenya, Lesotho, Liberia, Mauritius, Nigeria, Rwanda, Tanzania, Uganda and Zimbabwe have adopted industrialization strategies or policy frameworks.

The AfCFTA can be instrumental in achieving these goals. Research shows that successful industrialization historically went hand in hand with trade related measures as part of the overall development strategy. Eliminating tariffs for strategic sectors can facilitate the import of key inputs for the domestic industry and support value chain integration across the continent.

Furthermore, trade liberalization within Africa would mitigate the issue of tariff escalation, in which tariff levels increase according to the level of processing of an imported product. This discourages resource-rich countries from moving up their value chain, a situation in which many resource-endowed African countries currently find themselves. If tariffs are liberalized within Africa, countries have an incentive to add more value to their intra-African exports without any repercussions.

Flanking policies

Besides trade liberalization, other flanking policies are crucial to ensure nascent industries get the support they need. Export subsidies for selected product categories, export insurance or ensuring a comprehensive export quality infrastructure in the form of government assistance and quality controls are all tools that can be employed to stimulate industrial production. Sectoral incentives such as tax rewards or export rebates (in which the exporter can get a refund on the duties paid for importing raw materials, once these are processed into a more-value-added product and re-exported) can also be used.

Besides liberalizing trade in goods, another area where the AfCFTA can play a role in supporting industrialization is trade in services and movement of people, by facilitating a better allocation of human capital and supporting services for specific industrial sectors. Currently, negotiations for liberalizing intra-African trade in services are under way. This has implications for sectors such as agro-industrial or textile value chains that require a host of services such as quality control, transportation, financial and insurance or storage services.

The main ambition of the AfCFTA is to significantly increase intra-African trade. Given the larger share of manufacturing value added for intra-African exports, there is abundant potential for increased industrial production on the continent. Nevertheless, in the absence of a sound industrial policy and AfCFTA flanking policies that would set the right incentives and provide adequate support for industrialization, there is no guarantee that liberalized intra-African trade will by itself be enough to generate more value-added production on the continent.

Our house is on fire

In August 2018, **GRETA THUNBERG**, then 15-years-old, decided she wouldn't go to school. Instead, she went and stood outside the parliament in her home country of Sweden protest at the government's lack of action on climate change. Every Friday since then, Thunberg has continued her strike. She has ignited a global movement. Hundreds of thousands of school pupils and university students around the world are following her lead.

Thunberg has risen rapidly in prominence and influence. In December 2018, she spoke at the United Nations Climate Change COP 24 conference, berating world leaders for behaving like irresponsible children. In January 2019, she addressed the global business elite at Davos.

Speech given by Greta Thunberg at Annual Meeting of the World Economic Forum 2019 in Davos, Switzerland

Our house is on fire. I am here to say, our house is on fire.

According to the IPCC (Intergovernmental Panel on Climate Change), we are less than 12 years away from not being able to undo our mistakes. In that time, unprecedented changes in all aspects of society need to have taken place, including a reduction of our CO2 emissions by at least 50%.

And please note that those numbers do not include the aspect of equity, which is absolutely necessary to make the Paris Agreement work on a global scale. Nor does it include tipping points or feedback loops like the extremely powerful methane gas released from the thawing Arctic permafrost.

At places like Davos, people like to tell success stories. But their financial success has come with an unthinkable price tag. And on climate change, we have to acknowledge we have failed. All political movements in their present form have done so, and the media has failed to create broad public awareness.

Photo: World Economic Forum/Mattias Nutt

"Yes, we are failing, but there is still time to turn everything around. We can still fix this. We still have everything in our own hands."

But Homo sapiens have not yet failed.

Yes, we are failing, but there is still time to turn everything around. We can still fix this. We still have everything in our own hands. But unless we recognize the overall failures of our current systems, we most probably don't stand a chance.

We are facing a disaster of unspoken sufferings for enormous amounts of people. And now is not the time for speaking politely or focusing on what we can or cannot say. Now is the time to speak clearly.

Solving the climate crisis is the greatest and most complex challenge that Homo sapiens have ever faced. The main solution, however, is so simple that even a small child can understand it. We have to stop our emissions of greenhouse gases.

Either we do that or we don't.

You say nothing in life is black or white. But that is a lie, a very dangerous lie. Either we prevent a 1.5C of warming or we don't. Either we avoid setting off that irreversible chain reaction beyond human control or we don't.

Either we choose to go on as a civilization or we don't. That is as black or white as it gets. There are no grey areas when it comes to survival.

We all have a choice. We can create transformational action that will safeguard the future living conditions for humankind or we can continue with our business as usual, and fail.

That is up to you and me.

Some say we should not engage in activism. Instead we should leave everything to our politicians and just vote for change instead. But what do we do

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when there is no political will? What do we do when the politics needed are nowhere in sight?

Here in Davos – just like everywhere else – everyone is talking about money. It seems money and growth are our only main concerns.

And since the climate crisis has never once been treated as a crisis, people are simply not aware of the full consequences on our everyday life. People are not aware that there is such a thing as a carbon budget, and just how incredibly small that remaining carbon budget is. That needs to change today.

No other current challenge can match the importance of establishing a wide, public awareness and understanding of our rapidly disappearing carbon budget that should and must become our new global currency and the very heart of our future and present economics.

We are at a time in history where everyone with any insight of the climate crisis that threatens our civilization – and the entire biosphere – must speak out in clear language, no matter how uncomfortable and unprofitable that may be.

We must change almost everything in our current societies. The bigger your carbon footprint, the bigger your moral duty. The bigger your platform, the bigger your responsibility.

Adults keep saying: "We owe it to the young people to give them hope." But I don't want your hope. I don't want you to be hopeful. I want you to panic. I want you to feel the fear I feel every day. And then I want you to act.

I want you to act as you would in a crisis. I want you to act as if the house is on fire… because it is.

FURTHER READING

An Inclusive Circular Economy: Priorities for Developing Countries – Felix Preston, Johanna Lehne and Laura Wellesley
Biomimicry: Innovation inspired by nature – Janine M. Benyus
China's Green Transformation through Eco-Industrial Parks – Douglas Zhihua Zengi and Lei Shiii
Circular Economy in India: Rethinking growth for long-term prosperity – Ellen MacArthur Foundation
Cradle to Cradle: Remaking the Way We Make Things – Michael Braungart and William McDonough
Designing for the Circular Economy – Edited by Martin Charter
Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist – Kate Raworth
Harnessing the Fourth Industrial Revolution for the Circular Economy: Consumer Electronics and Plastics Packaging – World Economic Forum/PACE
The Circular Economy and the Global South – Edited by Patrick Schröder, Manisha Anantharaman, Kartika Anggraeni, Timothy J. Foxon
The Circular Economy: A Wealth of Flows – Ken Webster
The Circular Economy: A User's Guide – Walter R. Stahel

FURTHER SURFING

www.acceleratecirculareconomy.org/ – The Platform for Accelerating the Circular Economy is a public-private collaboration platform and project accelerator for the circular economy.
www.acen.africa/ – The vision of the African Circular Economy Network is to build a restorative African economy that generates well-being and prosperity inclusive of all its inhabitants.
www.cep-americas.com/ – The Circular Economy Platform of the Americas.
www.circle-economy.com/ – Dutch cooperative with a mission is to accelerate the practical and scalable implementation of the circular economy.
www.circulareconomyclub.com – The Circular Economy Club is an international network of over 4,000 circular economy professionals and organizations from over 130 countries.
www.ellenmacarthurfoundation.org/ – The Ellen MacArthur Foundation was launched in 2010 with the aim of accelerating the transition to the circular economy.
www.thinkdif.co/sessions/africa-a-circular-continent – Africa: Can It Become a Circular Continent?
www.repaircafe.org/en – Repair Cafés are free meeting places and they're all about repairing things (together).

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