



Circular Economy: Don't let Waste go to Waste

By Satvinderjit Kaur Singh

Waste¹ generation is a major global problem that is worsening by the day. Growing population, rising affluence and rapid urbanisation unsupported by proper waste management systems drive this global waste crisis. The World Bank² estimates that annual global solid waste generation will rise by 69 percent from 2.0 billion tonnes in 2016 to 3.4 billion tonnes in 2050. High-income economies contribute one-third of global waste despite accounting for only 16 percent of the world population. On the other hand, lower-income economies generate increasingly more waste per capita, an issue that is particularly exacerbated by inefficient waste management systems and lack of awareness (Kaza et al., 2018; McAllister, 2015). Poorly managed waste contaminates oceans, breeds diseases, releases harmful greenhouse gases like methane, and litters landscapes causing harm to health and the economy.

Managing plastic waste is particularly challenging because not only are plastics non-biodegradable, but they are also produced in colossal amounts: 242 million tonnes of plastic waste were generated globally in 2016 alone, accounting for 12 percent of all municipal solid waste.³ Large amounts of plastic waste end up in the oceans contributing to gyres of garbage like the infamous 'Great Pacific Garbage Patch,' a floating mound of plastic waste in the ocean estimated at 80,000 tonnes.⁴ These marine plastics are a cause for concern as they release toxic chemicals, entangle marine life, are consumed by marine animals, and can eventually enter the human food chain. Marine plastics also affect the economy by imposing costs on the tourism, aquaculture and fisheries industries. A study by Deloitte and the Ocean Cleanup estimated a yearly economic cost of around USD 6 to 19 billion due to marine plastics.⁵

The APEC region has not been spared from the impacts of the waste crisis, and Leaders have repeatedly voiced their concerns over the issue. They identified the need for better waste management and called for more work in this area in their 2015⁶ and 2016⁷ Declarations. Similarly, concerns for better management of resources were echoed in the 2017⁸ Leader's Declaration. More recently, APEC Chile 2019's priority on 'Sustainable Growth' looked into marine debris prevention and reduction with a specific focus on plastics.⁹ Senior Officials endorsed the APEC Roadmap on Marine Debris at the Third Senior Officials' Meeting held in Puerto Varas in August 2019.¹⁰ This work within APEC is an indication of the importance of a regional approach in addressing the waste crisis.

A new guiding principle to tackle the waste crisis has emerged in the form of a circular economy that, by design, eliminates waste, keeps materials in use and regenerates natural systems.¹¹ The circular economy has been proposed as an alternative to the more familiar linear economy, which disposes materials after a single use. The next section of this policy brief considers the waste generated in APEC and its economic inefficiency. The paper then presents the circular economy as a viable solution to this problem by encouraging more sustainable and efficient use of resources with almost zero waste generation. While implementing the circular economy model brings several benefits to the economy, there are some barriers as well. This policy brief then discusses policies that can be useful in tackling the barriers and ensuring the smooth adoption of circular economy principles. It ends with a discussion of APEC's current work and opportunities in this area.

The Economic Inefficiency of Waste

APEC economies are responsible for a large share of global solid waste: 43 percent of global solid

¹ For the purpose of this policy brief waste is defined as any product or material that is disposed in the process of consumption or production and may include solid, liquid, gaseous, recyclable and organic wastes.

² <https://openknowledge.worldbank.org/handle/10986/30317>

³ Ibid.

⁴ <https://theoceancleanup.com/great-pacific-garbage-patch/>

⁵ Ibid.

⁶ https://www.apec.org/Meeting-Papers/Leaders-Declarations/2015/2015_aelm

⁷ https://www.apec.org/Meeting-Papers/Leaders-Declarations/2016/2016_aelm

⁸ https://www.apec.org/Meeting-Papers/Leaders-Declarations/2017/2017_aelm

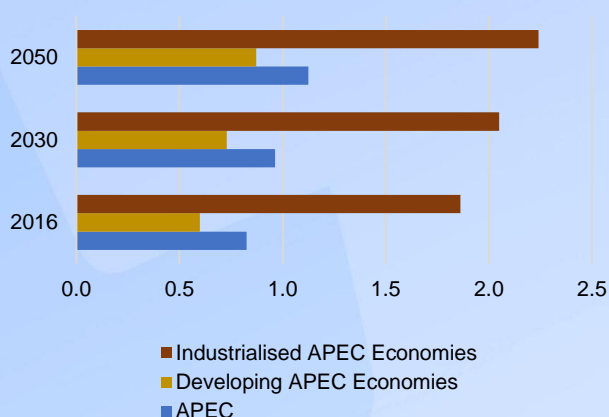
⁹ <https://www.apecchile2019.cl/apec/media/news/state-department-ocean-conservancy-and-apec-chile-launching-clean-city>

¹⁰ https://www.apec.org/Meeting-Papers/Annual-Ministerial-Meetings/2019/2019_AMM/Annex-B

¹¹ <https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy>

waste originated from APEC economies in 2016. Projections by the World Bank in their 'What a Waste 2.0' database¹² show increasing trends over the next 30 years up until 2050. On average, an APEC economy resident generated 0.8 kilogramme (kg) of solid waste per day in 2016, and this number is expected to increase to 1.1 kg per day by 2050, which is a 36 percent increase over the period (Figure 1). There is a particular cause for concern in developing APEC economies, where daily solid waste generation per capita is expected to increase by 46 percent between 2016 and 2050. While the growth is not expected to be as high for industrialised APEC economies, their current waste generation is already at a high level of 1.9 kg per person per day. Albeit lower than their share in 2016, APEC economies are still expected to be responsible for a significant 37 percent of global solid waste in 2050.

Figure 1: Daily Solid Waste Generation per Capita in APEC (in kg)



Source: World Bank, 'What a Waste 2.0' database.¹³

About 59 percent¹⁴ of waste in APEC economies was mismanaged¹⁵ (i.e., dumped into unspecified landfills, open dumps, waterways, other or unaccounted locations) according to data from the World Bank (Kaza et al., 2018). A large portion of the mismanaged waste, about 66 percent, arose from developing APEC economies. A 2015 study found that four developing APEC economies¹⁶ accounted for 60 percent of the world's mismanaged plastic waste in 2010 (Jambeck et al., 2015). Often, mismanaged waste, including plastics, are dumped into inland waterways which then empty into the oceans.¹⁷ A recent study found

¹² The data covers only solid waste.

¹³ The data from World Bank covers all APEC economies with the exception of Chinese Taipei.

¹⁴ The year of data availability differ across the economies, ranging between 2008-2017.

¹⁵ Waste treatment and disposal data is provided in the following categories: Open dump, landfill unspecified, controlled landfill, sanitary landfill, recycling, composting, anaerobic digestion, incineration, waterways, other and unaccounted for. We consider waste that has been dumped into unspecified

that about 90 percent of the oceans' plastic comes from 10 rivers, of which six flow through APEC economies (Schmidt, Krauth, & Wagner, 2017).

All these plastics in the oceans are expected to cost USD 1.3 billion per annum to the tourism, fishing, and shipping industries in the APEC region (McIlgorm, Campbell, & Rule, 2011). Though the health cost of mismanaged waste has not been calculated for APEC, recent work in this area found that about 400,000 to 1 million residents in developing economies die yearly due to the harmful effects of mismanaged plastic waste (Tearfund, Fauna & Flora International, WasteAid, & The Institute of Development Studies, 2019).

Proper waste management is a cost-effective strategy to address these issues. A study of five APEC economies¹⁸ found that mismanaged household waste costs the economy approximately USD 375 per tonne (Engel, Stuchtey, & Vanthournout, 2016), while implementing an integrated waste management system for the same region costs only USD 50 to 100 per tonne (Kaza, Yao, & Bhada-Tata, 2018) and is therefore at least four times more economical.

Further, waste is not supportive of future economic growth since resource security and efficiency are necessary for economic resilience (Preston, 2012). The Sustainable Development Goal 12 on Sustainable Consumption and Production¹⁹ also identified the importance of reducing waste and pollutants in ensuring that the needs of the future generations are met. Clearly, the waste issue is not just an environmental one, but it also has detrimental and lasting impacts on the economy and the well-being of people.

The concept of a circular economy has been gaining traction in recent years as a comprehensive response to the growing costs of the waste crisis. Less waste management is required in a circular economy model where waste is considered a raw material with value and hence there is almost no residual waste generated.

What is a Circular Economy?

Economies, firms and households often practice a linear model of production that follows a 'take-make

landfills, open dumps, waterways, other and unaccounted locations as mismanaged waste.

¹⁶ The economies are China; Indonesia; the Philippines; and Viet Nam.

¹⁷ <https://www.nationalgeographic.com/magazine/2018/06/the-journey-of-plastic-around-the-globe/>

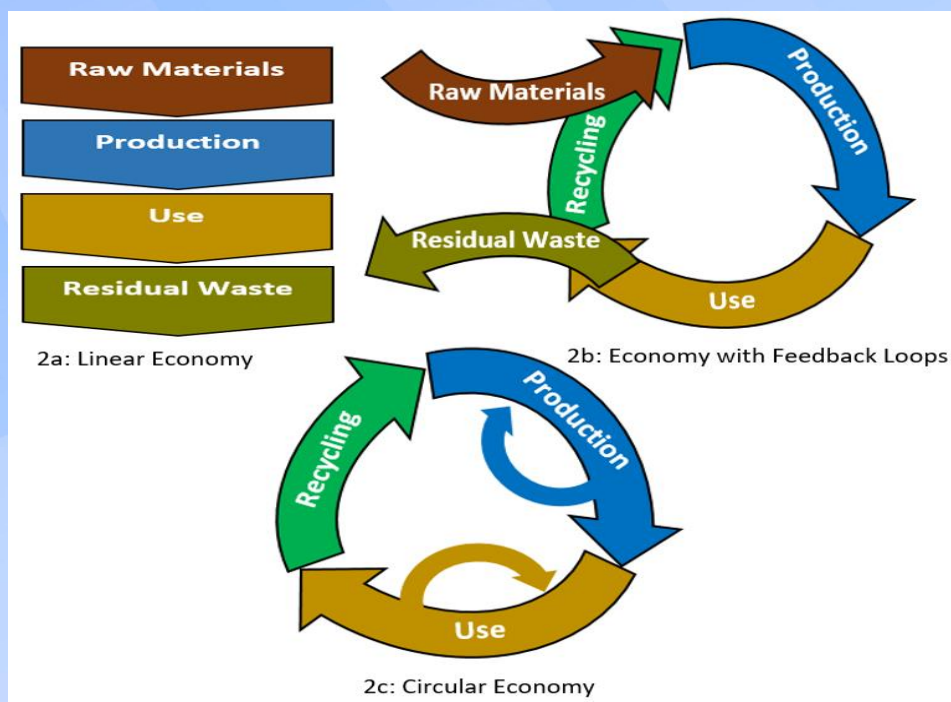
¹⁸ The economies studied are China; Indonesia; the Philippines; Thailand; and Viet Nam.

¹⁹ <https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-12-responsible-consumption-and-production.html>

dispose' pattern (Figure 2a). In the linear model, raw materials are extracted from nature, transformed into products, and consumed; unneeded by-products or residual matter are then disposed as waste. Calls for better use of resources and reduction of waste, especially non-biodegradable waste, have led to the development of resource feedback loops that aim to reduce waste. This production model with feedback loops provides an avenue for some products to be recycled or reused, but there is still a significant amount of residual waste generated (Figure 2b). The circular economy

energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling" (Geissdoerfer, Savaget, Bocken, & Hultink, 2017, p. 763). Van Buren et al. (2016) find that the circular economy plays not only an environmental but also an economic and social role. A circular economy creates economic value by ensuring the efficient consumption of raw materials and products; it creates social value by improving people's well-being due to less competition for limited raw materials; and it creates environmental value by

Figure 2: Types of Material Use Life Cycles



Source: Adapted from van Buren et al. (2016).

model, on the other hand, closes the loop so that almost no residual waste is released into the environment (Figure 2c).

The circular economy model is defined as “a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing and narrowing material and

reducing the consumption of natural resources.

In its most extensive form, the circular economy comprises 10 stages, shown here as the 9R framework (Table 1). These different stages are listed in decreasing order of their circularity in the table below:

Table 1: The 9R Framework of Circular Economy

		Strategy		Examples
Smarter manufacture and product use	R0	Refuse	Avoid the use of raw materials by abandoning the function of a product	Avoid packaging where possible
	R1	Rethink	Make the use of a product more intensive	Shared use of products like vehicles, washing machines
	R2	Reduce	Consume less raw materials or increase production efficiency	Buy fewer consumer products, build well-insulated houses to reduce energy consumption for heating

Extend lifespan of products and their parts	R3	Reuse	Use discarded products which are still in good condition and fulfil their original function	Buy second hand goods, return packaging to retailer for reuse
	R4	Repair	Repair a defective product so that it can be used for its original function	Repair defective part of an electronic product instead of buying a new product
	R5	Refurbish	Redesign and restore an old product	Refurbish an electronic product by replacing the old parts with new ones
	R6	Remanufacture	Reuse functional discarded parts to manufacture new product with the same function	Use functional parts of an old laptop to produce a new laptop
	R7	Repurpose	Reuse functional discarded parts to manufacture a new product with a different function	Use functional part of a laptop to manufacture a digital fan
Useful application of materials	R8	Recycle	Process materials to attain the same or a lower quality of the material	Recycle PET bottles to attain PET pellets
	R9	Recover	Incinerate leftover material and recover energy	Use heat from combustion to drive generators to produce electricity

Source: Adapted from Kirchherr, Reike and Hekkert (2017).

The 9R framework helps illustrate the difference between a circular economy model and the current linear economy model with feedback loops which practices recycling and energy recovery to some extent. The circular economy model entails many more stages which focus on rethinking the way production and consumption are conducted.

Transition to a Circular Economy: Benefits and Barriers

Pursuing the creation of a circular economy has three benefits (van Buren et al., 2016). The first is that an economy or region would become less dependent on external sources of raw materials. Population growth and increasing affluence have strained the supply of raw materials, while natural disasters and trade tensions have demonstrated the vulnerability of supply chains to external shocks. Adopting the circular economy could reduce uncertainties over the domestic supply of scarce resources.

The second advantage of a circular economy is the generation of new types of employment and businesses. New business models could emerge from existing businesses that tweak their practices to be more environmentally friendly, such as a milk company that collects milk bottles from customers for reuse, or a phone manufacturer that processes old phones for retrieval of usable parts. New business opportunities could also arise from innovations based on the circular economy. For example, the circular economy can give rise to

industries that make smart meters to analyse trash, that use carbon from trash to make biofuels, or that use soft plastics to produce asphalt for roads. The European Commission expects a circular economy to generate 580,000 new jobs within Europe in areas like product development, research, innovative designs and business models.²⁰ The Economic Research Institute for ASEAN and East Asia (ERIA) finds that opportunities brought by the circular economy would create 1.5 million jobs in the manufacturing, agriculture and forestry sectors in Asia over the next quarter century (ERIA, 2017).

The third major benefit of the circular economy lies in the potential reduction in environmental degradation. The over-reliance of economic growth on natural resources has driven an unsustainable demand for raw materials. Devoid of any intervention, the United Nations Environment Programme expects a 200 percent increase in the consumption of minerals, fossil fuels and ores between 2000 and 2050 (UNEP, 2011). The increasing use of such non-renewable resources will most likely jeopardise future economic growth (Haque, 2000). The circular economy provides opportunities for reducing the pressure on natural resources not only through sharing and recycling but also by expanding the life cycle of products and their parts through reuse, repair, refurbish, remanufacture and repurpose. The European Commission expects to reduce the EU's carbon emissions by 450 million tonnes by 2030 by switching to a circular economy.²¹ Similarly, SUSANOVA (2019) estimated that a fully circular

²⁰ https://ec.europa.eu/commission/sites/beta-political/files/circular-economy-factsheet-general_en.pdf

²¹ Ibid.

economy would reduce greenhouse emissions by 60 percent and hence make a significant contribution towards meeting climate goals. This is possible because larger amounts of greenhouse gasses are released in extracting, processing and manufacturing of products as compared to their delivery and use (Circle Economy, 2019).

Despite the benefits, there are evident barriers to setting up a circular economy (Preston, 2012). Firstly, high upfront costs are expected in the short run when revamping business practices and investing in necessary infrastructure. Policies that encourage investment by providing incentives and subsidies could help shoulder the costs. However, in the long run, businesses are expected to enjoy reduced vulnerability to resource price shocks.

Secondly, a circular economy will lead to more complex international supply chains since resources flow in both directions. Greater cooperation across businesses would allow for better management of these supply chains. To facilitate this, incentives have to be aligned across the supply chain so that businesses are actively considering the sustainability of the materials they use. Business-to-business cooperation will also be necessary to adjust operations in line with circular economy practices. This may be particularly challenging among competing businesses and for smaller businesses that are prone to external pressure. Clear guidelines to develop norms, standards and cooperative arrangements are necessary in this case.

Thirdly, the transition to a circular economy requires the sharing of smart infrastructure and advanced technologies that is often hindered by weak intellectual property rights and data privacy concerns, among others. This challenge to innovation can be addressed by encouraging adoption of laws and measures that develop a safe sharing environment. Greater transparency and openness would also allow for easy transfer of these ideas across economies.

Fourthly, profitability of the circular economy requires a strong demand from consumers, which only arises if consumers are well informed about the concept and can easily recognise a business's circularity. There is hence a need for awareness-raising and education on the circular economy and its benefits. Governments could also encourage adoption of labelling and certifications. Political obstacles may arise in incorporating externalities and determining resource prices. In this case, differences among various interest groups would

have to be managed well to facilitate the change in pricing methods.

Closing the Loop

The challenges that hinder the transition to a circular economy need to be addressed with sound and targeted policies. While every economy is at a different stage of implementing a circular economy model, some policies necessary to deal with the broad challenges and more generally to facilitate the transfer to a circular economy are elaborated below (Preston, 2012).

Develop well-designed regulations. Well-designed regulations are necessary to facilitate the easy movement of materials without increasing the burden on the innovating private sector. Some of these regulations could include laws on end-of-life reuse or remanufacturing, removal of distorted subsidies on resources, and creation of comprehensive anti-trust and data protection frameworks for smooth cooperation across businesses (Preston, 2012). For example, Japan's End-of-Life Vehicle Recycling Law describes the responsibilities of the various parties involved including car owners, car manufacturers and dismantling businesses.²² Governments have a clear role in developing policies supportive of innovation, creating an investment-friendly environment, and encouraging collaborations between businesses, educational institutes and research organisations to foster work on circular economy.

Moreover, governments could develop policies to encourage clustering of industries that are dependent on each other to enable easier quality and safety control, and sharing of services like waste treatment and renewable energy production (van Buren et al., 2016). The Danish government has developed the Lifestyle and Design Cluster to encourage companies, including SMEs, to support each other in developing circular business models and practices (Nielsen & Nielsen, 2019).

Encourage standardisation. New technologies and circular economy infrastructure require standardisation to ensure common protocols across economies and businesses, and especially to maintain quality across highly globalised supply chains. The French Standardisation Association (AFNOR) developed a voluntary standard to help businesses understand the concept of a circular economy and provide guidelines to implement circular economy projects. The standard²³ was published in 2018 and covers seven areas of action

²²

<https://www.meti.go.jp/policy/recycle/main/english/law/end.html>

²³ Circular economy – Circular economy project management system – Requirement and guidelines (XP X30-901). Refer to

the link for further details:

<https://www.resourceefficient.eu/en/support-programme/circular-economy-project-management-system>

including eco-design, responsible consumption, sustainable procurement and end-of-life management.

The positive response to the French standard inspired the International Organization for Standardization (ISO) to form a technical committee to produce standards for the circular economy. This committee aims to produce an internationally agreeable framework to govern the circular economy that will include production, distribution, disposal and assessment, among others.²⁴ Central and local governments have an important role in encouraging adoption of circular economy standards to guide implementation, signal quality and improve competitiveness.

Raise public awareness. To encourage change, there is a need to change people's mindsets and that starts with education. Circular economy-oriented thinking should be introduced early on at schools to ensure students are equipped with the technical and creative skills necessary for this new economy. In Finland, circular economy education begins very early: children are taught to think about food waste and waste sorting in day care centres. This education continues up to the university level where students learn about technical and soft skills, among others, necessary to transform the economy into a circular one. As of June 2019, more than 70,000 young people in Finland had studied about the circular economy in schools or universities (Silvennoinen & Pajunen, 2019). Numerous universities around the globe are now providing courses on the circular economy.^{25,26,27} The Ellen MacArthur Foundation has developed three interlinking programmes which recognise universities that are pioneers, partners or networks with regard to the circular economy. Through this initiative, the Foundation hopes to encourage collaborations in training activities and research programmes (Ellen MacArthur Foundation, 2015).

Apart from education, governments and the private sector need to increase awareness through campaigns and by organising events, competitions and workshops to educate the public. The James Cook University and the Singapore International Chamber of Commerce organised a competition to improve awareness on the circular economy and sustainability.²⁸ The London Waste and Recycling Board organises an annual Circular Economy Week

to encourage circular design thinking, innovation and collaboration opportunities.²⁹

Certification or labelling of circular economy products can also help raise awareness among consumers and encourage businesses to adopt sustainable production processes so that they can capitalise on green premiums.

Set credible benchmarks. It is necessary to measure the circular economy to recognise progress and set global benchmarks that businesses and economies can work towards. Some existing indicators can be used to guide circular economy policies, for example, carbon emissions, life cycle analysis and resource intensity (Geng, Sarkis, Ulgiati, & Zhang, 2013). However, Preston (2012) finds that resource intensity indicators would be more fitting to measure progress only in the short term in emerging economies while using carbon emission measures to develop targets is often challenged due to political and methodological issues. Further, Geng, Sarkis, Ulgiati and Zhang (2013) identify the need for more suitable indicators that take into account the broad context and network of a circular economy rather than only measure effectiveness at the product or process level.

The European Commission published a monitoring framework³⁰ in 2018 that provides a list of key indicators that will capture the important elements and complexities of transforming to a circular economy. Several efforts are also underway at the economy level: China, France, and the Netherlands have developed key indicators to measure their transformation.³¹ Similar research efforts are needed to develop innovative indicators that can provide a complete picture of a circular economy. Some of the more feasible and transferable indicators could then be standardised and set as benchmarks to assess the global shift to a circular economy.

Promote best practices and knowledge-sharing. Governments, businesses and civil society groups that are committed to the circular economy have been communicating the benefits of shifting to a circular economy. SITRA³² (an independent Finnish public foundation), the Ellen MacArthur

²⁴ <https://www.iso.org/news/ref2402.html>

²⁵ <https://www.centre-for-sustainability.nl/education/circular-economy-masters-programmes>

²⁶ <https://www.cranfield.ac.uk/courses/short/design/circular-economy>

²⁷ <https://online-learning.tudelft.nl/courses/circular-economy-design-and-technology/>

²⁸ <https://www.jcu.edu.sg/news/releases/sicc>

²⁹ <https://ceweek.london/>

³⁰ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0029&from=EN>

³¹ https://ec.europa.eu/newsroom/ENV/item-detail.cfm?item_id=624232&newsletter_id=300&utm_source=env_newsletter&utm_medium=email&utm_campaign=Beyond%20GDP&utm_content=Measuring%20circular%20economy%20-%20new%20metrics%20for%20development&lang=en

³² <https://www.sitra.fi/en/themes/about-sitra/#about-us>

Foundation³³ (a UK based charity) and the European Commission are some organisations that are actively involved in communicating benefits, innovations and redesigned policies to encourage building a global circular economy. Moreover, committed economies could develop platforms to allow exchange of ideas and knowledge sharing on the topic.

Since transforming to a circular economy would require the collaborative efforts of multiple sectors, Preston (2012) recommends the development of cross-sectoral networks and hubs to allow for discussions and exchange of information and best practices. Further, documentation of successes and failures in implementing circular economy principles at the economy, industry, and firm levels would allow for better understanding of the determinants of success.

APEC's Role

As a forum representing about 60 percent of the world's GDP, APEC can play an important role in transforming the global economy into a circular one. Work relating to the circular economy has been gaining momentum within APEC in recent years. The term 'circular economy' was first mentioned in the 2014 Leader's Declaration³⁴ when Leaders called for the creation of a new economy that promises growth which is, among other things, green, blue and circular. Since then, several related projects have been conducted under the Committee on Trade and Investment (CTI), the Policy Partnership on Science, Technology and Innovation (PPSTI), and the Chemical Dialogue (CD).

CTI conducted a two-day workshop in October 2018 to exchange best practices on the circular economy and build capacity on handling waste.³⁵ Similarly, PPSTI organised workshops in 2018 and 2019 to help develop a policy framework that will accelerate the transition to a circular economy.³⁶ CD contributes to APEC discussions on circular economy and has submitted a proposal to organise a workshop to highlight the role of chemistry in a circular economy.³⁷ Further, the APEC Business Advisory Council's (ABAC) 2019 work plan prioritised promoting energy, innovation and the circular economy under their Sustainable Development Working Group.³⁸

More work in APEC in this area would be beneficial. APEC could discuss how a circular economy model

could be implemented in the context of the region. This can aid in developing a fitting framework that will foster transformation to a circular economy while accounting for the region's diversity.

While a number of APEC fora have been actively working in this area, there is a need for more discussions on a cross-fora level to develop initiatives that will help restructure all dimensions of the economy into a circular one. APEC provides a platform to facilitate these discussions and can encourage sharing of information and best practices across industries and economies. Given the importance and cross-fora nature of the topic, it may be beneficial to elevate circular economy discussions to a higher level within APEC to ensure that related initiatives are properly coordinated, implemented, and monitored. Work in this field will significantly contribute towards reducing environmental impact and help transform the mindsets and behaviours of industries, businesses and people to prioritise sustainability.

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³⁵ <https://www.apec.org/Publications/2018/11/2018-CTI-Report-to-Ministers>

³⁶ <https://aimp2.apec.org/sites/PDB/Lists/Proposals/DispForm.aspx?ID=2272>
³⁷ http://mddb.apec.org/Documents/2019/SOM/SOM1/19_som1_010anxi.pdf
³⁸ <https://www.apec.org/Groups/Other-Groups/APEC-Business-Advisory-Council>

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The views expressed in this Policy Brief are those of the author and do not represent the views of APEC member economies. The author would like to thank Denis Hew and Emmanuel A. San Andres for providing substantial comments to this policy brief. Research assistance by Jason Carlo O. Carranceja is gratefully acknowledged. This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Singapore License.

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APEC#220-SE-01.2