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Perspective

Accelerating circular economy solutions to achieve the 2030 agenda for sustainable development goals

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A B S T R A C T

Circular economy seems a vital enabler for sustainable use of natural resources which is also important for achieving the 2030 agenda for sustainable development goals. Therefore, a special session addressing issues of "sustainable solutions and remarkable practices in circular economy focusing materials downstream" was held at the 16th International Conference on Waste Management and Technology, where researchers and attendees worldwide were convened to share their experiences and visions. Presentations focusing on many key points such as new strategies, innovative technologies, management methods, and practical cases were discussed during the session. Accordingly, this article compiled all these distinctive presentations and gave insights into the pathway of circular economy towards the sustainable development goals. We summarized that the transition to circular economy can keep the value of resources and products at a high level and minimize waste production; the focus of governmental policies and plans with the involvement of public-private-partnership on 3Rs (reduce, reuse, and recycle) helps to improve the use of natural resources and take a step ahead to approach or achieve the sustainability.

1. Introduction

On 25 September 2015, the United Nations adopted the 2030 development agenda entitled "Transforming our world: The 2030 Agenda for Sustainable Development". It outlines 17 sustainable development goals (SDGs) associated with 169 sub-targets that are structured around five pillars (5Ps)—people, planet, prosperity, peace, and partnership with the aim of shifting the world onto a sustainable and resilient development path and leaving no one behind. The first pillar (People) targets to end poverty and hunger; the second pillar (Planet) defines to protect the planet from degradation; the third pillar (Prosperity) ensures that all human beings can enjoy prosperous and fulfilling lives; the fourth pillar (Peace) dictates to foster peaceful, just, and inclusive societies; the fifth pillar (Partnership) helps to establish a network and mobilize the means to implement this agenda, as illustrated in Fig. 1. On the whole, the 5Ps are designed to surround three main elements—economic, environmental, and social elements to achieve

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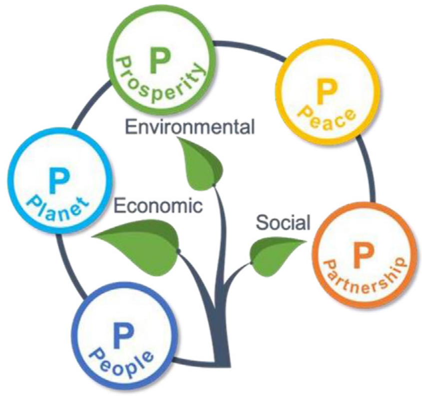

Fig. 1. Five pillars of the sustainable development goals.

SDGs (Khajuria et al., 2009). Currently, the United Nations is preparing a new Global Sustainable Development Report which is planned to release in 2023.

The global population is expected to exceed 9 billion by 2045 (United Nations, 2019). The increases in population, urbanization trend, and living standard have led to an increase in natural resource use. Since 1970, the global resource extraction has more than tripled, including a fivefold increase in the use of non-metallic minerals and a 45% increase in the use of fossil fuels (GBC, 2019). The unsustainable use of resources generates vast amounts of waste, including municipal solid waste (MSW) which is a heterogeneous collection group of waste produced in urban areas, can be varied in terms of characteristics from region to region (Khajuria et al., 2010), and may lead to enormous environmental consequences such as marine environment damage and climate change. Therefore, managing waste in the most efficient and environment-friendly manner is of great importance for the future.

In recent years, the circular economy approach and technological innovation have been proven to be a highly efficient way not only to reduce the amount of final waste but also to decrease the use of virgin natural resources meanwhile increase product efficiency which enables a quality life with respect to environmental health (Kirchherr et al., 2017). Further, the method of reduce, reuse, and recycle (3Rs) under circular economy concept can improve social and economic benefits and these potential benefits can help to mitigate numerous pressures of the planetary boundaries (Khajuria, 2020). But despite these environmental as well as economic benefits, the current pace of transformation towards circularity does not seem sufficient, more efficient policy approaches are necessary to accelerate this process. Thus, this article covered some distinctive case studies regarding their latest implementation and promotion of circular economy in alignment with the SDGs, as well as discussed the key points about the current standing and possible future directions in the application of circular economy approach in various scenarios.

2. Information and data collection at the 16th ICWMT

A special session of the 16th International Conference on Waste Management and Technology (ICWMT) entitled "International partnerships for waste management services—towards the 2030 agenda for sustainable development goals" was held in Beijing, China, on 27 June 2021. The purpose of this session was to exchange ideas, share knowledge and research activities worldwide, and provide critical solutions and pathways to achieve multiple SDGs. During the session, innovative circular economy solutions were discussed, and specific 3Rs policies and practices in fast-developing countries including Bangladesh, China, Guyana, and so on, were presented to compare and summarize essential points. The participants invited included policymakers, engineers, researchers, and experts who have relevant experience in waste management; they were from Austria, Bangladesh, China, Germany, Guyana, India, Japan, Thailand, and the Philippines.

3. Recognition of circular economy in SDGs

In comparison to the "take-make-consume-dispose" policy of the traditional linear economy model, the "made-to-be-made-again" policy of the circular economy model has tremendous opportunities not only to drastically reduce the requirement of virgin resources but also to re-think the entire process of handling both the resources and wastes, re-design the product in a way that it becomes cost-efficient, creates jobs, facilitates new and innovative technologies and finally results in an environment-friendly exercise. The circular economy approach focuses on the sustainable management of resources, in which material components are reused, shared, repaired, refurbished, remanufactured, and recycled to create a closed-loop system, as well as minimize the use of natural resources.

The model of circular economy is founded on the idea of bringing the waste back, at least partially, into the streamline of production so that it goes back in the production loop and can either become the resource for the next cycle of production or is channeled for an independent new product. Fig. 2(a) depicts how the product at the end-of-life (EoL) stage can be channeled to reuse,

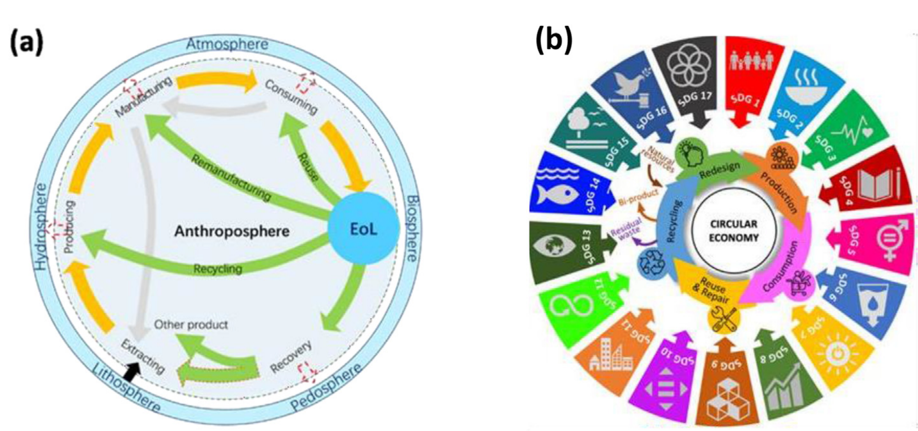

Fig. 2. Concept of circular economy, (a) systematic material cycling diagram for closed-loop supply chain (reprint with permission from Zeng and Li (2018)); (b) integration of circular economy with the sustainable development goals.

remanufacture, recycle, and recover to make up the circular economy approach (Zeng & Li, 2018, 2021). Even if the waste may only be partially useful in the next cycle, it can loop around the production cycle as long as one can extract some value out of it. This process of reutilizing the waste has the potential to revolutionize the economy as it circulates the resource and gradually decouples economic activities from the consumption of limited resources and hence allows us to keep our environment safe and saves natural resources for our future generations.

Circular economy is the way to the future that would help us to move towards renewable energy sources. The benefits of circular economy have been well recognized throughout societies, governments, and stakeholders, and it secures its respectable position in the declarations of most summits and conventions. Most noticeably, the importance of circular economy has been a part of many goals and targets in the United Nations 2030 agenda for SDGs. This relationship and involvement of circular economy in almost all SDGs is depicted in Fig. 2(b) and the basic idea behind the concept of circular economy is also shown in the inner circle of this figure.

It is obvious that, in general, only a part of the waste can be reusable after the resource has been utilized once to create the production. Therefore, it becomes important to properly channelize the waste in several parts so that its reusable part goes back into the production cycle, possibly a small part can be channelized as the resource for a different useful product, and the rest unusable part can be channeled out and properly dumped, where usual waste management techniques can be adopted. This becomes even more important to handle the waste with proper care when either the resource, product/by-product, or waste involves chemicals, such as the persistent organic pollutants (POPs). The model of circular economy provides an opportunity to reuse the POPs in the waste, effectively reducing the amount of these potentially toxic chemicals in the final waste. However, looping around toxic chemicals in the production cycle can potentially create some risk of exposure, and hence general safety of both workers and the environment is of high concern in circular economy. Non-recyclable waste that is channeled out of the loop, particularly potentially hazardous materials such as the POPs, must be properly handled and dumped, for which so-called sinks can be useful, which will be discussed later in this article.

4. Key aspects of circular economy solutions to waste

4.1. Innovative method examples of waste management

A reduction of environmental impacts of products and services can be achieved by the establishment of a circular economy. The sharing economy has become a mechanism in which consumers play a key role. For example, the global guest arrivals through the booking platform “Airbnb” went from a few hundred in 2010 to 80 million in 2015 and the users of car-sharing apps rose from a couple few hundred in 2006 to almost five million in 2014 (OECD, 2019). Bicycle sharing is another illustrative example that reduces the items put-on-market and therefore natural resource extraction. In addition, bicycling is a green transport mode with fewer emissions compared to fossil-driven cars. In China, there are about 12 million monthly users of sharing services (Statista, 2019). Moreover, not only individual consumers but also large industries can start adopting the sharing economy with strategies like chemical leasing or ship container reusage. The key to successful circular industrial-level business models relies on its supply chains as an area of action.

According to World Health Organization and United Nations Children's Fund (WHO and UNCICEF, 2015), about 2.4 billion people on the globe still had no access to basic sanitation of which 946 million people were still relieving themselves outdoors. Diarrheal diseases kill 700,000 children every year, most of which could have been prevented with better sanitation. Access to sanitation facilities, one of the most basic elements of public health infrastructure, remains a major challenge for the developing world. This has led to a series of consequences beyond public health, including poverty, pollution, water wastage, and other potential hazards.

Against this background, the so-called “Eco-LooBox” was put into place under the United Nations Global Compact Sustainable Infrastructure for the Belt and Road Initiative to accelerate the SDGs' Action Platform. The “Eco-LooBox” is a bio-toilet system built from cargo containers, which are reused and recycled. The container-made boxes are highly durable and adaptable in extreme environments. As the very first SDGs pilot project of “Sustainable Infrastructure for the Belt and Road Initiative” to accelerate the SDGs’ Action Platform, COSCO Shipping and Tsinghua University have joined forces to deliver an affordable and highly replicable model for the region with poor accessibility to water and electricity. As an innovative and integrated solution, it addresses sustainability challenges from multiple fronts including filling the gap of eco-health infrastructure in poor areas with resources constraints following SDG 3, adding up multiple sustainable elements including renewable energies into one integrated solution, using recyclable materials and containers, water-saving and biodegrading technologies to ensure safe reuse of waste.

4.2. Circular economy solutions to marine plastic waste

Based on a global estimation in 2010, about 5−13 million tons of plastic waste ends up in oceans every year. Most of the waste is composed of single-use plastic products and packaging material (Jambeck et al., 2015). The plastic waste affects several species in marine and coastal environments. The European Commission adopted various strategies and presented an ambitious European Strategy for Plastics in a Circular Economy (European Commission, 2018) which envisages that by 2030 all plastic packaging placed in the EU market will be either reusable or recyclable. In 2020, China has issued the notice “Opinions on further strengthening plastic pollution control” (National Development & Reform Commission of China, 2020) to reduce the production, sale, and use of certain single-use plastic products. Furthermore, guidelines on “Opinions on Accelerating the Establishment and Improvement of Green Low Carbon Circular Development Economic System” (State Council of China, 2021) were recently issued to promote the transformational change to circular economy.

Several best practices are piloted in China to reduce the plastic waste and combat marine litter, including the mulch film collection mechanism in Inner Mongolia, reusables of plastic packaging for online express delivery in Haikou; reusable and shareable standardized integration containers in Qingdao as shown in Fig. 3(a), ship waste management in Tianjin Port and Shanghai Port, and fishing for litter scheme in Hainan Province as shown in Fig. 3(b). With the pilots implemented in 2021, a total number of 40,000 standardized containers will be used in Qingdao, which means more than 1 million single-use containers will be avoided; a total number of 5,000 reusable express deliverable packages will be used in Haikou replacing for more than 100,000 of single-use delivery bags; more than 2,000 kg of the plastics will be caught by fishermen from the ocean and sent to proper waste treatment in Hainan province through the Fishing for Litter Initiative. It can be further expected that joined efforts in different sectors and among different entities will help to succeed against marine litter.

4.3. Circular economy solutions to food loss

According to Food and Agriculture Organization (FAO, 2011), about one-third of the foodstuffs are lost every year on the way from

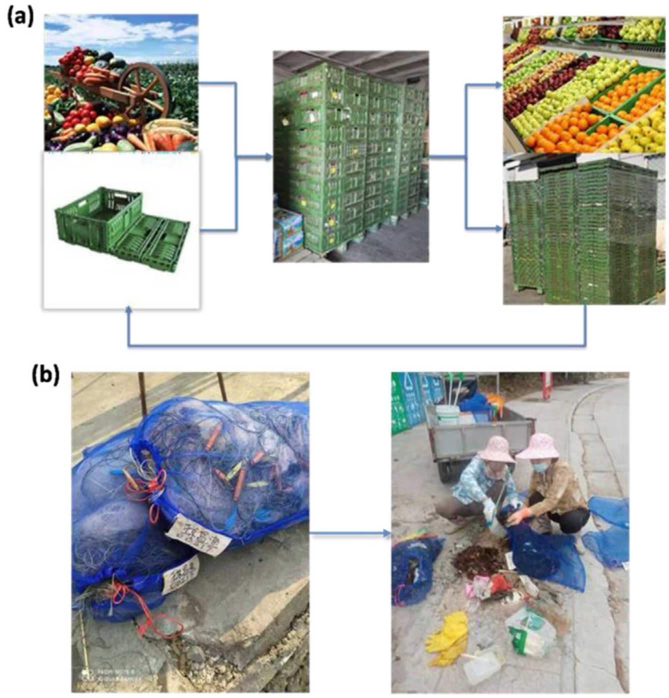

Fig. 3. Circular economy solutions to marine litter: (a) reusable and shareable standardized integration containers in Qingdao; (b) fishing for litter in Hainan.

the field to the plate. Next, the COVID-19 pandemic seems to have amplified food losses due to interrupted supply chains. The prevention of food waste has been identified as an important priority by many countries. Nevertheless, only very few countries have developed an economic assessment of their waste prevention policies and there is a clear lack of methodological guidance in this area. This lack hinders efficient circular solutions to avoid food losses.

To provide evidence-based data, the study by Rethink Food Waste Through Economics and Data followed a bottom-up approach by analyzing different food waste prevention measures and their concrete reduction potentials (ReFED, 2016). Similarly, the Waste and Resource Action Programme focused on the analysis of purchasing expenditures and assumptions on the share of avoidable food waste. Despite significant differences in the analytical approaches, the overall assessment of the economic benefits from preventing food waste shows similar results. The financial benefit of reducing food waste by 20% in Sweden is between 100 and 150 EUR per person and 250 EUR per person in the USA (WRAP, 2015).

Based on these findings, some conclusions can be drawn regarding potential next steps in facilitating food waste prevention: (1) the United Nations and international organizations could support the further exchange of experiences with economic assessments of food waste reduction policies between the member countries, especially with regard to policies aiming to influence consumer behavior with respect to food waste; (2) Uncertainties about necessary negotiation, implementation, or monitoring efforts might be one of the key barriers that hinder more comprehensive or stringent policy approaches. Future research could focus on the transaction costs linked to food waste prevention policies; (3) Only a few studies systematically assessed the indirect economic effects of food waste prevention policies. An open question, which should be answered in the future, is the following: "How do households spend the money they save from reduced food losses?" Macroeconomic modeling will be necessary to assess overall net environmental benefits.

4.4. Integration of final sinks into a sustainable circular economy

Circular economy aims to cycle materials at high value in observance of high protection levels towards human health and environment. Special attention is given to those materials that can be given a second life through recycling. Recycling is tasked to produce secondary materials of high quality. One quality parameter among others is the absence of legacy substances and impurities, which need to be removed during recycling. Next to the removals are non-recyclable wastes and emissions due to economic and technological recycling constraints. To avoid unacceptable risks, driven by non-recyclable wastes and emissions, regions provide sinks to accommodate these unwanted material flows. Limited natural sinks such as air, water, soil are available and man-made sinks such as landfills for inorganic substances and thermal treatment plants for organic substances have to be provided where natural sinks are missing or overloaded.

The narrative of final sinks as a necessity for sustainable circular economy is demonstrated in two case studies in Canton Zurich, Switzerland (Kral et al., 2019). One case study is about the management of polycyclic aromatic hydrocarbons in road pavements and the second one is about copper management in bottom-ash from MSW incineration. The case studies allow the following conclusions: (1) Product quality determines which capacities are required for sinks (waste-to-energy plants, landfills, dissipation in environment); (2) Circular economy should not favor recycling over thermal treatment and land disposal; (3) Circular economy should also consider the costs for providing man-made sinks in the waste management sector. From a waste management perspective, the circular economy requires regulations, guidelines, and good practices that (1) define and control the quality of recycling material, (2) direct non-recyclable materials to safe final sinks, and (3) change product policies if safe sinks are lacking.

4.5. Contribution of nature-based solution towards circular economy

Circular economy strategies hold the key to a resource-efficient, low-carbon, and inclusive future (Stefanakis et al., 2021). These strategies aim at improving the way we meet our current needs but through less use of natural resources and through reduction of the environmental impacts including greenhouse gas emissions. Nature-based solutions (NbS) are significant tools in a new circular economic model for climate change mitigation and adaptation. NbS provide a broad spectrum of applications, while they can be used to complement existent gray infrastructures, and they are means to establish ecosystems in urban environment, forests, coastal wetlands, and support the economy and livelihoods of people, by provisioning fuel and food, creating critical habitats for biodiversity, nurturing better health, creating jobs, and providing recreation benefits. Thus, NbS can facilitate the transition to a circular economy and support the sustainable management of the environment, with a reduced carbon footprint. NbS offer opportunities to evaluate present growth trajectories holistically to balance and regenerate the embedded natural and human capital. The circular economy approach provides the necessary framework and conditions that could be leveraged to attract investments for NbS.

5. Case studies in fast-developing countries

5.1. Case of Philippines

Fig. 4(a) shows the composition analysis of MSW where biodegradable waste counts for 52% per weight of the total waste and is, therefore, the highest ratio compared to other waste

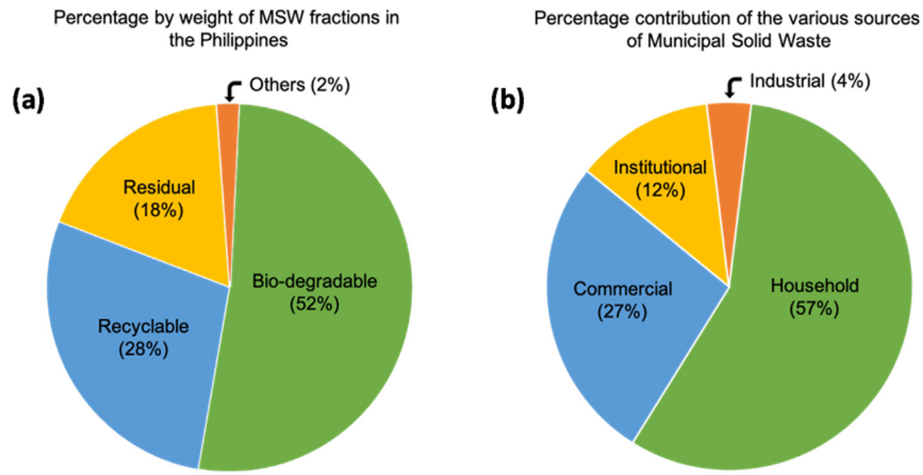

Fig. 4. Composition of municipal solid waste in the Philippines in 2008–2013 (EMB-DENR, 2015), (a) percentage of weight by type; (b) percentage of weight by source.

ingredients. The largest amount of waste is generated by household sector as shown in Fig. 4(b). This indicates the potentials for composting and recycling industries in the country (Atienza, 2017). The application of the concept of the circular economy is a key approach that affects waste management. Although there is no specific national policy framework on circular economy, it can be observed that the circular economy principles are being applied in many of its waste management policies and programs such as the promotion of 3Rs, the Green Energy Option Programs (DOE, 2017), the ban on Single-Use Plastic Products (Republic of the Philippines, 2018) and other relevant policies and programs.

To demonstrate practical examples, the experiences of the local government of San Carlos City, Negros Occidental will be represented. The city has implemented barangay-based and school-based recovery systems. They also sorted biodegradable and non-biodegradable waste at the Eco-Center or centralized Material Recovery Facility (MRF). Through these initiatives, the city was able to increase the waste diversion rate from 6.40% in 2003 to 70% in 2010 (Atienza et al., 2012). Another novel technology, called as "centralized gravity-driven MRF", was introduced in the city in addition to clay-lined landfill cells. This technology increased the efficiency of material sorting without requiring electricity (Acosta et al., 2013). Hence, the replication of these activities should be promoted to further enhance the benefits of circular economy solutions in managing waste in a more efficient and sustainable manner.

5.2. Case of Bangladesh

As shown in Table 1, the rising urban population leads to increased waste generation, which is projected to be 47,000 tons per day of waste by 2025. It shows that MSW management activities in Bangladesh are merely limited to the collection and disposal of waste while the strategies to adopt cost-effective opportunities of waste reduction and recycling mostly remain unexplored.

Bangladesh was one of the first countries in Asia, which banned plastic and polythene bags in 2002. However, due to the lack of enforcement, there has been no significant reduction in the use of plastic and polythene bags and Bangladesh is responsible for a share of 2.47% of global mismanaged plastic waste in 2010. Bangladesh's share is higher than those in neighboring countries (Jambeck et al., 2015). The mismanagement of waste causes health hazards, marine life disruptions, and deteriorations of soil and air qualities. The waste that chokes drainage networks, canals, and wetlands are the major causes of floods. According to Waste Concern (2019), about 36% of the total generated plastic waste is recycled, 39% is landfilled, and the remaining 25% ends up in marine environments.

The 8th Five Year Plan (July 2020–June 2025) also addresses sustainable waste management and aims to introduce circular economy for recyclable goods such as paper, metal, glass, leather, and plastic (GED, 2020). The government has adopted National 3R Strategies for Waste Management. This policy along with other policies needs to bring in practices suitable for sustainable waste management. The application of circular economy principles in the manufacturing sector helps to optimize resource utilization and waste reduction and therefore supports green supply chain initiatives.

5.3. Case of Guyana

Guyana, like many other countries of the global south, is facing challenges with the management of its increasing waste. Recently, Guyana generated about 422,248 tons per year of municipal solid waste, which is about 559 kg per capita per year, and about 0.22 kg of waste per one USD of waste intensive consumption (Waste Atlas, 2020). Waste generation and the current practices in waste management deteriorate the environment and human health. The environmental and human health challenges forced the country to develop new policies. The Ministry of Local Government and Regional Development developed a waste management strategy for 2013–2024 (MLGRD, 2013) called "Putting Waste in Its Place: A National Solid Waste Management Strategy for the Cooperative Republic of Guyana". This strategy aims at the reduction of waste generation and/or better waste management. It also aims to involve communities nationwide, integrated, and financially self-sustaining way. The strategy is based on three objectives including (1) a cleaner environment, (2) a better public health protection, and (3) a significant contribution to economic prosperity. The strategy has six goals and key directions involving (1) less litter and illegal dumping, (2) less waste generation, (3) better resource recovery, (4) efficient and cost-effective waste collection, (5) better waste infrastructure, as well as (6) strengths to enhance human and institutional capacity.

The circular economy solutions to sustainable waste management for Guyana include key elements as followed: Linking national policies to local beneficiaries; preparing for the expected economic and urban growth; meeting the United Nations SDGs 8 &

Table 1
Growth of urban population, per capita GDP, and waste generation in urban areas of Bangladesh 1991–2025 (source: Waste Concern, 2019).

Issues	1991	2005	2014	2019	2025 (projected)
Urban population in million	20.8	32.8	53.3	62.6	78.3
Waste generation (tons per day)	6,493	13,330	23,688	30,000	47,000
Per capita GDP (USD)	220	482	1,113	1,875	2,984

11 with focus on decoupling economic growth from environmental degradation; and making cities and human settlements safe, inclusive, and sustainable (Oyedotun & Moonsammy, 2021). In addition, the strategy also focuses on consistent life cycle thinking, industrial ecology, waste flow analysis, monitoring of local outcomes of circular economy patterns, and sustainability of different policies in the waste sector. The adoption of these emerging circular economy paradigms and principles within environmental management is one of the strategies the Cooperative Republic of Guyana is focusing on in its transition pathway towards a low-carbon and less polluting economy.

5.4. Case of Thailand

Circular economy has been a subject of interest in Thailand in the past couple of years. The country is in a good position and addresses circular economy in the 20-year National Strategy (2018–2037) (National Strategy Secretariat Office, 2018). To drive a circular economy, two approaches were proposed (NXPO, 2020): (1) applying circular thinking to solve existing problems, and (2) applying circular economy to create a new economy. To accelerate the implementation of circular economy principles, the government has established a new economic direction known as the Bio-Circular-Green (BCG) economy model, which is based on the philosophy of sufficiency economy. It provides guidance and integrates all sectors in all dimensions including behavior changes, mindset promotion, and innovation for natural resource protection (MHESI, 2019).

The government has approved a Five-year Strategic Plan (2021–2026), consisting of four key elements to boost the BCG economy model as the best path to sustainability and more equitable and resilient development (MHESI, 2019). These key elements are (1) promoting sustainability of biological resources through balancing conservation and utilization, (2) strengthening communities and grassroots economy by employing resource capital, creativity, technology, biodiversity, and cultural diversity to create value to products and services, enabling the communities to move up the value chain, (3) upgrading and promoting sustainable competitiveness of Thai BCG industries with knowledge, technology and innovation focusing on green manufacturing, and (4) building resilience to global changes. In addition, the BCG economy expects to lead the country to Thailand 4.0. This model also conforms with SDG.

5.5. Case of China

Material depletion and environmental pollution over-reliance on the linear economy may be resolved by applying the circular economy. To close the loop of critical materials, the anthropogenic circularity science with three basic principles: spatial distribution, waste generation, and recycling rate, were proposed and exemplified in China (Zeng & Li, 2018, 2021) as shown in Fig. 2(a). As one of the largest producers and markets in the world, China has huge amounts of new and old scarp flows through anthroposphere. Due to less resource consumption, less environmental deterioration, and harmonized development benefits among economy, environment, and society, therefore, the urban mining under the concept of circular economy is now widely practiced and rapidly developed in China. Some presentative examples are the ban on importing low-quality and untreated foreign waste in 2017, Zero Waste Cites Construction Pilot Program in 2019, and Dual Circulation Strategy in 2020.

In China, the total weight of anthropogenic minerals reached 39 million tons in 2010 and is forecasted to double in 2022 and quadruple in 2045 (Zeng et al., 2020). Urban mining of anthropogenic minerals today is a promising option for securing copper and aluminum resources. The costs of obtaining 1 ton copper or aluminum from e-waste, EoL vehicles, and waste wiring and cables are already lower than virgin mining in China (Zeng et al., 2021). If the economic benefits of recycling can be demonstrated for other metals, it is very likely to see a positive impact on waste disposal and mining activities globally, thereby advancing towards more sustainable waste management.

6. Conclusion and future perspective

Globally, governments, research institutes, enterprises, and other stakeholders are promoting various measures to accelerating circular economy waste management solutions including innovative technologies, management methods, and practical cases. With no doubt that none of them could solve all issues alone, we must understand and integrate them together, as well as put the right amount of efforts on efficient points. Through a knowledge-sharing discussion platform—16th ICWMT, some key points from macro to micro levels, and some specific cases in some typical fast-growing countries were raised and discussed in the special session "International partnerships for waste management services – towards the 2030 Agenda for Sustainable Development Goals", including the following, but for not limited to the following:

- The transition to circular economy can keep the value of resources and products at a high level and minimize waste production.
- The circular economy evolved from 3Rs is of facilitated value to realizing a zero-waste society by optimizing resource efficiency, reducing environmental pollution and emissions.
- The waste containing POPs is considered as a special concern and widely presents in the environment in all regions of the world, in turn, every person carries a body burden of POPs.
- The green chemistry principle of designing chemical products to be less hazardous should become a core approach towards circular economy.
- The circular economy must establish a clean material cycle and not a dirty one with unacceptable risk for environmental health.
- The focus of governmental policies and plans with the involvement of public-private-partnership on 3Rs helps to improve the use of natural resources and take a step ahead to achieve the SDGs.

Finally, all participants of the special session agreed that the circular economy is a useful tool to achieve the 2030 agenda of SDGs. This kind of knowledge-sharing platform should continuously be held regularly to keep addressing issues on the way to sustainability and finding solutions.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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