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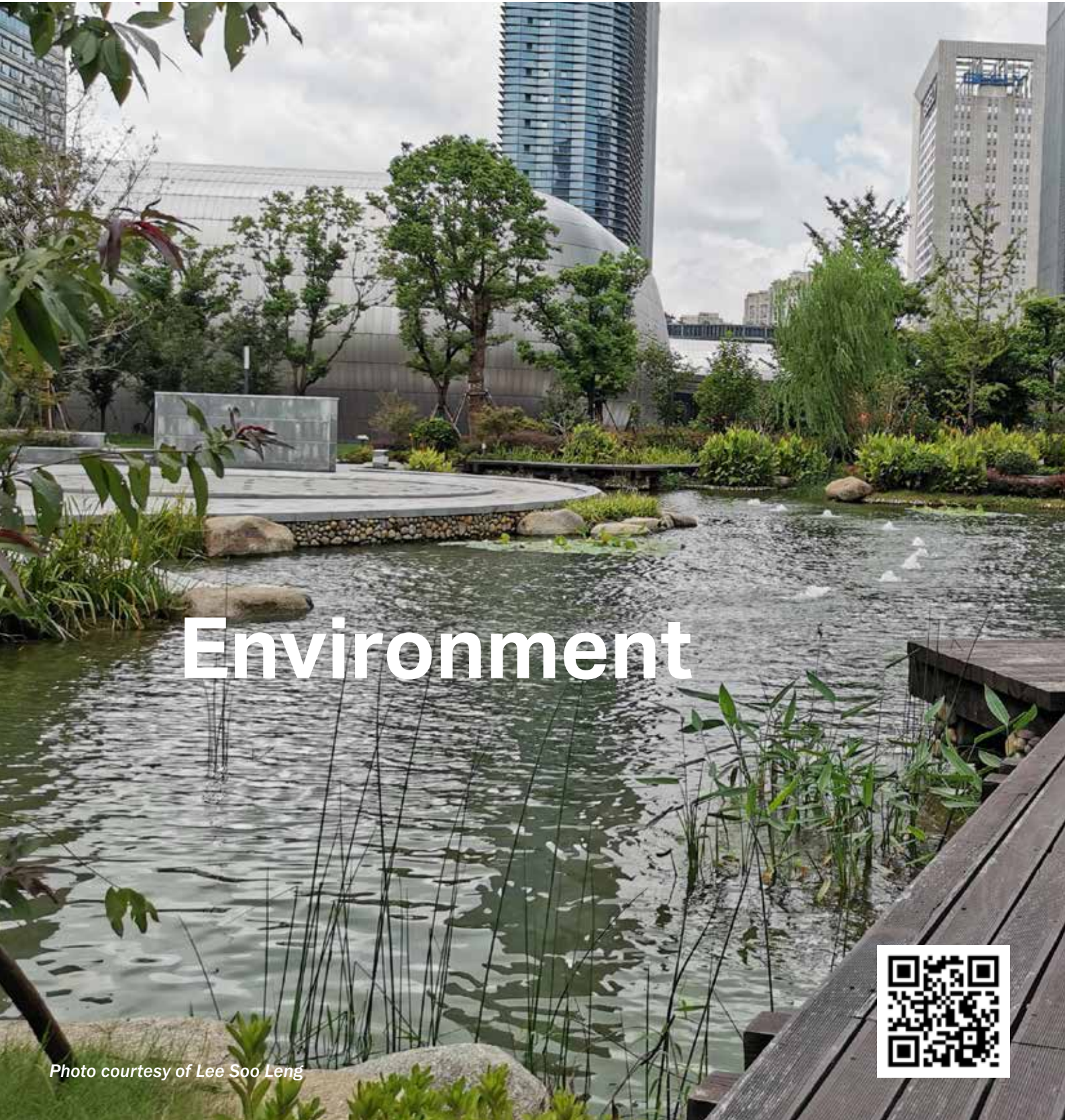


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## Environment

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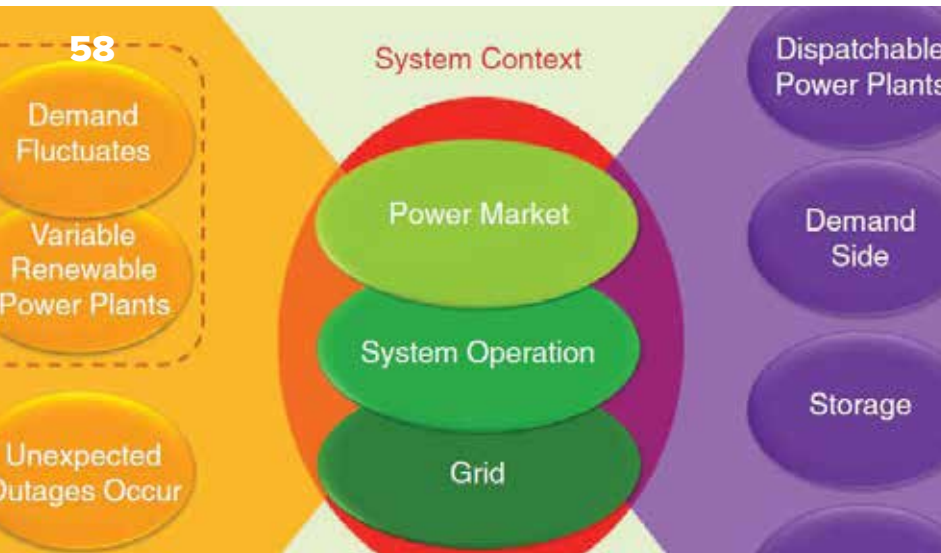
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**80** Johor Bahru Causeway, 1960





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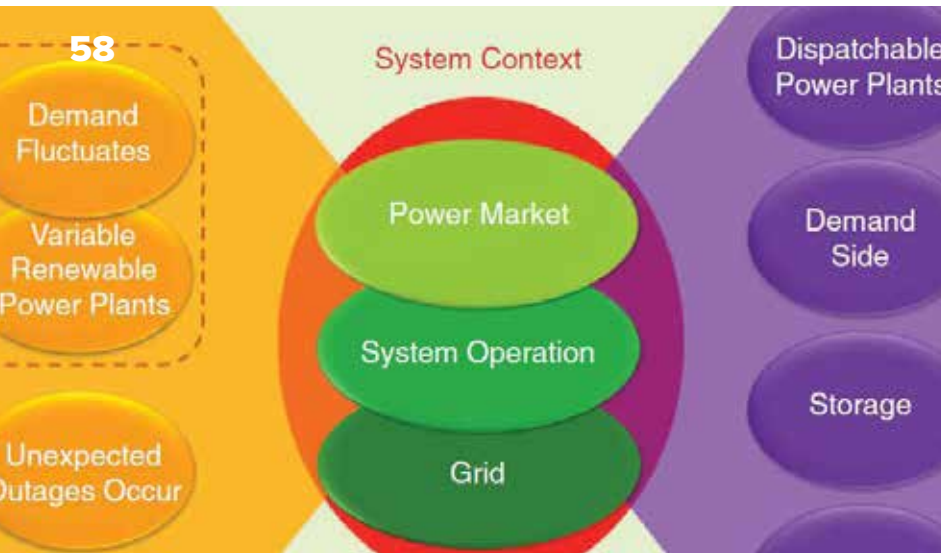
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# Plastic Waste Management: Transition to a Circular Economy

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**B**est practices in waste management support economic growth and societal wellbeing by enabling a clean, resilient, productive, and sustainable environment. However, today's world economies are dominated by a linear approach in the way products are manufactured, used, and disposed of. This means manufacturers extract natural resources, process them into products and packaging, then sell the products to consumers who ultimately dispose of them. That is reflective of our society which is very linear in adopting the "take-make-use-dispose" approach. It is not sustainable financially or environmentally sound and it is a missed opportunity as valuable materials are thrown away. Fortunately, there is a solution; it's called the circular economy. In a circular economy, there is minimal waste; we reduce what we don't need and reuse what we do need. By moving to a circular economy for waste management, Malaysia could capture an estimated RM900 million annually in lost value which corresponds to 2.3 million tonnes of recycled materials going to landfills [1].

Emerging threats due to the unchecked linear economy growth model subscribed by Malaysia since the 1900s are causing an adverse impact encompassing environmental and social spheres.

Malaysia has started to address plastic pollution through the circular economy approach which eliminates the production of unnecessary plastic products, shifting to alternative materials and circular design, thus extending the life of products through reuse, repair, resell and finally recycling discarded products back into the production phase [2]. As a result, recent trends in waste management in Malaysia exhibit a substantial increase in the rate of recovery and recycling of plastic wastes. The National Recycling Rate to date is 30.67%, which is a 2.61% increase from 2019. By 2025, the Ministry of Housing and Local Government (KPKT) is targeting to achieve a 40% National Recycling Rate [3, 4].

## LINEAR ECONOMY VS CIRCULAR ECONOMY

In the linear economy model, a resource from nature is exploited for wealth creation without any consideration of regeneration and post-use sustainable waste management. For example, in the logging industry, valuable resources from the natural environment are taken for granted as if they are unlimited and forever replenishable

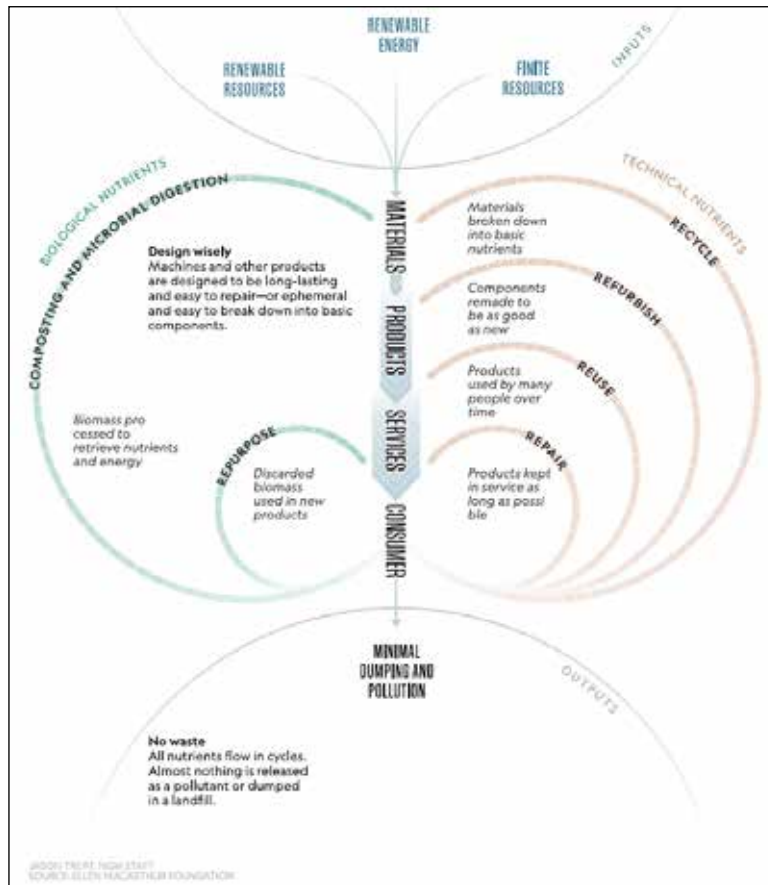


Figure 1: The Circular Economy, The Ellen MacArthur Foundation, 2017 [6]

by natural processes. As a result, we have lost a significant amount of CO<sub>2</sub> absorbing forests that have existed for millions of years in our backyard. Such unsustainable natural resource mining and processing industry has come full circle, threatening to cause adverse health impact to surrounding communities.

Indiscriminate waste generation from modern lifestyle and unsustainable waste disposal management are directly causing environmental pollution and climate change. Moving from agriculture and mining-based activities to rapid industrialisation, Malaysia's linear economic growth journey is threatened by the growing heap of waste disposed in landfills. Landfilling is unsustainable as it takes valuable land and renders it unsuitable for commercial and residential development until the site is fully remediated, without a guarantee that it will not inflict a health impact on people residing on the site.

Unchecked Greenhouse Gas (GHG) emission also comes directly from waste disposal

management via incineration. An increase in the atmosphere of CO<sub>2</sub> concentration brings about devastating events that threaten our existence on planet earth. CO<sub>2</sub> acts as an insulator that raises the atmospheric temperature, causing a rise in ocean levels due to melting polar ice. Another source of GHG is methane gas which is released from landfills due to the decomposition of food and organic waste.

Waste generation and pollution from consumerism, specifically single-use plastic packaging, leaking into the environment and resurfacing in the Pacific Ocean, along with discarded fishing gear especially fishnets, have formed an unnatural garbage island of approximately 1.6 million square km right in the middle of the ocean. It has been dubbed the Great Pacific Garbage Patch with an estimated floating plastic waste of 79,000 tons in 2018 [5].

Since its first invention in the early 1900s, plastic has come a long way in every aspect of the modern world. It has kept food fresh

for much longer making it possible for long distance transportation, catering to population growth in expanding cities. Plastics made land transportation more economical due to its lightweight and durable properties making cars and trucks lighter, therefore saving fuel. Plastics replaced expensive glass bottles as the container of choice for fast-moving consumer goods (FMCGs) companies selling soft drink beverages and water to bring down the cost to consumers. Plastics transformed the packaging industry making it cheaper to transport manufactured goods. Unfortunately, when it comes to managing the disposal of post-consumer plastic materials, it is much easier to resort to the cradle to grave approach rather than applying the circular economy approach.

In essence, the circle economy or circular economy is more aligned to natural processes where almost no material is left without a purpose upon its expiration and is either returned to nature in one form or another or reformed to serve a new purpose.

The circular economy concept as promoted by the Ellen McArthur Foundation, a charity organisation based out of the UK, encompasses the wider aspect of the economy, not just the usual 3R – reduce, reuse, and recycle activities that we are all familiar with [6]. This is crucial to the key idea that valuable hard-earned materials extracted from nature for various purposes do not

become waste and are kept in use for as long as possible if not indefinitely. This feat is achieved, among others, through reuse, repair, refurbish, repurpose, regenerate, and recycle [7]. The material and energy flowchart (Figure 1) depicts the general idea of the circular economy.

## PLASTIC WASTE MANAGEMENT TRANSITION TO CIRCULAR ECONOMY

The key enablers for the transition from a linear economy to a circular economy (Figure 2) includes (i) policy and regulation, (ii) waste prevention and optimisation, (iii) technology and expertise, (iv) renewable energy utilisation, (v) market creation, (vii) stakeholders’ engagement, (vii) financial support and (viii) data management [8].

### (i) Policy and regulation

Policy and regulation are crucial in changing the linear economy mentality which can only be achieved when the components of the circular economy are acknowledged as a legal mandate by the governing bodies or local authorities. This is a ‘stick approach’ to boost the circular economy and can take place in several dimensions such as having several circular economy related directives or laws, that mandate systems, disposal bans or landfill bans, and mandate a take back system.

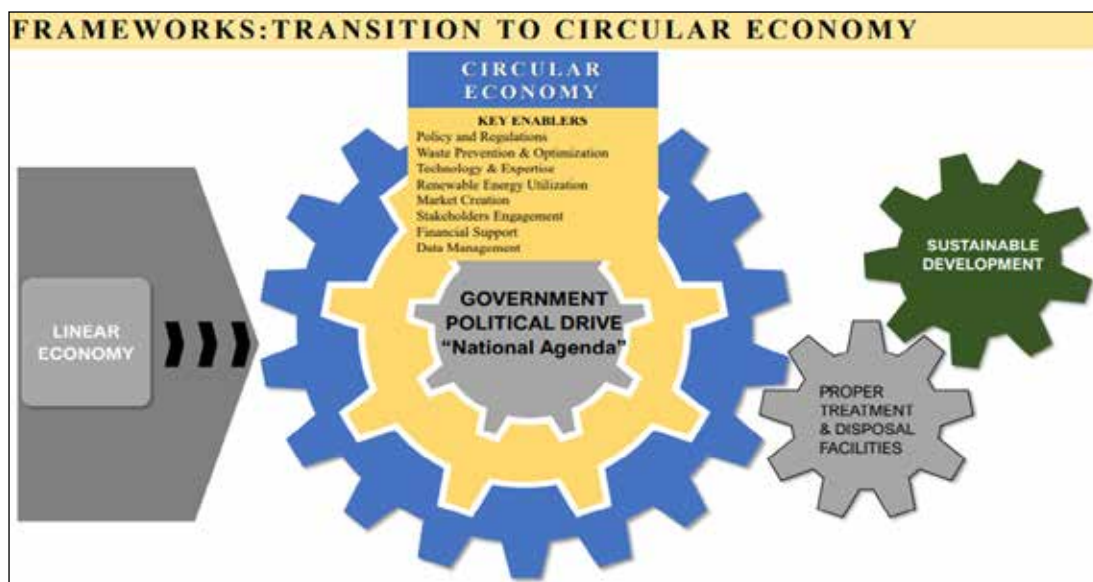


Figure 2: Framework of the transition to a circular economy [8]

### ***(ii) Waste prevention and optimisation***

Waste prevention or minimisation helps to develop a more sustainable society by reducing or eliminating the production of undesirable and persistent wastes. Massive plastic waste generation can be controlled by eliminating its use at an earlier point or by extending the life of plastic based products. Redesigning products and processes, as well as transforming community consumption and production patterns, are all part of waste minimisation.

### ***(iii) Technology and expertise***

Advanced technology and expertise are the backbone for success of the circular economy. Mature technologies should be in place to drive the components of the circular economy such as recycling, and this should be made applicable to all kinds of plastic waste. Technologies such as for collecting the waste, separating it, including mixed waste, cleaning, recycling, and turning it into useful products either for the same function or cross-sector use. Such technologies and expertise should be ready before the legislative enforcement takes place especially when it comes to mandating recycling.

### ***(iv) Renewable energy utilisation***

Renewable energy also contributes to the conservation of the country's natural resources. Renewable energy provides consistent power and fuel diversification, enhancing energy security and minimising the risk of fuel leaks while also reducing the requirement for imported fuels. Renewable energy technologies have an economic advantage for two reasons: (i) they require new knowledge, skills and technology thus resulting in more jobs per cost invested than traditional electricity generation technologies; and (ii) they primarily use indigenous resources, allowing the majority of energy costs to loop inside the organisation.

### ***(v) Market creation***

For a circular economy to work, the creation of a functioning market for recycled and sustainable plastics is a must. It is undeniable that market creation is heavily dependent on current demand. The demand here is not only for the waste for re-processing but also the demand for recycled plastic materials. Diversified market segments are important and the ability to supply the waste

for recycling is also crucial to keep the market stable.

### ***(vii) Stakeholder engagement***

The circular economy cannot be successful in a silo type environment, hence the need for big networks and relevant stakeholder engagement. This can range from individuals to groups either profit based or non-profit based organisations which come together complementing each other to drive the circular economy initiatives. The systematic identification, analysis, planning and implementation of actions that are mutually agreed upon will help each stakeholder to contribute based on their strength.

### ***(vii) Financial support***

Financial support, either from the Government or the private sector, is key for the success of the circular economy. The availability of budgets gives meaningful space to the relevant parties to work within the circular economy through incentives, grants, tax relief, business rewards and others. The aid could be in a non-monetary form as well.

### ***(viii) Data management***

Data capturing is essential for planning circular economy practices. Data and the management of data are crucial. In fact, to date, most of the collection programmes or take back approaches are struggling because of the minimal amount of data and information that is available on waste/material that has been identified for recycling. It should be compulsory to have data such as type and quantity of waste that is generated, the capacity, the transportation mode that is available, the capacity of reprocessing facilities, market demand and supply, identification of the process/organisation which will benefit from the re-processed material and others. This data should be valid and traceable whenever needed at different levels.

## **Challenges in the implementation of a Circular Economy**

The circular economy transition has reached out to the relevant stakeholders in Malaysia, but the acceptance and response levels are still varied.





The Malaysian Productivity Centre (MPC) surveyed 500 executives across diverse sectors including plastics and resins, and the findings indicated that only 7% of the respondents are currently adopting circular economy practices. The majority are still planning to shift towards a circular economy (80%), while 10% are in the phase of learning more about the circular economy before implementing and 3% of the respondents are not considering circular economy practices at all.

Based on Figure 3, the general challenges to fully implement the circular economy in plastic waste management include: the absence of an Extended Producer Responsibility (EPR) scheme, inadequate and incoherent policies on plastic consumption and disposal, absence of macro data to monitor plastic production, consumption, and treatment, as well as limited responsible investment for innovative small or medium enterprises (SME). Specifically, challenges are also categorised as upstream, midstream and downstream, which are detailed as follows:

1. Upstream
  - a. Lack of circularity integration in corporate decision making,
  - b. Lack of clarity on using recycled plastic material in food grade applications, and
  - c. Lack of research and development (R&D) in plastic design.
2. Mid-stream
  - a. Lack of awareness of sustainable consumption, and
  - b. Consumer price sensitivity to alternative products.
3. Downstream
  - a. Unsatisfactory quality of the municipal waste stream,
  - b. Unsatisfactory enforcement of policies,
  - c. Limited recycling facilities, and
  - d. Lack of alternative end-of-life solutions for municipal solid waste.

Thus, to successfully implement a plastic circular economy, these challenges must be met with the availability of a stable supply of high-quality plastic as feedstock, increase in material recovery facilities to improve their output, adoption of standards for designing plastics so that they can be recycled, and recycled content and standards for major plastics used in industries.

The implementation of circular economy approaches has resulted in societal, environmental, and economic benefits across various parts of the world including China, Japan, and Europe. Their success stories have a stream of processes including 'top-down' and 'bottom-up' approaches [9].

### **The 'Top-down' Circular Economy approaches in Malaysia**

The 'Top-down' approach involves policy intervention and the "Bottom-up" approach involves capacity building, people's participation, promotion and use of appropriate technologies and private sector participation [9]. The combination of these two approaches and the successful implementation of circular economic practices will help in realising the vision of a circular economy in plastic waste management in Malaysia [10].

Many 'Top-down' initiatives of the circular economy that can be seen in Malaysia are primarily driven by Government's effort, especially by the relevant Ministries. Several examples are included in Table 1.

### **The 'Bottom-up' Circular Economy approaches in Malaysia**

The 'Bottom-Up' circular economy approaches are more effective in Malaysia as the relevant stakeholders and companies set up their plans, which are in their control in terms of execution capability. Many companies started with initiatives that ranged from awareness programmes to the improvement of technologies, which enable the development of new products through the recovery of waste. Some of the circular economy implementations resulting from the 'Bottom-Up' approaches in Malaysia are tabulated in Table 2.

## **THE WAY FORWARD**

It is undeniable that both 'top-down' and 'bottom-up' approaches should synergise effectively to boost plastic waste transition to a circular economy for Malaysia. Although the Government

<p><b>PETRONAS Chemicals Group Berhad (PCG)</b></p>	<ul style="list-style-type: none"> <li>• PCG is collaborating with Plastic Energy Ltd (Plastic Energy) to construct a facility that produces crude naphtha from plastic waste as a feedstock for polymer production. The plant will be located in Johor and will be the first in the Southeast.</li> <li>• Collaboration with the Ministry of Education, Solid Water Corporation (SWCorp) and the Malaysian Plastics Manufacturers Association (MPMA) to develop an educational module for primary and secondary school students on plastic waste management and the environment.</li> </ul>
<p><b>The Malaysian Recycling Alliance (MAREA)</b></p>	<ul style="list-style-type: none"> <li>• The first alliance of its kind in the country comprises 10 key industry leaders in the fast-moving consumer goods sector in Malaysia made up of Coca-Cola Malaysia, Colgate-Palmolive Malaysia, Dutch Lady Milk Industries, Etika Group, Fraser &amp; Neave Malaysia, Mondelēz International Malaysia, Nestlé Malaysia, Spritzer, Tetra Pak Malaysia, and Unilever Malaysia [14].</li> <li>• MAREA aims to enable a voluntary, industry-led Extended Producer Responsibility (EPR) group of like-minded companies to focus on boosting the value chain and significantly improve the collection and recycling of post-consumer packaging.</li> <li>• An incentive scheme will also be implemented via a pilot project where consumer-packaging waste, including polyethylene terephthalate bottles, used beverage cartons; high-density polyethylene and flexible packaging will be collected and channelled to local recycling providers.</li> </ul>
<p><b>Hatta Dolmat</b></p>	<ul style="list-style-type: none"> <li>• Hatta Dolmat has creatively recycled 200 plastic bottles into scarf and facemasks. The designer collaborated with Malaysian Green Technology and Climate Change Centre (MGTC) for the collection of plastic bottles. The initiative which is called MGTC X Hatta Dolmat, was launched on May 7, 2021 [15].</li> </ul>
<p><b>Heng Hiap Industries Sdn Bhd</b></p>	<ul style="list-style-type: none"> <li>• One of a growing number of companies working with environmentalists to collect and remove plastic waste in the country's waters. The pellets made by Heng Hiap are sold to companies such as Kian, a furniture maker [16].</li> <li>• French multinational Capgemini SE is collaborating with Heng Hiap Industries Sdn Bhd to develop a mobile application to facilitate plastic recycling in three stages where it begins with consumers calling collectors for the collection of recyclable plastic waste from their homes. Collectors then accept the requests and have the ability to review the plastic haul and reward consumers with points. They receive their payment digitally via a digital wallet from Heng Hiap. The mobile app is expected to be launched in October 2022.</li> <li>• Heng Hiap is working with over 28,000 domestic plastic recyclers to buy and convert plastic scraps into high-performance resins before selling it to clients including major South Korean appliance manufacturers and Japanese automotive companies [17].</li> </ul>
<p><b>Malaysia Airlines, Firefly and MAG Sustainability Blueprint</b></p>	<ul style="list-style-type: none"> <li>• Malaysia Airlines and Firefly have targeted 50% of in-flight and ground waste to be recycled and up cycled by 2025 onwards. Both carriers also aim to achieve net-zero carbon emissions by 2050 as part of a newly launched sustainability blueprint by its parent company Malaysia Aviation Group (MAG). The MAG Sustainability Blueprint will also promote other green initiatives such as reducing overall carbon dioxide emission by 25 million kg in 2021 and reaching 50% biodegradable materials usage for in-flight operations [18].</li> </ul>
<p><b>Nestlé (Malaysia) Berhad</b></p>	<ul style="list-style-type: none"> <li>• Milo <i>Sayang Bumi</i> campaign – to reduce the production of plastic and promote the use of renewable energy sources.</li> <li>• Milo <i>UHT Paper Straw</i> – an innovation to make packaged drinks more sustainable by replacing 100% of plastic straws with paper straws for their products. It is estimated over 200 million plastic straws will be eliminated yearly.</li> <li>• <i>Projek CAREton</i> - Used Beverage Cartons recycling campaign that transforms drink packs into 'green' roofing tiles and panel boards</li> <li>• The <i>Stik Pek X-Change Programme</i> – plastic waste upcycled into handicraft goods through collaboration with local upcycling communities [19].</li> </ul>

Table 2: Examples of 'bottom-up' circular economy approaches in Malaysia

has undertaken many initiatives, the promising results are still far from expectations. The awareness campaigns are a good start for many organisations, but they should be taken to the next level such as practices where tangible results can be seen. Awareness programmes such as 3Rs have been practised for almost 30 years but tangible results cannot be seen comprehensively. Therefore, legislation and policy interventions should progressively take place strategically. The national agenda should be strengthened on plastic waste issues.

Some of the efforts that could assist towards the success of plastic waste transition to a circular economy in Malaysia are:

1. Eco-friendly alternative materials or products to replace conventional plastics need to be identified urgently.
2. Implementation of efficient waste take back policies such as the Extended Producer Responsibility (EPR) or Product Stewardship that suit the Malaysian culture.

3. Balancing plastic recycling awareness with stick approaches such as pay-as-you-throw or additional disposal fees.
4. Development of recycling technologies for plastic including the smart waste separation system.
5. Collaboration between the Government and the private sector in utilising modern capabilities and expertise to transform the plastic linear economy into a circular economy.
6. Reward systems for companies that achieve the circular economy goals (e.g., levies or tax exemptions)

In a nutshell, a plastic circular economy roadmap has to be in place to address plastic production, consumption, recycling, and waste management and to keep plastic products and materials circulating in a state of use for as long as possible, while offering new ways to mitigate risks to allow the plastics industry to grow and diversify. Additionally, the Malaysian Government



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is targeting private sector participation given that the private sector is well equipped to lead through innovations in product design, business models, recycling technologies, experience of producer responsibility gained from other markets and project financing. By embracing the circular economy, Malaysians can build a thriving economy while also taking care of the planet for today and future generations. ■

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