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RETHINKING EXTENDED PRODUCER RESPONSIBILITY FROM THE CIRCULAR ECONOMY PERSPECTIVE

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Acronyms/Abbreviations

ASP	average selling price
BMA	Bangkok Metropolitan Administration
BOI	Board of Investment of Thailand
CE	Circular economy
CEPA	Consumer Education and Public Awareness
CEWT	Circular Economy for Waste-free Thailand
CPCB	Central Pollution Control Board
DEQP	Department of Environmental Quality Promotion
DH	Department of Health
DIW	Department of Industrial Works
DLA	Department of Local Administration
DLT	Department of Land Transport
DMCR	Department of Marine and Coastal Resources
DOE	Department of Environment
DPIM	Department of Primary Industries and Mines
E-waste	discarded electrical or electronic devices
EPR	extended producer responsibility
EU	European Union
FDA	United States Food and Drug Administration
FMCG	Fast-Moving Consumer Goods
FTI	Federation of Thai Industries
ICI	institutional, commercial and industry
IIIEE	International Institute for Industrial Environmental Economics, part of Lund University, Sweden
JICA	Japan International Cooperation Agency
JPSPN	National Solid Waste Management Department – Malaysia
KASA	Ministry of Environment and Water – Malaysia
KPKT	Ministry of Local Government and Housing – Malaysia
LCA	Life-cycle assessment
LGO	Local Government Organisation
MBR	material balance reports
MECE	mutually exclusive but collectively exhaustive
MHESI	Ministry of Higher Education, Science, Research and Innovation
MOFA	Ministry of Foreign Affairs
MONRE	Ministry of Natural Resources and the Environment
MOPH	Ministry of Public Health

MOT	Ministry of Transport
MSW	Municipal solid waste
MSWM	municipal solid waste management
MTEC	Thailand National Metal and Materials Technology Center
NGO	non-governmental organization
NXPO	Office of National Higher Education Science Research and Innovation Policy Council
ONEP	Office of Natural Resources and Environmental Policy and Planning
PAO	Provincial Administrative Organisations
PCB	printed circuit board
PCD	Pollution Control Department
PCD	Pollution Control Department
PPP	Purchasing power parity
PRO	producer responsibility organisations
RoHS	restrictions on the use of hazardous substances
SAO	Sub-district Administrative Organisation
SAS	Separation at Source
SCP	Sustainable Consumption and Production
SPCB	State Pollution Control Board
TBCSD	Thailand Business Council for Sustainable Development
TEI	Thai Environment Institute
TIPMSE	Thailand Institute of Packaging and Recycling Management for Sustainable Environment
TISI	Thai Industrial Standards Institute
UBC	used beverage cartons
UN SDG	United Nations Sustainable Development Goal
WEEE	waste from electrical and electronic equipment

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Introduction

This report provides an overview of important steps to develop efficient Extended Producer Responsibility (EPR) systems with a particular focus on countries in Asia. It builds on experiences from the introduction and development of EPR systems globally, focusing on India, Malaysia and Thailand. These countries were selected based on the availability of experienced experts for the study, but we are convinced that the conclusions and ideas that emerged would be relevant in many other Asian countries, and even beyond Asia. The authors also think it is essential to develop EPR in the context of the Circular Economy (CE), which implies paying special attention to how EPR implementations can contribute to the wider goals of CE when it comes to ensuring that products and materials are treated in a way that ensures the durability of services, re-use and high-quality recycling. We have noticed that these issues have received wide recognition in the past few years and there have been considerable efforts expended to develop EPR implementations so they will better contribute to the development of CEs.

The question the study has aimed to answer is how best to develop EPR systems in Asia in a way that contributes to the introduction of EPR-based policies supporting CE on this continent. To answer this question in a useful way for various stakeholders, we took a practical approach to the issues rather than an academic approach. Along with general studies and the authors' previous experiences, the study has included various approaches for gathering relevant, updated information. This report, showcasing important learnings from the studies, interviews, discussions and webinars and workshops in India, Malaysia and Thailand, as well as in two regional webinars, consists of an introduction to EPR and CE, followed by three main chapters elaborating the experiences and situation in the three case-study countries: India, Malaysia and Thailand, written by the respective experts from these countries. The report concludes with the general outcomes of the project.

The members of the project group were selected based on their substantial work experience in EPR.

Mr Soon Hun Yang, Director, Eco-Ideal Consulting, Certified ISWA International Waste Manager is Founder and CEO of Eco-Ideal Consulting in Malaysia, a company specialising in waste and carbon management in Malaysia. Hun is a certified International Waste Manager (International Status) under the International Solid Waste Association. He has 22 years of experience in waste management consultancy, including EPR experience in used tyres, e-waste, and packaging waste in Malaysia. His most recent EPR experience was as the team leader of the EPR Feasibility Study Project contracted by the first voluntary EPR organisation for Malaysia's FMCG sector – Malaysian Recycling Alliance (MAREA) for the pilot EPR project in Pulau Langkawi. Additional experiences include:

- Developing an EPR regulatory framework for household E-waste in Malaysia
- Conducting pilot projects on collection, reporting and recycling of household E-waste under the EPR model
- Reviewing possible EPR for additional products including florescent lamps, rechargeable batteries and small home appliances
- Carrying out a feasibility study for the conceptual design of an EPR model for the collection and recycling of used disposable diapers in Malaysia
- Development of a used tyre collection and recycling scheme based on the EPR concept in Sarawak (legal enactment, levy charge, feasibility study)

Dr Panate Manomaivibool is Assistant Professor and Head of the Research Center at the School of Science, Mae Fah Luang University, Thailand. He graduated from the International Institute for Industrial Environmental Economics (IIIEE, in Sweden) in 2011 under the supervision of Dr Lindhqvist, and he has been at the forefront of EPR advocacy in Thailand. He has been assisting the Pollution Control Department (PCD) in drafting legislation for the management of WEEE and packaging waste. He initiated the movement called Chiang Rai Zero Waste which helps local governments in the province reduce waste disposal, and he

designed a household hazardous waste management system for the Chiang Rai Provincial Administrative Organisation. His research centre, Circular Economy for Waste-free Thailand (CEWT) works with both NGOs and companies to advance voluntary EPR and CE. He has published extensively about EPR in leading journals.

Mr Pranshu Singhal is the Founder of Karo Sambhav which designs and implements transformative Circular and EPR solutions by collaborating with producers/brands. Karo Sambhav has been creating a grass-roots ecosystem to set up robust India-wide solutions on collection, recycling and secondary material management of multiple types of waste including e-waste, plastics, batteries and glass. The company's technology platform and systems foster good governance, fairness, trust, transparency, and traceability. Prior to Karo Sambhav he worked as Director of Digital Learning Strategy for Microsoft, and as Head of Sustainability for Nokia. He was awarded the Social Entrepreneur of the Year 2021 India award by the Schwab Foundation, a sister organisation of World Economic Forum. He is an Aspen Fellow, Ashoka Fellow, Societal Platform Fellow, Chevening Gurukul Fellow, and Aspire Circle Fellow. Pranshu has a Master's degree in Environmental Management and Policy from the International Institute for Industrial Environmental Economics (IIIEE) in Sweden.

Dr Thomas Lindhqvist has worked as an Associate Professor at the International Institute for Industrial Environmental Economics (IIIEE) at Lund University since its creation in 1995. Since the mid-1980s he has worked in research and consulting on environmental product policy, with a special focus on the end-of-life management of products. He coined the concept of 'Extended Producer Responsibility' in a report to the Swedish Ministry of Environment and Natural Resources in 1990. Since then he has worked with various stakeholders, governments, industries and environmental groups in Sweden and globally. He has supervised masters and PhD theses on EPR and other topics related to sets of different products and for different parts of the world. Thomas introduced much of the terminology that is used to describe EPR systems, such as the different types of responsibility: economic, physical and informational responsibilities. With his colleague Erik Rydén he proposed the first elaborated system of individual responsibility in a work with the Car Industry Association. He has participated in the development of EPR ideas and systems throughout Europe as well as on other continents.

1. Introduction to EPR and Circular Economy

The 1980s was the decade that noticed the environmental impact of industrialisation from the perspective of how products are consumed and what constitutes the life cycle of products. Most of the industrial impact that was studied up to this time had to do with manufacturing units and raw materials extraction and processing. After many of these issues had been addressed in national environmental policies, the relative share of the environmental impact of the later stages of product life-cycles became more apparent, and the need for developing and introducing new polices for both consumption and end-of-life stages of manufactured products life cycles stood out more clearly.

Waste-related problems became more obvious not only through research, but also just by looking directly at them. Researchers became aware that landfills were filling up and that there were problems creating new ones. Landfill emissions became notorious both for leaching out into water courses and for evaporating; in addition, waste items were being blown out of them by the wind, and as such landfills became recognised as an important source of climate change. Further research revealed that much of the waste in landfills barely degrades and thus remains intact and almost unaffected over long periods of time. Other waste treatment such as incineration came under scrutiny as their emissions became better known and their effects more clearly understood. Just as for the landfills, better (and more expensive) designs for incineration facilities began to receive more support from governments, academic research, the public and more stakeholder groups.

Discussions about the possible depletion of raw materials and the problem of littering in nature and in the built environment have become more frequent. Consumption levels are increasing and the life cycles of many products are growing shorter, while reuse and recycling by individuals and in society is rapidly decreasing as the price of new products becomes lower, and purchasing power meanwhile increases.

As a result, in many countries there are discussions among researchers and decision-makers about new policy approaches that could guide product development from a consumption and production perspective. Waste management and recycling are among the key focal points. It has become clear that when addressing waste issues, the question is not only whether the necessary resources for waste management and recycling will be available, but also to design and redesign products that are better for recycling and re-use, cause fewer problems in all forms of waste treatment, as well as being durable and resource-saving.

In 1990, the German Government presented a proposal for new legislation for packaging waste and, in a report to the Swedish Government, Thomas Lindhqvist at IIIEE, Lund University, proposed a new strategy to use in product-related policies, Extended Producer Responsibility(EPR), namely to move responsibility for waste management to producers. This shift in responsibility will provide a better way to gather the economic resources needed to improve waste handling. By collecting fees from companies, the consumption stage will become the focus for resourcing the money, and this can encourage people to adjust: consuming only when they need something. This is what constitutes the financial responsibility of EPR.

But EPR is also proposing that producers be held responsible for the physical aspects of waste management and recycling. This will encourage the producers to work in ways that will make the management economically efficient through changes in the design of both products and systems for collection and recycling of products. This does not mean that every producer will have their own waste management system, any more than companies in general not covering all phases of product life cycle with their own facilities. Instead, producers can subcontract services out to other specialised companies, e.g. for transports, raw material extraction and provision and so on.

EPR has now rapidly spread throughout Europe and to many other countries. In the early 2000s there were many systems for managing waste streams from packaging, electric and electronic equipment, and cars and batteries. This latter sector came under EPR legislation in 2006 for the EU member states. Other countries have introduced similar legislation as well for products from other sectors.

Many countries in Asia have either introduced EPR legislation or are today developing EPR legislation. Our project has gathered information that should be useful for developing such systems with the focus on Asia. It has also been important to reflect the CE perspective and includes this in the elaborations of future EPR development. In our view CE helps to put emphasis on high-quality recycling, as well as measures to improve durability and reuse of products. High-quality recycling means that we should strive to return materials back to producers after recycling so that they can be used for the same purpose, or for as advanced a purpose as possible. This means that recycling must be improved through collection, sorting and treatment measures to avoid materials downcycling. It also means that we should strive to improve the durability of products by making them more repairable and encouraging their reuse.

2. European experiences with EPR

Extended Producer Responsibility (EPR) developed rapidly in the EU. The general design of the systems has been that producers gather in so-called Producer Responsibility Organisations (PROs),collect fees from producers for the products put on the market, and then organise waste collection and recycling to various degrees. In some countries, PROs organise the collection of discarded products by selecting waste collection companies and paying for their services. In other countries, cooperating municipalities are paid by the producers through the PRO to organise waste collection using their own services or subcontracting to waste management companies.

In some cases there is only one PRO in a country for a specific product group, but it is also quite common to find competing PROs. Such competition makes it possible for producers to select a PRO with the best offer, economically and in other aspects. Normally, when there is more than one PRO in the same market the idea is that the PROs will compete to offer better services to the producers. However, the risk is that the PROs do not compete with higher-quality services, but rather with lower fees made possible by lower-quality work, or by work based on incorrect data, e.g. by reporting exaggerated waste collection amounts. This phenomenon can also take place without competitive PROs if there is a reason to show higher collection results because of legal demands. To deal with such problems and make competition fair and not a 'race to the bottom' (that is, compromising the goals of EPR in attempts to get companies join their PRO), is to set up proper supervision, typically by instituting legal rules and monitoring the results. This in turn means that high demands are placed on governments to control the actors in EPR systems.When these controls do not work well, the system risks being compromised. This happened to the EPR for packaging in Germany some 7–8 years ago, when reported results were not always found to be accurate (Spasova 2014). This forced the German government to introduce rules combined with effective supervision, making it more difficult for such unintentional situations to arise.

What has worked well in EU countries is to get citizens to participate, and to separate waste at the source according to established systems already set up in their communities. Awareness-raising campaigns and simple, convenient solutions are approaches that have produced good results. In many cases, the information is transmitted to children in schools, or even in kindergartens, and the children take part in informing and convincing their parents and relatives.

The cost for paying the fees to PROs is overall quite reasonable (or even very low) for the producers. This has also made it less interesting for many producers to spend either money or time improving the design of their products to save on EPR fees, mainly because PROs essentially work as collective organisations with the same fees for products of a similar type, regardless of the design or suitability for recycling. The fact is also that for most products the main cost is related to the collection stage and less so for the recycling – which can in many cases be profitable, and collected material can be sold to recyclers. This situation has led to a general lack of product design improvements since any benefits are less connected to real cost gains than to image gains. Image gains, that would in principle provide advantages on the market, seldom offer enough motivation to justify design changes. Which is to say that consumers seldom adequately understand or appreciate improved product features, so producers need other benefits to justify spending efforts on design improvements.

There is consequently a need for measures to create incentives for design improvements for new products. One measure in that direction is the modulation of EPR fees for PROs installed in more than one EU countries: products with specified features pay lower fees to these PROs. To make this possible there must be rules determining when such reduction of fees should be given by the PROs and, to control the implementation, the EPR fees have to published and controlled in some effective way. So far, this modulation is seldom sufficient to create proper incentives for design improvements as today the fees are rather low, and the modulation just means the reduction of an already low fee.

There are also ideas around increasing the demands for what is accepted as recycling. Today most collected waste material gets downcycled, meaning that the recycled material cannot be used for the

same purposes again, but must be used where the quality demands are lower, and often substantially lower. Standards and other regulations that are used to determine the quality of the recycling could help by rewarding products that lend themselves to improved recycling, and processes that take advantage of such improvements. Approaches like these can create more incentives for designing products and recycling processes to achieve better recycling results. The same is also true for the durability of products, through better design and more repairability.

What should be understood is that municipalities in Europe often cover waste management costs by fees that are paid directly to them and that the municipalities are able to raise rather substantial funds without relying on money from national governments. This is important as waste management costs in the modern society are rather substantial, which is limiting the possibilities for introducing systems that work well in many places – in Asia, for instance. EPR is also a way of adding funds to the area of waste management from sources other than municipal fees and taxes, something that is attractive to many municipalities. This does not mean that all municipalities are happy about giving up even partial control of their administrative supervision. However, it has led to a compromise where many countries have built the EPR system so that producers provide financing (or part-financing), while municipalities retain the control of these waste management areas.

It is also important to understand that the markets for collected waste for recycling can be very limited in EU countries, even more so if the collected materials are mixed or badly sorted. These cases, such as for most plastics, lead to exports outside the EU, either legally or illegally. The role of the so-called informal sector is also very limited in the EU compared to many Asian countries. It does exist, but more often for products with a high value on second-hand markets, domestic or foreign, such as mobile phones and computers. Citizens also do not expect that they will be paid for discarded products, with the exception of mobile phones and computers, and even these are more often just taken to recycling centres.

A final comment is that since the EPR systems were implemented in the EU a few decades ago, a real change has been seen in the management of the discarded products in designated product groups. The separate collection of discarded products such as packaging, electrical and electronic equipment, and batteries has grown very substantially, and facilities for sorting and recycling have equally become more wide-spread and more advanced. In conclusion, EPR has achieved much in the EU, but there are still various areas that can benefit from improvements. An overall goal should be to aim to achieve the ambitions of a society built on the circular economy approach, and within this context to create incentives for improved durability and product repairability. Within such a framework, at the end of product life, recycling will lead to materials that can be the basis for manufacturing products that require good quality raw materials. Such a strategy would also make more raw materials available in Europe and support local manufacturing.

3. EPR in Asia & Circular Economy: India Scenario

India is now the third largest economy by purchasing power parity (PPP) in the world, after China and the United States of America, as the result of rapid industrialisation and population growth. Economic opportunities have also led to rapid urbanisation (Lahiry 2017).

Over 377 million urban people live in 7935 towns and cities and generate 62 million tonnes (t, metric tonne) of municipal solid waste per annum. Only 43 million t of the waste are collected, out of which 11.9 million t are treated and the remaining 31 million t are dumped at landfill sites (Larhiry 2017).

According to *Global E-Waste Monitor* 2020 report, India has generated 3.2 million t of e-waste in 2019, ranking third after China (10.1 million t) and the United States (6.9 million t) (Vanessa Forti, 2020). India has collected 10% of the e-waste which is estimated to be generated in the country in 2018–2019, and 3.5% of that generated in 2017–2018 according to a Central Pollution Control Board (CPCB) report (Board 2020). There is a significant gap between the amount of waste generated and the amount collected for recycling, which needs to be assessed to make resource efficiency effective in India.

Between 2013–2014 and 2016–2017, official data reveal a 1000% rise in tonnes of batteries sold in India. About 86% of the lead used worldwide is for the production of lead acid batteries, most of which are recycled formally or informally (Upadhyay 2022). The global lead acid battery market is projected to reach USD 52.5 billion by 2024, up from an estimated USD 41.6 billion in 2019. This demand has created a large and thriving informal economy around the disposal of lead acid batteries in South Asia. According to a study by Toxics Link, a New Delhi-based non-profit that campaigns against industrial and other pollution, in 2017–2018,1.2 million t of batteries entered India's recycling industry, 90% of which was processed informally. In addition to lead acid batteries, the recent development of electric vehicles and solar energy has driven an exponential rise in battery production.

To tackle the challenges of waste, the Indian Government has taken the lead among the South Asian Nations to chart out EPR regulations for multiple product categories starting with E-waste, plastics packaging waste, batteries waste, and tyre waste.

Depending on the product category, today the rules based on Extended Producer Responsibility (EPR) define the roles and responsibilities of many stakeholders, including producers, bulk consumers, consumers (waste generators), recyclers and regulatory agencies. The producers are responsible for the end-of-life management of the products they place on the market. They are required to ensure that a certain percentage of the 'end-of-life' products are collected back and recycled in an environmentally safe manner. The implementation of the rules lies with the central and State pollution control boards/committees.

3.1 Observations from EPR Implementation

EPR in India started being implemented in a systemic way in 2017 when both E-waste and plastic waste rules, with collection targets for producers, were introduced. The introduction of EPR-based regulations has led to many positive changes in the Indian market. The ones which have proved to be crucial are mentioned below:

- The producers in the sectors where EPR regulations were introduced started to recognise that they needed to take some action.
- The adoption of the EPR regulations was catalysed by the Port authorities who were given the power to stop imports from producers who did not have a valid EPR authorisation issued by the regulators. This stringent action by the Port authorities induced those producers who were not actively pursuing registration in the EPR rules to get started in some way.
- Prior to the introduction of the rules, the dialogue used to be *Why should we participate and fund these systems?* This dialogue has now fully shifted to *How do we participate?*

- The ecosystem comprised of both collection and recycling actors has started to evolve.
- Some Producer Responsibility Organisations (PROs)/producers have started creating systems for including informal sector groups/workers by formalising them.
- The dialogue at an industry and sector level has increased many-fold with a wide range of events being organised on a regular basis focusing on EPR implementation, challenges, ways of improving, and enabling circularity.

To enable material Circularity via EPR on the scale of entire country population, there are three distinct areas, each of which needs dedicated action. An important point to consider for formulating EPR-based rules is that up to now they have been subject to manipulation, leading to the establishment of large-scale malpractice. If the EPR policies are not well-monitored and -regulated, then the possibility for misreporting the collection and recycling numbers is very high.

Collection Infrastructure & Systems

Collection systems enable ease of participation for people to give away or discard their old products or packaging waste for recycling. By interacting with these systems, people also start to become aware of the various aspects of recycling – why recycle, what is my role in enabling recycling, etc. A broad, easily accessible, well-structured and robust collection network is at the core of a healthy EPR-based ecosystem and is essential to achieve the goal of enabling circular economy (CE).

People and bulk consumers need a widely distributed, formalised collection network covering homes, offices, institutions, and public spaces that they can readily access to play their role. The behaviour of people varies depending on the type of waste. Generally stating, while people give away/drop off low value waste like plastic packaging, they expect financial returns if they give away e-waste or batteries.

Although collection systems are mentioned in the EPR regulations, a further strong emphasis is required to define the nature, geographic scope, structure, financing the setup and functioning of these systems. The clearer the rules on collection systems, the better their implementation and effectiveness will be. EPR regulations must consider encouraging the use of existing private/public infrastructure like retail stores, customer care centres, repair shops, municipal spaces, post offices, Common Service Centres and so on for wide scale collection. The EPR regulations should also mention the need to create awareness among consumers on their role in enabling CE and thus inspire them to recycle. It is important that any regulations in this area clearly lay down details of what needs to be done to raise awareness that is actionable and will lead to an increase in formal collection rates.

In most emerging markets, the role of the informal sector is well-defined for both collection and recycling. However, owing to a lack of economic capital and limited access to technology, the methods employed by the informal sector for collecting, sorting, and managing the collected waste are risky and unscientific, leading to a serious impact on human health and the environment. It is imperative to create solutions where informal sector actors can become a part of the formal collection networks. Such solutions must ensure social equity, safe working places and practices, and fair wages for the competence brought by the workers from the informal sector.

It has been observed that even intermittent monitoring of collection systems by State Pollution Control Boards (SPCBs) or other enforcement bodies has led to a strengthening of the collection systems. An efficient and rigorous monitoring system of the collection mechanisms has the potential to catalyse the set-up and maintenance of these systems which are fundamental to enabling public participation.

Recycling Infrastructure & Systems

In recent years, with the advent of EPR-based regulations, there has been a growth in creating dismantling and recycling units in the country. There is a critical need to systemically guide the set-up and functioning of these recycling units by bringing in standards, environmentally sound technologies with a focus on depollution, strict monitoring mechanisms, harmonised ways of reporting, and benchmarking.

Efficient and effective recycling systems enable material recovery from the collected end-of-life products/ waste that are the largest source of secondary raw materials. However, for a very wide range of composite

materials, material fractions, and components, there are still no technical solutions which enable circularity. Except for metals, most of the materials either cannot be recycled easily or can only be downcycled. EPR policies must put special emphasis on the recovery targets for various fractions and enable pathways for developing technological solutions to enable circular use – and these are largely missing today.

Secondary Material Utilisation Systems

Secondary material utilisation systems enable reutilisation of the recovered materials to substitute for virgin materials in the manufacturing of new products. Secondary materials deriving from the recycling of post-consumer waste are mostly heterogeneous and thus difficult to reuse for creating new products. Re-engineering solutions are needed to ensure that the technical properties of the recovered secondary materials can be brought to a level where they are ready to replace virgin materials going into similar products. The material from the recycling unit finds its way back in the economy mainly for downcycling uses.

3.2 Lessons Learnt from the Present System, and the Way Forward

Need to Create a Level Playing Field

In the current system, critical and regulated stakeholders of EPR are all treated the same, irrespective of the quality of work they do. The current monitoring mechanisms do not have the breadth or capacity to analyse the data, conduct regular and deep audits, and assess the work being reported. This then leads to a situation where document submission starts being construed as compliance. This further causes malpractice to arise in the system, e.g. double counting, reporting targets without collection/recycling being done, misreporting. Lower compliance costs become the sole decision factor leading to a 'race to the bottom'.

In a typical regulatory setting, the concern for agencies is to ensure that the regulated entities are complying with the legal requirements while letting them choose the mechanism through which the requirements are met. Improving the effectiveness of regulatory enforcement requires making compliance actions and regulatory actions publicly available for the scrutiny of interested stakeholders.

To enable a level playing field, EPR based regulations can introduce radical transparency and public disclosures of data, showcasing both the fulfilment of obligations by the stakeholders as well as what has been done by producers, PROs, recyclers, retailers, public authorities, municipalities. Non-confidential data sets could be made available on public platforms for scrutiny. Such systems can create deterrence against malpractices and enable a level playing field.

Ensuring Sustained & Fair Financing of the System

The existing EPR regulations leave the financing of the system to market-based mechanisms and do not provide any guidance on how far funds should go for setting up collection systems, ensuring recycling and enabling the use of secondary materials.

Lack of guidance and an absence of benchmarks for the costs of compliance at an end-of life product level is leading to the aforementioned 'race to the bottom,' which essentially leads to poor quality collection and recycling systems along with a range of malpractices. At present the costs being met by the producers themselves, or the PROs or recyclers (on behalf of the producer), are neither being reported nor assessed by the regulators.

To create a deterrence towards wrongdoing and operating on unrealistic costs, it is important that the producers are asked to declare at least the total overall costs as a part of compliance reporting. Some of the costs incurred would be similar for various types of products/packaging waste, but other costs will vary with the type of end-of-life products/packaging waste. The breakdown of compliance costs includes: awareness costs/kg, collection and procurement costs/per kg, sorting costs/kg, logistics costs/kg, recycling costs/kg, and infrastructure costs/kg.

The EPR-based rules could create provisions for producers to have dedicated budgets linked to the products put on the market (spend/kg) for creating awareness, and for setting up collection systems and recycling. At the end of the year, the producers could be asked to declare to regulatory bodies the amounts they have spent, or these could be made available in the public domain. These data can then be assessed to conduct audits to estimate whether expenditures are adequate. This will perhaps create a deterrence to working at unrealistic costs of compliance.

The costs of compliance essentially cover the viability gap funding for a function system. It is of most critical importance that the EP-based regulations ensure optimal, sustainable, and fair finances for setting up and operating the system.

To ensure longevity and optimal infusion of funds, EPR-based policies should create a context in which the producers can easily pass on the costs of compliance/going circular to the consumers/bulk consumers who buy the products. This will lead to some increase in the average selling price (ASP) of the products. However, from our experience such increases will be minor in most cases and will depend on the product and its existing ASP.

EPR policy must include initiating research to assess the costs of compliance, and what the increase in the average sales price of various types of products put on the market will be if the costs of compliance are passed on to the consumers. A big chunk of the data for doing such research will already be available with the producers, PROs and recyclers. EPR policies should align the financial model in a way that leads to a level playing field and encourages all actors to play their role justify and be compensated fairly for their contribution.

The true cost of compliance, once established (and revised year after year), can help avoid adopting malpractice as well as provide a level playing field for the stakeholders.

Digital Process Flows and Monitoring Systems

A centralised digital system for effective end-to-end monitoring of EPR implementation is a must. Digitising the entire process, from submission of all documents pertaining to EPR compliance to monitoring implementation, facilitates the task of each actor, and integrates accountability and transparency across the value chain. Each actor should have their own digital interface and computer screen for participating in the system. The experience from five years of implementation has shown that there are massive amounts of data which need to be submitted, monitored, and assessed to ensure success in implementation and to drive circularity. Use of AI and machine-learning-based tools can offer great help to the enforcement bodies.

Digital systems will also enable the free flow of data among all enforcement bodies at all levels, and among the various actors. Digitising the information and data will also help stop the challenge of information asymmetry that currently exists among different levels of regulators about producer targets, collection channels and related datasets, awareness mechanisms and related datasets, sorting/dismantling/recycling and related material balance datasets.

This digital system should be developed so that the following data are monitored:

- EPR plans, producers' budgets, and actual costs/spending
- Data on collection/procurement & movement of waste from one node to another, e.g. from retail/bulk consumer to PRO, PRO to dismantler/recycler, recycler to secondary materials
- Awareness activities for mobilising and engaging citizens across the country
- Mass-balance of input and output fractions, and resource recovery data

Detailed reporting of both input and output fractions of end-of-life products/packaging will also help to generate the inventory of secondary raw materials at both state and national levels, and eliminate leakages and malpractice. EPR rules must make it mandatory for the relevant actors to report their input and output fractions using a reporting tool/format. The formats for the reporting should be harmonised

with international formats like WEEE Forum Reporting Tool (WF-Rep Tool)[1] which will allow datasets from multiple countries to be compared. The benefits of such reporting would include:

- Ease of auditing recycling certificates
- Taking inventory of secondary materials, and creating a national secondary materials database
- Identification of material fractions (and their volumes), which as yet does not have a solution in India
- Enable setting up cross-sector circular solutions

Building and practising an 'All Actors Approach'

Well-defined roles, and allocating responsibilities across the stakeholders are of critical important for the success of EPR and to enable CE. The responsibilities are to be allocated in a way that they follow the MECE (mutually exclusive but collectively exhaustive) principle. The current regulations have considerable overlap in the roles of PROs, dismantlers and recyclers – which dilutes the responsibilities of each entity within a well-functioning EPR framework.

Some of the roles that need to be strengthened include, but are not limited to:

PROs – The PROs work on behalf of producers and support them by taking on their mandate to fulfil EPR obligations. PROs are acting as infrastructure development organisations, as well as collection agencies whose focus is to create awareness and set up common collection systems on behalf of the producers. With responsible PROs, SPCBs also have an agency with whom they can collaborate for data, joint awareness campaigns, collection drives, bulk consumer collaboration, capacity-building initiatives, etc. The rules should also explicitly state who can and cannot be a PRO.

A *PRO* and a *recycler* are distinct entities mutually exclusive in their areas of competence and work. A PRO creates systems for collection and passes on the collected material to recyclers. PROs work as an extended 'arm' of the producers to ensure that processes are kept in check.

Dismantlers – The dismantlers collect e-waste and segregate the hazardous and non-hazardous fractions. Non-hazardous fractions can be processed locally, whereas hazardous fractions like printed circuit boards (PCB), capacitors, polyurethane, CFCs, oils, and batteries must be sent to the appropriate recyclers for responsible processing so as to reduce environmental impact and logistics costs.

Recyclers – This group recycles specific types of waste material and fractions after the dismantling/ sorting step at their unit, which needs to be authorised under EPR regulations. However, in many cases recyclers get umbrella authorization, which does not specify what fractions they really can recycle. The rules could specify whether the recycler is authorized to recycle a printed circuit board (PCB), polyurethane, CFCs, oils, batteries, or certain types of plastics. At present the system of authorising the recyclers across categories needs significant improvements.

Informal Sector – Since the informal sector plays a predominant role in collection activities, their role must be recognised and specified in the regulations.

Waste pickers – These are persons or groups of persons informally/formally engaged in collecting and recovering reusable and recyclable waste at the source of initial waste disposal (generation), e.g. streets, bins, the dwellings of domestic consumers, offices etc., in order to sell to recyclers directly or through intermediaries to earn their livelihood.

1 https://weee-forum.org/wf-reptool/

Enablement of Scalable Recycling Technology

Driving circularity via EPR would mean increasing the efficiency and output quality at the recycling end. An efficient recycling system must focus strongly on depollution practices, management of hazardous fractions and recovery of various materials. EPR-based regulations must include recovery targets covering a) hazardous fractions, b) fractions which have a high environmental load, and c) critical materials like rare-earth elements/metals.

Regulations can specify and classify various types of technologies in categories such as preliminary treatment, interim treatment, and final treatment. Recyclers can then be given authorisation in accordance with the treatment solutions they are deploying.

The enablement of Material Balance Reports (MBR) will support implementing the above recommendations as well as create a repository for all approved solutions to be stored efficiently.

Standards across the Waste Value Chain

There is a need to establish standards for the complete waste value chain to ensure higher efficiency within the system. These standards should define the requirements on how collection, logistics and treatment of waste should be done. The benefits of standardisation include:

- Better depollution practices
- Better recycling rates
- Enabling resource efficiency & CE
- Creating a level playing field for all stakeholders
- Promoting the adoption of the best available technologies
- Fairer competition among recyclers
- A smaller grey/informal market in the recycling industry

A 2018 study, *Enhancing Resource Efficiency through Extended Producer Responsibility* (EPR) (EU-REI 2018), as well as the *Strategy on Resource Efficiency in Electrical and Electronic Equipment Sector* (2019),[2] highlighted the importance of standardisation, research and development.

The transition of the waste sector from a semi-informal to a formal and regulated economic sector can be successful only when standards are implemented and adhered to by the entire value chain including producers, PROs, recyclers and all other relevant stakeholders.

Review Mechanisms and Evolution of the Rules

A system for regular review of the rules must be brought in with feedback and representation from major stakeholders including producers, recyclers, PROs, digital platforms along with environment-focused NGOs and relevant government agencies. Dataset assessment should advise decision-making in terms of how the rules should evolve.

2 https://www.eu-rei.com/pdf/publication/NA_MeitY_RE%20Strategy%20in%20EEE%20Sector_Jan%202019.pdf

3.3 Conclusion

In a developing country like India, which has a diverse geographical spread, managing different types of wastes and implementing EPR is a complex challenge. Since the EPR regulations were released for e-wastes, battery waste and plastic packaging wastes, there has been a gradual improvement in the formal collection and recycling systems. Stakeholder awareness of the need for responsible recycling of products has increased, thereby resulting in some behavioural changes with respect to consumption and disposal.

However, it is critical that regulatory and governance gap be closed by using the lessons learnt from five years of implementation. These lessons can catalyse the good work that has been accomplished while at the same time closing the loopholes that have surfaced and are harming the system. Most importantly, monitoring and enforcement mechanisms must ensure that the 'race to the bottom' is stopped, and ensure that each and every stakeholder is held accountable and liable for their part of the work in the value chain. The caveat is that any drastic changes to the rules can potentially disrupt ecosystems that have started to recover.

For a successful implementation of the EPR framework, an #Allactorsapproach – which involves participation of producers, dealers, retailers, collection systems, consumers, dismantlers, recyclers, and the Government, along with the PROs which foster the cooperation and active participation of all stakeholders in the system – will be essential to enable a CE.

For true transformation, a step-up approach is important: businesses cannot just be driven by compliance or fear of regulation. EPR must be linked to the wider goals of driving circularity and should be regarded as a solution to resource efficiency. Stakeholders, namely policy-makers, producers, PROs, and recyclers are all starting to realise that EPR can promote business models which are circular.

However, EPR regulations have also caused critical gaps within the system to surface, and these gaps need to be addressed to pace up India's transition to a CE.

1) Product design must be reassessed for better recyclability of products as well as elimination of materials that are problematic to recycle.
2) Funding remains one of the bottlenecks for implementing entire country population-scale collection systems.

4. EPR in Asia & Circular Economy: Malaysia

4.1 Brief introduction on solid waste management in Malaysia

Solid waste management in Malaysia is regulated based on two primary waste categories, hazardous waste and non-hazardous waste. Each category is regulated and supervised distinctively by different ministries and government agencies or departments.

Hazardous waste (both solid and liquid) is defined as any waste falling within the categories of waste listed in the First Schedule of the Environmental Quality (Scheduled Wastes) Regulations 2005.[3] The Environmental Quality (Scheduled Wastes) Regulations 2005 is enacted under the Environmental Quality Act 1974 (Act 127) and is applicable to all of Malaysia. Hazardous waste (also referred to as 'scheduled waste' in Malaysia) is managed by the federal government[4] under the Department of Environment (DOE) Malaysia, Ministry of Environment and Water (KASA), whereas non-hazardous or non-scheduled waste in Malaysia generally refers to municipal solid waste (MSW), which includes solid waste from households, commercial, institutional, and industrial entities (except for hazardous wastes).

MSW in Malaysia is traditionally regulated under the Local Government Act 1976 (Act 171), under which the solid waste management system (collection, treatment and disposal of solid waste) in each state is administered by the local councils. Under Act 171, the solid waste collection system is collected either by the local council itself or by an appointed private agency or concessionaire.

One of the key challenges faced by the local councils is the **lack of financial and technical resources** to implement modern solid waste management treatment and disposal facilities. In response to this major issue, the federal government of Malaysia decided in 2007 to centralise and transfer the regulation of MSW from state governments and local councils to the Ministry of Local Government and Housing (KPKT) under the Solid Waste and Public Cleansing Management Act 2007 (Act 672), with the exception of the States of Sabah and Sarawak, which are autonomous and regulate their own solid waste management. Act 672 empowers the federal government of Malaysia to take over the management of solid waste (including collection, treatment and disposal of solid waste) from state governments and local councils to ensure uniformity of law relating to the management and regulation of solid waste and public cleaning in Malaysia.[5]

As previously mentioned, the KPKT of the federal government is responsible for overseeing the management of solid waste, with the main role of the ministry being to draft policies and provide advice to the federal government, state governments and local councils in regards to solid waste management. Following the enforcement of Act 672, the National Solid Waste Management Department (JPSPN) was established under the KPKT to coordinate the implementation of national solid waste management and public cleansing policies between the federal and state governments as well as the local authorities. JPSPN is also responsible for regulating the policies on solid waste management and the national 3R policies.[6] In addition, the Solid Waste and Public Cleansing Management Corporation (SWCorp), was established by KPKT in 2008 with the authority to manage and enforce laws pertaining to solid waste and public cleaning under the Solid Waste and Public Cleansing Management Corporation Act 2000 (Act 673).

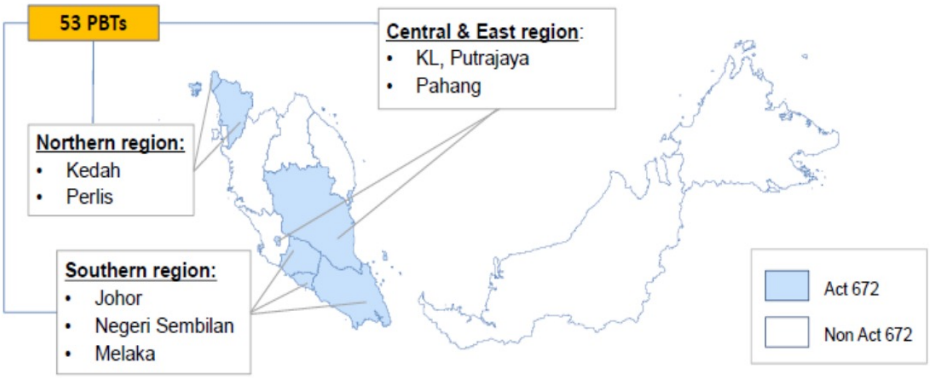
However, not all states in Malaysia are included in Act 672 and are separated by 'Act States & federal territories' and 'Non-Act States'. This means that currently, in Malaysia, solid waste management in 'Act States' is managed under the federal government, whereas 'Non-Act States' in Peninsular Malaysia remain regulated by the Local Government Act 1976. Sabah and Sarawak are regulated by their own local laws and regulation, i.e. the Local Authority Ordinance 1996 (Chapter 20) in Sabah and the Local Government Ordinance 1961 (Sarawak No.11 of 1996) in Sarawak (see Fig. 1).

3 https://www.env.go.jp/en/recycle/asian_net/Annual_Workshops/2012_PDF/D1S1-2[MALAYSIA]rev.pdf

4 Malaysia practices Federal constitutional Monarchy with governments at State levels, coordinated centrally by the Federal Government. Malaysia consists of thirteen states and three federal territories. All state governments are represented at a lower level by Local Governments.

5 https://www.researchgate.net/publication/324799506_Solid_Waste_Separation_at_Source_among_Households_for_Sustainable_Solid_Waste_Management_The_Application_of_the_Solid_Waste_and_Public_Cleansing_Management_Act_2007

6 https://wwfmy.awsassets.panda.org/downloads/study_on_epr_scheme_for_packaging_waste_in_malaysia_wwfmy2020.pdf



Responsibility	Act 672 States	Non-Act 672 States
Implementation	GoM	Local Authorities
Cost	GoM with contribution from PBT	Local Authorities

Figure 1. Overview of Act and Non-Act 672 States

Source: SWCorp, July 2019

The Act States include Perlis, Kedah, Pahang, Negeri Sembilan, Malacca, Johor, Kuala Lumpur and Putrajaya. Following Act 672, the solid waste management in Act States are subject to several key policy enforcements, which include but not limited to: the collection of waste following the 2+1 rule (twice a week for solid waste, and food and organic waste, once a week for recyclables, bulky and garden waste), waste segregation from the source (Separation at Source - SAS) for recyclables, residual waste and bulk waste as well as the requirement to have a license for recycling agents and public cleaning services.

In addition, the distribution of free wheelie bins to residential households and similar areas (commercial and institutional within waste collection scheme areas), new waste collection vehicles, and scheduled solid waste collection were some of the efforts mandated by JPSPN to ensure the applicability and progression of the Act. The major players in the waste collection system are the concessionaires, namely Flora Sdn Bhd, E-Idaman Sdn Bhd and SWM Environment Sdn Bhd, which were appointed through Act 672 and are monitored by SWCorp (see Fig. 2).

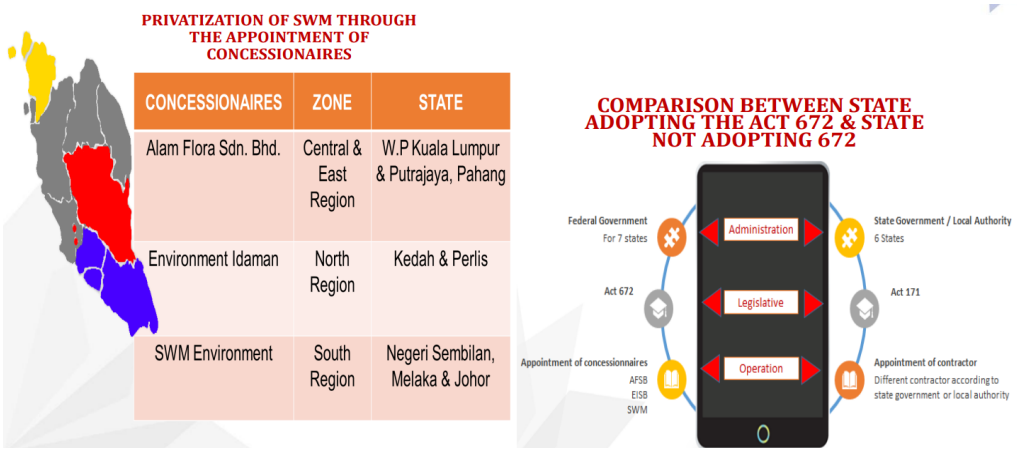


Figure 2. Current waste collection system

Source: SWCorp, July 2019

However, the collection coverage of the concessionaires does not cover all of the areas in their designated Act States, because of limitations such as concession waste collection scheme areas, road accessibility, cost, etc. In the 2+1 rule of Act 672, households and household-similar are required to place their generated solid waste in waste bins for curbside collection and segregation prior to collection and transportation of waste to either recovery sites for a secondary sorting of recyclables, or to a landfill or incineration sites for disposal. Meanwhile under Solid Waste and Public Cleansing Management (Scheme for Commercial,

Industry and institutional solid waste) regulations 2018, all institutional, commercial and industry (ICI) premises are required to dispose of solid waste generated by their activity/process on their own or by using private contractors.

For 'Non-Act states', which include Perak, Penang, Selangor, Kelantan, Terengganu, Sabah and Sarawak, the waste management system may be similar to that in the Act States depending on the management system employed by the local council. However, a major difference that can be observed is that non-Act states do not have to conform to mandatory waste segregation (Separation at Source – SAS) enforced in Act States effective 1st September 2015, and it is up to the state government and local council's discretion.

The key disposal method of MSW in Malaysia is landfill (mostly dumpsites). Only a few of the landfills are properly engineered sanitary landfills, while all others are open dumping sites with hardly any pollution control in place. Malaysia is proposing to establish large scale waste-to-energy plants in several large cities such as Kuala Lumpur, Seremban and Melaka, but none of these plants is in operation yet.

Recycling in Malaysia is mainly driven by informal sectors (from street-pickers, recycling collectors and agents to larger recycling aggregators) and covers essentially only material with recycling value, e.g. paper, metal, some types of plastics such as PET or HDPE. A majority of post-consumer packaging wastes, such as composite plastics, multilayers and laminates, are not sorted at source or recycled. The key challenges limiting the recycling rates in Malaysia are related to lack of recycling infrastructure and facilities, lack of willingness to source separately, as well as the lack of a recycling ecosystem (i.e. the availability of recycling technology, and lack of demand from manufacturers to utilise recycling material) for certain recyclable materials.

Under Act 672, the government makes it mandatory for residential households to separate their waste at source into recyclable waste, residual waste, and bulky or garden waste. This mandate is enforced under the Separation at Source (SAS) Regulation introduced in September 2015. The types of recyclable wastes that need to be separated according to groups are paper, plastics, and others which are glass/ceramics, metal/steel/aluminium cans, electronic waste/small electronic appliances, leather/rubber/shoes/fabrics, hazardous waste, bulky waste, and garden/farm waste. To date, the SAS implementation has not seen a high success rate due to the lack of enforcement as well as the lack of a proper recycling supply-chain ecosystem execution.

4.2 EPR in Malaysia – Existing legislation and proposed approaches

The subject of Extended Producer Responsibility (EPR) in Malaysia is not unknown, and has been mentioned in several policy and roadmaps announced by the federal government in recent years. Relevant policy that has mentioned EPR include the SDG Roadmap for Malaysia (Phase 1: 2016–2020), Malaysia's Roadmap towards Zero Single-Use Plastics 2018-–2030 and the Formulation of National Cleanliness Policy 2020–2030. In SDG Roadmap for Malaysia (Phase 1: 2016–2022), published by Economic Planning Unit of Prime Minister's Department (Malaysia) and the United Nations Country Team, under the approach to substantially reduce waste generation through prevention by 2030, Malaysia will expand the implementation of the polluter pays principle, take-back system and extended producer responsibility among others.[7] In Malaysia's Roadmap towards Zero Single-Use Plastics 2018–2030 published by the Department of Environment and Water (KASA), it was stated that EPR will be one of the approaches to tackle plastic sustainability in Malaysia.[8] The roadmap portrays EPR as a catalyst to enhance plastic sustainability with the initiation of voluntary scheme in 2026 and mandatory scheme by 2030 thereafter. In the Inception phase, the EPR scheme will be proposed in 2021–2022, with a preparation period for the industry players, government and relevant organisations to get accustomed to the practices of EPR adoption prior to transitioning to the Voluntary EPR Phase (2023–2025), and thereafter the mandatory EPR scheme in 2026. Generally, the operational cost of the eco-modulated fees will be funded by participating parties, and the independent organisation Producer Responsibility Organisation (PRO) will oversee the finance management system on behalf of the producers as well as the central network operation. In the National Cleanliness Policy 2020–2030 published by KPKT, implementation of the policy would focus

7 https://www.epu.gov.my/sites/default/files/2021-05/SDG_Roadmap_Phase_I_2016-2020.pdf
8 https://www.kasa.gov.my/resources/alam-sekitar/malaysia-plastics-sustainability-roadmap-2021-2030/24/

on five clusters, namely cleanliness awareness, environmental sustainability, circular economy, good governance, and enforcement and quality of awareness among the public. Under the circular economy (CE) cluster of this policy, EPR is seen as a strategy to promote recycling. Four (4) Actions Plans under this strategy were mentioned by the government, as follows: (1) Encourage the involvement of industry to implement Extended Producer Responsibility (EPR) through the EPR Implementation Plan, (2) Create an EPR Roadmap as a guide and reference for stakeholders, (3) Introduce the Reverse Vending Machine (RVM) to encourage recycling, and (4) Create a platform for engagement sessions between the government and industry, NGOs and educational institutions.

However, there are no successfully implemented EPR system in Malaysia that is operating at the moment. There are nonetheless a few pilot systems applying the EPR concept which have been or are currently being pilot tested. The waste type includes:

- Used tyres
- Household E-waste
- Post-consumer packaging waste

Used tyres

In the State of Sarawak, a mechanism incorporating the principles of EPR was introduced in 2005. With the support of the organisation Danish Cooperation for Environment and Development (DANCED), a used-tyre collection and recycling mechanism was developed by the Natural Resources and Environment Board of Sarawak.

Under the mechanism, a levy fee is imposed on imported and locally manufactured tyres at the selling point and the fee is directed to a used-tyre recycling fund. The recycling fund subsidises the collection and recycling of the collected tyres. A concessionaire was appointed for this system and a used tyre recycling plant was set up. A specific regulation was been enacted under the Natural Resources and Environment Ordinance 1999 to empower the implementation of this mechanism.

Although not introduced fully as an EPR mechanism, this is one of the earliest systems related to recycling waste that has been implemented in Malaysia. This system has not been replicated in other parts of Malaysia, and although it is currently still running, it faces a number of challenges.

Household E-Waste

E-waste is defined as a broken, non-working or old/obsolete electric electronic appliance, categorised as Scheduled Wastes under Code SW110, First Schedule, Environmental Quality (Scheduled Wastes) Regulations 2005 in Malaysia.

With the support of the Japan International Cooperation Agency (JICA), a proposed EPR system for household E-waste has been developed together with Department of Environment (DOE) Malaysia.

In this system, the recycling fees of the household E-waste are paid by the manufacturer/importer to DOE to disseminate funds and monitor performance. Thereafter, the registered collection centre will receive subsidies from DOE to receive and manage the E-wastes collected from the consumers. The application of EPR to E-waste should be able to divert more waste products from disposal areas with cost savings for the local government. It is hoped that this initiative will encourage improved product designs that are more durable and recyclable, and less toxic.

In DOE's E-waste EPR, generators refer to all individuals or entities where household E-wastes are generated and discarded into the system. These include an individual person, households, commercial entities and institutions. The generators are required to discard their household E-wastes into the formal collection channels through authorised collectors/collection centers.[9]

9 https://ewaste.doe.gov.my/index.php/about/responsibility-of-stakeholders/

Under this initiative, a pilot project on household E-waste collection and recycling has been implemented, and specific household E-waste legislation has been drafted and is in the process of enactment (see Fig. 3).

Figure 3. Overview of extended producer responsibility (EPR) for household E-waste under DOE and JICA

Post-Consumer Packaging Waste

In response to the Roadmap towards Zero Single-Use Plastics 2018–2030, a voluntary industry-driven PRO called Malaysian Recycling Alliance (MAREA) was founded in January 2021. MAREA currently consists of 12 members of the Fast-Moving Consumer Goods (FMCG) companies including Nestlé, Coca Cola, Colgate, Unilever and so on. According to MAREA, this Alliance is a voluntary industry-driven, multi-stakeholder solution to tackle post-consumer packaging waste issues. MAREA will serve as a not-for-profit, professionally run entity that acts on behalf of the industry as the interface between key stakeholders including the Malaysian Government. Each of companies will take its turn to helm the alliance every year, starting with Nestlé Malaysia Berhad in 2021. The Alliance's goals and objectives are:

- Collection for recycling for PET, HDPE and used beverage cartons (UBC)
- Collection for recovery/recycling of flexible packaging
- Maximising the use of recycled and renewable materials
- Avoiding post-consumer packaging materials leakage into the environment

By 2025, MAREA aims to reach a minimum recycling rate of 25% of members' packaging volumes. Other than material collection, they also conduct Consumer Education and Public Awareness (CEPA) activities to encourage behavioural change and spread awareness. In its initial stage, waste collection is focused on all post-consumer packaging materials and UBC, with a future target to expand towards post-consumer plastic service packaging and other material types such as paper grade, glass, aluminum and other metals.

MAREA is currently engaged with the first EPR feasibility study in Langkawi Island, initiated by the KPKT to analyze applicable approaches and strategies for the potential EPR pilot project. The location of the project was chosen because of its geographic location as an island, thus allowing easy monitoring of

product chain flow. The implementation of the EPR feasibility study is divided into 3 phases that will be administered for a period of 15 months. During the initial phase, a site survey will be conducted throughout Langkawi to obtain a thorough understanding on the local waste management system and the existing recycling system through survey interviews of travellers, households, commercial and institutional recyclers; a waste composition study; and stakeholder meetings. The subsequent Phase 2 is to conclude a model scheme that will be applied to improve existing system operations within a targeted area in Langkawi, thereafter scaling up the EPR system in Langkawi at Phase 3.

Some efforts are also seen on an individual industry level in Malaysia. Nestlé Malaysia Berhad has pioneered a voluntary EPR initiative on its own aimed at targeting the packaging waste of its end-of-life products in urban areas and increasing the awareness of managing packaging waste among the public since 2020 (see Fig. 4). Nestlé's voluntary EPR initiative is a pilot recycling programme involving household kerb-side collection (door-to-door collection) of Nestlé's end-of-life products. Nestlé's initiative involves local councils (local government of cities) and collectors, recyclers and also the community of the recycling programme. This programme has now reached a total of 85,000 households in the Klang Valley, including in Petaling Jaya, Subang Jaya, Shah Alam and the Greater Kuala Lumpur area, with over 2500 t of recyclables collected since its inception in 2020.[10] By the end of 2022, Nestlé Malaysia targets to reach 100,000 households in total. In addition, according to Nestlé, they are committed to ensuring that 100% of Nestlé packaging is recyclable or reusable by 2025. However, for the moment the focus by Nestlé Malaysia is seen only to be on household collection and sorting. Not many efforts have been made towards redesigning their packaging to reduce the waste burden or facilitate recycling.

Figure 4. Memorandum of Understanding (MoU) between Nestlé Malaysia and Shah Alam City Council (MBSA), 26 October 2021

Tetra Pak, on the other hand, has advertised that their entire Tetra Pak carton package including the straws and caps are recyclable.[11] According to Tetra Pak, their drink packs are made of 75% paper, 20% plastic, 5% aluminium and are 100% recyclable. Here in Malaysia, the plastic and aluminium layers can be extracted and recycled into roofing tile. It takes 7247 drink packs to make one 9 ft x 4 ft (2.7 x 1.2 m) roofing tile.[12] In Malaysia, the CAREton project of Tetra Pak (Malaysia) SDN Bhd (= public limited company) has collected more than 120 million used drink packs to be recycled into roofing sheets and panel boards to contribute to the construction of homes for the Orang Asli community, NGOs and various other community projects since 2012. Furthermore, under the CAREton Project, Tetra Pak has created a one-stop site that helps interested individuals, businesses and schools identify collection points for their beverage cartons, called Recycle Easy, as well as provide support to set up these collection points (see Fig. 5).

10 https://www.nestle.com.my/media/pressreleases/door2door-moa
11 https://www.tetrapak.com/en-my/sustainability/planet/community-recycling
12 https://www.tetrapak.com/en-my/sustainability/planet/environment-awareness-programme

Figure 5. The CAREton Project with social enterprise EPIC Homes in building homes for Orang Asli communities

Similar to Tetra Pak's packaging design commitment for easier recycling, Coca-Cola Malaysia has rolled out a 'Recycle Me' message on its package labels across its portfolio to encourage consumers to help recycle from 2021 by stages, and is expected to be completed across the majority of the company's packaging by the end of the year. In this 'Recycle Me' initiative, they announced that they have switched their iconic green Sprite packaging to clear PET in Malaysia as well as other markets in ASEAN including Singapore, Vietnam, Thailand, Indonesia, and the Philippines, to make the bottles easier to recycle and thus to be able to use more recycling content.[13]

To summarise, although EPR has been mentioned in several national policies, roadmaps, individual efforts and with pilot study initiated, currently there are no specific regulation on solid waste management systems for EPR in Malaysia as yet.

4.3 Perceived challenges in implementing well-working EPR

The outcome of implementing an EPR system in a country may depend on various factors that differ based on the structure of the country. In Malaysia, where EPR has yet to be officially put into effect, the current policies and enforcements do correspond as a guiding principle to an EPR scheme.

Before any EPR system can be applied nationwide, a formal law relating to the enforcement of EPR is required to be formulated beforehand. This should be considered the biggest challenge in implementing a properly functioning EPR system in a country that has not yet formulated any EPR laws, such as Malaysia. In Malaysia, the proposal to introduce a new law or make changes to an existing one is introduced as a Bill and needs to be passed in the parliament.[14] Generally, introducing a new law and passing it requires a much longer time than the process of making changes to an existing law. This becomes a challenging issue, as a mandatory EPR system in Malaysia would require law enforcement from a new law or the amendment of existing one, either of which will take time as EPR is only one of the bills to be debated in the parliament.

Currently, Malaysia already has Act 672, which has some elements of EPR incorporated within the Act itself. However, it is still debatable whether Act 672 itself is legally sufficient to enforce an EPR regulation. Nevertheless, for the sake of discussion in this paper, should Act 672 be legally sufficient to enforce an EPR regulation, Act 672 still faces the issue of enforcement jurisdiction limited only to the Act-States. As such, it could be said that the first challenge in implementing a working EPR system is a legal challenge

13 https://www.coca-cola.com.my/media-center/coca-cola-malaysia-rolls-out-recycle-me-message

14 In Malaysia, before a Bill can be passed in the parliament, the Bill has to be introduced to parliament in the first reading which principally consist of the act of submission. At the second reading, the bill is debated at length. It then goes through a committee stage before being returned to the House of Representatives for a third and final reading and vote. Once the Bill has been approved by both the House of Representatives and the Senate, and given the Royal Assent by His Majesty, The Yang di-Pertuan Agong, it will then be gazetted as an Act. https://www.parlimen.gov.my/glosari1.html?&lang=en

because of the varying situation for any country that has not yet formulated any EPR laws. Therefore, Malaysia is currently encouraging only voluntary EPR to related potential stakeholders of an EPR system to learn about implementation and also gauge the acceptance of stakeholders until a mandatory EPR scheme is formulated by 2030, as outlined in Malaysia's Roadmap towards Zero Single-Use Plastics 2018–2030.

Currently in Malaysia, the latest national waste composition data is the Survey on Solid Waste Composition, Characteristics & Existing Practice of Solid Waste Recycling in Malaysia, published by KPKT on 2012. In terms of an EPR system, the lack of published and updated waste data relevant to EPR implementation (such as waste composition data) may lead to insufficient and inaccurate baseline data upon which to construct an efficient EPR framework. For example, consumer consumption trends and behaviours may have changed over the past few years, meaning that existing data will be inaccurate, because it depends on data that is outdated. Moreover, published data that were studied before the EPR concept most likely did not consider EPR implementation, and may be insufficient to provide an actual situation upon which to construct the specific EPR framework.

Operation-wise, recyclable collection also forms a major component in ensuring a successful EPR system. Recyclable collection in Malaysia was established long before the enforcement of Act 672. As such, apart from concessionaires and appointed collection agents by authority (thus in the formal sector), recycling collections are also conducted informally in both Act and Non-Act states. In Malaysia, these include reputable Non-Governmental Organisations (NGOs) such as Buddhist Tzu Chi's voluntary recycling collection program, and private recycling collectors ranging from individual waste pickers, agents and larger recycling aggregators who work outside the formal recycling system. As such, these informal sectors would compete with the formal system to obtain recyclable waste materials. Although it is commendable that the informal sector conducts waste segregation and contributes to recycling rates, there are concerns for safety procedures and environmental standards of waste handling, as the authorities cannot thoroughly monitor the activity of informal sectors (see Fig. 6).

Figure 6: Example of informal sector in Malaysia's recycling industry

In addition, there is also a risk of cherry-picking of only material with value, which increases the recycling collection costs of the formal sector. However, recycling in Malaysia is mainly driven by informal sectors, unlike in most developed countries. This creates a challenge for the EPR system if the informal sectors are not addressed in the formal system, and there might be 'leakage' from the total amount of recyclable material to be collected in the EPR system, and in the form of competition. In fact, this is exactly what is already happening for e-waste EPR in Malaysia: the formal collection of e-waste in the DOE's e-waste EPR is hindered by informal sectors that are also collecting e-waste because of the high recycling value of the precious metals in electronic devices and appliances.

Similar to improving recycling rates, a correctly functioning EPR system also requires well-established recycling infrastructures and facilities, the segregation of waste, and a proper recycling ecosystem for the offtake/treatment of each material – all of which are interrelated. In terms of recycling infrastructure and facilities, this includes having a collection system for recyclables already in place, recyclable buy-back centres/drop-off points, centralised/decentralised handling, and sorting facilities for recyclables, etc.

For Malaysia, only Act-States under Act 672 and some Non-Act states with their own governance have collection systems for recyclables in place under 2+1 collection. This non-standardised recycling collection system for recyclables will limit the effectiveness of a nationwide EPR system. Moreover, under the 2+1 recycling collection system, households are not provided with separate bins for sorting recyclables and residual waste, which could lead to low participation rates of waste segregation when there is no continuous enforcement by the authorities. Furthermore, there is a general lack of other recycling facilities, such as recyclable buy-back centres/drop off points to cater for the needs and preferences of all household.

It can be seen that the previously discussed SAS enforcement in 2015 under Act 672 is in line with the preliminary practice of the waste collection system in an EPR scheme. As mentioned previously, the SAS implementation in Malaysia has not had a high success rate due to the lack of enforcement. This is also complicated by the fact that the 2+1 recycling collection system is widely known for its inconsistent collection schedule and the errors of the collectors who are not properly collecting the sorted recyclables because the recycling collection is mixed together with bulky and garden waste.

Lastly, Malaysia, like many countries, has established a proper recycling ecosystem (e.g. off-takers) for materials with value. However, the producer's responsibility in EPR includes all materials produced covering everything from valuable material, low value material and non-recyclable material. This means that Malaysia, which traditionally does not have a proper recycling ecosystem set up for low-value and non-recyclable materials, will face the challenge of limited or non-existent off-takers, which will lead to higher handling or new investment costs. For these materials to be properly collected and recycled, stakeholders will be required to subsidise handling or create new markets, which has not previously been taken into consideration.

The producers' commitment and willingness to support EPR is also foreseen to be a major challenge as there are concerns about the financial impact and liability of adopting EPR in the long run.

Another major gap seen here in Malaysia is the lack of capacity for and in-depth understanding of how EPR should work. This is evident in both public and private sectors, where such capacity gaps have been highlighted in many occasions as a barrier to moving EPR forward.

Options for EPR regulations and their strengths and challenges

In Malaysia, one of the regulatory challenges in EPR implementation is the fragmented status of regulations concerning the different stakeholders and waste types, which makes it difficult to have a coherent EPR law to cover all different types of waste, e.g. e-waste under DOE Malaysia (Ministry of Environment and Water), or packaging waste under Ministry of Housing and Local Government. Manufacturers are regulated under another administration, namely the Ministry of International Trade and Investment which is under another regulation. Thus, there will be a need to streamline these related regulations and perhaps in the longer term to consolidate all the EPR regulations under one law.

4.4 The Way forward

For Malaysia, the success of EPR very much depends on whether all the actors will reach consensus on the perceived shared responsibilities attributed to each of them and agree on a common approach forward. It is also critical to determine who will lead the policy decisions as well as the execution of the EPR mechanism proposed.

For the government, it is crucial for them to fully understand their targets and directions as well as their responsibilities in making EPR work. In general, there is a lack of capacity and experiences in EPR implementation, and therefore it is foreseen that external technical assistance will be required. The government is also playing the pivotal role in enacting the required laws and regulations to ensure the EPR will have the required legal basis and the roles of all stakeholders well defined within the legal framework. Moreover the government also needs to ensure proper enforcement of established laws and monitor the roles of all stakeholders within the EPR system. On the other hand, government can also provide incentives, such as tax incentives/rebates for investment in recycling technology for an EPR system.

For producers, a major step will be the assessment of their readiness for EPR implementation, including initiating the necessary data collection required. Furthermore, they should also start considering product recyclability and reusability in product design as part of their EPR responsibility. Moreover, producers play a role together with the government to educate and provide awareness to consumers on recycling participation in the EPR system.

For recycling actors in developing countries such as Malaysia where the recycling sector is driven mainly by informal sectors, it is important to formalize and include the informal sector, instead of considering them as competing with the formal sector. EPR should be seen as a mechanism to improve the existing condition of the informal sectors, instead of sidelining them due to their non-compliance risks, such as improper handling of recyclables or their child-labour practices. The recycling players themselves would also need to be open to embracing new recycling technology that will improve the effectiveness of recycling processes instead of depending on old technology and equipment with safety risks and limited efficiency. For the recycling collector/aggregators in the formal system, it is important to ensure a systematic collection system with schedules to encourage the consumer to participate in recycling. An inconsistent collection schedule will cause consumers to dispose of recyclable products in alternate channels outside of the formal system.

For consumers, as the final users of products, play a significant role in properly returning or disposing of the end-of-life products with formal channels. Without their willingness to separate recyclables and participate in EPR collection systems, there will be leakage in the material collection which will affect the sustainability of an EPR system.

5. EPR in Asia & Circular Economy: Thailand

5.1 Solid Waste Management in Thailand

In Thailand, solid waste is regulated under several overlapping laws. This section focuses on municipal solid waste (MSW) – waste from households and other sources with similar composition. Other waste streams, such as industrial waste and mining tailing, are managed by the Department of Industrial Works (DIW) and the Department of Primary Industries and Mines (DPIM), both at the Ministry of Industry (MOI) under separate laws.

The laws on decentralisation dating back to 1909 have placed municipal solid waste management (MSWM) under the care of local governments. At present, there are five types of local government organisations (LGOs) with elected governors and mayors in Thailand. Bangkok Metropolitan Administration (BMA) and Pattaya City are one type, with elected representatives for the 50 districts in the capital and a special tourist area in Chonburi Province, respectively. The rest of the country has two layers of administration. At a sub-district level, either a Municipality or a Sub-district Administrative Organisation (SAO) is established. According to the Department of Local Administration (DLA 2020), there are 5300 SAOs in rural areas and 2472 municipalities in more urbanised areas. At the provincial level, there are 76 Provincial Administrative Organisations (PAOs) responsible for tasks that require coordination between other LGOs such as the transportation of household hazardous waste for safe disposal and the construction of common waste disposal sites.

The details of MSWM are prescribed in the Public Health Act, B.E. 2535 (1992), and the Act on the Maintenance of Cleanliness and Public Order in Cities, B.E. 2535 (aka the Public Cleanliness Act, 1992). The Department of Health (DH) at the Ministry of Public Health (MOPH) is the key regulator for the Public Health Act, while the DLA at the Ministry of Interior supervises the Public Cleanliness Act. In a nutshell, the Acts authorise LGOs to issue local ordinances to govern the collection, transport and disposal of waste. They can also levy waste fees within the limits set by the laws. Both laws were amended in 2017 to raise the ceiling rates for waste collection and disposal fees, among other things. It is worth noting that source separation has not yet been mandated as a civic duty at a national level, although LGOs can set such a condition in a local ordinance as long as it does not contradict other requirements set in the laws. Waste is also one of the pollutants regulated in the Enhancement and Conservation of National Environmental Quality Act B.E. 2535 (1992) by the agencies under the Ministry of Natural Resources and the Environment (MONRE), such as the Department of Environmental Quality Promotion (DEQP), the Pollution Control Department (PCD) and the Environmental Fund.

In practice, the reality of MSWM varies across the country. About a third of LGOs do not have resources such as trucks or garbage collection crews to provide basic waste services. Some others, in particular SAOs in large sub-districts, have poor coverage for the collection services. Collected waste is sent to 28 transfer stations and 2246 disposal sites in operation. However, 1891 sites do not follow the pollution control standards, and open dumping is not uncommon. According to ONEP (2022), only 9.13 out of 25.37 million tons or 36% of waste generated in 2020 was disposed of properly and another 8.36 million tons or 33% were recycled, as shown in Figure 7.

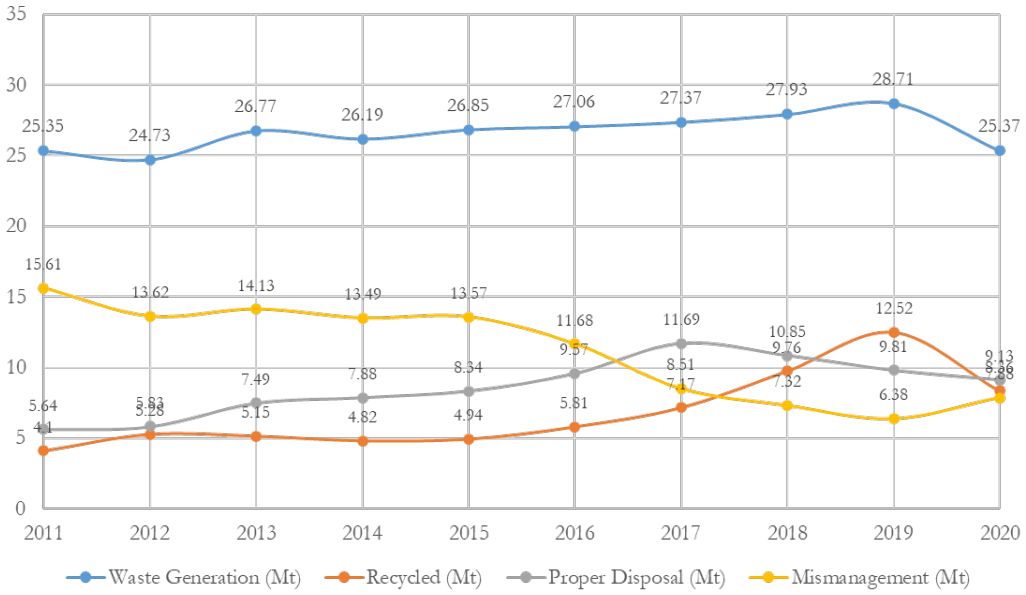


Figure 7. The quantity of waste by management options (in millions of t), between 2011 and 2020.

Source: ONEP 2022

Figure 8 presents the flows of plastic packaging in Thailand in 2017, prior to the import restrictions of untreated recyclables in China. It was estimated that 2.5 million t of plastic packaging were discarded, equal to 8% of municipal solid waste. Overall, 23% of the plastic waste was recycled, although the recycling rates were higher for certain types of packaging such as PET bottles (73%), where the market for secondary materials had been well established. Another 26% were collected and sent for proper disposal. The remaining mismanaged waste was the main cause of plastic pollution. It was estimated that some 143 kilotons, or 6% of plastic packaging, leaked into the ocean.

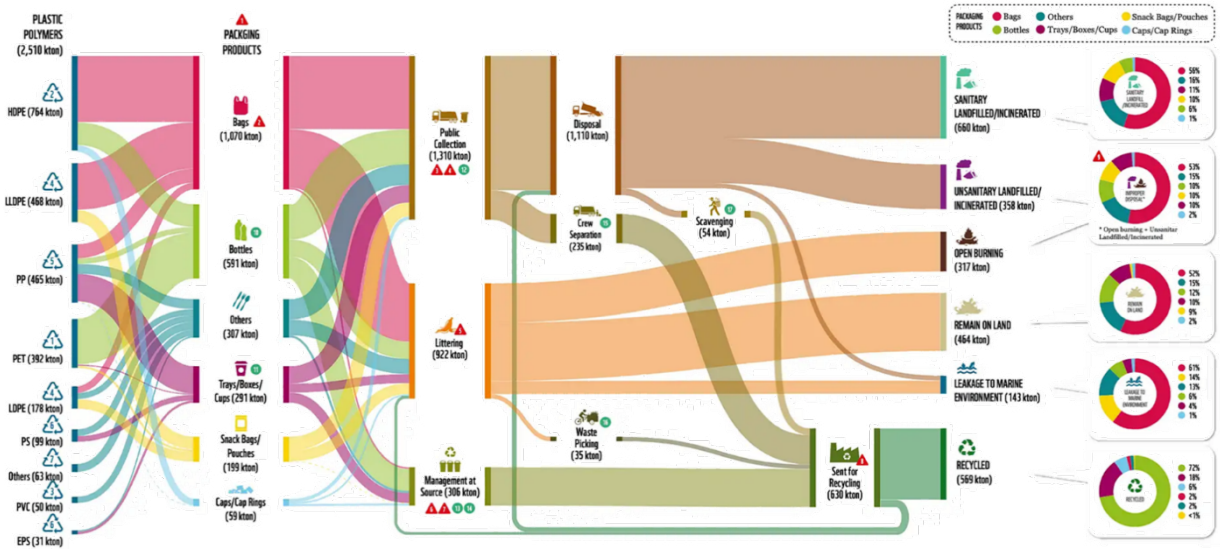


Figure 8. The flows of plastic packaging in Thailand.

Source: WWF Thailand 2020

5.2 EPR in Thailand

EPR is not a new concept in Thailand. As early as 2000, the Ministry of Foreign Affairs (MOFA) notified related agencies about several upcoming EU Directives. The initial concern was over the country's exporting industries. The Thai Environment Institute (TEI), an environmental NGO, was commissioned to study the impacts of the EU Directives on the automotive, electrical and electronic industries. The study

concluded that the restrictions on the use of hazardous substances (RoHS) in targeted products were the measures with the greatest impact on the industries heavily focused on component manufacturing (TEI 2003). The Thai Industrial Standards Institute (TISI) at the Ministry of Industry and the Thailand National Metal and Materials Technology Center (MTEC) led the capacity-building efforts to support the industries to comply with new trade requirements. TISI later issued a set of voluntary standards, known as Thai RoHS, for electrical and electronic equipment in 2008.

The knowledge about EPR has guided the public policy discourse on the management of waste products and packaging in Thailand. Early attempts to transfer policy could, however, be described as incomplete (Manomaivibool 2011). EPR was interpreted as a way to implement the Polluter Pays Principle (PPP). It identified the producers as the polluters, who should bear the financial responsibility for the management of waste products. In other words, EPR was perceived as a justification for green taxes. This interpretation met with strong opposition from the industries. In response to the proposal to levy packaging taxes, the Federation of Thai Industries (FTI) made a preemptive move by establishing the Thailand Institute of Packaging and Recycling Management for Sustainable Environment (TIPMSE) at the end of 2005. This voluntary, collective action successfully warded off any direct government intervention for packaging waste in the next decade. TIPMSE played an active role in promoting recycling through information campaigns and demonstration projects with communities, temples, schools, universities, municipalities, and junkshops.

Several draft laws were developed so as to have the producers pay advanced recycling fees. The first draft came out in 2004 through the study commissioned by PCD. It was fashioned after the so-called two-part instrument – levying fees on target products such as waste electrical and electronic equipment (WEEE) and used tires, on the one hand, and paying subsidies for their recycling and safe disposal, on the other. A new governmental fund would be set up to manage the money. This model was later revised under the Thai WEEE Strategy, an inter-ministerial roadmap. Fig. 9 shows the mechanisms under the 2009 draft decree developed under the Ministry of Finance's draft Act on Economic Instruments for Environmental Management. The product fees would be deposited in a separate account under the new Environmental Taxes and Fees Fund. The proposed fees for different types of WEEE would be in the range of 33–1200 THB (with the then exchange rate of 1 THB to USD 0.03) per unit in order to subsidise the buy-back, recycling and administrative operations; the fees for fluorescent lamps and batteries would be significantly lower (Manomaivibool and Vassanadumrongdee 2011). The proposal was terminated after the Ministry of Finance withdrew its draft.

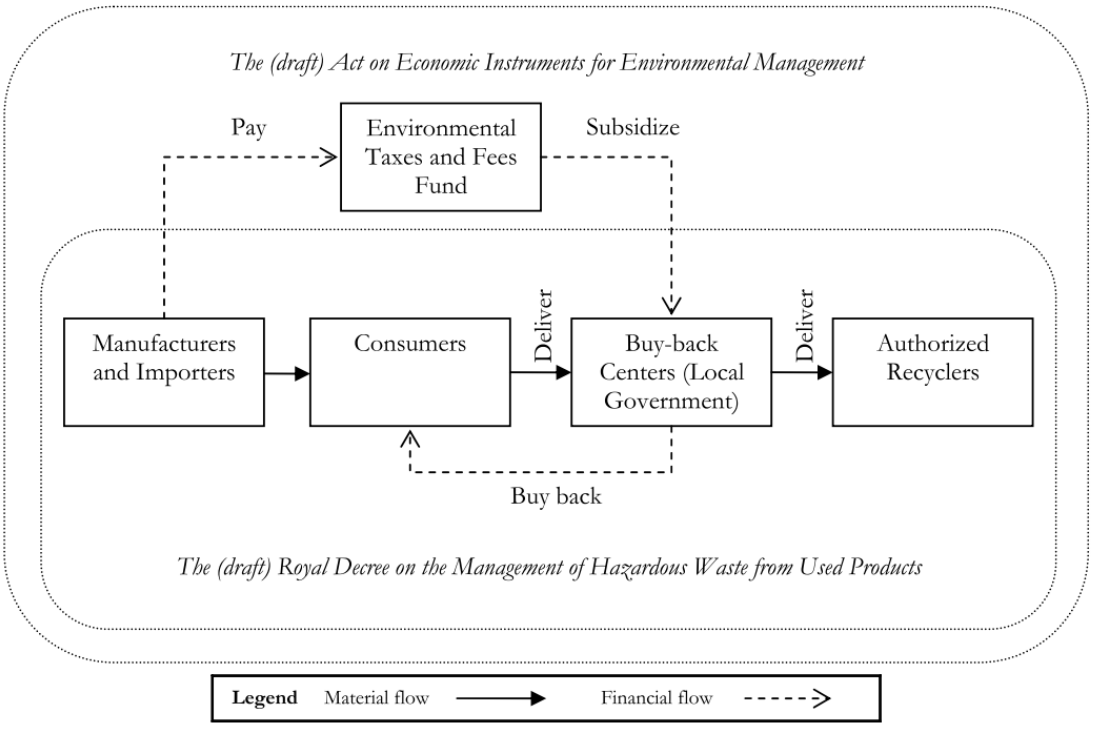


Figure 9. The governmental fund model under the 2009 Thai WEEE draft.

Source: Manomaivibool and Vassanadumrongdee 2011

Later development of a legal framework in the 2010s shifted toward an industry-led EPR program. A consortium of multinational corporations in the electronics sector, that had successfully advocated a similar program for WEEE management in Vietnam, played an active role in the public consultation process. The 2014 draft law for WEEE proposed a hybrid model (Manomaivibool and Vassanadumrongdee 2016) in which the producers would have an opportunity to develop their plans collectively or individually to comply with take-back and recycling requirements. The government, through a committee, would evaluate the implementation of the plans on a yearly basis. If the plans were deemed to be ineffective, mandatory targets could be set with a penalty similar to the system in South Korea (Manomaivibool and Hong 2014). In addition, the government could also introduce product fees at a later stage in order to raise funds to support LGOs and recyclers. The hybrid model was better received by the industries than the government fund model. Unfortunately, the *coup d'état* later that year put the draft on hold, and it was finally dropped in 2019 just before the general election.

There has been a renewed interest in EPR in recent years after the issue of plastic pollution was put on the public agenda in the region. Thailand and other Southeast Asian countries were listed as the biggest polluters of marine debris (Jambeck et al. 2015). The Plastic Waste Management Subcommittee was set up under the National Environment Board. PCD, DEQP and the Department of Marine and Coastal Resources (DMCR) jointly served as co-secretaries for the subcommittee. In April 2019, Thailand's Roadmap on Plastic Waste Management 2018–2030 (PCD 2021) was adopted under the government's grand scheme: the Bio-Circular-Green (BCG) Economy. EPR was mentioned as one of the guiding principles in the roadmap. Later in that year, the Association of Southeast Asian Nations (ASEAN 2019) issued the Bangkok Declaration on Combating Marine Debris in the ASEAN Region.

Currently EPR is driven largely by voluntary actions. In order to meet the timeline of the roadmap, MONRE has concluded several MOUs with large producers to phase out cap seals on drinking water bottles, oxo-degradable plastics, microbeads, plastic bags with a thickness of less than 36 microns, Styrofoam food containers, plastic cups with a thickness of less than 300 microns, and plastic straws. These so-called 'bans', however, do not have teeth, and these products can still be found in the market. At the back-end of the value chain, there are many initiatives to promote recycling. Major brands such as Coca-Cola, Pepsico, Nestlé, Unilever, and Tetra Pak have their own schemes to fulfil the global ambitions set by their headquarters. They have also joined FTI's collective actions, such as the Public-Private Partnership for Sustainable Plastic and Waste Management (PPP Plastic) and PackBack. Launched in 2019 by FTI and Thailand Business Council for Sustainable Development (TBCSD), PPP Plastic has support from major players including plastic producers, fillers, distributers, recyclers, waste management companies and other institutions, as shown in Fig. 10. It has a major pilot project, 'Rayong Less Waste', in Rayong Province. In 2021, FTI initiated a new project, 'PackBack: Chonburi CE City Model' (Fig. 11), under TIPMSE using Chonburi Province as a sandbox to test the feasibility of a multi-material PRO model for packaging waste. The PackBack Project covers both high-value materials such as glass bottles, corrugated boxes, PET and HDPE bottles and metal cans, and low-value materials such as multilayer flexible packaging and beverage boxes.

Figure 10. Thailand Public Private Partnership for Sustainable Plastic and Waste Management (PPP Plastics).

Source: (PPP Plastics 2020)

Figure 11. The 72 organisations supporting the FTI PRO pilot project, PackBack.

Source: FTI 2022

5.3 Challenges for EPR

There are three main challenges for EPR to be an effective driver for CE in Thailand. The first challenge is a lack of legal backing. Despite several active brand owners, there are many that remain indifferent to the environmental consequences of their products at the end-of-life stage. Not only do they avoid voluntary actions, but some of them also make decisions that compromise end-of-life management, like adding colours or directly screening logos on PET bottles (Fig. 12). Many voluntary agreements such as the 'bans' on single-use plastics are ineffective because they do not cover the majority of products in circulation. Therefore, there is a general agreement that there is a need for a legal framework to force the establishment of a level playing field.

Figure 12. PET screened bottles found in Mekong River, Chiang Rai, Thailand.

The second challenge is the organisation of EPR. Who are the producers, and how can they work together, are the key questions that must be addressed. A PRO, or collective compliance schemes will have to be established to allow the producers to assume their fair share of responsibility. It is very helpful that GIZ did translate the PREVENT Waste Alliance (2021) EPR Toolbox into Thai (Fig. 13). However, the status of such collective bodies under Thai laws, in particular, in relation to the anti-trust law, remains unclear. In addition, there is still a concern in among industries that the government may turn back to the governmental fund as an implementing model for EPR.

Figure 13. EPR Toolbox, Thai Version.

Source: PREVENT Waste Alliance 2021

The third challenge is the integration of EPR into existing MSWM and recycling systems. There is an expectation that an EPR program should help fix the underdeveloped system. But interdependency is very complicated, if not complex, as seen in the 2014 draft law for WEEE that would require the producers to support LGOs' take-back centers. On the one hand, the industries perceive that this should be provided as part of public services. On the other, LGOs feel that this requirement would overburden them and that they should have control over the collected waste, especially high-value materials. In addition, the additional resources mobilised through EPR should make betterment of recycling both in terms of quality and quantity. An EPR program should not pay for materials that would get recycled anyway. A robust auditing and reporting system is needed in order to monitor this issue.

5.4 Options for EPR and a Way Forward

For EPR to fully function, there needs to be an ecosystem of laws and institutions. There should be a basic law that endorses EPR and complementary measures. The Office of National Higher Education Science Research and Innovation Policy Council (NXPO) at the Ministry of Higher Education, Science, Research and Innovation (MHESI) has been working on a draft law for Circular Economy, the 'CE Law'. This should be linked with the other improvements made in other domains. For example, in early 2022, the United States Food and Drug Administration (FDA) finally revised its rule and lifted the ban on recycled plastics for food-contacting packaging, which in turn, generated an interest for investment in bottle-to-bottle technologies. The CE Law should set a mandatory recycled content target to further drive closed-loop solutions. Similarly, an incentive package and tax benefits offered by the Board of Investment of Thailand (BOI) and the Revenue Department to the manufacturers and users of bioplastics should be paired with EPR to ensure that the new materials will be properly treated at the end of their life.

Under the basic law, there can be several EPR laws for different types of products. Legal backing will be necessary for a level playing field. PCD is working on new draft laws for WEEE and packaging waste. They are likely to introduce an EPR program that relies on a national PRO. But, the draft for WEEE may retain elements from the government fund model. In addition, the Department of Land Transport (DLT) at the Ministry of Transport (MOT) has commissioned a study on the management of ELVs as it has an interest to develop a proper system after vehicles are deregistered.

At an operational level there are several options for physical arrangements. Junkshops can be aggregators of materials before they reach the recyclers; they would need a reliable verification and reporting system. And recycling operations that can cause serious adverse effects on the environment, as can be seen in e-waste recycling villages, must be stopped with strong enforcement. LGOs can play an important role in waste collection and separation. Voluntary actions can be used to find a workable solution. A pilot project is helpful to address sceptics and concerns. The challenge is to find solutions that deliver quantity combined with a reasonable cost.

There are expected to be different tiers of interventions in the value chain to create CE. The lowest tier is where we can rely on the existing recycling businesses and just add public education and reporting requirements to get more and correct numbers. A pilot project at the Coca-Cola Foundation Thailand shows that by simply fixing the broken chain by subsidising the shipping costs between the islands and the mainland a good result can be achieved at a cost as low as USD 10 per ton (Manomaivibool 2022). Then, there are materials that need a few fixes but nonetheless possess proven recycling technologies and have an established demand for secondary products. The more challenging tasks are where there is no existing trade, and the technologies are uncertain, or there are undeveloped markets such as for beverage boxes and multilayer flexible packaging. In this low-context setting, a life-cycle assessment (LCA) should be carried out to determine the most favourable course of action that would justify the high cost of intervention. Table 1 presents possible measures in an EPR program, their cost of intervention and suitable settings.

Table 1. Measures in an EPR program, their cost of intervention and suitable settings

Intervention	Low	Mid	High
Measures	Public information + Auditing	Incentives + Comfort + Enforcement	Clean-up activities + Market creation
Setting	**High**	**Mid**	**Low**
Collection	Sort commercially	Working waste management	High leakages
Treatment	Establish technologies for commercialised products	Potentially polluting technologies for commercialised products	Unproven technologies with limited demands

6. Conclusions

There is a clear need for improved waste management for the three countries in this study. Their situations are not unique but are similar to those in many Asian countries and beyond. A policy of Extended Producer Responsibility (EPR) is a promise to address important aspects of these challenges. By tying the costs of waste management to the consumption of the products that constitute the waste, the cost of waste management will stand a much better chance of being met. EPR also provides incentives to improve the design of the products. How strong these incentives will prove to be depends on the implementation of EPR rules. There will also be room for producers to influence the collection, sorting and recycling activities based on their knowledge of how competitive markets operate.

It is expedient to link the goals of EPR to CE so as to continuously strive for the long-lasting durability, re-use and repairability of products, as well as their recycling, which will create high-quality used materials that can be refurbished for robust use and not just discarded as waste. This strategy will help maintain resources for continued use, as well as furnish local supplies of raw materials for manufacturing activities where resources are scarce. Such an approach, which will imply a breakthrough in current EPR systems, will induce producers to design products that will better fit into the circular economy.

The three countries in special focus for this study, namely India, Malaysia and Thailand, all have substantial so-called informal sectors involved in waste management activities such as collection, sorting, dismantling and recycling. These informal activities rely on cheap labour that can outcompete more environmentally and socially harmonised activities. It is thus necessary to find solutions that gradually lead to more formalised activities with better working conditions, improved environmental work and a higher quality of the recycling chain. To improve recycling output, it would be beneficial to start with the most dangerous production activities.

In addition to the proposals derived from the experiences of the three countries, it is also essential that the legislation would create fair rules for the various producers, as well as waste management actors. Such rules must also be followed up with fair, competent supervision by the authorities. And beyond the creation of rules, the EPR system must also be supported by training the inspectors and other personnel who will be carrying out the oversight work for the authorities. These systems must also work against corruption and cheating. Good systems for data gathering and processing must be established and made available for verification. Most importantly, monitoring and enforcement mechanisms must ensure a halt to the ‘race to the bottom’ and ensure that each stakeholder is held accountable and liable for its part of the work in the value chain.

An important task in all EPR systems is the education and capacity building of all relevant actors in society. The consumers must be convinced to participate in and support the systems. An important step is to reach the children at kindergarten and primary school levels, and to transform the children into agents of change who can convince parents, relatives, and friends of the need for action towards a Circular Economy.

For developing countries, passing an EPR law can be a crucial milestone. But the law must have clear mechanisms to deliver results, and preferably it must integrate the existing systems to be cost effective. Enforcement of reporting standards, enhanced transparency, and capacity building of enforcement agencies are essential components in well-functioning systems. For countries without existing systems, it is essential to anchor the EPR systems in adequate laws. As waste management and recycling are typically dependent on the informal sector, it is necessary to find ways to include this sector and enhance its work, without unnecessarily compromising future environmental and social goals.

7. References

Association of Southeast Asian Nations (ASEAN). 2019. Bangkok Declaration on Combating Marine Debris in ASEAN Region. Online. Available: https://asean.org/bangkok-declaration-on-combating-marine-debris-in-asean-region/ (accessed on 31 October 2022).

Department of Local Administration (DLA). 2020. Local Government Organizations in Thailand. Online. Available: http://www.dla.go.th/work/abt/summarize.jsp (accessed on 31 October 2022).

Federation of Thai Industries (FTI). 2022. PackBack: Chonburi CE City Model. Online. Available: https://fti.or.th/2022/09/29/tipmse (accessed on 31 October 2022).

Jambeck, J.R., Geyer, R., Wilcox, C., Siegler, T.R., Perryman, M., Andrady, A., Narayan, R., and Lavender Law, K. 2015. Plastic waste inputs from land into the ocean. Science, 347(6223): 768-771.

Kingdom of Thailand. Act on the Maintenance of Cleanliness and Public Order in Cities, B.E. 2535. Royal Gazette, 109(15), 28 February 1992.

Kingdom of Thailand. Enhancement and Conservation of National Environmental Quality Act, B.E. 2535. Royal Gazette, 109(37), 4 April 1992.

Kingdom of Thailand. Public Health Act, B.E. 2535. Royal Gazette, 109(38), 5 April 1992.

Lahiry, Samar. 2017. DownToEarth. 09 January. Accessed November 07, 2022. https://www.downtoearth.org.in/blog/waste/india-s-challenges-in-waste-management-56753.

Manomaivibool, P. 2011. Advancing the Frontier of Extended Producer Responsibility: the Management of Waste Electrical and Electronic Equipment in Non-OECD Countries. Ph.D. Dissertation. Lund, Sweden: IIIEE, Lund University.

Manomaivibool, P., and Hong, J.H. 2014. Two decades, three WEEE systems: How far did EPR evolve in Korea's resource circulation policy? Resources, Conservation and Recycling, 83: 202-212.

Manomaivibool, P. 2022. Promoting Circular Economy on Touristic Islands: Where is the bottleneck? Presented at 2022 Green Synergy Solutions Event: Green Synergy Solutions for Sustainable Community on Agriculture Residue-Based Energy and Circular Economy, 15-17 September, Taichung, Taiwan.

Manomaivibool, P., and Vassanadumrongdee, S. 2011. Extended producer responsibility in Thailand: Prospect for policies on waste electrical and electronic equipment. Journal of Industrial Ecology, 15(2): 185-205.

Manomaivibool, P., and Vassanadumrongdee, S. 2016. A hybrid law model for the management of waste electrical and electronic equipment: a case of the new draft law in Thailand. Applied Environmental Research, 38 (1): 1-10.

Mehta, Meera. 1985. "Urban Informal Sector: Concepts, Indian Evidence and Policy Implications." Economic and Political Weekly, Vol. 20:8., 23 February.

Office of National Environmental Policy (ONEP). 2022. The 2020 Thailand's State of Environment Report. Online. Available: https://www.onep.go.th/book/ (accessed on 31 October 2022).

Pollution Control Department (PCD). 2021. Thailand's Roadmap on Plastic Waste Management 2018-2030. Online, Available: https://www.pcd.go.th/wp-content/uploads/2021/10/pcdnew-2021-10-19_08-59-54_995414.pdf (accessed on 31 October 2022).

PPP Plastics. 2020. Thailand Public Private Partnership for Sustainable Plastic and Waste Management. Online. Available: https://www.facebook.com/PPPPlastics/ (accessed on 31 October 2022).

PREVENT Waste Alliance. 2021. EPR Toolbox, Thai Version. Online. Available: https://prevent-waste.

net/wp-content/uploads/2022/06/PREVENT_EPR-Toolbox_Thai-version_2022-06.pdf (accessed on 31 October 2022).

Priti Mahesh, Chief Programme Coordinator, Kopal Dixit, Programme Officer. 2022. Less is More-Strategies for minimisation of Electronic Waste. Research, New Delhi: Toxics Link.

Spasova, B. 2014. Competition among Producer Responsibility Organisations and role of municipalities in an EPR system. Case study of EPR for household packaging in Belgium, Germany and Austria. MSc thesis. IIIEE Lund University, Sweden.

Supplementary Review and Action Taken Report in the matter of OA No. 512 of 2018 and Submission of CPCB in Compliance of Hon'ble NGT, Principal Bench order in the matter of OA No. 1001 of 2019. 2020. 1001 of 2019 (HON'BLE NATIONAL GREEN TRIBUNAL, 18 December).

Thai Environmental Institute (TEI). 2003. Final Report: Project: A Study on Impacts from the WEEE and RoHS Directives on Export Electrical and Electronic Industries. Report presented to Electrical and Electronics Institute, Thailand (in Thai).

Upadhyay, Monish. 2022. The Third Pole. 14 February. Accessed November 07, 2022. https://www.thethirdpole.net/en/pollution/south-asias-toxic-battery-recycling-problem-2-2-2/.

Vanessa Forti, Cornelis Peter Baldé, Ruediger Kuehr, Garam Bel. 2020. The Global E-waste Monitor 2020: Forti V., Baldé C.P., Kuehr R., Bel G. The Global E-waste Monitor 2020: Quantities,flows and the circular economy potential. United Nations University (UNU)/UnitedNations Institute for Training and Research (UNITAR)– co-hosted SCYCLE Programme.

WWF Thailand. 2020. Scaling Up Circular Strategies to Achieve Zero Plastic Waste in Thailand. Online. Available: https://www.metabolic.nl/projects/zero-plastic-waste-thailand/ (accessed on 31 October 2022).

8. Appendix A – Webinars

The project has organised several webinars to gather information and ideas from a number of stakeholders.

India Webinar Series summary

Title: Demystifying EPR: A Key Enabler for Circular Economy

Episode 02 Capacity Building of Stakeholders to enable a Circular Economy

Date: 18th May 2022, 3:00pm-4:30pm via Microsoft Teams

Description: From his experience of EPR across the world, Thomas Lindhqvist shared his perspective on visible competence gaps, necessary capacity building strategies that encourage ownership driven responsibility allocation to all the stakeholders. Pranshu shared the learnings from India on the type of capacities that need to be built across multiple stakeholders.

Objective: This episode intended to discuss solutions & address gaps within the present infrastructure where capacity building pertaining to EPR is needed; EPR can work well only if all stakeholders in the value chain act, take accountability and develop required skills.

Stakeholders: Multisectoral involvement such as Government & Regulatory bodies etc., Producer Responsibility Organisation (PRO), Recyclers, Waste Management Organisations, Non-Governmental Organisation (NGO), bilateral & multilateral agencies such as GIZ, UN agencies etc., relevant public sector and premise owner (Industrial, Commercial, Institutional).

Episode 04: What is the right cost for EPR compliance?

Date: 9th Sept 2022, 3:00pm-4:30pm via Microsoft Teams

Description: In this session, Thomas Lindhqvist shared his insights on both tangible and intangible factors involved in deriving the true costs of EPR and also discussed relevant case studies from Europe. Pranshu discussed with the panelists how to determine the Costs of EPR and the Costs of Going Circular.

Objective: This episode intended to facilitate a discussion to understand the true cost of EPR compliance and how can this knowledge be implemented in real time.

Stakeholders: Multisectoral involvement such as Government & Regulatory bodies etc., Producer Responsibility Organisation (PRO), Recyclers, Waste Management Organisations, Non-Governmental Organisation (NGO), bilateral & multilateral agencies such as GIZ, UN agencies etc., relevant public sector and premise owner (Industrial, Commercial, Institutional).

Malaysia Webinar Summary

Webinar title: Extended Producer Responsibility (EPR) Capacity Development Training Program

Description: Thomas Lindhqvist and Pranshu Singhal shared their experiences of EPR in Sweden and India

Objective: To gather input about the challenges faced in pilot EPR scheme which the pilot EPR project in Pulau Langkawi is designing and provide input and comment for the development of the pilot EPR project

Stakeholders: Multisectoral involvement such as Government, Producer Responsibility Organisation (PRO), Recycling Agents and Recycler, Waste Management Company, Non-Governmental Organisation (NGO), relevant public sector and premise owners (Industrial, Commercial, Institutional)

Thai Webinar Summary

Webinar title: Extended Producer Responsibility and Circular Economy: The Thai Dialogue

Date 12 September 2022, 1-3pm (Thai time) via Webex

Description: Thomas Lindhqvist gave the presentation about EPR and the applications in Europe. This was followed by the participants who introduced their work related to EPR, with their reflections. The second hour was a discussion between project experts and participants.

Objective: To exchange experiences and share insights about the potentials and challenges facing EPR in developed and developing countries

Stakeholders: Experts from Electrical and Electronics Institute (EEI), researchers from Chulalongkorn University who are working on circular economy, the secretariat of the Solid Waste Management Association (Thailand), law scholars from Thammasat University who are reviewing the ELVs laws for the Department of Land Transportation, law scholars from Mae Fah Luang University who are working on the packaging draft law, and a representative from TetraPak Thailand.

Global Webinars with focus on an Asian audience

EPR Asia webinar with invited experts from India, Malaysia and Thailand

Date 3 October 2022, 3-6 pm (Thai time) via Webex

Description: Everyone in the project group presented their findings and ideas on the questions of how to best develop EPR in Asia in order to promote a circular economy.

Stakeholders: The group of participants were selected because of their known experiences of EPR-related work as waste collection and recycling. The organisation allowed for all participants to interact with the project group, ask questions, exhibit their previous experiences and propose ideas for this project.

Open webinar with broad participation from Asia and beyond

Date 19 October 2022, 3-6 pm (Thai time) via Webex

Description: Everyone in the project group presented their findings and ideas, including previous experiences from in particular Europe and the three focus countries: India, Malaysia and Thailand. The presentations were followed by comments/questions and additional experiences from a group of selected experts, including three professors from Japan, and representatives of EXPRA and Amazon.

Stakeholders: A general invitation was broadly distributed and was positively responded by more than 150 persons from, in particular, Asia and Europe.

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