UNIVERSITY OF PORTSMOUTH
GLOBAL PLASTICS POLICY CENTRE

REVOLUTION PLASTICS

A global review of plastics policies to support improved decision making and public accountability

Global Plastics Policy Centre

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Acknowledgements

Lead authors: Antaya March, Sayyidah Salam, Tegan Evans, Judith Hilton and Stephen Fletcher.

Contributing authors (alphabetical):
Phylippa Foster, Ebenezer Alenga Amadi, Huldah M. Ateka, Thomas E. Baker, Paul Davidson, Christina Dixon, Indradhi Faisal, Trisia Farrelly, Indira James-Henry, Rachel Karasik, Frithjof Laubinger, Erica Nuñez, Ana Rocha, Venetia Spencer, John Virdin, James Wakibia, and Lucy Woodall.

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Executive Summary

At present, policies to tackle plastic pollution are failing to reflect or effectively handle the scale of the problem (IRP, 2021b) with current government and industry commitments expected to generate a reduction of only 7% in marine plastic litter against business as usual by 2040 (Lau et al., 2020). The need for effective policy is particularly critical given the mandate agreed at UNEA 5.2 to develop an international legally binding instrument to end plastic pollution. Attempts to develop and implement effective plastics policies are hindered by a **lack of knowledge of the impacts of existing policies and how effective they have been at reducing plastic pollution**. This study presents an evidence-based assessment of the effectiveness of a suite of plastics policies, including an evaluation of the factors that inhibit or enhance policy effectiveness. This study has evaluated 100 policies implemented by government, business and civil society world-wide to tackle plastic pollution.

A novel analytical framework of 48 reference statements was developed to determine an overall 'effectiveness rating' of a particular policy. The composite score is presented alongside a measure of the strength of evidence available to assess the policy. The framework itself was developed iteratively through consultation with industry leaders, academics, researchers and policy specialists and tested on a range of plastics policies before adoption. Evidence was taken from time-limited searches using publicly available data.

Plastics policies were identified from existing sources including the Duke University Nicholas Institute for Environmental Policy Solutions' Plastic Policy Inventory (Karasik et al., 2020), The Pew Charitable Trusts and SYSTEMIQ joint report: Breaking the Plastic Wave and the International Resource Panel's Policy options to eliminate additional marine plastic litter by 2050 under the G20 Osaka Blue Ocean Vision. Policies were then purposefully sampled to cover broad demographics (including economic, cultural, geographical, capacity for waste management, and sector). The results of the analysis were reviewed at two expert workshops and through a series of expert interviews, which served to enrich the analysis and validate the conclusions.

The policy types analysed covered legally binding and voluntary measures: Bans on plastic bags, bans on single use plastic products, taxes on plastic bags, producer accountability, recycling regulations, affirmative action, information instruments, business interventions (including from multinational corporations and small and medium enterprises), and plastic pacts. For each of these policy types, the key enabling factors for effective plastics policy were identified, as well as the consistent gaps in evidence. Alongside the in depth evaluations by policy type, wider implications became evident and have been conveyed in three key findings.

Key finding 1: There is a lack of monitoring and evaluation of plastics policy effectiveness

The analytical framework could not determine an overall effectiveness score for 24 of the 100 plastics policies due to a lack of evidence. In most of these cases, it was uncertain as to whether there was no evidence of policy effectiveness recorded, or whether there was a lack of disclosure and public access to evidence. Regardless, it is clear that there is a significant data gap that impedes the assessment of plastics policy assessment, which is incompatible with the urgency of tackling the plastic pollution problem. Of the policies with no available evidence to be analysed, 65% were from 2019 and 2018, and 20% were from before 2018. It was surprising that the policies from before 2018 had such little evidence to analyse considering they have been in place for over five years, which speaks to an absence or lack of monitoring and reporting embedded into policy making on the effectiveness of policies. A further 31% of reviewed policies had a limited evidence base.

The persistent evidence gaps across all plastic policy types were:

- Steps taken in policy formulation
- Amount of direct plastic prevented from the environment as a result of the policy
- Impact on waste exports and imports
- Social burden placed on society
- How stakeholders were engaged during policy formulation
- Monetary cost of policy implementation
- Long term financing commitments
- Monitoring and evaluation of the process and the impact of the intervention

Key finding 2: Identification of critical enablers

Policy enablers were identified including wider, more consistent factors that were applicable to most policy types. Other enabling factors have been identified that are specific to certain policy types, such as the need for **investment in infrastructure for recycling**, reuse policies, **innovation** in EPR/DRS, and the **availability of alternatives** for SUPP and bag bans.

The cross-cutting critical enabling factors identified were:

Leadership and commitment
through clear visioning and communication and sustained finance

Public buy-in and trust
which facilitated high compliance across policy types

Education and awareness raising
achieved through context specific activities and in tandem with other enabling factors

Stakeholder engagement through
enables fair, equitable and contextually appropriate policy supported by alternatives or mitigations where needed

Data collection and monitoring
where identified led to higher levels of public support in the policy and reflexivity in ensuring policy remained appropriate (particularly in taxes)

Use of quantitative and time bound objectives
to facilitate clear data monitoring and communication to support public buy in and trust.

Key finding 3: Integration of policies is lacking

When analysing the outcomes of the policy reviews, consistent themes around the interdependence of policies became apparent. The majority of national policies have been implemented in a piecemeal and sometimes reactionary fashion, often focusing on single items or groups of items such as bags, straws and cups. By examining the dependency of one policy type on another, it was found that there were two distinct areas of policy interaction within the plastic policy landscape: 1) those that target consumption of plastic (such as taxes and bans), and 2) those that target end of life (such as recycling). End of life policies are often more complex, and require all earlier stages of the plastic life cycle to be cognizant and synergistic to be effective. For example, a DRS or newly designed product that is completely recyclable is only effective when a sufficient recycling scheme exists to support it. Effective action requires synergies between upstream and downstream interventions. Moreover, prioritising policies which have a wider extent of coverage across the lifecycle has the potential to address the impact of a wider breadth of plastics along varying stages of the production and waste streams. It is clear that diverse policy mixes are needed within an integrated policy framework that accounts for all stages and actors across the plastics value chain and across all plastic types; and a suite of policies that operate across boundaries and in synergy with other areas of policy including health, climate, biodiversity, and economy.

Key Conclusions

1 Public support, acceptance and buy-in are paramount for effective plastic policies

Policies that attempt to impose a top-down intervention without sufficient public support tend to require strong enforcement, which can result in widespread discontent and noncompliance. Where public support for a policy does not exist, extensive sensitisation through targeted education and awareness raising activities as well as direct opportunities for ongoing involvement is imperative to create equitable and effective policies.

2 Filling evidence gaps, particularly related to the impacts and effectiveness of plastic related policies, should be prioritised

Major evidence gaps exist within the plastic policy landscape, particularly around how plastics policy is formulated, such as how stakeholders were included, how the policy was implemented, and how it was financed. There is an urgent need to fill evidence gaps to identify and share effective practice in plastic policy development and implementation.

3 Monitoring and evaluation should be built into all plastics policies

Plastics policies should include clearly defined monitoring and evaluation measures that are agreed by stakeholders at the outset. Furthermore, using time bound and quantitative goals that align with monitoring and evaluation schemes provides a means of holding policymakers accountable for meeting those goals. These elements are currently missing from most plastics policies, which creates ambiguity in claims of policy success and undermines any attempt to refine policies based on current performance. Efficient monitoring and evaluation not only allows a nation or business to track progress, but it also offers potential to unlock investment, particularly in areas where progress is seen.

4 Policy effectiveness evidence needs standardisation

A consistent standardised approach to measuring effectiveness across plastic policy, made available transparently (to allow for more widespread use), could enable better understanding of the types of policy that are most successful. Within any nation, all plastic policies would benefit from a standard monitoring method with data published for the same time periods so that plastic policy types can be directly compared. Globally consistent data collection of plastic policies needs to be combined with international standardisation metrics which may emerge from the process to develop an international legally binding treaty to end plastic pollution. Consistent data collection protocols may need to be supported by international financing to enable coordination nationally, regionally and internationally.

Key Conclusions

5 Policy effectiveness reporting should be transparent and available for public scrutiny

Transparency of information generates improved shared knowledge and supports public and stakeholder buy-in of the implementation of policies. Where there is a lack of transparency, policy making is hindered by misconceptions about policy effectiveness. As an example, worldwide, published recycling rates include exported plastic waste, with no indication of whether the plastic waste has been recycled at destination, engendering skewed perceptions of how waste is managed globally. In some cases, the lack of transparency may be unintentional or as a result of insufficient resourcing as opposed to resistance to sharing of information. In this regard, raising the equitability of access to data and evidence should be considered.

6 Coordinated policy approaches are more effective than isolated, standalone actions

Given that plastic pollution is generated at all stages of the life cycle, a coordinated whole life-cycle approach to policy making is crucial. A balanced policy mix that addresses the entire plastics life-cycle, with a focus on circularity and reduced reliance on virgin material, is more likely to be effective than individual policies focused on downstream actions.

7 Effective plastics policy requires careful consideration of context

While reviewing the effectiveness of plastics policies can provide valuable insight into which policies are effective, and why, there is a need for consideration of contextual nuance. When looking to implement a plastic policy, sensitivity to national or local context is imperative. This includes recognising that every country has a different starting point, with different national infrastructure, varying capacity for technology development, and unique trade dependencies.

8 Moving beyond the existing paradigm of plastics policy

The lessons learned from this study have highlighted the successes and failings of a large number of policies which address the plastics crisis at varying scales. However, it is clear that there is a pressing need to progress beyond the current siloed thinking about plastics and acknowledge that there are various other interacting policies beyond the plastics life cycle. In this regard, a paradigm shift towards a system in which climate, health, labour and other policies are developed with plastics policy in an integrated way is strongly encouraged.

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Abbreviations

ABST	Antigua and Barbuda Sales Tax
ASEAN	The Association of Southeast Asian Nations
DRS	Deposit Return Scheme
ECAL	Environment and Climate Adaptation Levy
EIA	Environmental Investigation Agency
EPR	Extended Producer Responsibility
ESDO	Environment and Social Development Organisation
EU	European Union
GPAP	Global Plastic Action Partnership
HIC	High Income Countries
LMIC	Low to Middle Income Countries
NBPB	Non-biodegradable Plastic Bags
NEMA	National Environmental Management Authority
NGOs	Non-Governmental Organisations
OECD	Organisation for Economic Co-operation and Development
PET	Polyethylene Terephthalate
rPET	Recycled Polyethylene Terephthalate
PPE	Personal Protective Equipment
RRC	Revenue Recovery Charge
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SUPP	Single Use Plastic Product
UK	United Kingdom
UN	United Nations
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment programme
USD	United States Dollars (currency)
VND	Vietnamese Dong (currency)
WRAP	Waste Resources Action programme
WWF	World Wide Fund for Nature

Glossary

In the context of this research, the following definitions have been adopted:

Plastics
Plastics are a wide range of synthetic or semi-synthetic materials that use polymers as a main ingredient. Their plasticity makes it possible for plastics to be moulded, extruded or pressed into solid objects of various shapes. This adaptability, plus a wide range of other properties, such as being lightweight, durable, flexible, and inexpensive to produce, has led to its widespread use. Plastics are used in nearly every sector of the economy including the use of plastic for packaging, agriculture, fishing gear, catering, construction and electronics. Plastics typically are made through human industrial systems. Most modern plastics are derived from fossil fuel-based chemicals like natural gas or petroleum; however, recent industrial methods use variants made from renewable materials, such as corn or cotton derivatives.

Policy
Any action taken by government, private businesses, charitable organisations, and interest groups in response to the plastic pollution problem. This can include legislation, policy, initiative campaigns or voluntary commitments.

Policy Effectiveness
The degree to which the policy under evaluation contributes to reducing plastic litter in the environment and entering the ocean. This is drawn from the available evidence.

Unnecessary plastics
While this study tries to avoid attaching a perceived value to any products, the term 'unnecessary plastics' is used within the Plastic Pacts section as a direct translation of the terminology used therein. In this context, it refers to where the plastic is avoidable or a re-usable alternative is available. These include, for example, plastic stirrers, straws, cotton bud stems and disposable plastic cutlery, plates and plastic wrapping on food such as fruit.

Problematic plastics
Plastics that are difficult to recycle, high in contaminants or break down easily into microplastics, making them more difficult to manage. Examples include polystyrene packaging, oxo-degradable plastics which break down into microplastics, and PVC packaging which is not recyclable and is a contaminant.

Plastic pollution
Any fugitive plastic (whether that be thermoplastic, elastomer, thermoset; or single-use, packaging, cables, construction, etc.) that has escaped the system or lifecycle of plastic, through any leakage point, ending up in the natural or human environment without fulfilling an intended function.

Plastics Life Cycle
The stages that make up our relationship with plastic from oil extraction, to petrochemical production, to our use of plastic products, to waste and recycling, to incineration and disposal. The lifecycle is broken into three key hotspot areas: Upstream (resource extraction, production); midstream (design and use); and downstream (waste management).

Circular economy
In contrast to the prevailing linear economy, a circular economy is an industrial system that aims to decouple economic growth from resource extraction and consumption. A circular economy designs out waste and pollution, circulates products and materials at their highest values, regenerates nature and restores the natural cycles that provide the economy with resources. Within a circular economy, the product is reused or recycled at the same level, rather than downcycling, therefore preserving the material input.

Photo by James Wakibia

1 Introduction

1. Introduction

Plastic is a useful and ubiquitous material, as packaging, saving weight for transportation, keeping food fresh and providing convenience in all aspects of our lives. However, a large proportion of plastic becomes a pollutant when mismanaged, entering the environment in vast quantities and contaminating ecosystems for the foreseeable future (Jambeck et al., 2015). Microplastics are everywhere, even the remotest locations including the summit of Mount Everest, the deepest ocean trenches and the Antarctic (Ajith et al., 2020). The detrimental effects of plastic on the environment (MacLeod et al., 2021), its presence in the human body (Danopoulos et al., 2021; Smith et al., 2018), and its contribution to climate change (Shen et al., 2020; Ford et al., 2022) are all well established. The effects on the environment and human health by potentially harmful chemicals associated with plastic production and waste management are gaining increasing attention (Azoulay et al., 2019; Alabi et al., 2019; IPEN, 2022).

Mismanaged plastic has significant social and economic impacts. Globally, managing plastic waste costs US$32 billion (WWF and Dalberg, 2021), including the cost to collect, sort, recycle and/or dispose of the waste by both the formal and informal sector. In the overwhelming majority of countries, formal waste management is subsidised by the government with public funds, where formal collection for municipal solid waste alone cost governments US$27 billion globally in 2016 (WWF and Dalberg, 2021). These funds could otherwise be used to address pressing social areas such as education, health or livelihood diversification. Furthermore, plastic waste reduces the value that people can derive from the ocean and terrestrial natural environments, both from a wellbeing perspective and from the ecosystem services that the environments can deliver (Deloitte, 2019; Jambeck et al., 2020). An inhibited ability of ecosystems to deliver essential services drives declines in revenue, livelihoods and food security.

An estimated 8.3 billion tons of plastic have been produced since 1950 and today roughly 11 million tons of plastic enters the ocean each year (Lau et al., 2020). The COVID-19 pandemic has exacerbated the single use plastic problem. As a result, a tsunami of personal protective equipment (PPE) and plastic film coverings have been recorded as litter in the environment (Roberts et al., 2021). Globally, waste management systems are usually overloaded, particularly in low to middle income countries where the amount of waste produced and imported through global waste trading far exceeds the capacity of the national or local waste management system (EIA, 2021). This results in mismanaged waste, where plastic is often illegally burned with significant health implications, or dumped in areas not specifically designated for waste, often impacting natural ecosystems and local communities. The rate of recycling is very low globally, and even in high income countries the average is only 9% (Sakthipriya, 2022). The financial implications of mismanaged plastic waste are estimated to be USD 5.86 billion per annum in Europe (Pouikli, 2020) and USD 80-100 billion per annum globally (Pew Charitable Trusts and SYSTEMIQ, 2020).

At present, policies to tackle plastic pollution are failing to reflect the scale of the problem (IRP, 2021b) with current government and industry commitments expected to generate a reduction of only 7% in marine plastic litter against business as usual by 2040 (Lau et al., 2020). The private sector has made notable commitments to reduce both plastic production and consumption, but

these are almost exclusively voluntary in nature with limited accountability for progress (Changing Markets Foundation, 2020) and thus have varying degrees of success.

Modelled scenarios have provided industry and government with solutions to reduce plastic pollution, including by approximately 80% by 2040 (Pew Charitable Trusts and SYSTEMIQ, 2020). However, major challenges remain to ensure that policies are designed using reliable evidence and have meaningful monitoring and evaluation. This challenge is even more pressing given the mandate agreed at UNEA 5.2 to develop an international legally binding instrument to end plastic pollution. Attempts to develop and implement effective plastics policies are hindered by a **lack of knowledge on the impacts of existing policies and how effective they have been at reducing plastic pollution.**

To help tackle this knowledge gap, this study presents an evidence-based assessment of the effectiveness of a suite of plastics policies, including an evaluation of the factors that inhibit or enhance policy effectiveness. This study has evaluated approximately 100 policies implemented by government, business and civil society world-wide to tackle plastic pollution.

An analytical framework was developed composed of a set of objective reference statements against which the intent and performance of each policy was assessed and rated. The overall 'effectiveness rating' of a particular policy is a composite of its performance against all reference statements. This is presented alongside a measure of the strength of the evidence used to assess the policy. The analysis also considers inter alia the socio-economic burden of the policy, its contribution to a circular economy, and its alignment to the UN's Sustainable Development Goals (SDGs).

Section 2 details the methods applied in this study, which is followed by the main body which presents an analysis of plastic policies by type of policy (separated into legally binding and voluntary policy types) and identifies key enablers and barriers in each area (Sections 3 and 4). The analysis is enriched with a global synthesis of results to identify overarching trends and key messages (Section 5) before conclusions are drawn to inform improved plastics policy and associated decision making (Section 6).

Photo by James Wakibia

2 Methods

2. Methods

2.1 Analytical framework

In this study, a plastics policy is defined as 'any action taken by government, private business, charitable organisation, or interest group in response to the plastic pollution problem'. This includes legislation, policy, awareness or behaviour change initiatives, or voluntary commitments. No pre-existing or accepted framework to assess plastics policy effectiveness exists. Therefore, in order to ensure a consistent and evidence-based assessment of a diverse range of plastics policies, a new **analytical framework** was developed.

This was focused on assessing:

- The performance of each policy against its own objectives;
- The extent to which each policy reduced plastic pollution regardless of the stated purpose of the policy; and
- The factors contributing to policy effectiveness.

The analytical framework is composed of 45 reference statements against which the intent and performance of each policy was assessed. The framework itself was developed iteratively through consultation with industry leaders, academics, plastic researchers and policy specialists and tested on a range of plastics policies before adoption. The evidence used to undertake the policy analyses was taken from publicly available sources, (see section 2.2 on data collection) including the academic literature (some of which may be behind paywalls for some users). This also enabled an assessment of the transparency and availability of evidence relevant to plastics policy effectiveness. Where no evidence of effectiveness was available, the gaps were noted. The full set of reference statements in the framework are in Annex 1. Each policy was reviewed in isolation, although where possible, other policies which might have influenced the outcomes identified in the evidence, were considered. This recognises that plastics policies do not exist in siloes and that there are multiple linkages and interactions with climate, health, labour and many other areas of policy.

The study progressed through the following steps:

1. Classification of policy types.

Drawing on existing approaches including the Duke University Nicholas Institute for Environmental Policy Solutions' Plastic Policy Inventory (Karasik et al., 2020), The Pew Charitable Trusts and SYSTEMIQ joint report: Breaking the Plastic Wave and the International Resource Panel's Policy options to eliminate additional marine plastic litter by 2050 under the G20 Osaka Blue Ocean Vision, the following categorisation of plastics policy types was adopted:

Legally binding policies

- bans on plastic bags
- bans on single use plastic products (SUPPs)
- taxes on plastic products
- recycling regulations
- extended producer accountability

Voluntary policies

- industry commitments
- affirmative action
- information instruments
- plastic pacts

The policy types were further grouped into legally binding and voluntary policies and initiatives. Searches were conducted to identify additional policies (such as production controls on plastic resin, product design, and virgin pellets, powders, and flakes), but in general, there was insufficient evidence available to properly apply the analytical framework to these policy types, largely due to their comparatively recent implementation.

2. Selection of policies for review.

In all policy types, policies were selected using purposive sampling methods, identifying policies with maximum variation in terms of geographical location and temporal scale. This was to ensure a variety of different contexts (including economic, cultural, geographical, capacity for waste management) are accounted for to determine key elements for policy effectiveness. To identify business policies, geographic scale of operations and revenue were taken into account as a proxy of size and scale of plastic produced or used. Businesses were selected to ensure a breadth of business types and focuses were included (e.g., retail, food, cosmetics).

3. Application of the analytical framework to 100 plastic related policies.

Once policies were selected, a systematic method of data collection and analysis was employed to assess each policy against the statements within the analytical framework. Section 2.2 on data collection and analysis provides much more information about the evidence searching and evaluation process.

4. Synthesis of all policies and their ability to reduce the effects of plastic pollution on the environment.

In all policy types, policies were selected using purposive sampling methods, identifying policies with maximum variation in terms of geographical location and temporal scale. This was to ensure a variety of different contexts (including economic, cultural, geographical, capacity for waste management) are accounted for to determine key elements for policy effectiveness. To identify business policies, geographic scale of operations and revenue were taken into account as a proxy of size and scale of plastic produced or used. Businesses were selected to ensure a breadth of business types and focuses were included (e.g., retail, food, cosmetics).

2.2 Data collection and analysis

This study drew its evidence base from open-access sources only. A wide range of sources including published scientific literature, grey literature, industry reports and news reports were used, supplemented by expert opinion to fill evidence gaps. In practical terms, each policy review involved searching online databases and catalogues to find published evidence related to each policy. Multiple databases were searched to ensure full coverage of the published evidence, including Science Direct, Scopus, Google and Google Scholar. Careful consideration was given to the choice of keywords and the design of each search to ensure that each was as focused as possible. Each search was time-limited to ensure consistency between searches and to make allowances for the different volumes of available evidence. In total, 100 time-limited searches were undertaken, one for each policy included in the study. The evidence found during each time-limited search was used to complete the analytical framework for each policy, which was not undertaken in a time-limited manner. The quality and robustness of the evidence used to complete the analytical framework was assessed, allowing an overall 'strength' rating to be attached to each policy review. This strength of evidence criteria was based on the methods of the International Resource Panel (IRP, 2021a). The criteria used to characterise the strength of the evidence were: 1) the size of the body of evidence; 2) the type of evidence included, ranked by their reliability (scientific, peer reviewed literature ranking the highest, followed by grey literature and white papers, industry reports, news and other media); and 3) the robustness of the methodologies employed to generate the evidence. These criteria were then combined to reach an overall assessment of the strength of evidence used to assess each policy, as presented in Table 1.

Table 1. *Classification system of Strength of Evidence used to evaluate policy contributions to reducing plastic pollution.*

Strength of evidence	Definition	What it means
Very strong	High quality body of evidence, large in size, consistent and contextually relevant.	We are very confident that the intervention does or does not have the effect anticipated. The body of evidence is very diverse and highly credible, with convincing and stable findings.
Strong	High quality body of evidence, medium to large in size, moderately to highly consistent and contextually relevant.	We are confident that the intervention does or does not have the effect anticipated. The body of evidence is diverse and credible, with the findings convincing and stable.
Moderate	Moderate quality studies on this policy, medium sized evidence body, moderate level of consistency. Studies may or may not be contextually relevant.	We believe that the intervention may or may not have the effect anticipated. The body of evidence displays some significant shortcomings. There are reasons to think that contextual differences may unpredictably and substantially affect intervention outcomes.
Limited	Moderate - to- low quality studies, medium - to- small sized evidence body, low levels of consistency, studies may or may not be contextually relevant.	We believe that the intervention may or may not have the effect anticipated. The body of evidence displays very significant shortcomings. There are multiple reasons to think that contextual differences may substantially affect intervention outcomes.
No evidence	No/too few studies exist	There is insufficient plausible evidence to evaluate this policy against the framework -either due to the policy being too recently implemented, or due to insufficient reviews of its progress.

Expert workshops and individual interviews with academia, NGOs, industry leaders, policymakers, practitioners and a variety of other stakeholders were held to enrich the analysis and validate the resulting conclusions. The workshops consisted of presentations of the findings and the overarching policy landscape, followed by plenary discussions on the key findings. Thereafter, key questions to participants were posed to critically evaluate specific components of the analysis and report. All participants were given the opportunity to review, comment on and contribute to the draft report.

When considering a policy implemented some time ago, for which there have been amendments relevant to this research, the amendments were accounted for and the evidence gathered for that specific policy's review encompassed all evidence following the amendment. However, if the amendment was only introduced from 2020 onwards, evidence after that point was not included for two reasons. Firstly, due to the COVID-19 pandemic, decreased policy implementation took place (OECD, 2020). Secondly, policies implemented after 2019 are too recent to show evidence of implementation in external literature.

2.3 Limitations

When interpreting the findings, the following limitations and cautions should be considered:

The analysis is largely based on evidence derived from published literature:

As with any study that draws heavily from literature (in this case including non-peer reviewed sources), the relationships and assertions presented within this study are constrained by the reliability of the underlying evidence base. To offset this risk, several steps were taken: 1) the evidence was compiled and reviewed by knowledgeable scientists who could exercise their professional judgement to identify strength of evidence; 2) the evidence included in the study (over 1500 individual sources) represents a wide variety of authors, institutions, locations and methods, and systematic bias or error is therefore unlikely; and 3) within the framework of the study, expert workshops were held to independently review and validate the analysis.

Varying languages used in global policy:

In this study, only policies in English, or in a format easily translated, were reviewed. In this regard, policies and associated evidence unavailable in English were excluded which may have skewed the overall results. Where possible, translations of policy documents and evidence were made using online translation services.

Complex relationships between various interacting policies:

Evaluating any policy in isolation does not fully account for possible interactions between policies and other initiatives. To recognise this, in our review of each policy, we identified other policies as possibly contributing to observed changes in plastic pollution. Future work will endeavour to investigate the nexus of interacting policies at the national, regional and international levels.

Sample size:

Although 100 individual policies, as well as a broad type of policies were covered, only a relatively small number of policies in each policy area were reviewed. This makes the comparison within each policy type based on a small sample size. However, the specific contexts and contributing factors in each policy review were extensively examined, allowing for the postulation of the effects in similar development, economic, social and environmental contexts.

Photo by James Wakibia

3 Legally Binding Policies

3. Legally Binding Policies

Legislation and regulations at the national level vary greatly, including in their scope and focus. At present, national interventions with sufficient evidence to apply the analytical framework tend to focus on banning or taxing individual items or groups of items (most commonly associated with packaging and food). The adoption by governments of plastic product bans and taxes is often attributable to situations where improving waste collection services and controlling the design of products is particularly difficult, especially in low to middle income countries (Godfrey, 2019). Recycling regulations tend to exist as part of wider waste management interventions, and producer accountability strategies that place more responsibility on upstream actors are emerging. A summary of the findings for each policy type is presented below.

The policy types evaluated were:

3.1 Bans on plastic bags

Plastic bag bans are frequently used to prevent pollution from discarded plastic bags. Bans include bans on importation, distribution, sale or use of single-use plastic bags. The bans generally target shopping bags or 't-shirt' bags (carrier bags with handles) and are often enforced by penalties to the producers and consumers. Bag bans have been in use since the early 2000s and there are now 127 countries that have some form of plastic bag legislation (UNEP, 2018). The scope of these bans varies from country to country. A few countries have banned all non-compostable bags, while others have instituted partial bans based on bag thickness or characteristics such as biodegradability. Some policies exempt certain uses for 'essential' plastic bags, such as for some foods, healthcare or garbage disposal, although the definition of essential is problematic and can lead to implementation loopholes.

The following policies were reviewed:

The Bangladesh ***Amendment to the 1995 Bangladesh Environment Conservation Act of 2002,***

is the **world's first prohibition of single use plastic bags.** It was implemented after deadly floods in 1988 when plastic bags were found to be blocking waterways and drainage systems. The government imposed a strict ban on the manufacture, import, marketing, sale, demonstration, stock, distribution, commercial carriage, and commercial use of all kinds of polythene shopping bags, including polyethylene (PET) and polypropylene (PP) bags. The penalties for the production, import, and marketing of plastic bags was 10 years imprisonment, or a 1 million taka ($11,780) fine, or both. And for the sale, storing, distribution, transportation, or use for commercial purposes, 6 months of imprisonment or 10 thousand takas ($120) fine, or both (Huq, 2002). Initially, the government was able to claim success due to strict enforcement of the law, but in 2008 a new government came into power and the enforcement efforts were stopped. Whilst initially there was a reduction in plastic bags, they have become widespread again.

The Sindh (Pakistan) *Prohibition of manufacture, sale, and use of polythene bags act, Sindh Act No.XV of 2006,*

was a **prohibition of the manufacture, sale and use of black polythene bags** including PET bags below 30 micron thickness specific to the Sindh Province of Pakistan. The ban suffered a lack of enforcement, with few alternatives available, and limited awareness. The Sindh Government attempted to ban bags again in 2009 and in 2014, without success. Recently, a nationwide bag ban was adopted in 2019 when Pakistan joined the Global Plastic Action Partnership (GPAP).

The San Francisco (USA) *Environment Code - Chapter 17: Plastic Bag Reduction Ordinance 20076,*

was a **prohibition of the manufacture, sale and use of black polythene bags** including PET bags below 30 micron thickness specific to the Sindh Province of Pakistan. The ban suffered a lack of enforcement, with few alternatives available, and limited awareness. The Sindh Government attempted to ban bags again in 2009 and in 2014, without success. Recently, a nationwide bag ban was adopted in 2019 when Pakistan joined the Global Plastic Action Partnership (GPAP).

The Italy *Law 24 March 2012, n. 28 Conversion into law, with amendments, of the decree-law of 25 January 2012, n. 2, containing exceptional and urgent environmental measures*

was **the first prohibition of plastic bags in Europe** (Povoledo, 2018). This included banning the manufacturing, distribution and importation of non-biodegradable bags less than 50 microns, with only biodegradable, cloth or paper bags made available to consumers. The policy was introduced due to the effect of plastic pollution on Italy's blue economy. The policy has produced a 50% reduction in plastic bag consumption (Imbert et al., 2017) and increased recycling rates.

The Rwanda *Law No. 57/2008 of 10/09/2008 relating to the prohibition of manufacturing, importation, use and sale of polythene bags in Rwanda*

banned the manufacture, importation and use of PET bags or non-biodegradable polythene bags of less than 60 microns with a few exceptions for food wrapping in hospitality establishments. Rwanda was the first country to introduce a ban on plastic bags in East Africa, aiming to be the world's first plastic free nation. The ban was extended to include all polythene bags in 2008. The ban is far reaching, but an informal market for bags, smuggling and price hikes have occurred, partially due to a lack of alternatives.

The Kenya *Notice No. 2356 - The Environmental Management and Co-ordination Act, 2017,*

banned the use, manufacture and import of all plastic bags used for businesses and households. Exceptions include garbage bin liners, medical waste, construction and food packaging. The ban has resulted in an 80% decrease in use of single-use plastic bags (NEMA, 2019).

The Sri Lanka *National Environmental Act - Order No. 2034/35, 2017,*

prohibits the manufacture and sale of high density polyethylene (HDPE) bags. This ban was unsuccessful, due to the provision of limited alternatives, fast implementation, lack of stakeholder engagement, insufficient cooperation between government agencies and poor enforcement.

The Mauritius *Environment Protection (Banning of Plastic Bags) Regulations 2015,*

bans the import, manufacture, sale or supply of plastic bags. This ban was unsuccessful due to lack of public engagement resulting in little citizen compliance, fast implementation and poor enforcement. The public were reluctant to use alternatives (Foolmaun et al., 2021).

The Panama *Regulating the reduction and progressive replacement of SUPs, Draft Law 0.30. Commission on population, environment and development (including plastic bags), 2019*

targets single use plastics including plastic bags in supermarkets, pharmacies and retailers in Panama. Panama became the first country in Central America to ban plastic bags.

The Antigua and Barbuda *External Trade (Shopping Plastic Bags Prohibition) Order, 2017, No.83,*

prohibits the importation, distribution, sale and use of 5 types of plastic bags which accounted for 90% of the plastics released into the environment. In the first year, the ban contributed to a 15.1% decrease in the amount of plastic reaching landfills in Antigua and Barbuda. Strong leadership delivered a ban that achieved early stakeholder buy-in, public awareness through social and televised campaigning, a phased approach, tax incentives, and financial support from China which allowed for capacity building and educational awareness.

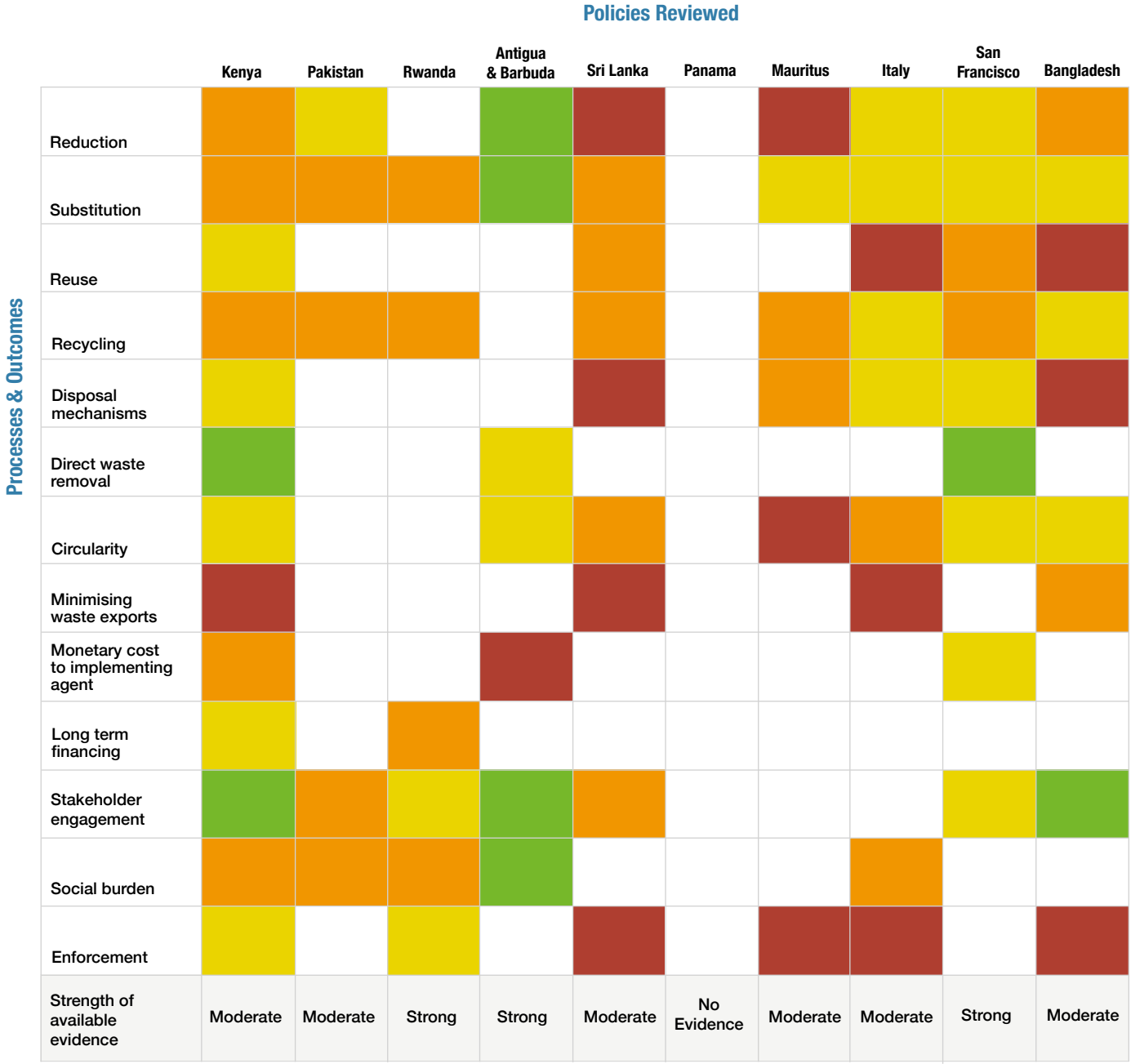

Figure 1: *This matrix shows how each policy performed against a selection of the reference statements in the analytical framework. The overall strength of evidence upon which the policy review is based is noted.*

Key: *Contribution to policy processes and outcomes*

	Strong contribution
	Moderate contribution
	Weak contribution
	No contribution
	No evidence

Three policies were found to be largely effective (Kenya, Antigua & Barbuda, and San Francisco, USA) with moderate to strong evidence. Two were moderately effective (Italy, Rwanda) with either moderate or strong evidence. Four were ineffective (Sindh, Pakistan, Sri Lanka, Mauritius, and Bangladesh), all with moderate evidence. The Panama bag ban was too recent to analyse. The most significant gaps in information were for financing responsibility to government departments and local authorities, long term financing of the bans, waste removal and the reduction of waste export (Figure 1). The evidence found was a mixture of peer-reviewed literature, white papers, news articles and reports from implementing government agencies and NGOs. Most notably, the discussion of Clayton et al. (2021) on the successes of Antigua and Barbuda, and Clapp and Swanston (2009) on bag bans from an international perspective. Rwanda had a particularly good evidence base of peer reviewed journals and reports. Overall, the majority of policies examined showed a reduction in the use of single use plastic bags although none have eliminated them completely. All of the policies reviewed were motivated by concerns about negative environmental impacts and in some cases political and economic factors such as tourism enhancement in Rwanda and Kenya.

Policy effectiveness barriers and enablers

Strong political commitment and leadership

Political drive and long term commitment were strong enabling factors. Antigua and Barbuda's policy was particularly effective due to clear ambitions, strong leadership, a phased approach and a defined timeline including a phase of adjustment for industry and the public. Kenya's successful approach also had ambitious leadership and included some of the strictest penalties in the world. Studies carried out in 2004 demonstrated the effects of plastic waste on the environment which led to Rwanda developing nation-wide awareness campaigns and enacting the ban in 2008. Effective enforcement has led to successful implementation and a reduction in plastic bag use (Dagan, 2011; Clavel, 2014). Overall, strong leadership and coordination are major enabling factors in the successful policies reviewed.

Stakeholder engagement

Policies that performed better within the analytical framework were found to engage with internal and external stakeholders from the early stages of policy development and implementation. Holding multiple dialogues with relevant stakeholders creates opportunities for buy-in to the process (and outcomes). Where disputes and objections are not resolved, implementation usually fails in the long term, therefore early and regular stakeholder engagement is critical. This was critical to the success and effectiveness of the Antigua and Barbuda bag ban. Stakeholders unanimously voted against importing plastics. Such early engagement meant there was widespread support for the ban before it came into effect. In Bangladesh, the government held industry consultations in 2001 concerning plastic bag regulations. This included not only plastic manufacturers and bag makers but also Bangladesh's jute manufacturers associations (jute is a natural fibre used to make alternative, reusable bags). The polythene manufacturers in Sri Lanka claimed that the government had not discussed the matter with them before enforcement and this led to non-compliance (Fernando, 2022).

Public awareness, campaigning and education

Progressive phasing out of shopping or 't-shirt' bags requires changes in public behaviour. In Bangladesh and Kenya, it was the environmental awareness campaigns that drew the attention of their governments. ESDO in Bangladesh organised a nation-wide anti-polythene campaign as early as 1992. Seven years later the Ministry of Environment and Forest worked with the organisation to pass the legislation. In Kenya, environmental journalist James Wakibia successfully used Twitter to mobilise the online community and won the support of Prof Judi Wakhungu, the Cabinet Secretary for Environment and Natural Resources. These were examples where campaigning led to calls for action and prompted legislative change. Effective public communication requires simple, clear and accessible messaging including television, radio campaigns, social media and

jingles providing bag ban information. This can include information notices at borders and airports as is the case in Rwanda. The tagline used for the Antigua and Barbuda awareness campaign was "Make a difference one bag at a time" which was launched on World Environment Day (June 5, 2016). The tagline was stamped onto the free reusable bags that were given away to members of the public and through public service announcements by the Minister of Health and Environment who used national media to spread the message (Hill, 2016). More than 70% of respondents in a subsequent survey agreed their awareness was increased through these plastic bag ban campaigns (Holmberg, 2020). Conversely, residents across the Sindh Province, Pakistan complained that they were not aware that a ban was in place. Similarly, in Sri Lanka, the general public were unaware of which plastic bags were banned and that burning plastic was unlawful.

Alternatives

A major enabler of effective plastic bag bans has been accessibility of more sustainable alternatives that promote reuse and shift behaviour away from disposable, single-use consumption. Moving away from a single-use mindset to approaches that deliver long-term reusable items should be prioritised. Waste generation is set to grow 70% by 2050 if significant efforts to drastically reduce waste generation are not prioritised (World Bank, 2018). The provision of alternative bags for consumers has been shown to support effective implementation and if championed by the leading figures in government, gives further credibility and reassurance to consumers. Antigua and Barbuda introduced tax incentives for the importation of reusable (non-plastic) bags to aid enforcement of the ban. The Cabinet waived duties and other taxes, inclusive of Antigua and Barbuda Sales Tax (ABST) and the Revenue Recovery Charge (RRC) on the importation of reusable shopping bags, making the bags affordable. The ban was well received by the big supermarket chains and was followed by adoption by smaller stores. Government approved alternatives were determined through research and consultation with importers and distributors. There was substitution with paper bags made available in supermarkets and shops as well as the reusable, alternative bags. Reusable alternatives are essential to reduce plastic bag use. In Bangladesh, jute, a natural fibre, is a major national industry which was established prior to the plastics industry. They were included in the industry consultations and supported the ban, which later led to increasing demand for this alternative material (Clapp and Swanton, 2009).

Jute bags or 'Sonali bags' i.e. golden bags, are biodegradable, water soluble and burn without releasing fumes. They have been a successful alternative however they still remain more expensive than plastic bags. The lack of affordable alternatives was cited as a reason for the Sri Lankan ban failing and an increased use of polythene bags. Reports suggest the number of plastic bags used has unintentionally risen after the ban (Fernando, 2022). In Mauritius, there is a preference for plastic bags over alternative bag materials, and as a result the government was unsuccessful in forbidding the supply and utilisation of the prohibited bags (Foolmaun et al., 2021). In Italy for example, certain biodegradable plastics and so-called 'compostable' bags were touted by industry marketers as the solution to plastic pollution. However, these only break down under certain conditions such as at high temperatures (Rethink Plastic, 2021), not all alternatives are necessarily better for the environment. The Italian government also refused to distribute eco-friendly bags for free and this increased surcharge caused uproar with the Italian public (Treehugger, 2019) due to the social burden. A 2015 consultancy report also found that 50% of producers were not complying with biodegradability and compostability criteria (Arcelli, 2015) and noted that banned products and alternatives can often be difficult to distinguish (Borkey et al., OECD, 2022). It is critical to avoid social and financial burdens to consumers when imposing a ban to ensure compliance (Palugasewa, 2018).

Penalties and enforcement

Penalties and enforcement measures vary between policies. The Antigua and Barbuda ban came with a fine of $1,110 USD or up to 6 months imprisonment. However, due to the positive support of the ban, stringent enforcement was not required. In contrast, Bangladesh initially used stringent measures to enforce the bag ban however with a change in government, these efforts were discontinued and plastic bags re-emerged. The enforcing

agencies were affected by petty corruption and local political influences and local authorities often lacked resources to implement the bans. An insufficient budget meant that patrolling police in the Sindh province of Pakistan were unable to check the stamped information on bags identifying them as biodegradable (Hadid et al., NPR, 2019). Bans have also been unsuccessful where the prosecution process takes a long time. The Mauritian judicial system was not only lengthy, but likely to impose the minimum fee, which undermined the efficiency of the bag ban. More rigorous enforcement measures and streamlined prosecution process through a separate Environmental Tribunal are required (Foolmaun et al., 2021).

Industry influence

Bag bans were generally used in countries where the plastics industry's structure, influence and communication are weak but the environmental impact of the bags is severe (Clapp & Swanston, 2009). Without strong opposition, it was easier for Bangladesh, Rwanda and others to pass strong legislation at a national level prohibiting single use plastic bags. In Pakistan, however, plastics are the 5th largest industry with an annual growth rate of 7-9% (Munshi, 2019). (Ali et al., 2021). The plastic producers believe the problem isn't plastics but waste management and recycling. Resistance by stakeholders, lack of eco-friendly alternatives and public awareness has led to the failure of the Sindh ban bag.

Social injustice

The emergence of illegal trading of outlawed plastics bags is a significant barrier. Rwanda has experienced challenges to its plastic bag ban due to porous borders where plastic bags are smuggled in from neighbouring countries. These bags are still cheaper than the alternatives and so the demand remains. This negatively impacts the poorest within society who find themselves trapped in this trade despite the risk of imprisonment. Another caveat to replacing single use plastic bags in low to middle income countries are concerns around access to clean water in order to sanitise reusable shopping bags used for carrying produce (Muposhi, A et al, 2021). This may place an additional burden on the poorest within society and increase health risks.

Conclusion

No country or region has eliminated plastic bags completely. This can be attributed to limited public awareness, a lack of alternatives, poor stakeholder engagement, illegal trading, and lack of proper enforcement and loopholes. Data collection around the illegal bag trade would provide invaluable information for policy makers. Bag bans cannot be imposed in isolation, Incentives such as tax exemptions and subsidies are required for industry to properly phase out and replace plastic bags with adequate alternatives. A phased approach and strategic planning have been found the most suitable means of ensuring policy uptake and behaviour change. Long term financing is also critical to the policy implementation. The successful bans incurred costs from distribution of alternative bags, awareness campaigns and enforcement. Finance can come from the central government, local government or other countries as seen with China's financial aid for Antigua and Barbuda. Financial support was most effective when coupled with capacity building, and public awareness campaigns. A lack of data examining the impact of plastic bag bans suggests either there is a lack of recorded information or a lack of transparency. Effective policies are ones that incorporate data collection into the legislation. Conducting consumer and producer surveys before and after implementing a policy can help to determine its effectiveness and provide the evidence for engagement and acceptance. The policies examined were generally effective and have led to a reduction in plastic bag use but it remains unclear whether single policy interventions can have enough effect on the global plastic waste problem.

3.2 Bans on single use plastic products

For the purposes of this research, single use plastic product (SUPP) bans include prohibitions of multiple plastic items that are designed to be used once and then discarded. These can include items such as disposable utensils, plastic bags and commercial packaging. Bans can include prohibition of manufacture, importation, provision, commercial distribution, and use, targeting all or just one area. Bans often tackle a specific sector of SUPP, particularly packaging of food and expanded polystyrene takeaway containers which have been specifically banned in Antigua and Barbuda, Guyana, and Zimbabwe. SUPP bans can also include items used in construction or commercial distribution and cosmetics.

The following policies were reviewed:

The Ecuadorian ***Resolution No.05 (2015) Supreme Decree,***

that **aims for the reduction of single-use plastic** and responsible consumption of plastic, restricting the use of plastics such as straws, polyethylene (PE) containers and non-returnable plastic bottles. imports of these products with the specific exception of tonic and sparkling water bottles were also restricted. The effectiveness of this policy could not be determined due to insufficient evidence.

The Rwandan ***Law No 17/2019 OF 10/08/2019 Relating to the prohibition of manufacturing, importation, use and sale of plastic carry bags and single-use plastic items,***

prohibits the manufacturing, importation, use and sale of plastic carrier bags and single-use plastic items. Local businesses were given three months to transition to more sustainable alternatives leading to criticism of the short time for adjustment (FlipFlopi Report, 2021). The effectiveness of this policy could not be determined due to insufficient evidence.

The Malibu *City Ordinance No.432, which regulates plastic straws, stirrers and cutlery (2018.*

The effectiveness of this policy could not be determined due to insufficient evidence.

The French *Law No. 2015-992 on Energy Transition for Green Growth (Energy Transition Law),*

bans all plastic cups, cutlery and plates and replaces them with biodegradable alternatives. The effectiveness of this policy could not be determined due to insufficient evidence.

The Antigua and Barbuda *Litter Control and Prevention Act 2019 No. 3 of 2019*

focuses on takeaway SUPP food containers, utensils, and other products made of expanded polystyrene used for selling, holding or providing food. This policy was widely successful, attributed to strong awareness raising activities and a focus on alternatives. This legislation, in conjunction with polystyrene regulations, was strongly motivated by public health.

The Guyana *Environmental Protection (Expanded Polystyrene Ban) Regulations, 2015 (No. 8 of 2015),*

which **prohibits the importation, manufacture and sale of expanded polystyrene products** and **the sale, use or provision of expanded polystyrene containers by food service establishments**. The policy promotes the use of biodegradable, recyclable and other environmentally-friendly containers food products instead of expanded polystyrene. This policy failed due to poor communication with stakeholders and no government-led exploration of alternatives.

The Seychelles *Environment Protection (Restriction on importation, distribution and sale of Plastic Utensils and Polystyrene Boxes) Regulations 2017,*

This policy **restricts import, distribution and sale of plastic utensils** (such as forks, spoons, knives, plates, bowls, cups and trays made of plastic) and polystyrene boxes. The effectiveness of this policy could not be determined due to insufficient evidence.

The Malaysian *Roadmap Towards Zero Single-Use Plastics 2018-2030,*

aims to move towards zero single-use plastics by 2030. The effectiveness of this policy could not be determined due to insufficient evidence.

The Zimbabwe *Statutory Instrument 84 of 2012 (Plastic Packaging and Plastic Bottles) (Amendment) Regulations, 2012 (No. 1)*

focuses on takeaway SUPP food containers, utensils, and other products made of expanded polystyrene used for selling, holding or providing food. This policy was widely successful, attributed to strong awareness raising activities and a focus on alternatives. This legislation, in conjunction with polystyrene regulations, was strongly motivated by public health.

The Vanuatu *Waste Management Regulations Order no. 15 of 2018*

prohibited manufacture of disposable containers, single use plastic bags, and plastic straws, and the use or sale of plastic straws, disposable containers, and single use plastic bags with the exception of bags used to carry or wrap meat or fish. This policy is regarded as successful, due to the strong public support and investment in alternatives.

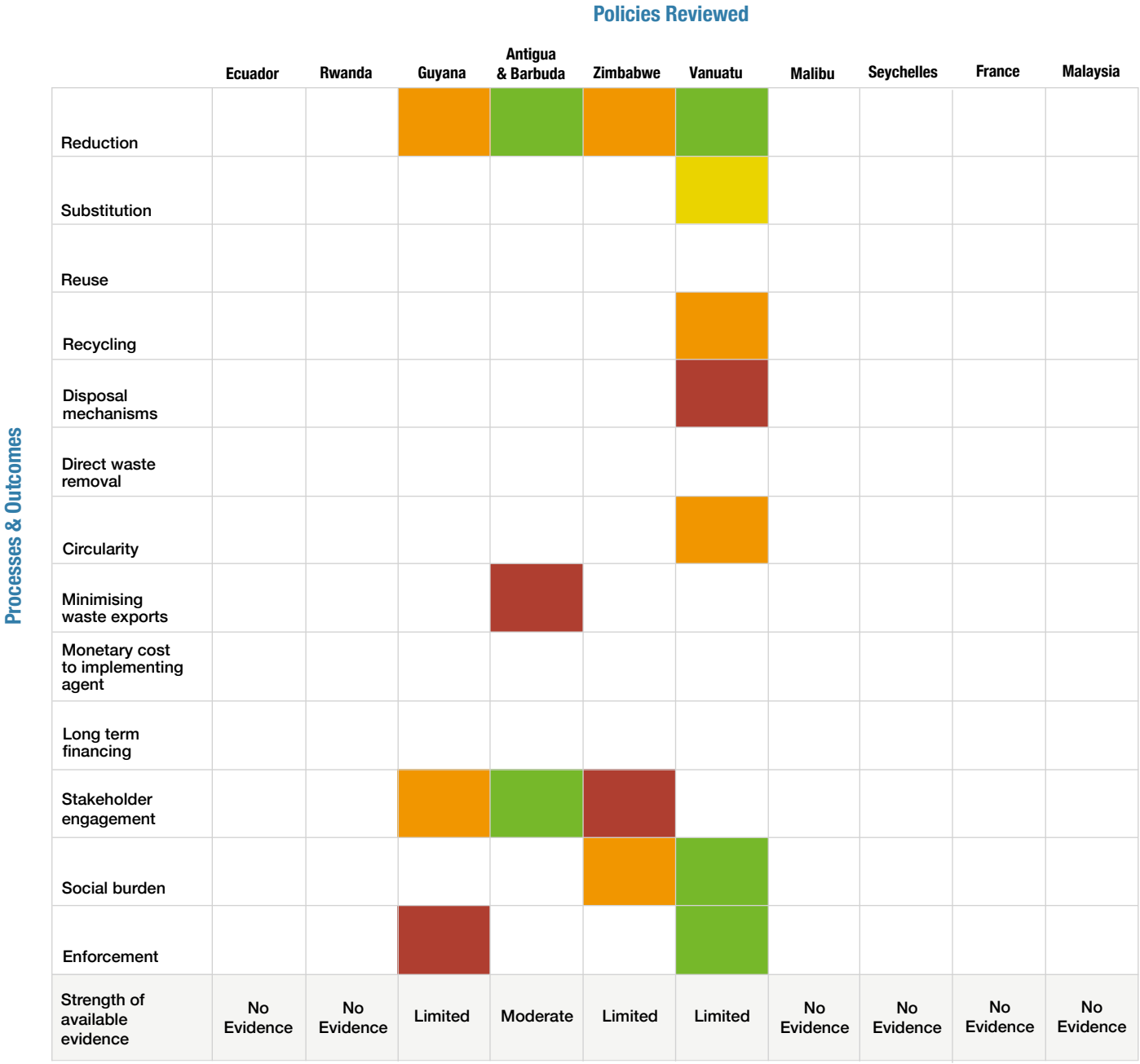

Figure 2: *This matrix shows how each policy performed against a selection of the reference statements in the analytical framework. The overall strength of evidence upon which the policy review is based is noted.*

Key: *Contribution to policy processes and outcomes*

	Strong contribution
	Moderate contribution
	Weak contribution
	No contribution
	No evidence

Of the 10 reviewed policies, 6 did not have enough evidence for evaluation, therefore conclusions are limited. Of the four remaining policies, three, Guyana, Zimbabwe, and Vanuatu, had limited data for analysis. Antigua and Barbuda and Vanuatu were the only SUPP bans to meet their objectives. Antigua and Barbuda had a 'moderate' evidence base, but little peer reviewed data. All policies were motivated by environmental protection with the notable exception of Zimbabwe, who identified public health as a major motivating factor for the ban.

Overall, there is very limited data or evidence available regarding the effectiveness or ineffectiveness of SUPP bans, with most references coming from news articles (see Figure 2). National reporting of impact data was not found for these SUPPs bans. There are some examples of peer-reviewed literature including academic and NGO reports regarding the success of bans for example Tudor and Williams (2021), who examined the success of Vanuatu, and an article by Clayton et al., (2021) which discussed policy effectiveness of SUPP bans, including Antigua and Barbuda as a case study. Analysis of the effectiveness of bans is still in early stages, and represents a critical area for further research. There is no evidence in any case study about finance for implementation and long term, specific reuse of plastic SUPP items, and whether the policy has reduced plastic import and export.

The European Single-Use Plastics Directive was not included in this policy review as it came into effect in 2021 and is too recent to review. More than 25 million tons of plastic waste are generated in Europe every year (Zero Waste Europe, 2021). The 2018 EU Plastics Strategy and the Single-Use Plastics Directive 2019 led to the European Single-Use Plastics Directive which aims to address plastic production and use by aiming to reduce the impact of the 10 most commonly littered single-use plastic products on the environment. The policy includes EPR obligations, targets for separate collection of plastic bottles for recycling and design requirements. The policy has also incorporated measures to record the quantitative reduction of these banned single-use items.Of the 10 reviewed policies, 6 did not have enough evidence for evaluation, therefore conclusions are limited. Of the four remaining policies, three, Guyana, Zimbabwe, and Vanuatu, had limited data for analysis. Antigua and Barbuda and Vanuatu were the only SUPP bans to meet their objectives. Antigua and Barbuda had a 'moderate' evidence base, but little peer reviewed data. All policies were motivated by environmental protection with the notable exception of Zimbabwe, who identified public health as a major motivating factor for the ban.

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Policy effectiveness barriers and enablers

The most significant enablers were public engagement through education and awareness raising activities, access to alternatives, stakeholder consultation and consistent messaging.

Public support and education and awareness raising activities

Education and awareness raising activities are critical to the success of SUPP bans as they rely on the participation of businesses and consumers. In Vanuatu, this was evidenced by the increasing awareness of the impacts of plastic pollution on local beaches resulting in a Facebook campaign to ban straws and other SUPP items. This public momentum rapidly led to a phased SUPP ban being introduced by the Government in 2018. The rapid and comprehensive approach to the banning of select SUPPs helped to gain acceptance. At the time of writing, Vanuatu is debating adding disposable nappies to the list of banned items due to concerns around the lack of sustainable alternatives.

Public support for the ban in Antigua and Barbuda aided by extensive awareness campaigns, which included public workshops. In contrast, in Zimbabwe, there was no evidence of educational campaigns to support the implementation of the ban of SUPPs, leading to widespread noncompliance. In Guyana, the situation is more complex with some support by businesses and consumers for the ban, but no evidence of public support and limited evidence of educational campaigns or public awareness-raising activities. Education and outreach should be undertaken in tandem with wider facilitating actions, such as provision of alternatives and stakeholder engagement.

Access to alternatives

For a ban to be successful there must be the provision of alternatives as part of the policy. Government leadership was critical in establishing the acceptance and availability of alternatives, and to ensure any cost increase did not fall upon consumers. In Vanuatu, alternatives were created and adopted as a result of existing local cultural practices such as basket weaving and local solutions were identified in Antigua and Barbuda, with the government identifying and promoting Bagasse (sugarcane pulp) as an alternative with awareness campaigns for consumers. The lack of alternatives and increased costs heavily affected the implementation of bans in Zimbabwe or Guyana. In Guyana, the prices of alternatives were a major deterrent to industry and businesses, and resulted in the failure of the first SUPP ban proposed in 2013. (Stabroek News, 2015). A similar situation occurred in Zimbabwe, where the cost and weight of alternatives to takeaway food containers were major barriers to compliance, and suggestions for alternatives from the Zimbabwean Environment Management Agency such as sit-in rather than takeaways was not supported by businesses. Businesses claimed that not enough notice was given to source alternatives, which increased costs significantly. Zwinoria (2018) quoted a business owner stating that they got a three week instead of a three month window to source alternatives, which has cost them "between Z$250,000 (USD 690.79) to Z$350,000 (USD 967.11) per month" and have lost 60-70 workers as a result. Substitution rather than reuse does not reduce waste and can also harm the environment. Vanuatu and Antigua and Barbuda ensured that substitutes were either reusable or compostable

Effective stakeholder engagement

Engaging with stakeholders early solves problems and reduces disengagement and disagreement and solutions can be evaluated for equity and sustainability. Antigua and Barbuda adopted an eight step process which resulted in the ban being integrated into existing legislation (UNEP, 2019a). Specific stakeholders were targeted, including supermarkets to resolve outstanding issues (UNEP, 2019b). In contrast, there was no evidence of stakeholder consultation in Vanuatu, and variable evidence of consultation in Zimbabwe and Guyana with industry stating that engagement was not sufficient.

Concise and consistent messaging

Concise and consistent messaging throughout the ban is needed for successful implementation. Vanuatu and Antigua and Barbuda had a clear implementation plan for the bans, and consistent communication about what was banned and when. It is unclear when Zimbabwe intended to enforce the ban; although it was announced in 2012. Some reports document the first date of enforcement being in 2016 before a significant backlash that led to a further delay. The ban was then re-enforced in 2017 with varying reports of the level of warning given to businesses. The lack of clear timelines that are adhered to causes expense for businesses and lack of compliance by the public.

Conclusion

The lack of evidence surrounding SUPP bans meant that only four policies could be analysed for effectiveness. From these, three high-level factors, government leadership, stakeholder engagement, and public support, were necessary for compliance and support for SUPP bans. These factors provided opportunity for dialogue and problem-solving for alternatives to SUPPs from consumers and businesses, otherwise the social burden of this type of bans was high causing widespread non-compliance.

SUPPs bans such as the EU Plastics Directive (European Commission, 2021) have come into effect within the last few years and go beyond bans on bags and disposable cutlery. Areas that may be much greater in volume such as textiles and microplastics are emerging fields that could benefit from lessons learned in the implementation of current SUPP bans.

SUPP and plastic bag bans are popular in countries where the natural environment provides tourism and other important income as they are quick and relatively easy to implement.

3.3 Taxes on plastic bags

Taxes are an economic instrument used to discourage or encourage specific behaviours via taxes, charges and levies. Taxes can be imposed on the manufacturer, the importer, the distributor, the retailer or the consumer. The responsibility for paying the tax may be placed on different parties, but the impact of the tax will likely be felt throughout the product life cycle. Taxes were mostly plastic bag taxes as there was little information found on other taxes or incentives.

The following policies were reviewed:

The Vietnam ***Circular No. 159/2012/ TT-BTC amending and supplementing Circular No. 152/2011/ TT-BTC of 11 November 2011***

guides the Government's Decree No. 67/2011/ND-CP of 8 August 2011. This further guides a number of articles of the Law on Environmental Protection Tax, including the imposing of an environmental tax of VND 40,000 (USD1.75) per kilogram imposed on the manufacturer of the plastic bags. This policy was regarded as unsuccessful due to the lack of consumer awareness, issues in enforcement, and regulatory loopholes.

The Botswana ***Amendment of the Waste Management Act 2006***

banned bags of a certain thickness, and introduced a levy on others. This plastic bag tax was replaced by a prohibition on plastic bags in 2018. The effectiveness of this policy could not be determined due to insufficient evidence.

The South Africa *Customs and Excise Act (1964) Amendment of Rules (No. DAW931, 2004),*

imposes a fixed price of 46 rand cents (USD 3.16) per plastic bag and was increased by an extra 3 rand cents (totalling USD 0.21). This policy was initially regarded as a major success, but ultimately failed to achieve long-term change as consumers became used to the tax.

The England *Single Use Carrier Bag Charges, Order 2015,*

imposes a fine of 0.05p (USD 0.07) on single use plastic bags. This policy was regarded as a success as it had positive consumer participation, despite the tax on plastic bags initially being deemed not high enough.

The Fiji *Environment and Climate Adaptation Levy (Plastic Bags) (Bill) Regulations 2017,*

which imposed a levy of 10 cents (USD 0.05) on plastic bags at point of sale, increasing to 20 cents in 2018 (USD 0.10). This policy had limited effectiveness, mostly attributed to administrative difficulty to track policy efficacy. However, this policy preceded a plastic bag ban which was deemed successful.

The Tonga *Waste Management (Plastic Levy) Regulations 2013*

focused specifically on the import of plastic bags, placing the levy charge on importing actors. The effectiveness of this policy could not be determined due to insufficient evidence.

The China *Administrative Measures for the Paid Use of Plastic Bags at Commodity Retailing Places (2006),*

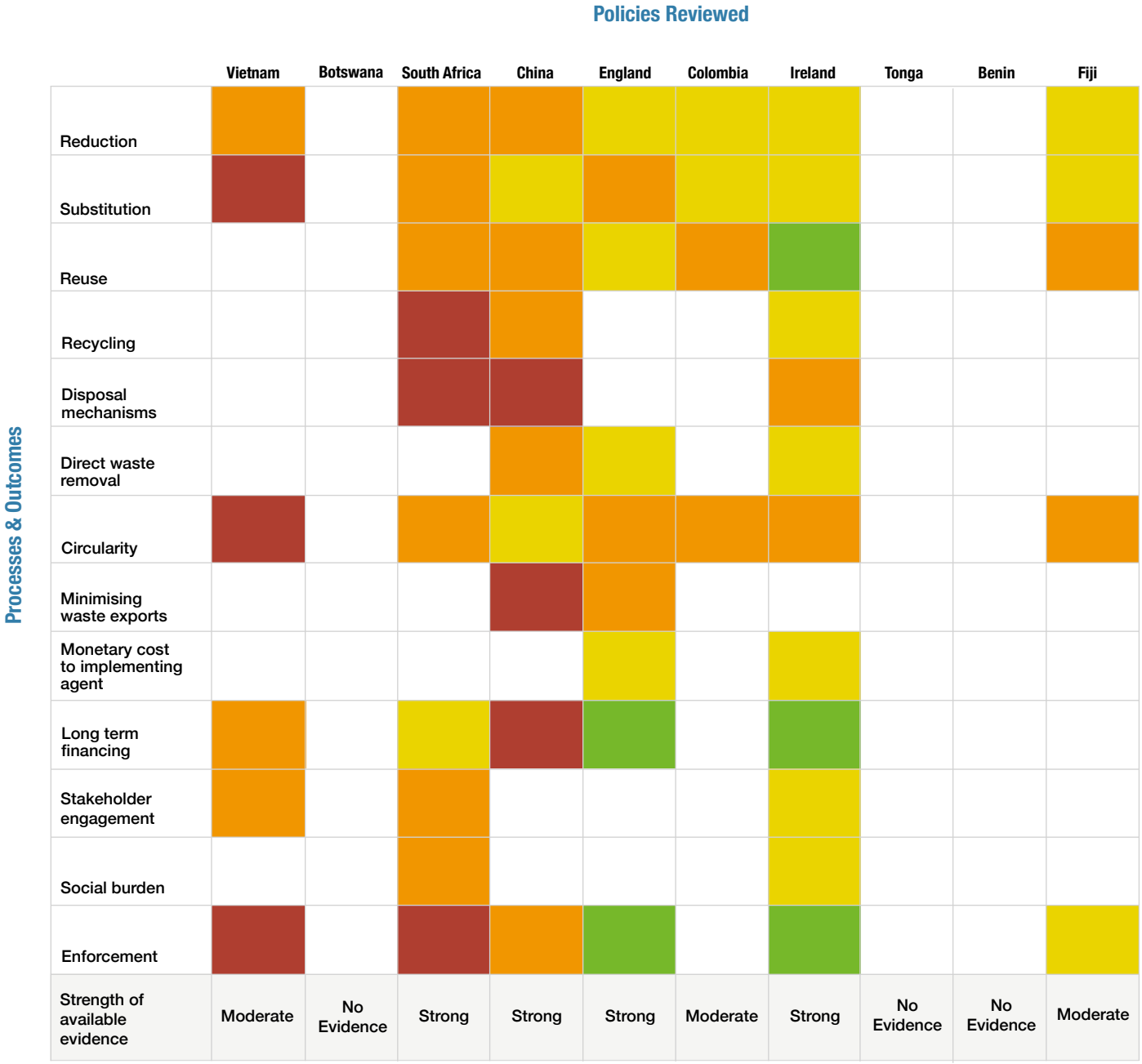
requires retailers to charge consumers a fee for thicker plastic bags not covered by the ban. The amount of the charge is at the discretion of the retailer. This policy failed to achieve its anticipated results, and has many exceptions to the ban; in 2021, SUPP bags were still free of charge in many places (Wang and Li 2021 in Liu., 2021)

The Colombia *Decree no. 2198/2017 National Tax on the Consumption of Plastic Bags,*

imposes a fine of 0.05p (USD 0.07) on single use plastic bags. This policy was regarded as a success as it had positive consumer participation, despite the tax on plastic bags initially being deemed not high enough.

The Ireland *Waste Management (Amendment) Act 2001, (Policy: S.I. No. 605/201 Waste management (Environmental levy) (Plastic Bag),*

in which consumers were charged 15 cents (USD 0.17) on plastic bags at point of sale. This later increased to 22 (USD 0.24) cents in 2017. This policy was effective in reducing plastic pollution and had widespread public acceptance.



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Key: *Contribution to policy processes and outcomes*

	Strong contribution
	Moderate contribution
	Weak contribution
	No contribution
	No evidence

Several evidence gaps are present: social burden, stakeholder engagement, monetary cost to implementing government agencies, minimising waste exports, and direct removal of plastic from the environment (Figure 3), but direct removal of waste from the environment is often not considered a key part of tax policies. Overall, the evidence base for taxes was strong except in a few areas.

Policy effectiveness barriers and enablers

The most significant enablers were public engagement through education and awareness raising activities, access to alternatives, stakeholder consultation and consistent messaging.

Availability of alternatives

Availability and suitability of alternatives acted simultaneously as a barrier and as an enabler for taxes on plastic bags. For example, in Ireland there was concern over the use of free paper bags as an alternative to plastic bag use (Anastasio and Nix, 2016) as they were considered not environmentally friendly. Consumers and retailers must be in support of the sustainable alternatives or they may continue to use single-use plastics out of necessity. Lack of viable alternatives was cited as one of the reasons that led South Africa's plastic bag tax to be ineffective (UNEP, 2020; Adeyanju, 2021). Taxes disproportionately affect lower income households particularly when no alternative is available and the possibility of smaller behaviour changes in higher income households (Thomas et al., 2019).

Tax effectiveness

Consumers may become used to the tax, resulting in a lack of effectiveness, such as in South Africa (UNEP, 2020). The South African levy was raised on 1 April 2022, but is too recent to assess the effect. Governments should consider building flexibility into the law so that the price can be adjusted to respond to changing market conditions. Ireland's plastic bag levy is an example of a flexible tax system (UNEP, 2020). Public information campaigns on the negative environmental impact of plastic bag usage are necessary to maintain the effectiveness of this type of policy (He, 2010).

Unintended consequences

Whilst England's single use carrier bag charges saw a decrease in thin-gauge bags, it does not take into account the significant increase in the so-called thicker-gauge 'bags for life', which are themselves being bought and used by customers on a single-use basis. A report by EIA and Greenpeace UK (2019) revealed 1.24 billion bags for life were sold by 8 companies in 2019 in comparison to the 960 million in the previous year. These thicker bags are charged at a slightly higher price to encourage reuse but this may not be occurring.

Information and education campaigns

An increase in public awareness through information and education campaigns is critical for the longevity and success of plastic bag taxes. Consumers need to be made aware of the tax and understand that they can avoid the tax by reducing the purchase of single-use plastic products. Retailers could be required to display a notice informing consumers of the charge as required in Fiji (UNEP, 2020). awareness and information campaigns were present in the more successful of the policies analysed for example in Ireland, there was a publicity campaign to promote the levy, stating the environmental reasons for its introduction (Anastasio and Nix, 2016).

Public acceptance

Consumer attitudes, perceptions and behaviours towards a regulation significantly influence policy implementation. Doing good for the environment was found to be key to engagement by the public (Adeyanju, 2021). In Ireland, a survey post-implementation found that there was strong awareness of the positive effect that the levy had on the environment among households. Some consumers admitted to feelings of guilt when they had forgotten to bring their bags, and the levy was found to induce “enthusiasm and affection” (Convery et al., 2007). Contrastingly, plastic bag tax is likely to fail if it is used to coerce stakeholders to alter behaviour (Muposhi et al., 2021). The language used by governments to communicate the purpose of the taxes is critical to changing behaviour. To achieve public buy-in, it is also beneficial to clearly establish the purposes of the revenue collected through taxes on plastic products and helps to address public controversy or scrutiny, particularly for unpopular taxes. The allocation of revenues for environmental projects strengthens the suggestion of a “green tax”. In Fiji, the Environmental Levy (Budget Amendment) Act 2017 states that money raised by its plastic bag tax will go to an Environment and Climate Adaptation Levy (ECAL) (UNEP, 2020). Similarly, Ireland's plastic bag environmental fund of 2002 saw all revenue being spent on environmental matters. In South Africa, however, there was a lack of transparency as to where taxes would be spent (Nahman, 2010; Muposhi et al., 2021).

Point of taxation

Taxation as a means of incentive or disincentive may not have the effects intended. Tax on producers is only effective if the tax is passed on to retailers in full (UNEP, 2018d; UNEP, 2020). Retailers are more likely to charge their consumers for plastic bags or to offer an incentive in the form of a rebate or reward to consumers not asking for plastic bags, which in turn may promote the use of reusable bags. In Vietnam, retailers were absorbing the cost of the tax due to the level being set too low and were still providing free bags, the plastic bags were being sold to the retailer at a price lower than the tax (Tuoi Tre News, 2019).

Conclusion

The specific enablers and barriers reflected throughout this policy type focus predominantly on plastic bag taxes due to availability of evidence within the given search timeframe of this study. These taxes have had mixed success and policy effectiveness. Ireland is a good example of a robust yet flexible tax that is strongly supported by the public. When implemented flexibly, taxes are efficient at incentivising behaviour change and can be applied to other stages of the plastic life cycle such as waste infrastructure, disposal mechanisms, and virgin plastic. However, care should be taken to avoid disproportionately impacting communities with limited access to alternatives.

There is scope to increase the evaluation in future studies to include taxes on plastic products beyond single-use plastic bags, such as the UK Plastic Packaging Tax which came into force in April 2022 and was introduced to disincentivise single use and stimulate increased levels of recycling by charging £200 (USD 250) per tonne of plastic packaging that does not contain at least 30% of recycled plastic but this is much lower than the EU plastic packaging tax which is set at 800 euros (around USD 855) per tonne (Wildlife and Countryside Link, 2021).

Photo by James Wakibia

3.4 Producer accountability

Producer accountability in the context of this study includes extended producer responsibility (EPR) and deposit return schemes (DRS). These are both systems which require action and financial input from business.

A core characteristic of EPR policies is the placing of some responsibility for a product's end-of-life environmental impacts on the original producer and seller of that product who provide and cover collection and disposal costs. The intent is to incentivise producers to make design changes that reduce waste by improving product recyclability and reusability, reducing material usage, and downsizing products (Walls, 2006). Policies that shift the burden of waste generation from consumers to producers can enable the development of new business models and zero-packaging solutions. The costs of these developments are usually passed onto the consumer.

EPR schemes have three objectives:

1. Polluter pays principle
2. Funding to deal with plastic pollution
3. Financial incentives for producers and users of plastics to reduce, reuse, recycle and redesign products.

The economic rationale behind implementing sound EPR schemes is to create an incentive to design long-lasting products that are more easily reused or recycled. EPR requires producers to account for the environmental costs of their product's end of life. This requires the design of easy-to-disassemble products, reduction of the use of difficult to recycle plastics, avoiding toxic and coloured plastics and improving product labelling and recycling infrastructure (OECD, 2016; Pouikli, 2020).

In terms of financing an EPR scheme, the division of costs depends upon how individual EPR schemes are constituted within the various countries. Shared costs can be considered at two levels:

A. Costs for collection are split between the obliged industry, local authorities and municipalities,
B. The obligated industry costs can be further divided along the value chain and fees are paid by players at each stage (e.g. packaging manufacturers, producers/ importers and retailers).

These costs cover:

A. Separated collection of used packaging for recycling and recovery
B. Sorting for recycling
C. Consumer awareness campaigns and clear labelling

Deposit return schemes (DRS) are an example of Extended Producer Responsibility, requiring producers to be responsible for the packaging their products are sold in. In some cases, producers are responsible for reimbursing retailers for the deposit value on containers collected and pay an additional handling fee. Products are designed to fit the DRS and recycling stream and information on DRS is included on the packaging. Aims are often based on annual collection targets.

DRS schemes are usually funded through three areas:

1. Unredeemed deposits
2. Revenue generated by selling the collected materials for recycling
3. Producer fees. Fees may vary but are usually charged for each container placed on the market. DRS are included in this research under ''Producer Accountability as producers are responsible for the containers and have legal obligations relating to their collection and recycling.

The following policies were reviewed:

The Barbados *Returnable Containers Act. (1986) on the collection of plastic bottles and reduction of litter.*

There was limited evidence for this policy despite being in place since 1986. There are no set indicators for monitoring and also no defined objectives but plausible attribution suggests the scheme is successful as it has continued for so long and was extended to include other packaging in 2019. There were some problems with retailers refusing to pay consumers cash for their returns, providing vouchers for their stores instead which is contrary to the legislation.

The Norway *Product Control Act. (1999) on the recycling of plastic and metal beverage bottles*

sets a producer collection rate of over 95%. If they fail to meet this, there is a sliding scale environmental tax. There was limited evidence on this policy despite being in place since 1999. The policy itself is voluntary and DRS-based with tax incentives. There is notable awareness of this policy among the public and a return rate of 95%. The policy is being used as a framework for other DRS schemes in other countries.

The Chile *EPR Decree for Packaging (2019)*

aimed to increase recycling of plastic packaging by households and industry to 70% and 85% respectively by 2030. The effectiveness of this policy could not be determined due to insufficient evidence.

The South Africa *Extended Producer Responsibility (EPR) Regulations (2020), aims to reduce pollution and promote a circular economy.*

The environmental costs of end-of-life management of a product is included in the sale price. The policy was delayed due to the need for further stakeholder engagement. The effectiveness of this policy could not be determined due to insufficient evidence.

The Israel *Deposit Regulations on Beverage Containers, 5761 (2001)*

focused on the EPR for plastic waste via DRS. The policy has been updated to include larger bottles. There has been a collection rate of 85% for smaller bottles that has led to less ending up in the environment. Large bottles, on the other hand, have continued to be a source of pollution. More infrastructure is needed in the form of bottle return machines.

The Canada *Action Plan for Extended Producer Responsibility (2009)*

was an EPR based policy implemented by provinces. EPR has been set up in different ways in each province creating a fragmented approach with responsibility left to municipalities and varying degrees of producer funding, while many municipalities are already financially constrained. This has also led to inconsistent regulations and systems being introduced (McRobert et al., 2019). There has been no significant reduction in plastic packaging debris in areas where EPR has been developed and minimum recyclable content has not increased.

The Japan *Packaging Recycling Act on the Promotion of Sorted Collection and Recycling of Containers and Packaging (1997)*

was an EPR based regulation to reduce waste to landfill and increase recycling. High collection rates were achieved for bottles and half were reported as recycled, but half were either combusted, collected as heat source or exported (Yamashita & Matsumoto 2014). Implementation is via municipalities who can choose which items are collected. The costs for municipalities are high, but there is strong evidence of improvements to recycling infrastructure. The policy is only aimed at household waste and exempts small businesses from producer responsibility.

The Belize *Returnable Containers Act (2009)*

focuses on beverage containers including bottles or cans used to contain 1 gallon (3.8 litres) or less that are made of plastic, glass, metal, aluminium, or steel. It declares that all distributors must collect a deposit on beverage containers sold or distributed. The effectiveness of this policy could not be determined due to insufficient evidence.

The Germany *Mandatory deposit for one-way drinks containers, Packing Ordinance (2003)*

was a mandatory DRS for plastic single use bottles. This policy has succeeded in reducing littering of plastic bottles to nearly zero. The aim was to increase refillable bottles to 80% but this policy caused an unintended reduction of refillable bottles to 50% due to manufacturers changing from glass bottles to PET bottles which are cheaper to produce and transport after collection. There is a higher fee for buying and returning PET bottles as a deterrent but it had the opposite effect due to the funds generated by manufacturers from bottles that were not returned (Rhein and Sträter, 2021). The nationwide use of the Deposit Return Logo on all PET bottles that fall under the DRS has contributed to high return rates by consumers.

Figure 4: *This matrix shows how each policy performed against a selection of the reference statements in the analytical framework. The overall strength of evidence upon which the policy review is based is noted.*

Key: *Contribution to policy processes and outcomes*

	Strong contribution
	Moderate contribution
	Weak contribution
	No contribution
	No evidence

There was a lack of evidence for three of the policies; Belize, Chile and South Africa. Chile and South Africa are recent policies, 2019 and 2020 respectively. Belize was implemented much earlier (2009), but there is a lack of evidence about this policy to be analysed against the framework. Six of the ten policies studied were DRSs. Few full EPR policies were examined as most are too recent to evaluate their contribution to preventing plastic

entering the environment. Only two of the EPR policies examined had enough information for analysing under the framework. While policies with sufficient evidence to review generally had few gaps in evidence, for this section a notable portion of the evidence came from the press or association and other websites. There was very little peer-reviewed evidence in those with limited evidence bases, which may be due to a lack of data collection by the companies involved, or poor dissemination of monitoring information. The strength of evidence for each reviewed policy is highlighted in figure 4.

Norway's DRS policy, which is based on voluntary commitments from producers, performed well in most categories. This policy is being used by other countries as a framework for the introduction of DRS. Apart from this case, generally the voluntary EPR or DRS policies reflected as less effective in the analytical framework in comparison to those with mandatory components.

Few policies addressed reduction and reuse of plastic, yet reuse should be an important element of EPR. Incentives to design for reuse should be part of a DRS policy for producers. Recycling was an important part of the successful policies however, reduction of waste exports was not identified, as recycling waste may be exported instead of recycled locally. This type of policy performs well for the circularity of plastic but places burdens on the public to deposit and sort as well as a financial burden on the companies. Evidence of collected bottles being recycled was difficult to find and was not transparent due to exports of plastic waste.

DRS is proclaimed as one of the most successful types of policy (Chatham House, 2020). The analytical framework shows similar evidence of success, as seen in Figure 4, but in the cases analysed, exclusively focus on PET bottles. Where DRS policies have performed less well, it was due to a lack of cohesive waste management, EPR or recycling policy to manage the returned plastic resources (see Section 5.3 regarding integrated policies). Although policies such as the DRS of Germany and Switzerland performed notably well against their own objectives and saw an incredible return in post-consumer plastics, they performed less well against the analytical framework given that most of their plastic waste is exported rather than recycled in-country. Exporting plastic waste under the guise of 'recycling' without transparency of actions to the receiving nation is not a sufficient waste management option. Cross-referencing recycling capacity and output data with domestic plastic waste generation and imports of a nation receiving plastic waste paints a clear picture of the misalignment between what is produced and what is managed in an environmentally and socially responsible manner (EIA, 2021). There are opportunities for DRS to be expanded across other plastic products in addition to PET bottles but clarity of labelling, ease of access and effective recycling are a major requirement. The drive for DRS should be focused on a reuse policy rather than a recycling policy once the items are collected to encourage more effective use of resources.

Policy effectiveness barriers and enablers

Labelling

A major enabler that contributes to effective EPR and DRS policies is using clear labelling on the plastic production or bottle. The DRS schemes analysed have seen significant success in return rates where clear national labelling systems were in place, such as Germany's Pfand (deposit) system.

Integration with supporting policies

For EPR or DRS to have meaningful impact, policies need to be integrated at the national level with other policies that deal with plastic waste management. The evidence suggests that DRS should be well integrated into a further EPR system, and that sufficient recycling strategies and legislation are required. As an industry-led example, Lush Cosmetics (found in section 4.3) have performed particularly well against the analytical framework from a producer accountability and DRS perspective. Once their plastic packaging is returned through the in-store DRS scheme, Lush have ownership of the recycling programme and manage the waste and distribution of recyclate where the DRS operates, ensuring that only 10% of all waste goes to landfill (see section 4.1 on industry).

Communication and education

The DRS systems that are implemented alongside public awareness campaigns are the most effective. Norway's DRS is such an example with a very high rate of return. The public, schools and charities have become accustomed to collecting bottles from the environment for the tokens they will receive in exchange for returning them to the vending machines (Life in Norway, 2018). Reverse vending machines are a means of making policies effective as they give a value to the plastic bottle and an incentive to the user who receives cash back.

Collaboration

An enabling factor for effective EPRs and DRS is found in collaboration between companies and recycling facilities. Not for profit collaborative recycling associations such as ELA in Israel are an essential part of EPR as recycling companies currently struggle to be profitable. Linking recycling companies to EPR and creating a central recycling collaboration provides a solution.

Finance and national consistency

The costs of implementing EPRs and DRS should be covered by the producer but central government financial support is also necessary for coordinating infrastructure nationally. This could be a significant barrier to policy effectiveness. This was evident in the Canadian and Japanese EPRs which were implemented by municipalities and provinces with limited finance. There are variations and inconsistencies across the different municipalities or provinces relating to the types of plastics that could be returned, causing large gaps in recycling rates. This confusion has also caused disengagement by the public.

Conclusion

Within EPR, DRS is one of the more successful types of policy leading to very high collection and sorting rates of up to 95%, which in turn reduces litter drastically. Placing a value on a waste product is essential for achieving a circular economy and DRS does this very successfully. When linked to efficient recycling, DRS can provide high rates of recycling for PET bottles as well as other plastic items. The weighting of incentives and disincentives needs to be carefully applied to avoid unexpected consequences. DRS and EPR, when self-funded by producers rather than centrally funded by the government, offer increased prospects for long-term, sustainable financing. The 'polluter pays' principle aligns with EPR and this type of policy is likely to lead to innovation and ease of recycling. DRS and EPR can be very successful as seen in Norway and this type of policy can be implemented in all countries. Norway is currently assisting the implementation of DRS in a number of nations. With proper stakeholder involvement, informal waste collectors can also enhance this type of policy in low to middle income countries and benefit via direct payments. Ultimately, the success of EPR and DRS schemes rely heavily on sufficient waste management structures and other interlinked policies, and should not be implemented as a standalone policy.

3.5 Recycling regulations

Recycling policies are generally sections of waste management policies and the policies examined had no separation of chemical or mechanical recycling. Recycling policies target separate collection and reprocessing of plastic, and the objectives are usually framed as a percentage of plastic packaging to be recycled. Some plastics are difficult or impossible to recycle and the majority of plastic recycling centres around PET bottles. Successful recycling policies are often combined with EPR, where a central not-for-profit company collects, sorts and recycles the plastic waste. When combined with deposit return schemes, these can be highly effective but currently only apply to PET bottles. Recycling is multifaceted as there needs to be separate waste collection, recycling facilities and a market for the recycled plastic to be successful.

Extended Producer Responsibility (EPR) schemes have three objectives:

1. Developed (high-income) countries with local regulations for recycling achieving an average of 30% plastic recycling
2. Developed (high-income) countries with no regulations achieving about 10% plastic recycling.
3. Developing industrialised countries with little systematic collection leading to dumping. Unregulated recycling occurs via waste pickers leading to informal recycling of an estimated 20%
4. Developing countries with limited industrialisation countries with very little waste management leads to wide-spread dumping or burning and waste entering the ocean.

The policies reviewed in this section focus primarily on mechanical recycling as policy concerning chemical recycling is incredibly limited. Recycling policies should include monitoring of pollution, human health implications and their level of circularity, but this area is too recent to analyse currently.

The following policies were reviewed:

The Malta *Waste Management (Packaging And Packaging Waste) Regulations (2007)*

This is a recycling programme and a deposit return scheme. Malta has the worst recycling rate in the EU recorded as 5% in 2014 improving to 19% in 2018. There was no evidence the deposit return scheme had been implemented in the literature. Extended Producer Responsibility was only placed on Malta manufacturers not on imported goods, leading to 400 producers leaving the scheme. Malta was taken to court for not reaching targets placed by the European Waste Directive.

The Trinidad and Tobago *National Waste Recycling Policy (2015)*

which aims for a reduction in waste. There has been a 60% reduction in waste by 2020. One recycling centre has opened and a recycling programme has been initiated.

The Fiji *Environmental Management (Waste Disposal and Recycling) Regulations (2007)*

imposes strict requirements in relation to the disposal and recycling of business operations in Fiji but there are no recycling facilities on the islands for plastic bottles. The DRS for Fiji Water and Coca Cola plastic bottles has led to litter picking for the income generated by informal waste pickers. The collected bottles are packaged up and sent to China creating a lack of transparency for levels of recycling (Tudor & Williams, 2021).

The Austria *Ordinance on the prevention and recovery of packaging waste and specific waste products (2002)*

related to household separation and extended producer responsibility for packaging collection and recycling. Extended producer responsibility is obliged not enforced. Households are required to separate waste but many do not cooperate. Austria's plastic recycling is 31%, below the EU average of 41% but Austria has banned plastic from landfill.

The Canada *Strategy on Zero Plastic Waste (2018)*

which aims for 100% reuse or recycle and 50% recycled content of plastics by 2030. Single use plastics and microbeads were banned in 2020. The policy is enacted by provinces which is problematic as there is inconsistency of approach. There is a low level, 11%, of plastic recycled.

The Japan *Packaging Recycling Act on the Promotion of Sorted Collection and Recycling of Containers and Packaging. Packaging and containers (1997),*

focuses on packaging and containers. This is an Extended producer responsibility based, recycling and refill policy. Municipalities are responsible for implementation and this has led to a lack of consistency and confusion for the public, however 90% of PET bottles are recycled.

The Republic of Korea *Act on The Promotion of Saving and Recycling of Resources (2017) waste reduction and recycling*

The policy uses a volume waste fee system and DRS. The Republic of Korea has required standardisation of containers and there are bans on hard to recycle plastics. The recycling rate is 58% and there are 6 clear recycling categories. Unfortunately, despite the good recycling rates, the Republic of Korea has one of the highest rates of consumption of plastic per capita of anywhere in the world.

The Latvia *Regulations Regarding Separate Waste Collection, Preparation for Re-use, Recycling and Material Recovery (2013)*

separation of waste collection for recycling. The policy requires separation of waste into 4 categories and has been introduced due to the EU Waste Directive. There are taxes on landfill and hard to recycle plastic.

The Palau *Recycling Act (2011)*

has established a recycling programme for the Republic of Palau, and a beverage container deposit fee, creating a Recycling Fund. **The policy is a recycling and deposit return scheme for PET bottles and achieves a 90% recovery rate of plastic bottles.** The bottles are sent to Taiwan for processing.

The Turkey *Zero Waste Regulation (2019)*

focuses on decreasing waste at source and increasing recycling. Turkey has adopted a Zero Waste policy and Zero Waste Blue concerning ocean plastic. The recycling rate is 12.3%. Turkey is one of the top 10 importers of plastic waste and imports 40% of UK plastic but there is little evidence of recycling, and instead evidence of illegal dumps and burning of plastic (BBC News, 2021).

The Philippines *Ecological Solid Waste Management Act (2000)*

focuses on resource conservation, recycling, reuse, recovery, segregation of waste, research and education. There are collection points for waste separation and incentives for recycling, but there are many illegal dumps and little waste management structure. Only 21% of regions have implemented the policy and some have no waste collection. There is a lack of funding and technical skills.

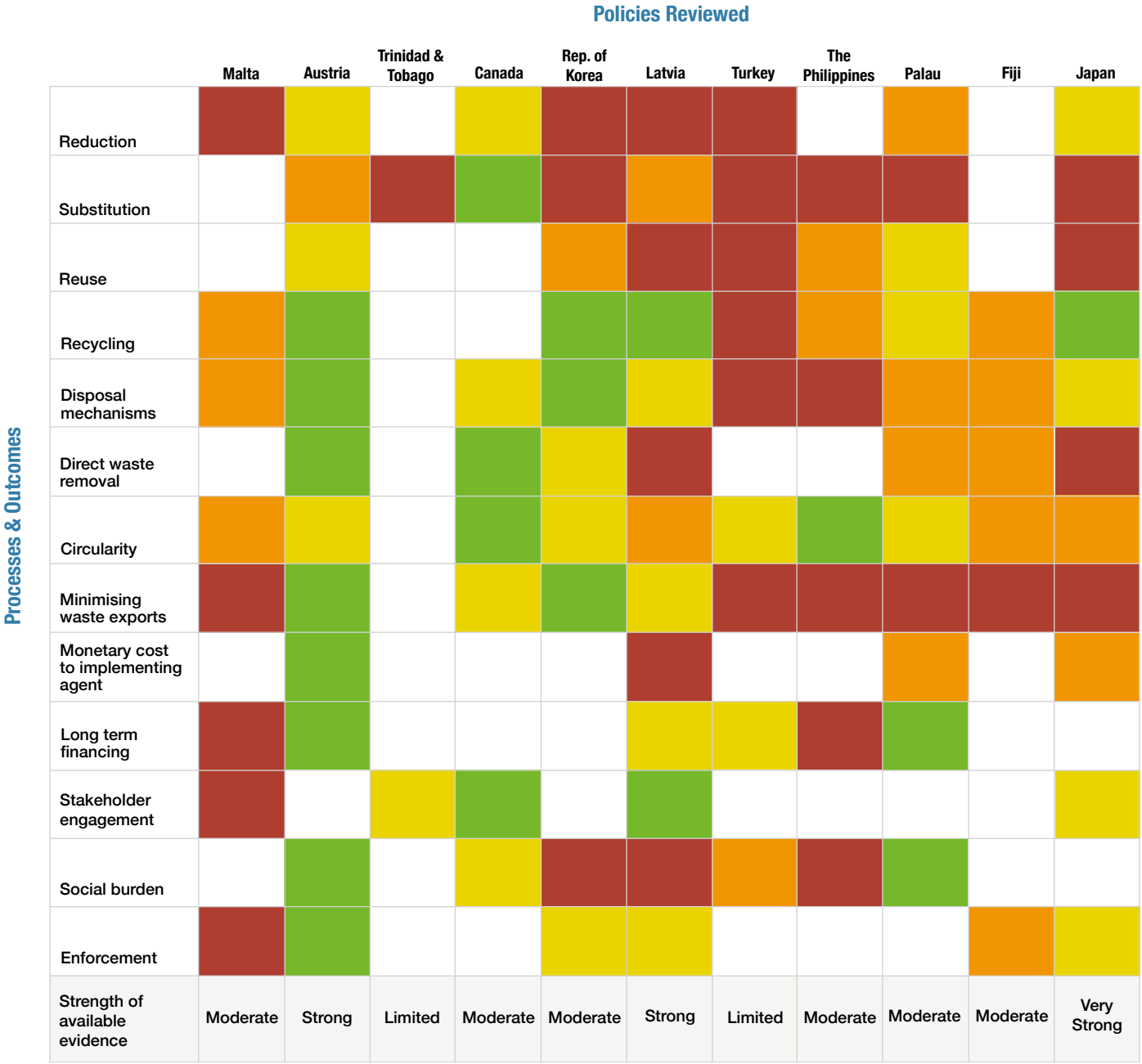


Figure 5: *This matrix shows how each policy performed against a selection of the reference statements in the analytical framework. The overall strength of evidence upon which the policy review is based is noted.*

Key: *Contribution to policy processes and outcomes*

	Strong contribution
	Moderate contribution
	Weak contribution
	No contribution
	No evidence

The recycling policies generally had good evidence although little was peer reviewed. Most of the evidence was from news articles, association websites and other websites. The higher level of evidence for this section may be due to public involvement in recycling as it is something at the forefront of an individual's perception of plastic waste disposal.

Recycling has a high social burden for the general public, but has limited effect on substitution and reduction. The policies failed to reduce waste export and this highlights the problem of plastic waste being exported for recycling. This type of policy should demonstrate high levels of success for the recycling sector but Figure 5 demonstrates that many of these policies are struggling to achieve good implementation and high recycling rates. The most significant problem with information in this area is assessing the true recycling rate when plastic is exported but presented as recycled.

Policy effectiveness barriers and enablers

Separated Waste Collection

The more effective policies were based on EPR and DRS. DRSs provide excellent collection rates of up to 90% and a pure stream of plastic for recycling. Separate waste collection is less effective due to confusion, contamination and regional variation. Effective policies have optimised separation with a national strategy and clear labelling, as seen in Japan, or volume waste charges, as seen in the Republic of Korea, where general waste is charged as a fee per bag but recycling is free. Contamination from plastic film is a major cause of downgrading of recyclate output. Clear consistent separation and collection on a national basis is essential (Antonopoulos et al,, 2021)

Education and public engagement

Public engagement and education are important for effective recycling policies (OECD, 2018). Kerbside separate collection and fees per weight refuse collection are the most successful ways of increasing separated waste, but unclear labelling and regional variations for recycling collection cause confusion and disengagement. Environmental concern increases consumer recycling but only if recycling is convenient (Jacobsen et al., 2022). Public education and a clearly communicated separation policy are needed for good cooperation.

25% of plastic waste arriving at recycling plants is contaminated with incorrect types of plastic, food waste and other materials and cannot be recycled (Collins, 2019). This reduces the effectiveness of recycling as a generator for recycling which is key for companies who are aiming to increase recycled plastic content in existing products (such as Coca Cola). Recycled PET plastic produces 79% less carbon emissions than virgin PET and uses less energy to produce. This contamination can be reduced by public awareness campaigns.

Innovation in infrastructure

The EU Waste Directive requires all plastic packaging must be reusable or recyclable by 2030 (Knoblauch & Mederake, 2021) but a lack of infrastructure is a barrier to this goal. Government policy is essential for the success of recycling but many policies are delayed or cancelled leading to a lack of development in recycling plants and innovation (Sakthripriya, 2022).

Infrastructure that is convenient for the consumer is also an effective policy enabler. For example, many countries lack or have limited kerbside collection of waste, a factor in the failure of the Philippines policy. Recycling, kerbside collection and convenience for the consumer are essential factors (Muller, 2013).

Creating a market for Minimum Recycled Content

To catalyse effective recycling policy, a market for recycled plastic needs to be established (OECD, 2018). Recycling companies close due to falling crude oil prices, reducing the costs of virgin materials and there is a lack of markets for recycled plastic. To facilitate effective recycling policies, incentives are needed and support from the government via taxation of virgin plastic and landfill (Collins, 2019).

Finance

Funding was a barrier to policy effectiveness, especially given the need for innovative infrastructure. The policies that were initially successful did not have enough funding to enact the policy fully. For example, in the Republic of Korea, many of the recycling companies were small, government owned businesses and therefore did not have funding for innovative new technologies (Asia Today 2014). Similarly, in the Philippines, there is no funding available to develop recycling infrastructure which was a major barrier to effective policy (Sapuay, accessed 2021). Recycling companies are currently unable to operate on a profit basis and should be given funding to be able to function.

EPR

EPR is the most effective means of developing recycling (OECD, 2018). Recycling plants can be created by cooperative groups of companies on a not for profit basis. EPR encourages companies to design packaging with easier to recycle materials. Plastic made from virgin materials has a high carbon footprint, recycled plastic has much lower greenhouse gas emissions (OECD, 2018) making reuse and recycling an essential part of the plastic cycle.

Stakeholder engagement

Stakeholder engagement was often an evidence gap in recycling policies, despite the need for EPR and innovative solutions for infrastructure. An exception to this is Latvia, who included a consortium of packaging businesses and industry, waste management organisations, and NGOs in policy formulation (Brizga, 2016). However, it is not clear to what extent this stakeholder engagement shaped the final policy.

Stakeholder engagement helps to formulate collection and recycling goals that are achievable for industry and local authorities, and acted upon by the public. Successful recycling policies had national waste separation rules and clear labelling that the public found easy to follow. Uncontaminated plastic is an essential component of recycling as contaminants produce downgraded plastic that is then downcycled and is lost out of the circular economy. In low to middle income countries, there was no evidence of informal waste pickers being involved in policy development, despite being an untapped resource. Informal waste pickers are essential for achieving effective recycling policy in low to middle income countries, and also facilitate separate collection. They can achieve recycling rates of 20-40%, higher than developed countries (which currently recycle at 10-30%) (OECD, 2018).

Export of Plastic Waste

More than a quarter of a billion tonnes of plastic has been exported since 1988. The flow of this export is mainly from developed Western countries to developing Asian countries and Turkey with a third of the exports originating in the USA, Japan and Germany. Before China's national ban on plastic waste imports in 2018, China was the biggest importer, making up just over 72% of global waste imports, but an estimated 76% was mismanaged (EIA, 2021; Wang et al., 2020). The ban moved an estimated 111 million tonnes of plastic waste elsewhere in South-East Asia and Turkey. The imported plastic waste is mismanaged with estimated mismanagement rates of: Malaysia 57%, Indonesia 83% and Thailand 75%, and Turkey 90% (Jambeck, 2015; EIA, 2021). Amendments in 2021 to the Basel Convention (1989) that address plastic waste exports have had

less effect than expected, according to data collected by EIA (EIA, 2021) although various countries including Malaysia, The Philippines, and Cambodia have started to respond by sending waste containers incorrectly labelled as recycling, or full recycling material containers back to the source countries.

The lack of transparency surrounding export of plastic waste is a barrier to effective plastic policy, as recycling rates cannot be confirmed. Countries with high GDP are claiming high recycling rates but exporting considerable amounts of plastic waste to Asia and Turkey where recycling facilities are overwhelmed or non-existent (Bishop et al., 2020). In the EU, 46% of plastic waste collected for recycling is exported. The UK has the lowest recycling rate of exported plastic in Europe, at 69%, when 100% was recorded as recycled. There are relationships between the amount of plastic exported for recycling from Europe and the percentage which results in ocean debris (Bishop et al., 2020; Wang et al., 2020). There is a desperate need to increase traceability and transparency in this area (EIA, 2021).

Data

A lack of available data is a barrier to the evaluation of effective policy. For all policies investigated, there was a lack of published and accessible data. Recycling rates are expressed as a percentage but often the base year or data is not mentioned making analysis difficult. The headline numbers for recycling can be deceptive due to high income countries exporting plastic waste to developing countries to be recycled. Instead of being recycled, this plastic is often dumped in an illegal landfill or burned but the waste is still recorded as being recycled.

Conclusion

Examining the differences between the most and least effective policies, the differences were mainly finance for infrastructure and the presence of good basic infrastructure for waste collection. There is a need for transparent reporting in this area due to the export of waste for recycling to countries with limited recycling infrastructure. Many of the more successful policies include a not-for-profit recycling cooperative often linked with EPR legislation where businesses join the corporate to fulfil their EPR requirements.

Recycling that has been developed is focused on easy to recycle PET bottles as this is a high value product and little innovation or infrastructure has been produced for other types of plastic. Successful recycling needs a market for the recycled material. Policy can help generate this market but the two are co-dependent. The market for the recyclate is an essential part of the financial success of a recycling company or corporate, but this market will only develop once there is a good flow of recyclate available. Recycling policy also needs legislation related to the sale of the recycled plastic such as a tax on virgin plastic or a requirement for a high percentage of recycled content in plastic packaging, or both. A recycling policy cannot stand alone but should be combined with EPR, DRS, recycled content requirements, taxes on virgin plastic and waste separation policy.

There is a lack of transparency and data of how much plastic waste is recycled due to waste plastic export being included in data with no evidence of the recycling occurring at the export destination. There is no differentiation between exported recycling and on-site recycling. Exporting waste to low to middle income countries provides cost effective sorting and processing, jobs and economic opportunities, but there are problems due to pollution, imported waste overwhelming infrastructure, transhipment, evidence of this processing occurring and downcycling due to contaminated waste from the country of origin. Thirty-eight member countries of the Organisation of Economic Cooperation and Development (OECD) produce 87% of all plastic waste exports (EIA, 2021). Ultimately, recycling is not a panacea for solving the plastic waste problem, as recycling is often a case of downcycling, due to contamination from toxins, colourants and incorrect separation. New recycling technologies can distract from the wider need to reduce and reuse materials, and the need for upstream interventions to slow the rate of extractive and harmful production practices.

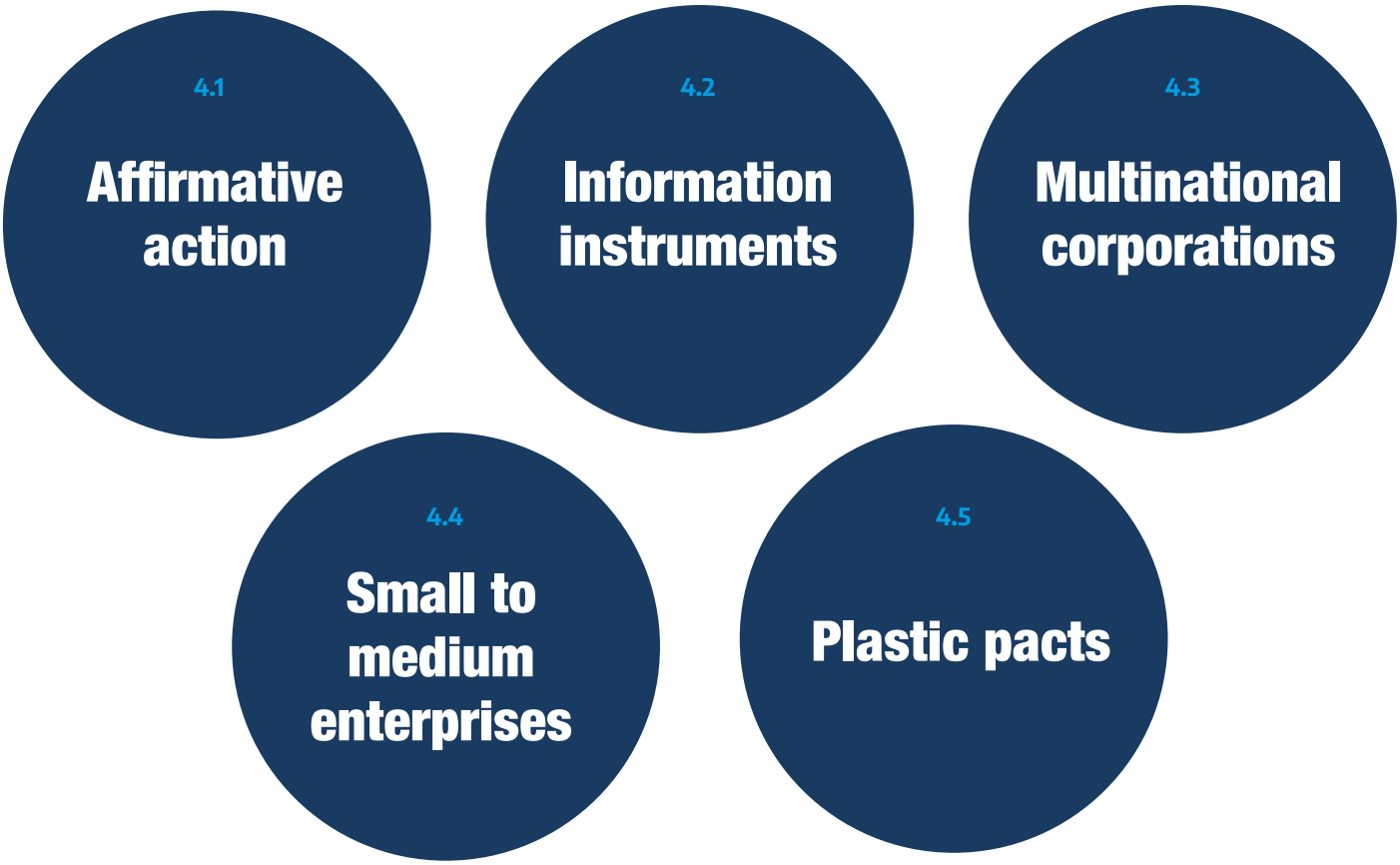
Photo by James Wakibia

4 Voluntary Policy Initiatives

4. Voluntary Policy Initiatives

Voluntary approaches refer to a broad range of possible interventions including self-regulation by industry, regulation mandated by the government with a voluntary application by industry or municipalities, or co-regulatory negotiated interventions. Many of these interventions are led by the private sector with the capacity to have wide-reaching impacts on supply chains and consumer behaviour. Voluntary policies have much to offer and if executed effectively with the right intentions can inspire and influence government action. Despite the positive nature of these interventions, the limited accountability, transparency, monitoring, clear targets and economic driven nature of industry generates much uncertainty as to what extent they can be relied upon in reaching the overarching goals of public policy (McCarthy and Morling, 2015).

A summary of the findings for each policy type is presented below. The policy types evaluated are:



4.1 Affirmative Action

Affirmative action, for the purpose of this study, is defined as policy contributions that describe what shall be done, usually in the form of action plans or strategies. This type of policy is usually voluntary and can develop via collaboration between government and the private sector and when successful, they can have global influence on international policy making. These can be in the form of agreements, action plans, roadmaps, or strategies. They have more freedom to address problems in innovative ways as they are not tied by the constraints of formal government policy, and can be implemented faster than legislation. These initiatives have the ability to change direction and adapt to the latest global concerns and policies. Affirmative actions are either developed by stakeholders or heavily involve them. Indigenous peoples and unregulated waste pickers have been central to the success of such policies. There is often good collaboration with a wide range of groups and this can lead to new innovative ideas and engagement of the public.

The methods and data collection for these initiatives vary greatly with little auditing and independent verifiable data. They can be viewed as enablers to drive policy and behaviour change. Affirmative action could provide a vehicle for progress across nations and regions by empowering countries to set targets, develop and implement national policies tailored to meet specific national needs and circumstances, and address the life cycle of plastics.

The following policies were reviewed:

The UK *Plastics Pact (2018)*

aims to eliminate problematic plastics and increase recycling and recycled content. The policy framework was provided by WRAP, a charity helping countries set up plastic pacts. Individual businesses sign up voluntarily. Since the policy was initiated in 2018, the recycling rate has increased from 44% to 52% and there has been an increased construction of recycling plants. Funding is via the companies who pay fees to be part of the pact and there is £20 million for research and £60 million from the UK Government which is to be matched with £149 million from business. Reporting is thorough and there are clear 3 year objectives. The roadmap provides a timeline for each area responsible for achieving targets. The pact has influence in government and is requesting legislation requiring EPR. Plastic Pacts are being initiated in many countries via WRAP, the UK was the first and is demonstrating some success.

The Netherlands' *'A Circular Economy in the Netherlands by 2050'*

aims for 100% circular use of raw materials by 2050 and 50% by 2030. There is a knowledge sharing platform called Hot Spot. The Netherlands has one of the highest recycling rates for general materials at 80% and circular use of 29%, but there is a large amount of plastic exported for recycling by the Netherlands to Asia. The Netherlands wants to be a world leader in zero waste and is helping other countries set up similar initiatives.

The Australian *Ghost Net Initiative (2018)*

focuses on the removal of ghost nets from the environment. Ghost nets are damaging marine life in Australia, but 90% are from other countries. The areas they collect are very remote with no basic waste collection or management. The initiative funds indigenous rangers to collect and record data and tag larger nets that cannot be retrieved by the rangers. This has expanded into a global initiative to tackle ghost nets.

The New Zealand *National Plastics Action Plan for Aotearoa (2021)*

aims to change behaviours, and redesign products, services and systems to avoid using plastics, and enable plastic reuse and repair. Deposit return schemes have been introduced and standardisation of kerbside collection. The plan places strict rules on compostable packaging. There is USD 100 million of funding for recycling infrastructure. Campaigns and education are included in the plan and USD 50 million for research and innovation.

The Japanese *National Action Plan for Marine Plastic Litter (2019)*

focuses on prevention of littering and dumping and aims to improve collection. The Plan incorporates initiatives, public clean-ups and separation at source. This plan is part of the G20 action on marine plastic and Osaka Blue Ocean Vision. Japan is helping a number of developing countries with plastic policy.

The Kenyan *Plastic Action Plan (2019)*

is a type of Extended Producer Responsibility led by industry and includes payment into a cooperative for waste management. The aims are to create a circular economy. There is currently very little waste management in Kenya and waste sorting is heavily reliant on informal waste pickers. The plan did not include a deposit return scheme which could have been very beneficial and could have produced a method of payment for informal pickers.

The Australian *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life (2009)*

policy aims to reduce marine debris by preventing and removing debris from the marine environment. The plan was particularly focused on shipping and fishing, enacted by individual states. The need for waste infrastructure was identified at marinas and ports but no progress was made. In 2015 the Australian Government declared the plan a failure. This was due to the voluntary nature of the plan, enacted by individual states and the lack of finance.

The Belgian *Action Plan on Marine Litter (2017)*

for the reduction of litter entering the marine environment from land and from fishing and the removal of plastic. The plan introduced 'Fishing for Waste' - fishermen collect waste in big bags which 98% of ports can receive and send for recycling. 'Fishing for Waste' has expanded globally due to its success.

The Vietnamese *National Action Plan for Management of Marine Plastic Litter by 2030 (2020).*

Marine plastic waste abatement. Vietnam is the 8th worst polluter for plastic into the ocean and 6% of all marine plastic comes from Vietnam. Vietnam is also one of the top 5 importers of plastic, but has little recycling infrastructure. Vietnam became chair of ASEAN in 2020 and Vietnam signed the Bangkok Declaration on Combating Marine Debris. Vietnam introduced this plan in 2020 as a result. There is a lack of infrastructure. Finance is provided by Germany and Japan and there is support from WWF. The plan is too recent to see any results.

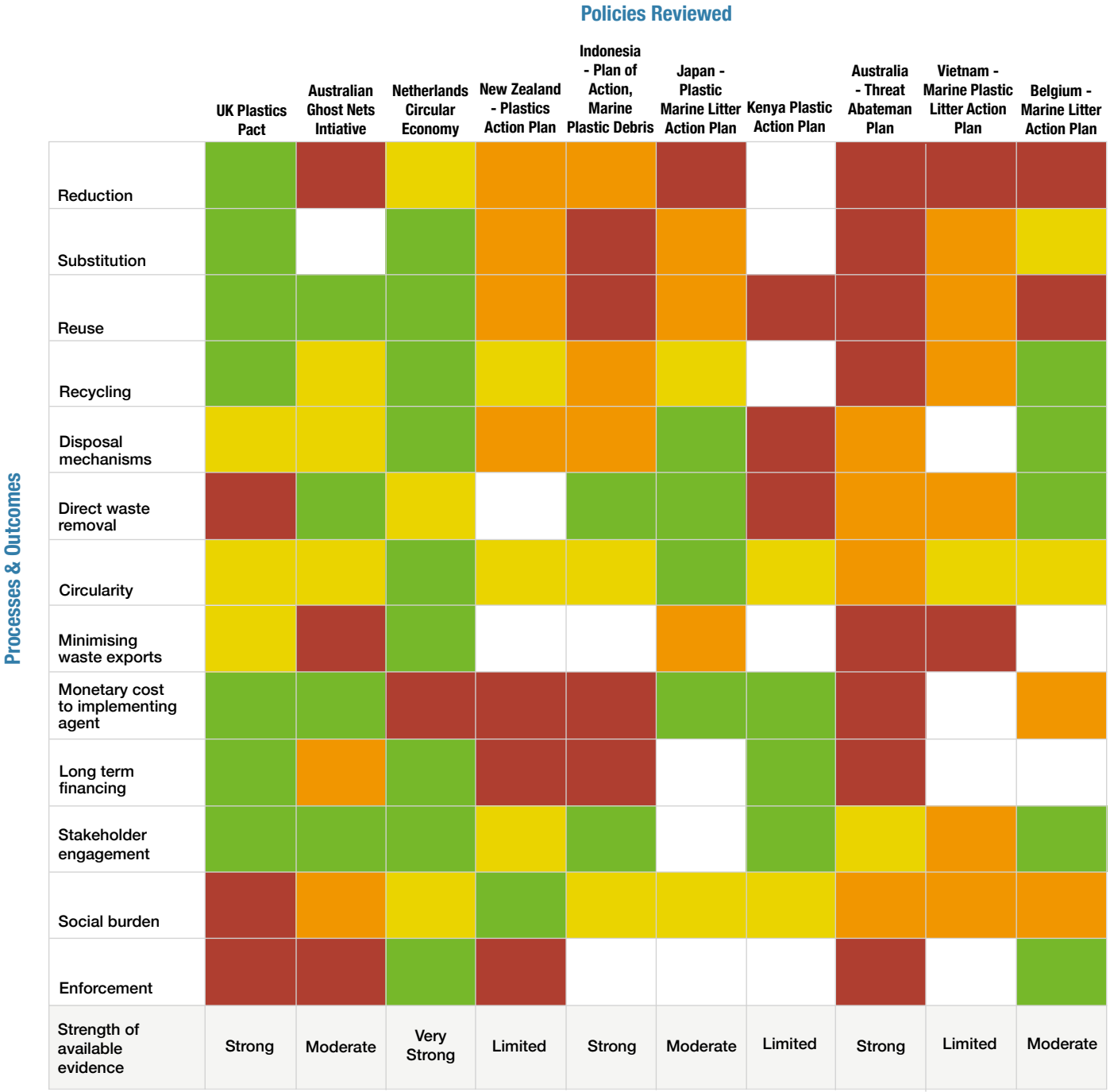


Figure 6: *Strength of available evidence and reference statement contribution to effective policy matrix for affirmative action policies. Not all 45 reference statements are included in this figure.*

Key: *Contribution to policy processes and outcomes*

	Strong contribution
	Moderate contribution
	Weak contribution
	No contribution
	No evidence

Evidence for affirmative action policies was generally high, as shown in Figure 6. This type of policy, when it is successful, has a global influence. There is often a large amount of news and media coverage but there was very little peer reviewed evidence or data. Most of the policies were successful with the exception of the Australian policy which failed to be implemented and was withdrawn by the government. They achieve high levels of stakeholder engagement despite their voluntary nature and they are achieving good circularity of plastic. This type of policy often results in waste removal, mainly by recycling, but can also focus on substitution. When properly implemented, this type of policy demonstrates a high level of success and can be used as frameworks for international policy as they tend to be wide ranging and not country specific. Many have already become international initiatives, such as Plastic Pacts, and the Global Ghost Net Initiative.

Policy effectiveness barriers and enablers

Voluntary

All affirmative action policies or initiatives reviewed were voluntary, which allows them to be adaptable and more collaborative at a wider scale. Compared to legislative commitments, voluntary actions have the freedom to address problems in innovative ways. Activities included under affirmative action commitments span from using GPS to track inaccessible ghost nets under the Australian Ghost Net initiative, funding marine biopolymer research as part of the Japanese Marine Litter Action Plan, and increasing circularity of plastics as part of the Netherlands approach. Voluntary agreements can be implemented faster than legislation and can be adapted more quickly. The breadth of these initiatives enables effective policy by facilitating diverse solutions to plastic pollution.

However, the voluntary nature of these commitments can also be a barrier to success, as lack of enforcement can make it difficult to deliver the policy goals. For example, the delivery of the Australian Threat Abatement Plan for the Impacts of Marine Debris on Vertebrate Marine Life (2009) was initially supposed to be implemented by Australian states. As a voluntary initiative, however, there was no enforcement (among other reasons such as a lack of funding and coordination) by the Australian government which meant that there was no implementation.

Finance

Another major enabler is sufficient financing, whether this is achieved by EPR or government funding. Funding is critical to ensure that the innovative approaches adopted as part of these commitments are achieved. Longevity of funding is a potential barrier to voluntary initiatives, particularly if the policy spans multiple years, and there is often a lack of evidence about what funding will remain available. This could be a deterrent to initiatives. A strong example of sufficient funding with long-term commitment is the Netherlands Circular Economy plan. This is government funded with 3.6 million USD, and with a further 490,000 USD available annually (Holland Circular Hotspot, 2019) supporting 85,000 initiatives.

Collaboration

Collaboration is also an enabler of policy success. Many of the policies invest and rely heavily on collaboration either internationally or nationally to be achieved, and collaboration can span businesses, industry and civil society. For example, the Japanese National Action Plan for Marine Litter is supported by multiple coalitions of businesses including the Japan Initiative for the Marine Environment, the Clean Ocean Material Alliance, and includes chemical and the retail industries (METI 2021). Collaboration with these major businesses and industry is essential to achieve the policy aim of reducing plastic.

The Australian Ghost Net Initiative also has evidence of good collaboration between the government, NGOs and Indigenous Rangers to achieve the policy's aim of reducing the impacts of and removing plastic ghost nets from the environment. Initiatives like the Plastic Pacts developed by WRAP are particularly effective as they are collaborative and innovative. Information sharing is key to the success of these initiatives.

Data and monitoring

There is a lack of published data outside of the policy sites themselves. The UK Plastics Pact has a detailed annual report but there is a lack of external analysis or data. By working through the plastic pacts, WRAP has achieved real change. With the help of WRAP, Wales is now the third most successful nation for recycling after Germany and Singapore due to this affirmative action, but a proportion of this recycling is exported. To enable effective policy and policy analysis, there should be transparent, independent data collection to avoid companies using these policies for greenwashing.

Conclusions

Affirmative action policies perform well in the analytical framework, but many are too early to be assessed fully. Ongoing financial support is essential, along with sufficient government support such as appropriate legislation to create a level playing field and this type of policy can be highly influential to government policy. Affirmative action can be adaptable and quickly implemented and is generally well supported. Data is also essential to determine policy effectiveness but is often lacking for this type of policy as they do not tend to have timebound quantitative aims and open ended targets are difficult to assess.

Transparent, consistent reporting is needed to provide comparisons with legislation both nationally and internationally. Affirmative action can be highly adaptable due to the voluntary nature of this type of initiative. This type of initiative can readily adjust to each country's individual legislation and differences, which need to be addressed in the implementation mechanisms.

Affirmative Action is often a precursor of what is coming next, and are enablers for future action and policy instruments. Multinational companies have been seen to sign up to many of these types of agreements, often coerced with the threat of legislation or as a method of greenwashing. Many affirmative action initiatives have been accused of greenwashing. Better time-bound, quantitative goals to generate a means for accountability and monitoring to track progress towards these goals would help to remove this accusation.

4.2 Information Instruments

Public awareness about the seriousness of the environmental risks caused by plastic pollution has increased in the past two decades (Syberg et al., 2018). Public awareness campaigns can change the way plastic is viewed, used and managed. Information instruments are not normally included in policy analyses, however have been included in this study given their capacity to catalyse and inspire action, increase awareness, and facilitate policy development. In the context of this study, information instruments are categorised as any education or engagement activities aimed at increasing awareness about the plastic problem, pollution issues, production, purchasing habits, responsible business practice, sorting and recycling, use and disposal. This can take the form of consumer awareness campaigns, business awareness campaigns, social media campaigns, documentary films, school initiatives and clean-up activities, among others. Information instruments can be implemented by NGOs, the public and private sectors, and governments.

Reflecting on this diversity of information instruments, the following policies were reviewed:

The Surfrider Foundation - *Hold onto your Butts 1991.*

To eliminate cigarette butt litter and pollution on beaches and in the ocean, Hold onto your Butts encourages the collection of cigarette butts from beaches to be sent to Terracycle for recycling into garden benches. The campaign has influenced legislation concerned with smoking at beaches.

Lonely Whale - *For a Strawless Ocean #Stopsucking 2017.*

This campaign aimed to stop the use of plastic straws via social media. Titled ‘Stop Sucking’ it achieved global reach with 74 million followers. It resulted in notable partnerships with companies producing alternatives to plastic straws.

Greenpeace Philippines - *Dead whale 2017*

was an art exhibition of a whale which had died of ingested plastic. Greenpeace Philippines hoped that this installation would encourage the public to take action and refuse plastic, and to influence leaders attending a summit of the Association of SouthEast Asian Nations (ASEAN) (Cresta, 2018). The viral effect both online and in traditional print media spurred conversation about the marine life of the Philippines and the worsening case of plastic pollution. (In a span of 24 hours, the online petition gained 3,000 signatures (Furman, 2017).

5Gyres - *Nix the 6 2018*

Number 6 plastics are made of polystyrene; and are difficult to recycle. Nix the Six aimed to remove polystyrene from waste streams through encouraging pledges for individuals, businesses and communities to refuse single-use polystyrene plastic and generate enough support to have polystyrene banned. The effectiveness of this policy could not be determined due to insufficient evidence.

The Adidas x Parley *Ocean Plastic Trainer 2015.*

The Ocean Plastic Trainer aimed to create awareness around the threat of marine plastic pollution, by incorporating 50% of the material for a range of sneakers as plastic intercepted from the ocean. Adidas had created more than 32 million pairs of shoes with Parley Ocean Plastic by 2020. This was the world's first shoe to be made from marine plastic waste and it brought about a sustainability revolution in the sports and fashion worlds (Jain et al., 2021). Evidence for reach in education and awareness can be inferred from the support of the product.

Lonely Whale - *For a Strawless Ocean #Stopsucking 2017.*

This campaign aimed to stop the use of plastic straws via social media. Titled 'Stop Sucking' it achieved global reach with 74 million followers. It resulted in notable partnerships with companies producing alternatives to plastic straws.

The Indonesian *Plastic Bag Diet Movement (GIDKP) 2013.*

This campaign aimed to reduce the use of new plastic bags. The Plastic Bag Diet includes many sub-campaigns such as Plastic Tourism, Plastic Robber, Plastic free Parade, and Pay4plastic. It has made some progress on providing education, instigating better legislation, and building cooperation between plastic producers and other stakeholders (Li and Patton, 2021). The Indonesian government followed this campaign by introducing legislation but this was never implemented due to opposition.

The Bahamas *Plastic Movement 2014*

This campaign aimed to reduce the use of new plastic bags. The Plastic Bag Diet includes many sub-campaigns such as Plastic Tourism, Plastic Robber, Plastic free Parade, and Pay4plastic. It has made some progress on providing education, instigating better legislation, and building cooperation between plastic producers and other stakeholders (Li and Patton, 2021). The Indonesian government followed this campaign by introducing legislation but this was never implemented due to opposition.

The 10,000 Changes Canada 2020.

10,000 Changes offer a series of resources to help citizens, corporations, governments, and businesses reduce their plastic waste. The initiative is part of Canada's Strategy on Zero Plastic Waste Initiative. Uses the tagline Refuse, Replace and Reimagine.

The Ocean Wise - ***Be plastic Wise 2018. The Fairy Plastic Ocean Bottle 2017.***

Developed the Plastic Wise initiative and the Plastic Challenge where households audit their plastic use. There are 12 challenges to undertake. The effectiveness of this policy could not be determined due to insufficient evidence.

The Surfers Against Sewage - ***Million Mile beach Clean 2021.***

This campaign aims to clean 10 million miles of beach by 2030, aligning with Surfers Against Sewage 10 year ambition of ending plastic pollution on UK beaches by 2030. They tackle the issue of plastics in the ocean at every level, from asking individuals to reduce their plastic consumption to lobbying the government for changes to legislation. The campaign mobilised around 150 thousand volunteers and has removed nearly 400 tonnes of beach litter per year. The campaign contributes significantly to litter data in the UK through citizen science.

Figure 7: *Strength of available evidence and reference statement contribution to effective policy matrix for information instruments. Not all 45 reference statements are included in this figure.*

Key: *Contribution to policy processes and outcomes*

	Strong contribution
	Moderate contribution
	Weak contribution
	No contribution
	No evidence

Of the eleven information instruments, two did not have enough evidence to analyse effectiveness. Of the nine evaluated policies, five were classified as having limited data availability to analyse, and four were analysed on a moderate evidence base. Evaluation of this type of policy is more challenging, given vague targets and difficult to measure indicators, as they tend to be information/challenge based. The persistent evidence gaps in the analysis were the lack of time bound and quantitative objectives, as evidenced in Figure 7.

Policy effectiveness barriers and enablers

Appropriate dissemination

Given that information instruments are focused on gaining and maintaining attention to create change, having an easily identifiable tagline was an enabler of policy effectiveness.

Making use of context and objective appropriate methods of engagement and outreach was an enabler of policy effectiveness. Policies that aimed to change consumer behaviour through a specific intervention were more successful when disseminated on social media for a wider, global reach. For example, the "Stop Sucking" campaign by Lonely Whale, which aimed for a straw free ocean asked people to take pictures of their reusable cups and containers and use the hashtag #StopSucking. This initiative sparked global support (Mosquera., 2020), and was identified as an effective policy by the analytical framework. This is in contrast to more place-driven efforts to raise awareness and inspire action, such as the "Hold onto your butt" campaign by Surfrider Foundation. This initiative has used citizen science to collect cigarette butts from beaches in San Francisco, before sending them to be recycled by Terracycle. On average, these beach clean events collect 6,500 butts. This approach was effective, and as a result has seen "buttcan" containers installed at beaches in San Francisco for cigarette butt disposal (NOAA, 2021).

Finance

Finance was expected to be an enabler of effective policy; however, it was difficult to identify specific funding commitments for information instrument policies. Most initiatives are either company based and financed in-house or are part of a charity and financed through participation and fundraising from the general public. Without explicit evidence, it is difficult to assess whether there is adequate funding for these policy types, and what impact funding has on information based policies.

Data and monitoring

The measurement of generic goals such as raising awareness, instead of quantitative and time-bound goals can be difficult, and is a major barrier to assessing the effectiveness of such policies. Many of the non-profit organisations choose specific key performance indicators to gauge the success of their awareness strategies. Common goals for awareness campaigns involve audience growth and digital engagement. For the corporate campaigns, digital engagement indicates efficacy as do sales figures but this is a subjective measurement. To enable effective policy, measurement of success of an information instrument should include data changes in other areas such as increase in separate collection, recycling and product choice. Initiatives that include clean up campaigns can measure plastic collected and therefore provide quantitative data. Improved data can lead to more engagement as the public can see the effect of the campaign.

Conclusion

Raising public awareness through education programmes has been documented as an effective way of reducing marine debris as it creates a sense of environmental responsibility in participants (Uneputty et al., 1998; Bravo et al., 2009; Willis et al., 2018). Public initiatives, education and activism can be a powerful method of mobilisation and lead to legislative changes. This is recently evidenced in the Twitter movement led by activist James Wakibia, using the hashtag #ISupportBanPlasticsKE, which won the attention of the environment ministers of Kenya, and resulted in a bag ban.

Where the purpose of the instrument is behaviour change, evidence for the success of information instruments is very different to other more quantitative policy types, and comparing this type of policy with others might not be possible. Understanding the impact of such projects may not be facilitated solely by engagement metrics either, as engagement on social media may not translate to behaviour change.

Generally, there is a lack of data to demonstrate success, given vague targets, inadequate monitoring or appropriate data, and lack of transparency, but successful campaigns with strong messages can diffuse and grow to have a global influence. Information instruments can have direct influence on policy making as was seen with Surfrider Foundation - Hold onto your Butts campaign which resulted in changes to legislation for smoking on beaches. It is also noted that the diversity of information instrument types, such as social media campaigns, citizen science and product-based initiatives, may have different enabling factors. Potential future research could dive deeper into the specific enabling factors for each different type. More evaluation of this policy area needs to take place including examination of more far reaching awareness campaigns where more data may have been collected. Further analysis could also include government specific information instruments, such as campaigns to support specific policy. Such campaigns have been identified as enabling factors to facilitate effective policy, such as the example of Antigua and Barbuda discussed in Section 3.2.

Photo by James Wakibia

4.3 Multinational Corporations and Small and Medium Enterprises

Businesses are uniquely positioned to reduce waste through improved sourcing, design, and business model innovation within their own supply chains, as well as serving as a point of influence beyond their supply chain for catalysing action among other stakeholders, including governments and the public. Businesses, particularly at the multinational scale, are also vital to reach economies of scale of plastic alternatives. Public and investor pressure to reduce plastic pollution is at an all-time high. For example, in 2018, a group of 25 investors responsible for more than USD 1 trillion in assets demanded that Nestlé, Procter and Gamble Co, and Unilever reduce their use of plastic (Chasan, 2018). It has been identified that as few as 100 companies have the potential to reduce roughly 10 million metric tons of the world's plastic waste per year (WWF, 2019). There are also calls from within the business community about the need to commit to sustainable business practices, particularly post-Covid, with the acknowledgment that "we can't run a business in a dead planet" (Handley, 2020).

Plastic free businesses have also grown as a part of the industry response to plastic policy. These generally exist in the form of SMEs, often meaning that there is limited data available for analysis. Plastic free businesses have been intentionally excluded as part of this analysis as they are specifically designed to operate on a plastic free business model, and therefore do not implement policies to transition or reduce plastic usage. A plastic free business model certainly is one approach to mitigating plastic entering the environment and is commendable where applicable, however where existing businesses are modelled either around plastic products or the use thereof in packaging and distribution, it is unfeasible to recommend a plastic free business model in that regard.
In the context of this study, a multinational corporation is defined as a business which either operates or sells in multiple countries and continents. Given their scale, multinational corporations often consist of a parent company and numerous subsidiaries and are often publicly traded. This review has analysed a breadth of multinational corporations, from the relatively small to mega-sized, and those focused on food and beverage industries, cosmetics and personal hygiene, clothing, and furniture.

The following multinational corporation policies were reviewed:

IBM Pollution Prevention Strategy (webpage accessed 2022).

This policy targets waste more broadly through the lens of prevention, reuse, recycling, recovery. A specific pledge of SUPP phase out from IBM-managed canteens by 2025 was also made. The effectiveness of this policy could not be determined due to insufficient evidence.

The Coca Cola Company World Without Waste (2018),

in which Coca-Cola aims "to collect and recycle a bottle or can for every one we sell, make our packaging 100% recyclable by 2025, and use 50% recycled material in our bottles and cans by 2030." As of 2020, 90% of packaging is recycled (out of a target of 100% by 2025), 22% across all materials and 11.5% of PET plastic (out of a target for 50% recycled material in packaging globally by 2030), and 60% collection rate for packaging globally (Coca-Cola, 2020a). Coca Cola still maintains ownership of the highest amount of their products ending up as plastic pollution in the environment in the world.

IKEA Sustainable Everyday: Phasing out Single Use Plastic (2018).

IKEA implemented a successful phase out of all SUPP in store.

Starbucks Plastic Straw Ban (2018).

Starbucks implemented a phase out of plastic straws, which was successful in meeting its own objectives but the alternative lids contained more plastic than the straws they replaced.

Lush Cosmetics Environmental Policy (1995).

This policy commits Lush to only using recycled plastic, using a deposit return scheme, and aiming to eliminate all packaging where possible. This policy reduced plastic use both in packaging and the amount of virgin plastic used. It has also generated significant consumer awareness around plastics and set up recycling systems and DRS in some countries to have increased ownership of the whole life cycle of their plastic packaging.

McDonalds Packaging and Waste Strategy (2018),

which aims to source 100% of their guest packaging from renewable, recycled or certified (specifically in the context of paper/cardboard) sources, and to recycle guest packaging in 100% of McDonald's restaurants by 2025. McDonalds reports moderate progress towards its goals, however there is still a way to go until these goals are met by 2025.

Nestlés Commitments for Tackling Plastic Pollution (2018),

which has the goal of "No packaging (inclusive of plastic) ends up in landfills or as litter (inclusive of oceans, lakes and rivers), 100% reusable or recyclable packaging by 2025, to reduce the use of virgin plastics by a third by 2025." Nestlé reports progress towards their goals, but faces criticism due to their focus on increasing the recyclability of their products and effectively placing responsibility on consumers.

Evian Water (Danone) Packaging and Recycling Strategy (2018).

This policy had the goal of "Making all of its bottles 100% recycled PET (rPET) by 2025 (enabling the transition from a linear to a circular economy of sustainable packaging)." Evian has yet to achieve this target, and there is limited evidence as to how close Evian is to reaching these goals.

Pampers - As a case study of Procter & Gamble's Ambition 2030 Environmental Sustainability Goal (2018).

Pampers have adopted Procter & Gamble's vision of 100% recyclable packaging by 2030 and 50% recycled content of packaging by 2030. Currently, Pampers reports progress towards these goals by product redesign and investing in recycling infrastructure.

Patagonia Climate Goals: No More Virgin Petroleum Fibres by 2025 (2018).

Patagonia reports progress towards this goal, but limited publicly available information can be found to verify progress.

Most multinational corporations' policies analysed had a moderate evidence base, the majority of which was composed of company published reports or press-releases on progress. This represents a major barrier to policy effectiveness analyses, as this information is unlikely to portray the company in a negative light and a lack of independent data exists. However, such data was often the only information available from which to analyse. Size of the company had an impact on data availability. For larger companies, additional independent media articles, some peer-reviewed literature, and external analysis by NGOs could also be obtained. Policies analysed ranged from a geographic presence in under 50 countries, to being present in over 200.

Multinational corporations are composed of major, multiple and nested systems. Changing these takes time, and there are often differing levels of progress towards overarching goals within the company and across brands depending on national country contexts. This means that there are often lags and delays, and that progress is not synchronous across the entire multinational corporation. Most of the policies identified were created and implemented in 2018 and adopt a long term perspective, often using 2030 as an end date, which makes analysing the success of these goals difficult as specific progress reports have not yet been released, which is a limitation of this research.

The type of plastic policies adopted by multinational corporations are diverse in scope, and can often address multiple overlapping parts of the plastic lifecycle (Table 2). Policy types can be loosely categorised as targeting packaging, the product itself, and disposal. Table 3 shows the types of policies analysed in the business sector. These types of policies align with many of the government policy types and can include investment into national DRS, investment in recycling facilities, and SUPP bans in company owned premises and stores. Businesses also have an additional policy type: product redesign. This is often used to reduce virgin plastic content of products (e.g., beverage bottles, diapers, packaging), and replaced with recycled content. It is important to recognise that product redesign does not necessarily equate to a reduction in plastic; for example, Starbucks' newly designed alternative lid to straws uses more plastic than the straw, and has been described as "the poster child of greenwashing" (Duprey, 2018). Redesigning products to increase the amount of recycled plastic used are often slow processes, and rely on a supply of available recycled plastic. These slow actions ultimately do very little to decrease plastic production. A challenge to product redesign is the need for businesses to remain competitive, both against other customers and consumer expectations (Baker, T., 2022, pers comms).

Small and medium enterprises have a vital role to play in efforts to tackle the plastics crisis. They make up around 90% of businesses and more than 50% of employment worldwide (SMEHub, 2020), meaning that meeting global challenges requires their involvement and innovative solutions.

The small and medium enterprises policies reviewed were:

Koinpack

(based in Indonesia), who "provide affordable zero waste products for end consumers and enable fast-moving consumer goods companies to sell their products zero waste." This company had a limited evidence base, but have so far made progress towards reducing single use plastic.

Molton Brown

(headquartered in the UK), who focus on a circular approach to their cosmetic products, by pledging to make 100% of plastic packaging reusable or recyclable, increase recycled content of packaging, and offer refillable solutions by 2023. The evidence for this policy was limited.

Fat Face

(headquartered in the UK), who are focusing on eliminating SUPPS, avoiding waste being taken to landfill, and increasing recycled content of polyester clothing by 2025. The evidence for this policy was limited, but progress towards their SUPPs being eliminated is evidenced.

Ella's Kitchen

(headquartered in the UK, analysis focused on UK operations only), who recycle their packaging in-store, and have pledged to make 100% of their packaging recyclable or compostable by 2024. The evidence base for this was limited, with limited progress towards their goals

Rebricks

(based in Indonesia) turns plastic waste into building materials, aiming to prevent plastic waste from entering landfill, incineration or the environment. The effectiveness of this policy could not be determined due to insufficient evidence.

ECover

(based in Belgium), who are focused on 100% recyclable materials by 2020, and creating refillable stations for their products. There was moderate evidence for this policy, and it has been regarded as somewhat successful.

Anglepoise

(based in the UK), who are a lighting company working towards plastics free operations and packaging. The effectiveness of this policy could not be determined due to insufficient evidence.

Dispatch goods

(based in the USA), partners with restaurants to offer food to customers in completely reusable packaging through two collection options – single point collection where businesses recollect the packaging, or distributive collection where dispatch goods collects the packaging from homes. The effectiveness of this policy could not be determined due to insufficient evidence.

Compared to multinational corporations, a major barrier when analysing small and medium enterprises is the availability of independent data. Given that these companies are relatively small, they often do not attract the same criticism or attention that multinational corporations do. Evidence was often limited to press-releases from the company and limited external review. Most of the initiatives analysed were also fairly new, with the exception of ECover which has been refilling for 30 years Many of the small and medium enterprises identified target a niche area- in contrast to multinational corporations, they often have a single area of focus (e.g., baby food, one brand of cosmetics) and a more constrained geographic scope, and do not have the resource capacity that multinational corporations do. Future research could take a more applied approach, that goes beyond publicly available information, and directly engages with the company.

Table 2: *Types of policies used by various multinational corporations and small and medium enterprises*

Target	General Goal	Multinational Corporations	Small and medium enterprises
Packaging	Increasing product packaging recyclable content	McDonalds	
Packaging	Making packaging recyclable	Pampers, Nestlé, Coca-Cola	
Product	Phase out single use plastic products	Lush Cosmetics, IKEA, Starbucks	Fat Face
Product	Increasing recycled plastic content of product	Pampers, Evian, Nestlé, Coca-Cola	Molton Brown
Product	Phasing out virgin plastic in products	Patagonia, Nestlé	ECover
Product	Making product recyclable	Nestlé	Molton Brown, Ella's Kitchen
Product	Making product reusable	Nestlé	ECover
Disposal	Increase product recapture / recycling	Nestlé, McDonalds, Coca-Cola	Molton Brown, Fat Face, Ella's Kitchen

Key enablers and barriers of policy success

Quantitative and time bound goals

The presence of **quantitative and time bound goals** was identified as an enabler of success in multinational corporations, and was a critical evidence gap in small and medium enterprises. In the larger companies analysed (Nestlé, Coca-Cola), there was an overarching vision of sustainability and multiple targets and actions to support that vision. In larger multinational corporations, individual targets were often bold, far-reaching and addressed significant areas of public concern, such as Coca-Cola's goal to "collect and recycle a bottle or can for every one we sell," and Nestlé's vision that "no packaging ends up in landfills or as litter." This approach allows targeted intervention across multiple parts of the plastic lifecycle, from production to disposal in a holistic manner. However, it has to be questioned if such a broad range of interventions is conducive to success

as to date, Nestlé are making significant progress on targets, but have not reached any of their overarching commitments. In (comparatively) smaller companies, such as Lush, Starbucks and IKEA, goals tended to be quantitative, objective-oriented, and relatively contained, such as a straw ban or SUPP product phase out by a specific date. Unsurprisingly, these more focused goals that targeted one product or range of the company were more successful. For example, Starbucks and IKEA initially had singular goals of phasing out SUPPs, which were ultimately regarded as successful. These targeted goals were successful in addressing a niche area of the business, and creating rapid change but are slow at facilitating systemic change.

Type of policy

There is much discussion around where in the plastics lifecycle policy interventions should be focused. The scope and scale of policy objectives are similar between multinational corporations and small and medium enterprises (as evidenced in Table 3), however, understanding where to intervene in the plastic lifecycle is critical for maximum plastic reduction. Phelan et al., (2022) identifies plastic packaging as a major area to target, with plastic packaging representing the largest market use of plastics (MacArthur Foundation et al., 2016), and identifies the linearity of existing plastic packaging value systems as an area to target change. Several companies have created targets that address packaging specifically, such as Nestlé, Pampers and Coca-Cola, which focuses on making plastic recyclable. However, this effectively pushes the burden of responsible disposal to the consumer - often with little evidence of activities undertaken to raise awareness, increase access or ease of recycling, or providing incentive to do so. Where this is the case, responsibility, through EPR, should also be extended to include effective waste management. It must be noted that increasing recycled plastic content of products does not decrease the use of plastic, and is therefore a policy response to plastic reduction that misses the point, particularly if no effort is made to increase recapture of plastic. Furthermore, the safety of recycled plastic containers for food and drink is questioned, which is compounded by a lack of regulation or guidance surrounding quality standards in plastic reprocessing (Gerassimidou et al., 2022).

The majority of policies of both small and medium enterprises and multinational corporations focused on increasing recycled content of packaging or product, or making the product itself recyclable. This has the challenge of relying on waste management infrastructure (and recycling in particular) to be sufficient to supply the volume of recycled plastic needed. Commitments to DRS, reusables and development of refillable infrastructure is limited across companies analysed. Instead, the focus is on retaining and recycling plastic in a circular system, often through partnerships with Loop Industries and Terracycle. Terracycle were recently sued on the basis that their recycling programme was deceptive to consumers, and limited full participation by charging "costly Zero Waste Boxes to return the Products to TerraCycle at a hefty price" (Last Beach Clean-up v. TerraCycle, Inc. 2021;).

A further issue identified with this approach is the lack of market for plastic once it has been recycled. Limited supplementary goals were identified that created a circular approach to packaging. Some goals identify the use of alternatives to plastics, for example, replacing products with paper, wood, or reusable cloth alternatives. These have had mixed results. Pampers have faced criticism of their reusable hybrid diaper, as the actual insert of the diaper is not reusable and is still made of plastic. The diapers are also still sold in plastic packaging, despite a total reduction in plastic used (there is 25% less plastic in the hybrid and the insert is plant based (Waste 360, 2021). Patagonia has adopted a unique approach in which instead of targeting a specific product a single goal has been identified that impacts all products. For example, Patagonia's goal of using no virgin plastic impacts all product lines and packaging will reduce the total amount of plastic used in production.

Stakeholder engagement

Public companies, which represent most of the multinational corporations analysed, are owned and accountable to their shareholders, necessitating a higher level of transparency in their targets, progress and frequency of reporting. The awareness of this is reflected in the analysis by higher scores of stakeholder engagement in public companies such as Coca Cola, Nestlé, and McDonalds. In contrast, the evidence of

stakeholder engagement in small and medium enterprises is sparse. Given the international presence of multinational corporations, stakeholders represent a diverse group of domestic and international representatives, including employees, consumers, NGOs, governments, and communities. A commitment of stakeholder engagement and inclusion was limited to an overarching component of company culture (for example, Nestlé 's statement "When we listen, we improve" Nestlé Global, undated A). However, specific evidence of engagement that contributed to the formulation of the analysed policy could not be found in any company evaluated. This could be an issue of such information not being deemed suitable for public access.

For both small and medium enterprises and multinational corporations, it's not clear to what extent inclusion of stakeholders could have strengthened these policies, or increased total plastic reduction. For multinational corporations, most policies focused on increasing recycled content of product or packaging, and not proposing viable, more sustainable alternatives. Stakeholder engagement at this stage is essential to ensure that the changes to the product actually achieve plastic reduction. For policies where a product has been redesigned to facilitate recycling or reuse, thorough consumer research and stakeholder engagement could have been beneficial to identify potential problems with the proposed solution. For example, Pampers' new hybrid diaper, despite "thousands of hours" of consulting with parents (Waste360, 2021), faces a major barrier to widespread adoption due to high cost (Bailey, 2021).

Partnerships, Collaboration and Innovation

Partnerships and collaborations were identified as an enabler of success across multiple policies for achieving policy goals. Partnerships facilitated innovation and investment. For example, Nestlé has invested USD 30 million in the Closed Loop Leadership Fund, which aims to "create a more sustainable recycling system" by investing in companies that aim to increase recycling awareness and "valuable materials in packaging supply chains'' (Nestlé Global, 2020). Partnerships also span government ministries- for example, McDonalds has partnered with the Japanese Ministry of the Environment in a toy recycling initiative, resulting in the collection of around 1.27 million used plastic toys in the first year, followed by 3.4 million in 2019 and approximately 3 million toys in 2020 (McDonalds, 2021). However, evidence of specific multinational corporation-Government partnership beyond this example could not be identified. There is also evidence of effective collaboration between Pampers, FaterSmart and Terracycle to produce a system for recycling diapers. Procter & Gamble are also working with Terracycle and Loop to reduce plastic packaging and increase reuse (Procter & Gamble, 2019). However, it is not clear if these partnerships still exist, or are still continuing. This represents a pattern identified across multinational corporations in that it is often difficult to identify if an initiative or project is ongoing or what progress has been made.

In partnerships, small and medium enterprises can be the vehicle to deliver innovative, sustainable and specialised solutions that target specific elements of the plastic lifecycle. An example of this is Koinpack, who collaborate with consumer brands such as Procter and Gamble to provide reusable solutions (Zero Waste Living Lab, undated). From the perspective of small and medium enterprises, further examples of collaboration include Molton Brown and Loop, to develop refillable liquid handwashes which are then recaptured and reused, and Ella's Kitchen who have partnered with Terracycle. However, there is a lack of available information around the strength or successes of these partnerships.

Public awareness, education and awareness raising

Given that many of the policies analysed are reliant on consumers to recycle the product (such as by increasing recyclability or investing in infrastructure), there has been limited evidence of public awareness raising. Notable exceptions have been identified, but these are often geographically constrained. For example, in Italy, Nestlé have pioneered an app which scans the barcode of a product and identifies if it can be recycled in that specific Italian municipality (Nestlé Italia, 2020). This innovative platform was launched in 2020, and aims to overcome a major barrier identified, which is the fact that recycling requirements vary by municipality, often causing confusion around what can and cannot be recycled (Nestlé Italia, 2020). This is still in its first phase and it

is not clear if this initiative is designed to be extended to other countries. In contrast, there is some evidence that small and medium enterprises have stronger public awareness campaigns to support their initiatives. An example of this is Ella's Kitchen, who rely on consumers to recycle baby food pouches via 'ellacycle'. This is incentivised by a rewards system, which is used to raise money for charity (Terracycle, accessed 2022). Similarly, Lush Cosmetics UK generates significant consumer awareness, not only through their company ethos of sustainability and associated awareness raising, but also on closing the loop of plastic as a material through their deposit return scheme and ownership of their own plastic recycling and upcycling facility (Fortunati et al., 2020).

Conclusion

Many of these findings are cognizant with wider literature of policy effectiveness, including McCarthy and Morling (2015) who identify the need for clear targets, reporting and monitoring and collaborative partnerships. Despite the moderate strength of evidence for multinational corporations, several key evidence gaps persist across policies analysed. These were largely unanimous. For example, there was no evidence about government support, or how compliance or progress across different geographical contexts was achieved. Specific communication around how companies planned to achieve their goals was often lacking. For example, Starbucks and IKEA issued SUPP phase outs, and little publicly available information can be found about how that was achieved beyond a final press-release that this target had been achieved. Without such information, it is difficult for other companies to learn from, or identify, positive and successful examples. There was also a lack of specific evidence surrounding financial commitments or support to facilitate policy achievement. Many of these evidence gaps were also observed in small and medium enterprises, due to the often limited and biased evidence base. Several further persistent evidence gaps included information around stakeholder engagement for policy formulation, progress reporting on policy goals and specific financing commitments. It was identified by the OECD in 2003 that financing for voluntary initiatives can play a role in the success of the initiative. Where costs of delivery were low, a 'business as usual' approach was observed. Without transparent information, it is difficult to identify if this can be observed in the policies analysed. The lack of transparency also prevents learning from other organisations, which risks many businesses reinventing the wheel multiple times over.

In summary, multinational corporations and small and medium enterprises operate in different contexts to national governments, with different internal and external pressures, drivers, and constraints. For multinational corporations and small and medium enterprises, compliance and enforcement are not enablers of policy as purchasing patterns dictate success or failure of product redesign. This represents a challenge unique to multinational corporations and small and medium enterprises. Innovation should be undertaken in a way that allows the product to be still commercially viable.

Photo by James Wakibia

4.4 Pacts

Pacts are voluntary agreements between governments, NGOs, manufacturers, recyclers and retailers. Voluntary agreements are useful when innovations and circumstances are changing quickly as the agreements can be more fluid and adaptable while legislation is slow to instigate and difficult to adapt. Collaborative approaches are more likely within a voluntary initiative (OECD, 2003). The engagement of large companies can produce powerful influence for change through the plastic pacts, but voluntary pacts cannot replace legislation. Legislation is essential and coordination with governments is necessary to avoid duplication and assumptions that the pact will remedy the problem alone. Legislation is required to establish a fair and equal market for all businesses however, the direction of the legislation can be influenced by a pact.

The first plastic pact was developed in the UK by WRAP, (a non-governmental organisation established in 2000) and the Ellen MacArthur Foundation, forming the New Plastics Economy. WRAP provides a framework and support for the development of voluntary plastic pacts.

Since the UK Plastics Pact in 2018, WRAP and the Ellen MacArthur Foundation's New Plastics Economy have scaled and repeated these pacts around the world using:

1. Voluntary agreements which are adaptable and proven
2. A single clear message
3. Fast application of projects
4. Clear messages to change behaviour

WRAP provides policy and insights, technology support, grants, investments, voluntary agreements and education. A network of pacts has developed covering 11 countries and two regional pacts with more in development. They are all working towards the goal of a circular economy for plastics. This is impressive coverage since the first pact developed in 2018, but there are many areas of the world without plastic pacts, including some of the biggest plastic polluting countries.

The following national plastic pacts were evaluated, but the effectiveness of these pacts could not be determined due to insufficient evidence:

- The South African Plastics Pact
- Circula El Plástico (The Chilean Plastics Pact)
- The Kenya Plastics Pact
- Meer met minder plastic (the Dutch Plastics Pact)
- Pacte National sur les emballages plastiques (The French National Pact on Plastic Packaging)

The UK Plastics Pact (2018), the first pact, was the only one fully analysed under the framework, and given the lack of other pacts with sufficient evidence to compare to, was included in Affirmative Action (4.1) due to its nature as coordinated action. Further information was gathered on this pact as part of an examination of plastic pacts in general to provide a basis for future evaluations of pacts as they become older and develop more of an evidence based upon which they can be evaluated for their effectiveness. Since the pact was initiated, there has been a 46% reduction in problematic or unnecessary plastic and a 10% reduction of plastic packaging on supermarket shelves in the UK. The recycling rate of plastic packaging grew from 44% to 52% and the amount of recycled content rose from 9% to 18% from 2018 to 2020 (WRAP, 2021). PVC, a problem to recycle, has reduced by 80% and there has been a 70% reduction of parts that make plastic hard to recycle, but there has been slow progress on eliminating polystyrene (Chadwick, 2021, Gramersi, 2022). The UK is ready to eliminate 6 out of 8 problematic plastic packaging materials but missed the target of 100% by 2020. Polystyrene has been removed by 20% of members and a further 20% will have removed this problematic plastic by the end of 2021. The aim of reaching 30% recycled content is being held back by a lack of high quality recycled plastic (The Grocer, 2021).

Progress by the UK Plastics Pact since 2018 launch (Packaging Insights 2020):

- 1.1 billion problematic or unnecessary plastic items identified for elimination by the end of 2020
- More than £90 million investment in recycling capacity in the UK
- An increase in recycled materials included in plastic packaging of products in UK supermarkets
- Collaborative action groups exploring solutions such as reuse and refill business models
- Agreement on 8 problematic or unnecessary plastics.

Although the UK Plastics Pact did well within the analytical framework, there are reported problems. The annual pact report only gave details of 45 of the 127 companies involved. Only one in five reported action on all four targets and 16% had not acted on any targets (WRAP, 2019). However, there are 96 business partners, 56 manufacturers, 15 retailers, 3 hospitality and 22 resin producers, representing 50% of packaging producers and 90% of grocery retailers, demonstrating good collaboration from most sectors of the plastics chain (WRAP, 2021). The UK Plastics Pact performed better than most policies analysed, and as companies head towards specific targets in 2025, the degree to which the pact has been successful will be more evident.

Funding

Most of the funding to achieve pact goals is from pact signatories although some funding is made available from sustainability charity WRAP and Innovate UK. An International Circular Plastics Flagship Projects competition provided a £1.7 million fund to support innovation to solve or replace problem plastics. Funding of infrastructure and innovation through research is an essential part of the pact's success.

Barriers

It was found that pacts sometimes lack focus on plastic reduction, as often companies are focused on reducing the weight or size of packaging but not eliminating the plastic item which may still create litter or go to landfill at end of life (Changing Markets Foundation, 2020). Without more focus on reduction and reuse of plastic, the recycling industry will become even more overloaded and ineffective (Triple Pundit, 2022). In addition, toxic substances and colours that make certain plastics impossible to recycle need to be eliminated, yet the pacts in general tend not to include policy on toxic elements and colourants.

Globally, the ten biggest business plastic polluters have been identified as Coca-Cola, Colgate-Palmolive, Danone, Mars Incorporated, Mondelēz International, Nestlé, PepsiCo, Perfetti Van Melle, Procter & Gamble, and Unilever (Break Free From Plastic, 2021). All have signed multiple plastics pacts except Perfetti Van Melle. There have been suggestions that this is a form of greenwashing used by these companies as a sign of action, while failing to meet the commitments. There is no ranking for achievement or failure of pact goals and many of these companies have consistently failed to reach the pact targets they have signed up to. There seems to be a lack of accountability or enforcement for not conforming to pact agreements and no companies have been removed from a pact for failing to reach the targets (Break Free From Plastic, 2021).

There are concerns that the targets set at 2025 could be used as a delaying tactic for replacing non-recyclable shrink-sleeves by some companies and there is a strong focus on recycling when in reality, most types of plastic have no value in the recycling chain (Waste Dive, 2020). The pact goals need to be supported by legislation for ERP and DRS to create a level playing field (Waste Dive, 2020). DRS is the most cost-effective and reliable way to achieve high collection rates of containers, with most systems reaching 90%+ return rates within a few years, but DRS is not included in any of the pacts (Break Free From Plastic, 2021).

Opportunities

Data needs to be collected consistently within each pact, and ideally across all pacts, and requires independent verification. The WWF ReSource Footprint Tracker could provide the means to collect data in a systematic manner across all pacts, not just the US pact, where this has been introduced. The pacts have the opportunity to create a scientific list of acceptable plastics and this could be used globally.

There are plastic pacts on every continent but currently only in a minority of countries (20%). There have been suggestions that robust EPR and deposit return scheme legislation is more effective, but this type of legislation does not necessarily foster collaboration and innovation.

There are major benefits available from joining existing pacts:

- They bring together business leaders to create a collaborative space and access to information.
- They provide accelerated access to research and innovation and advice.
- The pact can help to shape government strategy but needs to avoid being a route for companies to lobby.
- The pacts are ambitious in their approach and are supported by influential companies.

The pacts bring together very diverse groups and have achieved significant support in their early days. Most of the pacts have been in place for only one or two years, and during this time, COVID 19 has had a great effect on their implementation. Most of the pacts cannot be assessed at this early stage but there is the opportunity to apply pacts to the analytical framework in the future using information supplied directly from the pact, signatories of the pact, news and other media information and scientific, peer reviewed documents.

Conclusion

Pacts appear to be a successful way of creating producer responsibility and collaboration, but without external review, there is no validation of their achievements and accusations of greenwashing are likely to be made. There is evidence of success but also problems, when investigating the pacts through open searching for information there was evidence of both aspects that are working and areas that are proving problematic. The overall structure and expertise supplied by WRAP and the Ellen MacArthur Foundation provides a replicable method of developing these initiatives, but there are areas which could benefit from improvement and could be highlighted by further independent research.

Individual company change is difficult, but the Pacts encourage sector change and provide action plans for this to take place. Pacts provide low cost agreements, the ability to react quickly and create an arena for information sharing and innovation via peer to peer learning, but there is little evidence of effectiveness and transparent reporting is not required. Pacts can provide support for government mandated policies which have developed from the pact agreements avoiding resistance to legislation in this area, but some voluntary corporate action can undermine nationally mandated policy for example Coca Cola replacing glass bottles with plastic ones in Samoa undermining Samoan national policy (BBC, 2021).

These voluntary agreements can be a method of “testing the water” before the introduction of legislation producing a more accepted, successful policy as business is already onboard. The pacts can act as an enabler to facilitate legislation and with hundreds of members globally and some of the most influential businesses, from all areas of the plastic chain, the plastic pacts are a powerful collaborative method of progressing change towards a circular economy for plastics. They can have strong influence on the direction of government legislation and could provide some useful lessons during the development of a legally binding treaty to end plastic pollution agreed at UNEA 5.2.

Photo by James Wakibia

4.5 Section summary

Overall, voluntary initiatives performed lower than non-voluntary interventions, with some exceptions. There is very little verification of the effectiveness and impact of voluntary initiatives, which generates the need for independent and transparent data collection. To aid in this, government measures to mandate reporting (such as on plastic production, use and sales data), alongside the development of harmonised reporting metrics could facilitate improvement. The Plastics Pacts have done a fair amount of work on harmonising reporting metrics, but even within countries or sectors doing well on reporting, there are still a large number of inconsistencies both in the ability to collect accurate data and the manner in which it is collected, particularly with regards to material composition and recycled content in the case of industry (EIA and Greenpeace, 2021). This section has highlighted the critical enablers for policies of a voluntary nature that should be considered.

Photo by James Wakibia

5 Global Synthesis

Following the review of 100 policies across nine policy areas, a number of trends and key findings have been identified.

5.1 Geographic coverage of policies

The policies assessed in this review are from Europe, Asia, Australasia, Africa and North and South America as shown in Figure 8. There is an almost even split between high income and low to middle income countries (HIC = 35, LMIC = 38). Some countries appear in multiple reviews of different policy types, most notably UK (8), USA (6), Canada (4), Antigua and Barbuda (3). Policies in the USA were subnational, at city or state-wide scale, and therefore cannot be assumed to provide an overview of the entire country. Similarly, the UK had some regulations that were specific to England and therefore did not represent the whole of the UK. South America and Africa had the fewest policies reviewed partially due to policy documents being unavailable in the public domain or in English.

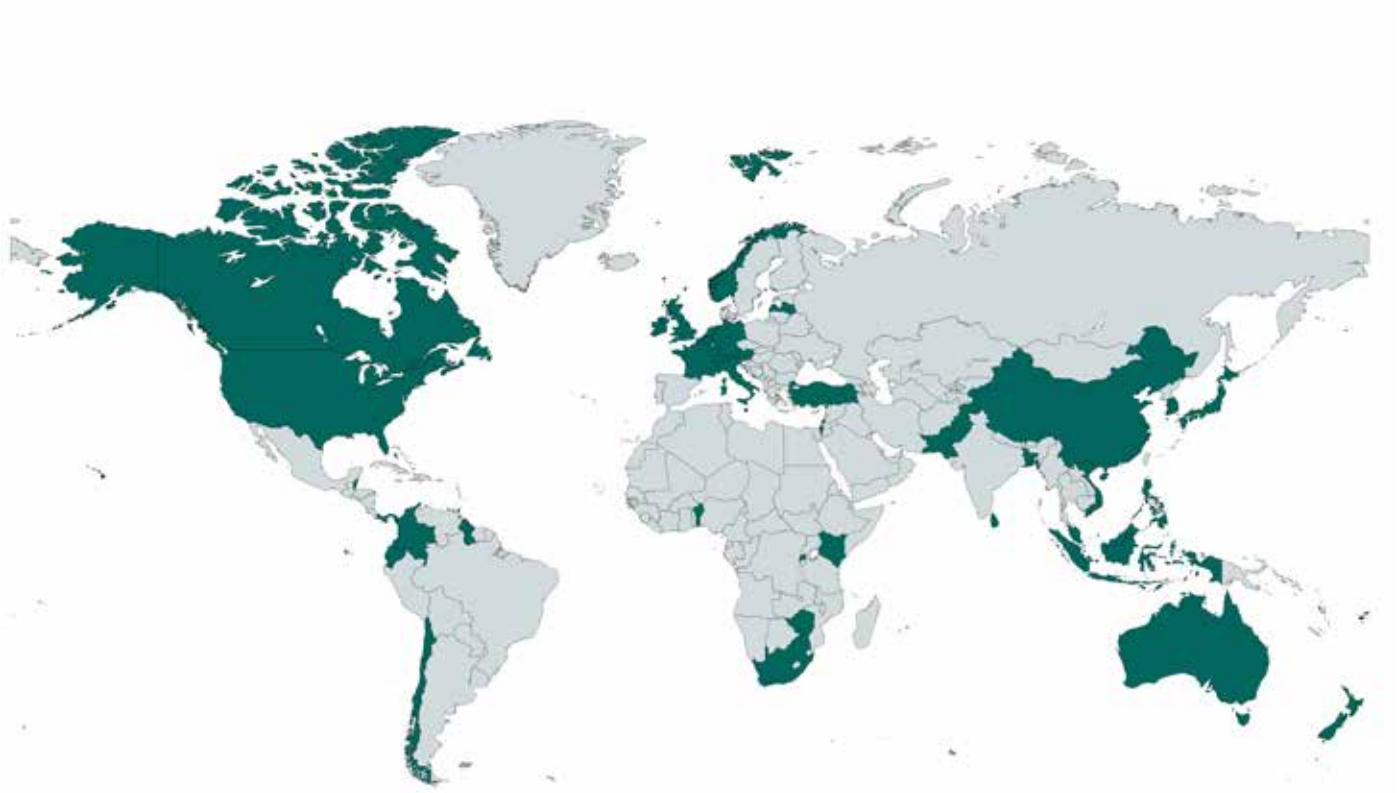


Figure 8. *Global coverage of policies reviewed (countries with policies reviewed in blue).*

5.2 Patterns of policies between low to middle and high income countries

Most low to middle income countries (LMIC) have now and historically lacked basic waste management and collection infrastructure which has caused plastic pollution to be more visible. Plastic waste exports and transhipment from high income countries (HIC) to LMIC has caused a deluge of plastic waste in Asia and Africa, overwhelming the already overburdened domestic waste management systems (EIA, 2021). Legal measures such as bans on plastic bags and SUPPs were common in LMIC whereas producer accountability, recycling, affirmative action and information instruments were more prominent within HIC. According to UNEP (2018), 127 countries have implemented full or partial bans on plastic bags. The majority of these bans are located in LMIC, particularly in Africa, while countries that have opted to introduce taxes to reduce plastic bag use are mainly in Europe. Strong lobbying by plastic producers occurs less in LMIC, making it easier to pass legislation banning bags. In more recent years, SUPP bans have become more prominent in Europe, but most are too recent to assess their effectiveness.

Small island developing states (SIDS) face notable challenges for plastic policies, such as restricted size, restricted economies of scale for development of recycling facilities, and proximity to the impact of marine plastic litter. Bans of plastic bags and SUPPs were common in SIDS. For example, in both Vanuatu and Antigua and Barbuda. In both places, policies were focused on banning the manufacture, import and sale of plastic items, which had public support and were enabled by convenient access to alternatives. Further investigation would determine whether factors related specifically to SIDS make these island nations favour plastic bans, such as the limited space or capacity for SIDS to regenerate or implement waste management systems that are focused on recycling (Barrowclough and Vivas Eugui, 2021). It was identified in SIDS by expert consultation that finance plays a critical role in implementing projects and initiatives.

Plastic bag taxes perform well in HIC where the public are accustomed to paying a fee or bringing their own bags when shopping. Taxes reviewed in LMIC performed less well or lacked strong evidence, often due to lack of enforcement and monitoring, as was evident in both China and Vietnam. When enforcement is weak, retailers in Vietnam handed out bags for free due to low cost thin plastic bags (Trang, 2019). Stakeholder engagement and consumer awareness campaigns were rare in LMIC. Recycling policies in HIC were found to perform better than those in the LMIC due to a lack of solid waste management, infrastructure, collection and funding in LMIC.

LMIC have an extensive informal waste collection sector which is responsible for 60% of global plastic recycling but its contribution to reducing plastic pollution is often unrecognised and underpaid (Pew Charitable Trust and SYSTEMIQ, 2020). With financial and technical input for infrastructure and education, there are opportunities for LMIC to leapfrog in the area of waste management and recycling and by integrating informal waste collectors with the formal recycling sector. In this sense, by giving the informal waste sector access to the formal sector streams, plastic separation and recycling could be an opportunity for improved livelihoods for informal waste workers. Integration of the informal sector into more formalised waste frameworks is emerging, such as

waste picker integration guidelines under development by South Africa. Waste pickers operating through non-profit organisations and cooperatives are included in the implementation of South Africa's EPR regulations which increases recognition of the informal waste sector and generates support from producers and municipalities to the informal waste collectors (DEFF and DSI, 2020). Importantly, the recent global agreement to develop a resolution to end plastic pollution at the fifth UNEA meeting includes specific reference to the informal waste sector and their role in global waste management (UNEA, 2022). As such, the upcoming negotiations present a unique opportunity to include their voices and experiences to shape just and equitable plastics policy. Whilst more EPR/DRS policies are appearing in LMIC, they are more commonly found in HIC. The HIC have widely known DRS/EPR systems however, even in the case of Switzerland and Norway, the evidence of their effectiveness was limited.

Information instruments in LMIC were of limited effectiveness, with three out of the four lowest performing campaigns originating in LMIC. Evidence of the impact of information campaigns was often from the campaigning group itself, meaning that the evidence is potentially biased. These campaigns were focused on raising awareness of the impact of plastic pollution, such as the Dead Whale art installation in the Philippines, the Indonesian Plastic Bag Movement, and the Bahamas Plastic Movement. Campaigns that used social media for petitions or to receive pledges, saw greater uptake in HIC than the LMIC. This could be due to variations in online access and usage.

LMIC often rely on collaborations with external partners to generate new policies to overcome capacity and financial limitations. LMIC may also benefit from economic assistance to support their efforts in dealing with plastic pollution, for example Antigua and Barbuda received financial support from China which was used to create reusable bag and garment training programmes to increase prevalence and availability of reusable bags on the island (Holmberg, 2020).

5.3 Key Findings

Key finding 1: There is a lack of monitoring and evaluation of plastics policy effectiveness

The analytical framework could not determine an overall effectiveness score for 24 of the 100 plastics policies due to a lack of evidence. In most of these cases, it was uncertain as to whether there was no evidence of policy effectiveness recorded, or whether there was a lack of disclosure and public access to evidence. Regardless, it is clear that there is a significant data gap that impedes the assessment of plastics policy assessment, which is incompatible with the urgency of tackling the plastic pollution problem. As shown in Figure 9, drawing together a global picture of plastics policy effectiveness is a challenging task given the overwhelming lack of evidence. In addition to the 34 policies with insufficient evidence to complete the framework, there were a large number of policies that were not publicly available, despite direct reference to their existence in articles or literature. Without access to the original policy, it was impossible to verify its objectives, intent and place it within the wider context of the policy type. Not being able to find policy documents themselves also limits any wider analysis of how policy objectives have evolved over time. Of the policies with no available evidence to be analysed, 65% were from 2018 and 2019, and 20% were from before 2018. It was surprising that the policies from before 2017 had such little evidence to analyse considering they have been in place for over five years. This perhaps reflects a wider culture of an absence or lack of monitoring and reporting embedded within policy making.

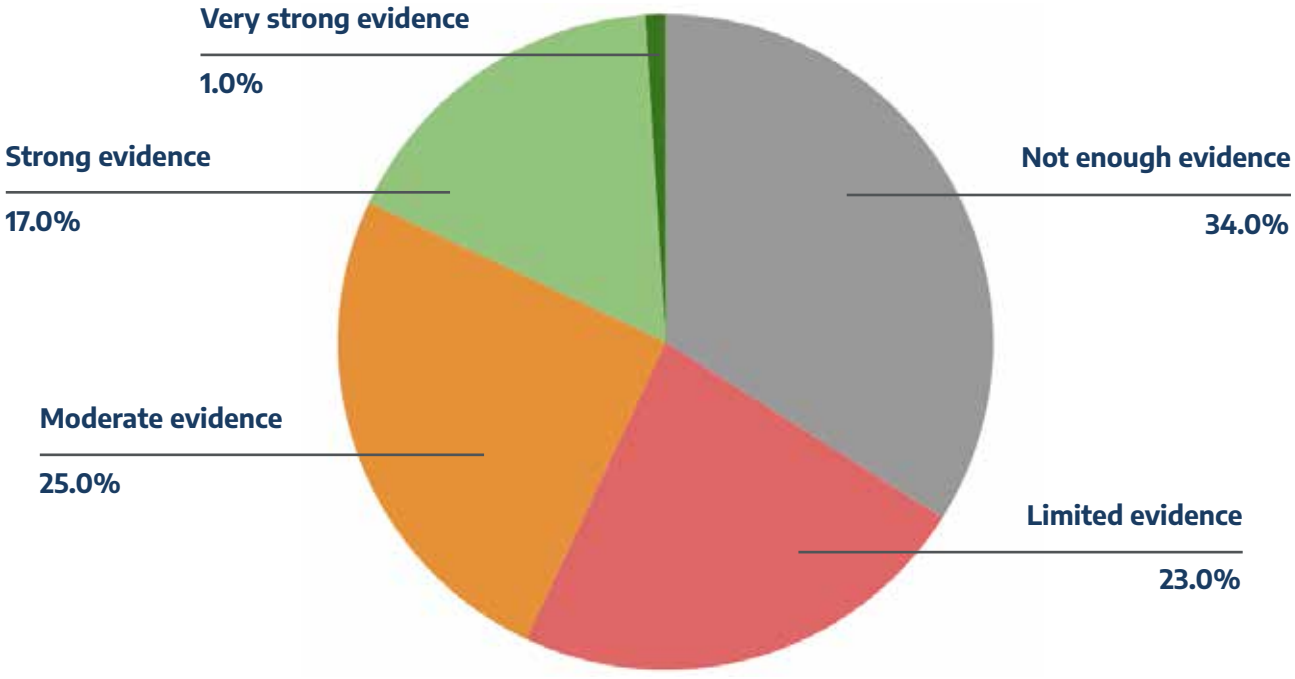


Figure 9. *Strength of evidence available for the policies reviewed (n=100).*

A further 23% of reviewed policies had a limited evidence base upon which to assess their effectiveness, or the evidence found was based on objective sources with no further sources to support the claims. It was initially expected that policies implemented from 2019 onwards would have significant data limitations due to the COVID-19 pandemic from March 2020. However, from the 24 policies that were implemented post 2019, nearly half had no available evidence to assess their effectiveness which is less than anticipated, given that the pandemic brought so many activities to a standstill.

The persistent evidence gaps across all plastic policy types and across all years, were:

- Steps taken in policy formulation
- Amount of direct plastic prevented from the environment as a result of the policy
- Impact on waste exports and imports
- Social burden placed on society
- How stakeholders were engaged during policy formulation
- Monetary cost of policy implementation
- Long term financing commitments
- Monitoring and evaluation of the process and the impact of the intervention

Few of the policies were mandated to directly remove plastic from the environment thus attributing to this evidence gap. This is also likely true for plastic export and import, which were often not explicitly targeted in policy and therefore no metrics exist to monitor the impact. The effects of an intervention, including upon human health and economic equity are explicitly included in the metric for social burden, however evidence is extremely limited. Where evidence of consideration of social burden is found, it usually only refers to the economic cost to consumers. The effects of plastics policy on human health and economic equity is an emerging field of study that reflects the complexity of measuring multiple effectiveness metrics. Increasing how this holistic interpretation of social burden, beyond solely considering economic burden, is accounted for in evaluating policy effectiveness. This could lead to increased stakeholder buy-in through ensuring equitable benefits and removal of uneven barriers to implementation of policy.

Other evidence gaps are more specific to the policy formulation process. Stakeholder engagement, for example, is critical for policy success by helping to support buy-in and fostering the collaboration and partnerships needed for innovative solutions. Similarly, there is little evidence surrounding long term financing commitments needed to implement policies.

In the context of industry, similar evidence gaps exist. These evidence gaps can be attributed to the fact that these are voluntary commitments. Therefore, in theory, less accountability exists as there are no requirements or current obligations for industry to make such data publicly available. While evidence gaps do not suggest that key factors have been omitted in the policy development process, they do demonstrate a lack of transparency.

There is growing demand for scientists to improve how evidence is communicated to decision-makers and the public (Ruggeri et al., 2020) which is coupled with the need for greater transparency in how policies are implemented and monitored. The pursuit of evidence-based policies can only be achieved by increasing monitoring and evaluation of policy progress, and standardising data collection. The introduction of the WWF Resource Footprint Tracker to the US Plastics Pact is a good example of a harmonised approach to data collection that enhances transparency and consistency of data collection. Further

interventions to address plastic pollution should prioritise the development of harmonised, efficient and transparent monitoring mechanisms. A comprehensive evaluation procedure that is included within the mandate of a policy is essential to determining the effectiveness of the policy and provide the basis for future decision-making as well as the refinement of the policy itself. It is also important to ensure that policy effectiveness evidence is objective, thorough and relevant, and is communicated into further policy processes relevant to plastics, human health, the economy, climate and biodiversity. Ultimately, we cannot manage what we cannot measure.

Key finding 2: Identification of critical enablers

From the analysis presented in sections 3 and 4, policy enablers were identified, as shown in Figure 10. Other enabling factors have been identified that are specific to certain policy types, such as the need for **investment in infrastructure for recycling**, reuse policies, **innovation** in EPR/DRS, and the **availability of alternatives** for SUPP and bag bans. This section details the cross cutting enablers that were applicable across multiple policy types. The most prominent enabler is **leadership and commitment**, which as well as being an important enabler in its own right was also found to facilitate many of the other enablers identified throughout this analysis. Leadership, through strong political will and commitment is evidenced by sustainable financing mechanisms in place, consistent messaging throughout implementation regarding the implications on all relevant actors, and a clear plan of action. For example, Antigua and Barbuda have repeatedly demonstrated strong political will and leadership in reducing plastic consumption through SUPP and plastic bag bans, which is especially important given the multi-phased approach to implementing the bans that was adopted. Their approach included an educational campaign about the purpose of the bans and clear messaging throughout the development of the prohibition policy. In contrast, Zimbabwe's SUPP ban (first announced in 2012) was widely regarded as ineffective due to inconsistent leadership and messaging, a lack of enforcement and poor public and stakeholder engagement (Sherrington et al., 2021). Much of the cost of Zimbabwe's ban was borne by businesses which had only three weeks' notice to source alternatives.

Leadership and commitment were especially important where policies such as recycling and taxes required significant public investment (whether financial or human resources) for implementation. Financial commitment by governments, NGOs or businesses to policies is often harder to evaluate, but was identified as a major barrier to innovation or infrastructure-focused policies such as increasing recycling and introducing EPR/DRS. Canada's Strategy on Zero Plastic Waste is a notable exception, with the Canadian government pledging $20 million CAD as part of the Canadian Plastics Innovation Challenge to facilitate the development of innovative solutions to plastic waste (Diggle and Walker, 2020). In contrast, insufficient government funding to support the Philippines Ecological Solid Waste Management Act 2000 meant that local authorities could not effectively implement the policy (Sapuay, 2005). Commitment was also demonstrated to EPR/DRS through the creation of legislation to ensure a level playing field for affected businesses. For example, businesses may incur additional costs in redesigning existing products to be compliant with the EPR schemes, but if only voluntary, the costs have unequal distribution.

The need for **public buy-in, trust and acceptance** of policies was also found to be paramount. In some of the countries analysed, policies were triggered by direct public campaign and action (such as Vanuatu's petition for a SUPP ban), which created pre-existing support for policy implementation. Where widespread public acceptance and demand does not exist, **education and awareness raising** activities are needed to facilitate acceptance. This is prominent in all policy types, particularly those in which consumer behaviour was directly targeted, such as bag and SUPP bans, taxes, recycling and DRS. In EPR/DRS policies, education and awareness raising are critical to ensure that consumers adopt the schemes. However, there is often a lack of evidence surrounding the presence or effectiveness of specific awareness campaigns associated with EPR/DRS. Mixed messages and confusing rules that change from region to region discourage informed participation.

In Antigua and Barbuda, a widespread public campaign of **education and awareness raising** activities increased the effectiveness of, and compliance with, bans on SUPP. Educational activities included workshops (with the focus of "Educate, Engage, Alternatives" Clayton et al., 2021) and consultations which explored common alternatives to plastic, and an international concert which was financially supported by Qatar and Norway (UNEP, 2019b). Antigua and Barbuda also launched a campaign with the slogan "We're making a difference, one bag at a time". Affirmative action policies have a strong educational component, for example, Australia's Ghost Net Initiative (2021) has an

educational programme for indigenous people focused on net identification and options for net recycling and reuse.

For policies that impose a public or business tax, **education and awareness** raising was crucial for support and compliance, yet there is little evidence of specific activities by the government to support the implementation of taxes in this way. Poor compliance to the plastic bag tax in Vietnam by businesses was facilitated by fragmented and discontinuous educational activities (Thang, 2019). People become accustomed to the financial implications of taxes, becoming less impacted by the cost and ultimately not considering it as too great a price to pay, leading to reduced impact of the policy, where businesses or consumers 'absorbed' the costs (Dikigang, 2012). Education and awareness raising could help to mitigate this barrier. In Ireland, educational campaigns were used to address public concerns about where profits from the tax were going and to establish why the bans were needed (Convery et al., 2007). For small and medium enterprises and multinational corporations that have adopted product redesign (such as Pampers' hybrid diaper, or fully recyclable beverage containers), education and awareness raising is imperative to ensure that the product is recycled appropriately. However, there was often limited publicly available evidence of such activities taking place. Companies such as Fat Face and Coca Cola have used social media campaigns to galvanise behaviour change, and Pampers and Ella's Kitchen incentivise behaviour by rewarding recycling. There is not enough evidence available to determine which approach is better, but education and awareness activities should be contextually appropriate.

Stakeholder engagement throughout the policy making and implementation process was identified as important to policy effectiveness in all policy types, with the exception of recycling. Ensuring that citizens and businesses are a part of the policy making process is important for reaching equitable decisions, and that burdens are not distributed disproportionately, facilitating acceptance prior to policy implementation. However, there was often a lack of evidence about how stakeholders were engaged in policy formulation. Where evidence was available, diverse strategies of stakeholder engagement were employed, reflecting the need for a nuanced and context-driven approach to stakeholder engagement. In Vanuatu, stakeholder engagement in the development of SUPP bans led to flexibility around which items were included in the ban and when they were banned. Ultimately, this ensured longevity of the policy by adopting an incremental approach which facilitated trust as the effects and progress of the ban could be observed on smaller timescales. Vanuatu's SUPP ban was originally meant to include disposable diapers, but following public consultation, disposable diapers were excluded due to a lack of available alternatives. The Vanuatu Government has committed to including diapers within the ban in the future once appropriate alternatives have been identified (McVeigh, 2019).

In national policies which target industry and the public, the strongest stakeholder engagement activities were extensive in breadth and often including multiple different forms of engagement. For example, Antigua and Barbuda had robust stakeholder engagement processes in the formulation of bag bans and SUPP bans. An eight step process was used, meaning that key stakeholders (such as supermarkets and customs agencies) had their views listened and reacted to (UNEP, 2019a; UNEP, 2019b). In EPR/DRS, tax-related policies, affirmative action, and information instruments, the process of stakeholder engagement was a major evidence gap. There is occasionally evidence that stakeholders were involved in policy formulation, but limited evidence as to how stakeholders were specifically engaged, and to what extent they influenced the final policy. For example, over 200 stakeholders were involved, including informal waste pickers, in the formulation of the South African EPR regulations of 2020, (Bünemann et al., 2020), but there is no specific evidence regarding how these stakeholders were involved. Stakeholder engagement is critical to identify and mitigate problems before they occur to allow for smooth implementation. For example, the size of bottles included in DRS in Israel is increasing, but the necessary infrastructure is not yet in place for shops to accommodate the larger bottles. Had proper stakeholder consultation and engagement been undertaken, this issue may have been prevented (Surkes, 2020).

In multinational corporations and small and medium enterprises, stakeholder engagement was also identified as important particularly where product redesign relies on consumers paying more for the product (such as Pampers' hybrid diaper) or recycling (such as Starbucks' plastic strawless lid). Similarly, to national policies, there was extremely limited evidence of stakeholder engagement activities used by companies, with the exception of overarching company culture statements around stakeholder engagement. In the private sector however, no evidence could be found of how stakeholders impacted policy formulation.

Data collection and monitoring was identified as an important enabler of effective policy for all policy types. There is a serious and persistent lack of data to monitor policy performance. A collection of the policies that target a specific product (e.g. plastic bag bans) have some available data, but this is mostly anecdotal or observational evidence reported in news articles (such as Mbugua (2020) who reports on the decrease in plastic bag litter following Kenya's plastic bag ban). The fundamental lack of monitoring data suggests that policies are being implemented without robust evidence to guide their development. This means facing the challenges and large scale efforts of implementing the initial data collection that is needed, and recognising that perhaps policies aren't working as well as intended. For example, many high income countries often report increases in recycling rates, but include labelling for recycling, transhipment and exporting waste plastic which means the real recycling figures would appear much lower than national reporting. The political barrier of reducing reported national recycling figures to be more transparent about the figures, alongside other data collection and the transparent communication of monitoring evidence, requires urgent attention.

Taxes are the exception, in that there is typically significant evidence upon which to assess effectiveness. For example, in Ireland, the Department of Environment, Community and Local Government measures the impact of the plastic bag levy, and monitors trends in consumption of plastic bags (Anastasio & Nix, 2016). This data is then used to change the levy rate if needed. Revenue from the levy is donated to environmental charities, and this information is also made publicly available so consumers can see what the levy has achieved (Anastasio and Nix, 2016). The practice of monitoring and reporting on the successes or failures of a policy approach should be adopted more widely to enable a more adaptive approach to plastics policy making and implementation. Multinational corporations and small and medium enterprises occasionally had good practices of data collection and monitoring, usually through corporate-social responsibility reporting, annual reports, or updates on the company's website. Evian operates a Sustainability Dashboard on their website which provides up to date information about progress towards the company's goal of circularity. In some cases, however, it was very difficult to find data about progress towards a company's plastics goals. If such data existed as a standard for all policy types, it would be possible to adapt policies quickly. Such data could also allow for better enforcement of non-compliant partners (which is important for EPR/DRS schemes that rely on external stakeholders).

A constant challenge is the lack of available data upon which to analyse objectively the success of plastics policies. Accurate and transparent data collection is vital for accountability. Missing or misleading information can lead to accusations of greenwashing and the erosion of public trust. The UN resolution to develop a legally binding treaty to end plastic pollution presents a key opportunity to develop monitoring and evaluation arrangements, which amongst other benefits, would enable more effective policy analysis.

The use of quantitative and time bound objectives was found to be an important enabler of effectiveness in all policy types. Objectives should be clear and based on clear baselines. For example, when developing a policy goal (such as a percentage reduction in plastic waste or production), clarity on how the goal was established is necessary. Furthermore, that baseline value, against which a policy-driven change is measured, should not be an outdated figure that no longer reflects the current national or business context, such as implementing a policy in 2022 using a baseline from 2015 which may be an inaccurate representation of the current state of affairs. When used realistically, time bound goals and objectives can be effective at reducing plastic pollution as they prompt timely action. Enforcement is a further enabler that often goes hand in hand with time bound and quantitative objectives. For example, in Zimbabwe following the re-introduction of a SUPP ban, enforcement was extremely weak resulting in widespread non-compliance and the continued sale of banned items (Sherrington et al., 2019). Similarly, EPR/DRS, policies that performed poorly lacked stringent accountability and enforcement mechanisms. Better performing policies (such as in Norway and Japan) employ enforcement mechanisms that make it more expensive for producers not to engage in the EPR or DRS scheme through heavy taxes and fines for non-compliance compared to reduced fees for compliance.

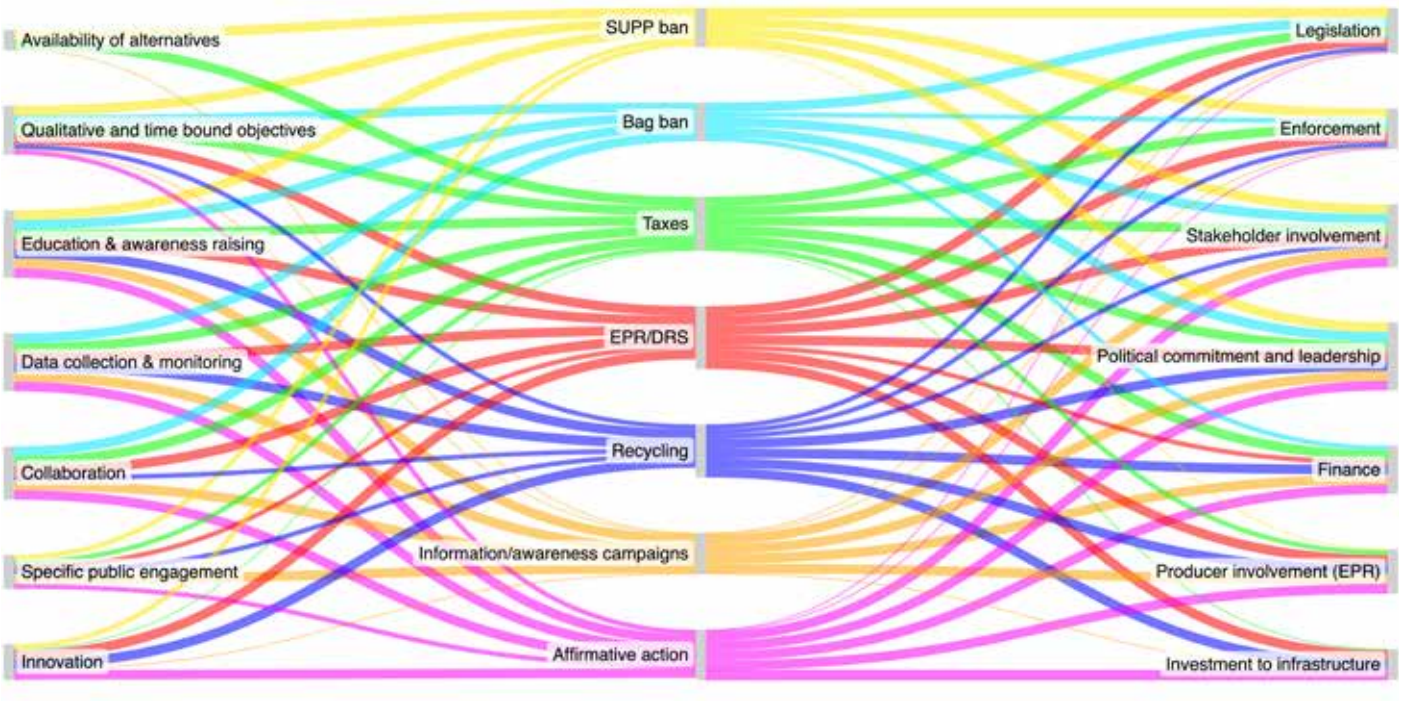


Figure 10. *Sankey Diagram displaying common enablers (on the left and right) of a range of policy types (listed in the centre of the diagram). The differing weights of flows represent importance, with the thickest lines being most important.*

Key finding 3: Integration of policies is lacking

When analysing the outcomes of the policy reviews, a consistent theme recognising the interdependence of policies became apparent. Figure 11 represents these interdependencies. The majority of national policies have been implemented in a piecemeal and sometimes reactionary fashion, often focusing on single items or groups of items such as bags, straws and cups. By examining the dependency of one policy type on another, it was found that there were two distinct areas of policy interaction within the plastic policy landscape: 1) those that target consumption of plastic (such as taxes and bans), and 2) those that target end of life solutions (such as recycling). End of life policies are often more complex, and require all earlier stages of the plastic life cycle to be aligned to the preferred end of life solution to be effective. For example, a newly designed completely recyclable product will only be successful when collection and recycling schemes are in place and are aligned. This highlights the importance of effectively implemented recycling strategies to support the delivery of other policy areas such as EPR, DRS, product redesign and affirmative action which depend on effective recycling systems with the capacity to manage the increased recyclable material.

The same is true vice-versa - for example:

1. Deposit Return schemes provide a well sorted supply of plastic waste products for recycling.
2. Products can be designed using materials that make them easy to recycle, to generate more recyclate.
3. EPR can provide motivation for better product design to include a minimum recycled content, which generates demand for recycled materials over virgin plastic.

Information instruments affect both consumer focused and end of life focused policies. They influence the success of both groups of interlinked policy areas because education and public engagement is essential for most policies to succeed (Plastic Smart Cities, 2022). Affirmative action and information instruments are usually voluntary policies but can have great influence on the structure and effectiveness of other policies. The links between policy types demonstrates the problems generated by the implementation of isolated policy and legislation rather than taking a more holistic approach.

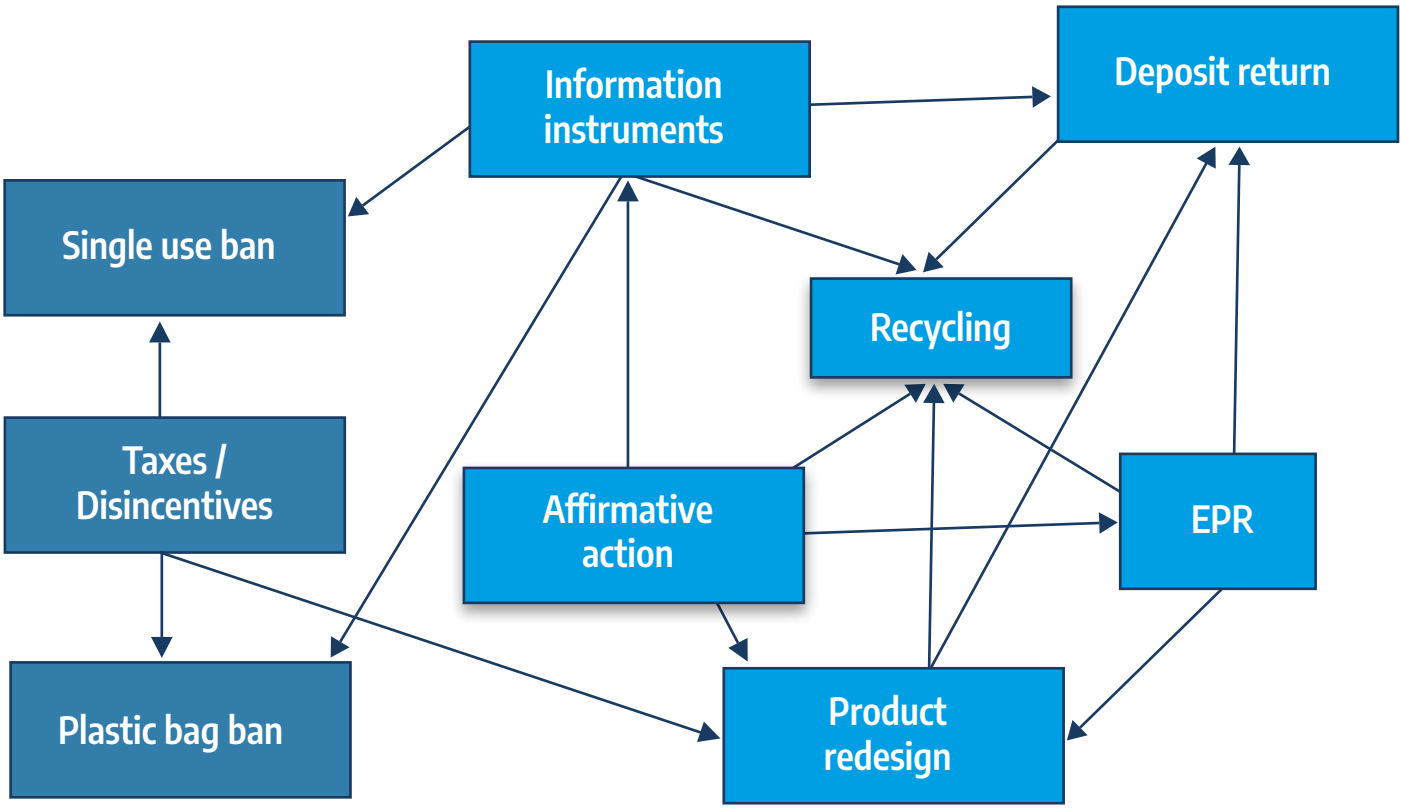


Figure 11. *Interdependencies between policy areas. Arrow direction indicates the influence one policy type (arrow source) has on another (arrow head).*

The need for coordinated policies that consider all stages of the plastic life cycle has been identified by a range of previous reports (e.g. Pew Charitable Trusts and SYSTEMIQ, 2020; IRP, 2021b; OECD, 2022). As such, the notion that "dramatically reducing the mismanaged waste generated by the plastic ecosystem is a complex system-level challenge that requires system-level interventions" (Pew Charitable Trust and SYSTEMIQ, 2020, p39) has become widely accepted. While this key finding is perhaps not novel, it is clear that policy coordination is largely absent in the existing policy landscape.

Table 3. *Stage of plastic lifecycle that policies reviewed address.*

	Stage of plastic lifecycle			
Policy type	**Pre-production** - Extraction - Raw materials - Polymerisation	**Upstream** - Production - Design	**Midstream** - Consumption	**Downstream** - Disposal
Bans on plastic bags		✓		✓
Bans on single use plastic products		✓		✓
Taxes		✓		✓
Producer accountability		✓	✓	✓
Recycling / Waste management				✓
Affirmative Action				✓
Information Instruments				✓
Pacts		✓	✓	✓
Industry commitments		✓	✓	✓

Table 3 shows where current policy intervenes in the plastic lifecycle, and illustrates the focus of policy on downstream plastics. In this study, upstream interventions were explored, but largely returned insufficient evidence to apply the analytical framework. Pre-production policies were explored, but largely returned no evidence on effectiveness and locating policy documents in this area delivered too few policies to evaluate with enough policies to compare. This highlights the significant gap in policy based on the current lack of upstream and pre-production interventions particularly targeting virgin plastic use and reduction strategies. Production waste is an area where a closed loop approach could be more straightforward as the material is not mixed. Taxation on virgin plastic could increase the likelihood of this approach being effective and could encourage companies to examine new methods of incorporating recycled material and reducing plastic use. Most crucially, to enable effective policy that has a wider reach across the plastic lifecycle, firm policy in the form of bans, taxes and incentives could be placed on upstream and pre-production plastic to facilitate recycling measures. Effective recycling policy can play a major part of an integrated solution but ever increasing production will ultimately overload any recycling system in place. Effective action requires synergies between upstream, midstream and downstream interventions; and a suite of policies that operate across boundaries and in synergy with other areas of policy including health, climate, biodiversity, and economy.

6 Conclusions

Following the review of 100 policies across nine policy areas, a number of trends and key findings have been identified.

There are eight conclusions related to improved plastics policy:

1 Public support, acceptance and buy-in are paramount for effective plastic policies

Policies that attempt to impose a top-down intervention without sufficient public support tend to require strong enforcement, which can result in widespread discontent and noncompliance. Where public support for a policy does not exist, extensive sensitisation through targeted education and awareness raising steve.fletcher@port.ac.uk activities as well as direct opportunities for ongoing involvement is imperative to create equitable and effective policies.

2 Filling evidence gaps, particularly related to the impacts and effectiveness of plastic related policies, should be prioritised

Major evidence gaps exist within the plastic policy landscape, particularly around how plastics policy is formulated, such as how stakeholders were included, how the policy was implemented, and how it was financed. There is an urgent need to fill evidence gaps to identify and share effective practice in plastic policy development and implementation.

3 Monitoring and evaluation should be built into all plastics policies

Plastics policies should include clearly defined monitoring and evaluation measures that are agreed by stakeholders at the outset. Furthermore, using time bound and quantitative goals that align with monitoring and evaluation schemes provides a means of holding policymakers accountable for meeting those goals. These elements are currently missing from most plastics policies, which creates ambiguity in claims of policy success and undermines any attempt to refine policies based on current performance. Efficient monitoring and evaluation not only allows a nation or business to track progress, but it also offers potential to unlock investment, particularly in areas where progress is seen.

4 Policy effectiveness evidence needs standardisation

A consistent standardised approach to measuring effectiveness across plastic policy, made available transparently (to allow for more widespread use), could enable better understanding of the types of policy that are most successful. Within any nation, all plastic policies would benefit from a standard monitoring method with data published for the same time periods so that plastic policy types can be directly compared. Globally consistent data collection of plastic policies needs to be combined with international standardisation metrics which may emerge from the process to develop an international legally binding treaty to end plastic pollution. Consistent data collection protocols may need to be supported by international financing to enable coordination nationally, regionally and internationally.

5 Policy effectiveness reporting should be transparent and available for public scrutiny

Transparency of information generates improved shared knowledge and supports public and stakeholder buy-in of the implementation of policies. Where there is a lack of transparency, policy making is hindered by misconceptions about policy effectiveness. As an example, worldwide, published recycling rates include exported plastic waste, with no indication of whether the plastic waste has been recycled at destination, engendering skewed perceptions of how waste is managed globally. In some cases, the lack of transparency may be unintentional or as a result of insufficient resourcing as opposed to resistance to sharing of information. In this regard, raising the equitability of access to data and evidence should be considered.

6 Coordinated policy approaches are more effective than isolated, standalone actions

Given that plastic pollution is generated at all stages of the life cycle, a coordinated whole life-cycle approach to policy making is crucial. A balanced policy mix that addresses the entire plastics life-cycle, with a focus on circularity and reduced reliance on virgin material, is more likely to be effective than individual policies focused on downstream actions.

7 Effective plastics policy requires careful consideration of context

While reviewing the effectiveness of plastics policies can provide valuable insight into which policies are effective, and why, there is a need for consideration of contextual nuance. When looking to implement a plastic policy, sensitivity to national or local context is imperative. This includes recognising that every country has a different starting point, with different national infrastructure, varying capacity for technology development, and unique trade dependencies.

8 Moving beyond the existing paradigm of plastics policy

The lessons learned from this study have highlighted the successes and failings of a large number of policies which address the plastics crisis at varying scales. However, it is clear that there is a pressing need to progress beyond the current siloed thinking about plastics and acknowledge that there are various other interacting policies beyond the plastics life cycle. In this regard, a paradigm shift towards a system in which climate, health, labour and other policies are developed with plastics policy in an integrated way is strongly encouraged.

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Annex 1: Analytical Framework

	Policy		Link to policy document				
1	**Context**						
1.1	**Details**						**Evidence**
a	What type of policy is this? What does it focus on?	Instrument type:	Focusing on:				
b	In what time frame was this policy implemented?						
c	What is the scale of this policy? Where is it based?		Country/region:				
d	Who is responsible for introducing and implementing this policy? (ie. which governing body, business, etc.)						
e	What are the objectives of the policy? Have they been updated over time? If so, how?						
f	Are the objectives quantitative and time bound?						
g	Is anyone accountable for delivering these objectives? If so, who?						
h	In what context was it implemented? ie. What was the primary driver for this policy being implemented?						
i	Was this policy voluntary or legally binding?						
j	In which year was it published and implemented?						
k	In which year was it published and implemented?						

l	Which point in the plastics lifecycle does it address? (Upstream - resource extraction, production, distribution or Downstream - consumption, disposal)						

1.2	Availability of evidence		Provide details				Evidence
a	Within the search timeframe, what is the availability of evidence for this policy?						

2	Contribution to minimising plastic pollution						
	Descriptive		**Evidence**				
a	Does the policy or evidence used to assess it refer directly to ocean plastic pollution (or artificial materials, PET, plastic pollution etc)? If no, explain how it relates to plastic pollution (ie. pathway, plausible attribution etc.)						

	Contribution to minimising plastic pollution						
	Assessment	**0**	**1**	**2**	**3**	**Score**	**Evidence**
b	To what extent has this policy been effective at reducing the amount of plastic used in production, distribution or consumption?	There has been no contribution to reducing plastics used in production, distribution or consumption that can be attributed to this policy	Some reduction of plastics used has been seen but progress attributable to this policy is limited	Some significant advances in reducing plastic have been seen, but not all are attributable to this policy	The amount of plastics used has significantly decreased due to this policy		

	Contribution to mini-mising plastic pollution						
	Assessment	**0**	**1**	**2**	**3**	**Score**	**Evidence**
c	To what extent has this policy been effective at increasing the substitution of plastic (either in production or consumption)?	There has been no contribution to increasing the substitution of plastics attributable to this policy	Some substitution of plastic has occurred, but progress attributable to this policy is limited	Some significant advances in increasing the substitution of plastic have been seen, but not all are attributable to this policy	The amount of plastic substitution has significantly increased due to this policy		
d	To what extent has this policy been effective at increasing the reuse of plastic?	There has been no noticeable increase in reuse of plastics attributable to this policy	Reuse of plastic has increased, but progress attributable to this policy is limited	Some significant advances in the amount of plastic reused have been seen, but not all are attributable to this policy	The amount of plastic being reused has significantly increased due to this policy		
e	To what extent has this policy been effective at increasing the rate or improving the systems for recycling?	There has been no improvement to the rate or system of recycling attributable to this policy	The rate and system of recycling has improved, but progress attributable to this policy is limited	Advances in the rate and system of recycling are significant, but not all are attributable to this policy	The rate and system or recycling has significantly improved due to this policy		
f	To what extent has this policy been effective at improving disposal mechanisms of plastics?	There has been no progress towards improving disposal mechanisms of plastics attributable to this policy	The disposal mechanisms for plastics has improved, but progress attributable to this policy is limited	Some advances in improving the disposal mechanisms of plastics are in place, but not all are attributable to this policy	The mechanisms for plastics disposal have been significantly improved due to this policy		
g	To what extent has this policy been effective at improving consumer awareness about plastics?	There has been no progress associated with this policy towards improving consumer awareness about plastics	Consumer awareness has increased, but progress attributable to this policy is limited, or it is uneven	With some exceptions (groups and attributable to other interventions), consumer awareness around plastics associated with this policy is good	There is strong consumer awareness around plastics generated by this policy		
h	To what extent has the policy generated public support for plastics solutions?	Public support across the scale of combatting plastic pollution is weak	Well informed support associated with this policy is present in some groups of the public, but not others	With some exceptions, there is good public support associated with this policy for minimising plastic pollution	There is strong support among the public for plastics solutions, associated with this policy		

	Contribution to mini-mising plastic pollution						
	Assessment	**0**	**1**	**2**	**3**	**Score**	**Evidence**
i	To what extent has this policy contributed to the direct removal of plastics waste from terrestrial or marine environments?	There has been no direct removal of plastics from the environment attributable to this policy	Direct removal of plastics from the environment has increased, but progress attributable to this policy is limited	Increases in direct removal of plastics from the environment are significant, but not all are attributable to this policy	The amount of direct removal of plastics from the environment has significantly increased due to this policy		
j	To what extent has this policy met the three circularity principles as defined by the Ellen McArthur Foundation (1. Design out waste and pollution, 2. Keep products and materials in use, 3. Regenerates natural ecosystems)	This policy meets none of the circularity principles	This policy meets one of the circularity principles	This policy meets two of the circularity principles	This policy meets all three of the circularity principles		
k	To what extent has the policy contributed to improving innovative solutions or technology for plastics? (specific to this policy type. eg. technology for PET production is irrelevant to technology for waste removal)	There have been no notable innovative solutions or technologies for dealing with plastics attributable to this policy	Notable innovative solutions or technologies for dealing with plastics have improved, but progress attributable to this policy is limited	Increases in innovative solutions or technologies for dealing with plastics are significant, but not all are attributable to this policy	Notable innovative solutions or technologies for dealing with plastics significantly increased due to this policy		
l	To what extent are relevant institutions collaborating effectively to deliver the policy's objectives?	There is limited collaboration between implementing institutions, and this is no more than the independent operating procedures employed before the policy's implementation	More integrated and collaborative approaches are in place by relevant implementing institutions, but some conflicts and disconnects are still in place	Collaboration between implementing institutions is generally good, but there are conflicts or disconnects from time to time	There is extensive collaboration between implementing institutions to ensure that implementation and management of this policy is integrated		
m	To what extent has this policy contributed to minimising the import and export of plastic products?	There has been no contribution towards minimising the import and export of plastic products attributable to this policy	The import and export of plastic products has been limitedly decreased by this policy	There has been a significant decrease in the import and export of plastic products, but not all advances are attributable to this policy	The import and export of plastics products has decreased significantly due to this policy		

	Contribution to mini-mising plastic pollution						
	Assessment	**0**	**1**	**2**	**3**	**Score**	**Evidence**
n	To what extent has this policy contributed to minimising the import and export of plastic waste?	There has been no contribution towards minimising the import and export of plastic waste attributable to this policy	The import and export of plastic waste has been limitedly decreased by this policy	There has been a significant decrease in the import and export of plastic waste, but not all advances are attributable to this policy	The import and export of plastic waste has decreased significantly due to this policy		

2	Contributing factors						
	Descriptive		**Evidence**				
a	Who was responsible for financing this policy and its outcomes?						
b	Was this policy sustainably financed? ie. are/were there funds for both short- and long-term financing?						
c	Is there a set of indicators to monitor the effects of the policy's ability to meet its objectives?						
d	Have there been any cases of major conflicts associated with this policy? If so, explain						
e	Are there any obvious policies in place alongside this one, which may have also contributed to this policy's effectiveness/ ineffectiveness? If so, what was it and how did it contribute?						
f	How was this policy communicated? To whom? Were those affected by the policy specifically communicated with? Make specific notes - especially where the policy is directed at consumers or non-experts.						

2	Contributing factors						
	Descriptive		**Evidence**				
g	For national policies: Does this policy contribute to the delivery of SDGs at a national level?						

	Assessment	0	1	2	3	Score:	Evidence
h	What was the monetary cost to the implementing agent?	The cost of implementing this policy is high	The cost of implementing this policy is moderate	Some costs were involved in implementing this policy, but had no major damaging effects	Minimal to no costs were incurred by the implementing agents		
i	What was the cost to those affected by the policy (consumers/ producers etc)	The costs incurred by those affected by the policy are high, and in most cases unevenly distributed	Some costs were incurred by those affected by the policy, or the costs were unevenly distributed	Minimal costs were incurred by those affected by the policy	No costs were incurred by those affected by the policy		
j	To what extent have investments been made into improving infrastructure for the objectives of the policy?	Infrastructure investments have been minimal and necessary infrastructure is missing or inadequate	Infrastructure investments have begun but are not sufficient for the scale of the policy	Infrastructure is in place but maintenance is poor, or infrastructure is unevenly distributed	Infrastructure is in place and is well maintained in all relevant areas		
k	To what extent has funding been made available over the long term?	The sustainability of funding is a major unresolved issue	Funding for the short term is adequate, but long term funding mechanisms are not in place	Some long term funding mechanisms are in place, but their sustainability or outcomes are uncertain	Short and long term sustainable funding mechanisms are in place and are secured		
l	To what extent was the social burden (cost to consumers, effects on human health, equity) on those affected by the policy?	Social burden to all those affected by the policy has been high	Social burden has been notable, with some groups affected more than others	There has been limited social burden on those affected by the policy, with some exceptions	There has been no notable social burden on those affected by this policy		
m	To what extent were/ are the alternatives accessible (financially, fit-for-purpose, or physically accessible) and available to those affected by the policy's requirements?	No alternatives exist/existed as substitutes for changing use or behaviour	Few alternatives are/were in place as substitutes for changing use or behaviour, but were/are mostly inaccessible	Alternatives are/were available, but were unevenly accessible	Sufficient accessible alternatives are available to all affected by the policy		

	Assessment	0	1	2	3	Score:	Evidence
n	To what extent does the policy have the human resources to implement it?	The necessary human resources for implementation have not yet been assigned	Staffing for implementation is inadequate	Staffing for implementation is present in some areas needed, but not others	Sufficient human resources are in place to fully implement this policy		
o	To what extent was this policy enforced by the implementing agent or enforcing agent?	Enforcement is weak and noncompliance with rules is widespread	Enforcement is uneven, with some groups targeted for more enforcement than others, or some rules enforced more than others	Enforcement is generally effective, but there are some notable exceptions	Enforcement is effective and compliance is high across the board		
p	To what extent have (would have) time bound and quantitative goals enabled or constrained this policy?	Time bound and quantitative goals have / would have been a key constraint to this policy	Time bound and quantitative goals have had/ would have had some minor benefits, but overall their use has/would have been detrimental to the policy	Time bound and quantitative goals (would) have posed some minor challenges, but their use would have/has been overall positive for the policy	Time bound and quantitative goals have been a key enabling factor of this policy		
q	If a corporate mechanism, to what extent was there government (or similar?) support?	Government institutions critical to the effectiveness of this policy have been resistant to it	Support from government institutions has been uneven	With few exceptions, the institutions relevant to this policy have supported its development and implementation	All institutions relevant to this policy have strongly supported this policy from its inception		
r	To what extent were stakeholders involved in the design and objectives of the policy?	Stakeholders were not involved in the formulation of this policy	Stakeholders and the public were informed of the formulation of this policy, but were not involved in contributing	Stakeholders were invited to comment; their suggestions and concerns were acted on in some instances but not others	Stakeholders were active participants in the formulation of this policy and significantly shaped its design		
s	When introduced, to what extent was there support from consumers/producers (those who the policy relates to) to existing plastic-related policies?	Several actors, critical to this policy's focus area were initially resistant to its implementation	Resistance and/ or opposition to this policy was limited to a minority of those affected	With minor exceptions, those affected by the policy have been supportive of its implementation	All those affected by the policy have been supportive of its implementation		

	Descriptive		Evidence				
t	After carrying out the assessment above, what other factors contributed to this policy's effectiveness/ ineffectiveness? This could include engagement, motivation, resource availability, corruption, perceptions and understanding etc.						

4	Conclusions						
			Evidence				
a	Is this policy scalable or transferrable to other situations?						
b	How would this policy be impacted by or contribute to an international plastics agreement?						
c	What are the major lessons / key messages from this policy that can be applied to others? Rank in order of importance. This could be key enablers, barriers and findings - anything that was integral to its performance.						

		0	1	2	3		
d	To what extent has this policy been effective at meeting its own policy objectives?	None of the objectives have been met at all	Progress has been made towards meeting some objectives, but not others	Most of the objectives have been met	All of the objectives have been met completely		
e	To what extent has this policy been effective at reducing plastic pollution?	This policy has had a negative or no impact on reducing plastic pollution	This policy has had very little positive impact on reducing plastic pollution	This policy has had some effect on reducing plastic pollution	This policy has been highly effective at reducing plastic pollution		

5	Strength of Evidence						
		Limited	**Moderate**	**Strength**	**Very Strong**		
	What is the strength of the evidence supporting this evaluation?	Moderate - to- low quality studies, medium - to-small sized evidence body, low levels of consistency, studies may or may not be contextually relevant.	Moderate quality studies on this policy, medium sized evidence body, moderate level of consistency. Studies may or may not be contextually relevant.	High quality body of evidence, medium to large in size, moderately to highly consistent and contextually relevant.	High quality body of evidence, large in size, consistent and contextually relevant		

6	Reference						
	Reference (APA)	**Link**	**Type**	**Quality**			