Prevention of plastic waste in production and consumption by multi-actor partnerships

PREVENT
Waste Alliance

Wuppertal Institut

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"Conserving resources" in cooperation with its members.

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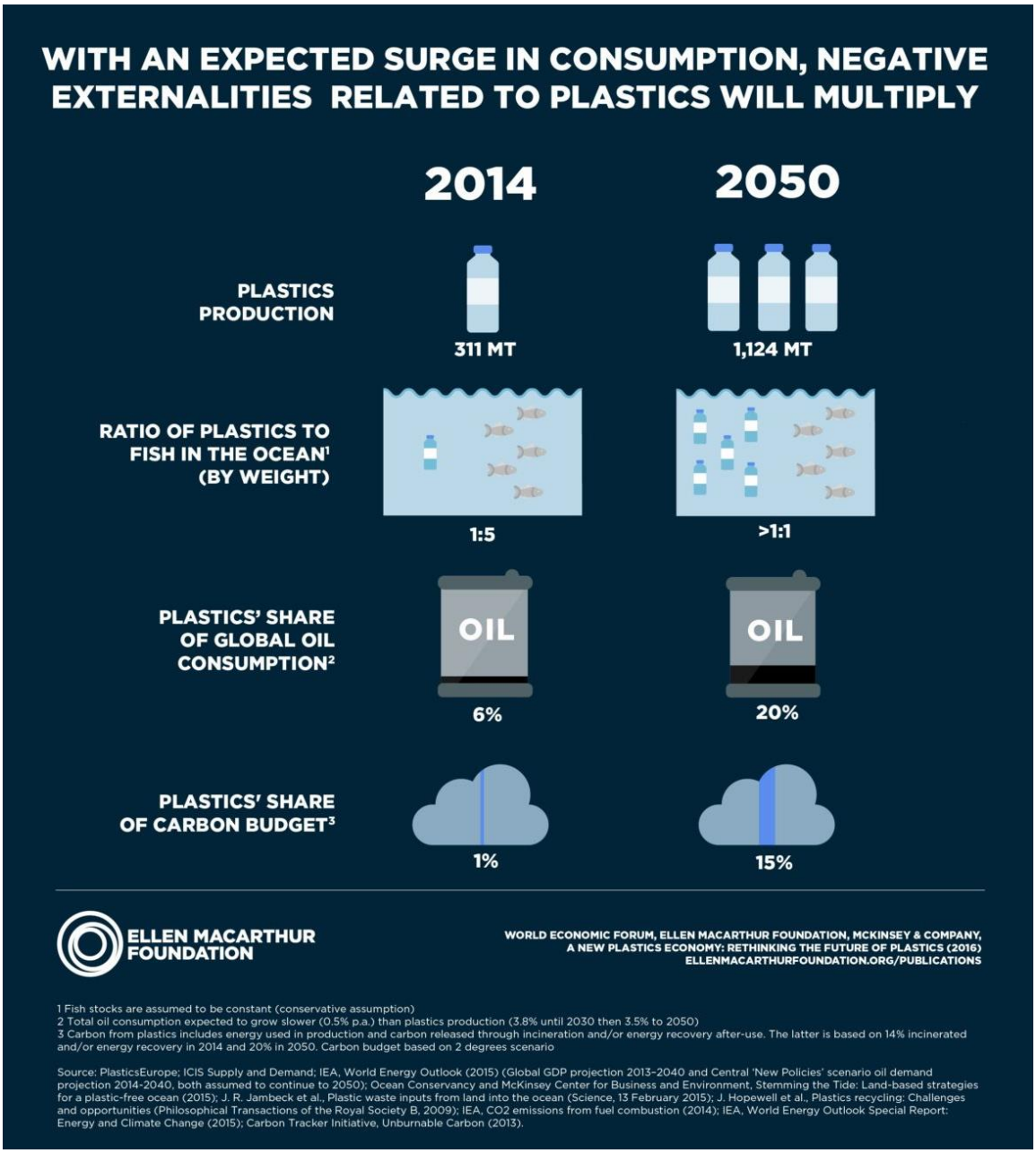
1 Introduction

The increasing littering of the earth with plastic waste has gained enormous attention in recent years, e.g. due to estimates that by 2050 there could be more plastic than fish in the oceans (Figure 1) (World Economic Forum et al., 2016).

Figure 1 **Forecast of plastics volume growth, externalities and oil consumption in a business-as-usual scenario**



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Plastic has become an indispensable part of our everyday life and contributes to the preservation of natural resources in many areas, e.g. through lightweight construction or the replacement of resource-intensive raw materials.

Nevertheless, the current plastics value chains have some inherent characteristics that are not compatible with the main objectives of waste prevention and a circular economy (Wilts & Bakas, 2019):

- Most plastic products are designed for single use only, without considering their potential for reuse.
- Plastics are mainly used for short-lived products (primarily packaging).
- Plastic products often contain hazardous substances that may be brought back into circulation through recycling (which means that there is a high potential for "qualitative" waste prevention).
- The recycling rates are low and downcycling predominates.

Waste prevention and related measures have the capacity to address most of these problems connected to the consumption of plastic products. In contrast to "end-of-pipe" measures, waste prevention requires the cooperation of various stakeholders at all stages of the value chain. In this respect, waste prevention is not primarily considered as the elimination of plastic altogether, but rather as innovative and smart use of plastic, which ultimately leads to a reduced amount of waste. For this purpose, the PREVENT Waste Alliance provides a platform to promote the actual prevention of waste, process and communicate inspiring practical examples of good practice and discuss and implement necessary further steps.

This study outlines the objectives, structure and work programme of the PREVENT Waste Alliance and provides a background to the prevention of plastic waste by describing the need for action, environmental impacts and risks to human health. To pool the know-how and practical experience of the various stakeholders in the PREVENT Waste Alliance regarding plastic waste prevention, the study presents examples of smart practices along the plastic value chain implemented by members of the working group “Conserving resources” and their partners. The focus is on multi-actor partnerships and examples that can be transferred to other countries. The examples cover education & consulting, the establishment of reusable options, the development of waste prevention infrastructure, innovative products, studies on plastic waste prevention as well as guidelines & overviews of best practice examples.

Finally, the study offers recommendations for the further work of the PREVENT Waste Alliance. This includes success factors for plastic waste prevention, necessary next steps and conclusions regarding required policy frameworks.

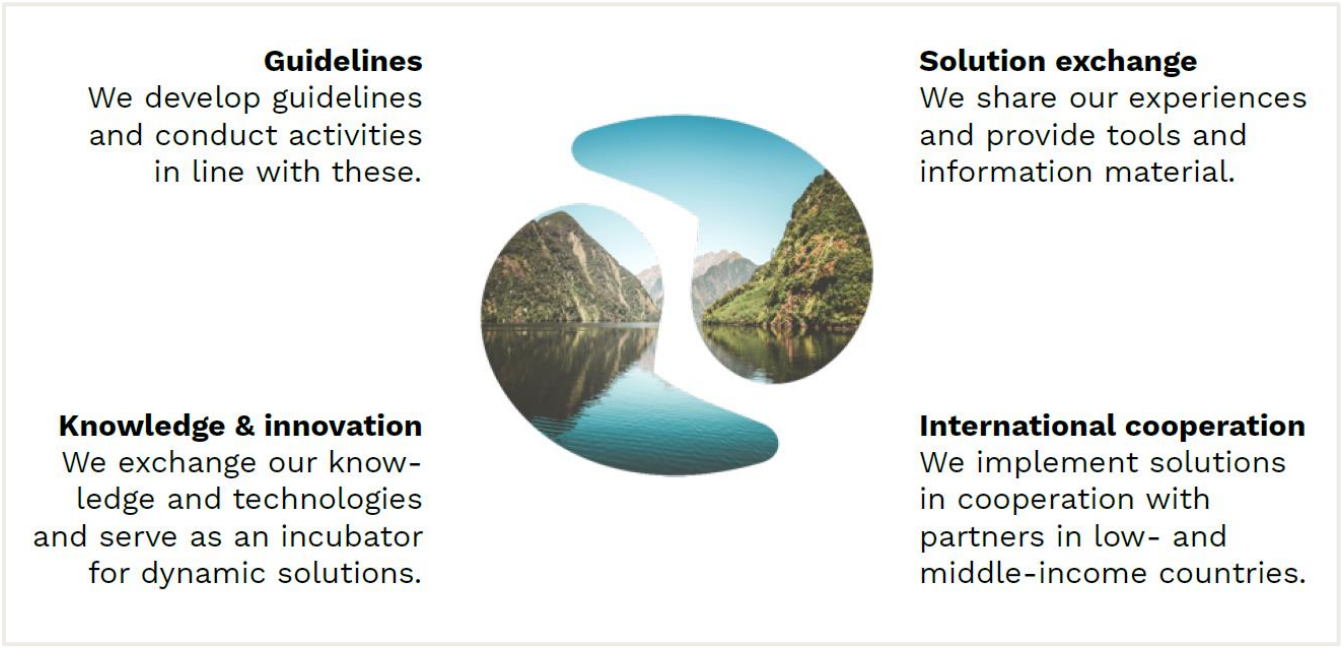
2 PREVENT Waste Alliance

The PREVENT Waste Alliance, launched in May 2019, is a multi-stakeholder partnership that brings together different actors from the private sector, academia, civil society and governmental institutions.

The Alliance wants to contribute to minimising waste, eliminating pollutants and maximising the reuse of resources in the economy worldwide. Therefore, it strives to develop effective waste management and circular economy approaches. Its members work together for waste prevention, collection, and recycling as well as the increased uptake of secondary resources in low and middle-income countries. The focus is on waste from plastic packaging and single-use products as well as waste from electrical and electronic equipment.

Specific activities by the PREVENT Waste Alliance are shown in Figure 2.

Figure 2 Activities of the PREVENT Waste Alliance

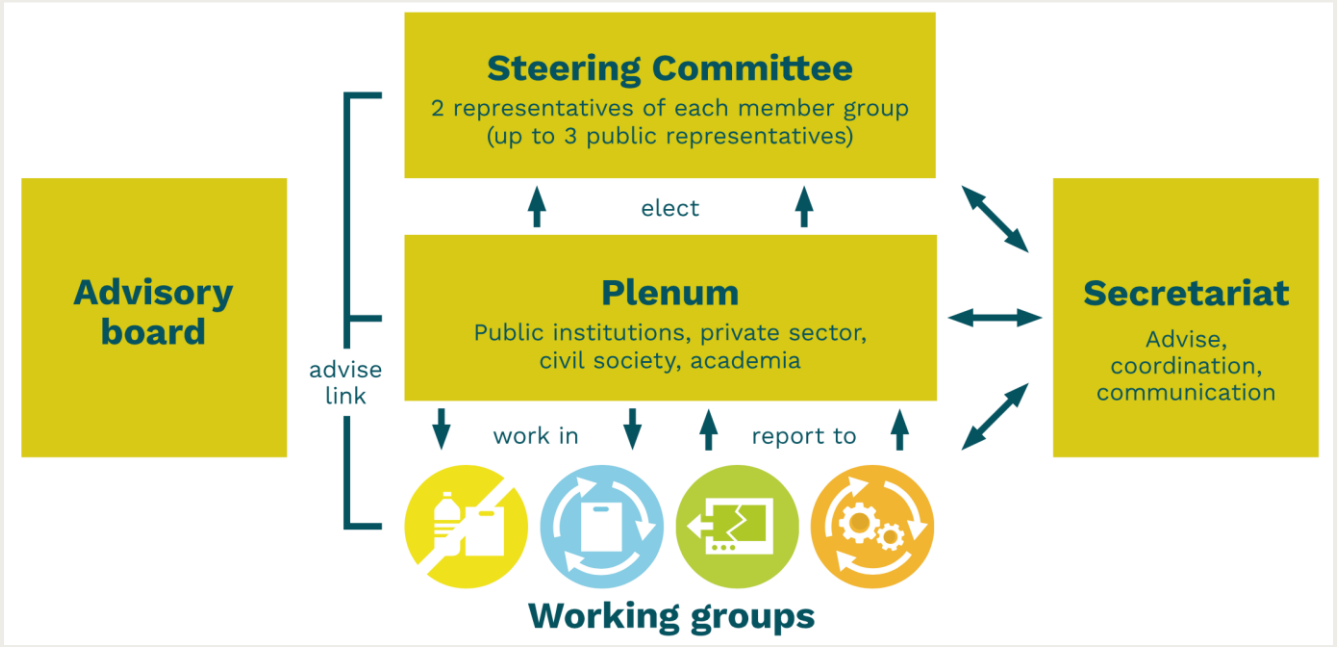


Source: PREVENT Waste Alliance (2020)

Structure & Organisation

The PREVENT Waste Alliance consists of a steering committee, plenum, thematic working groups, secretariat and advisory board (Figure 3).

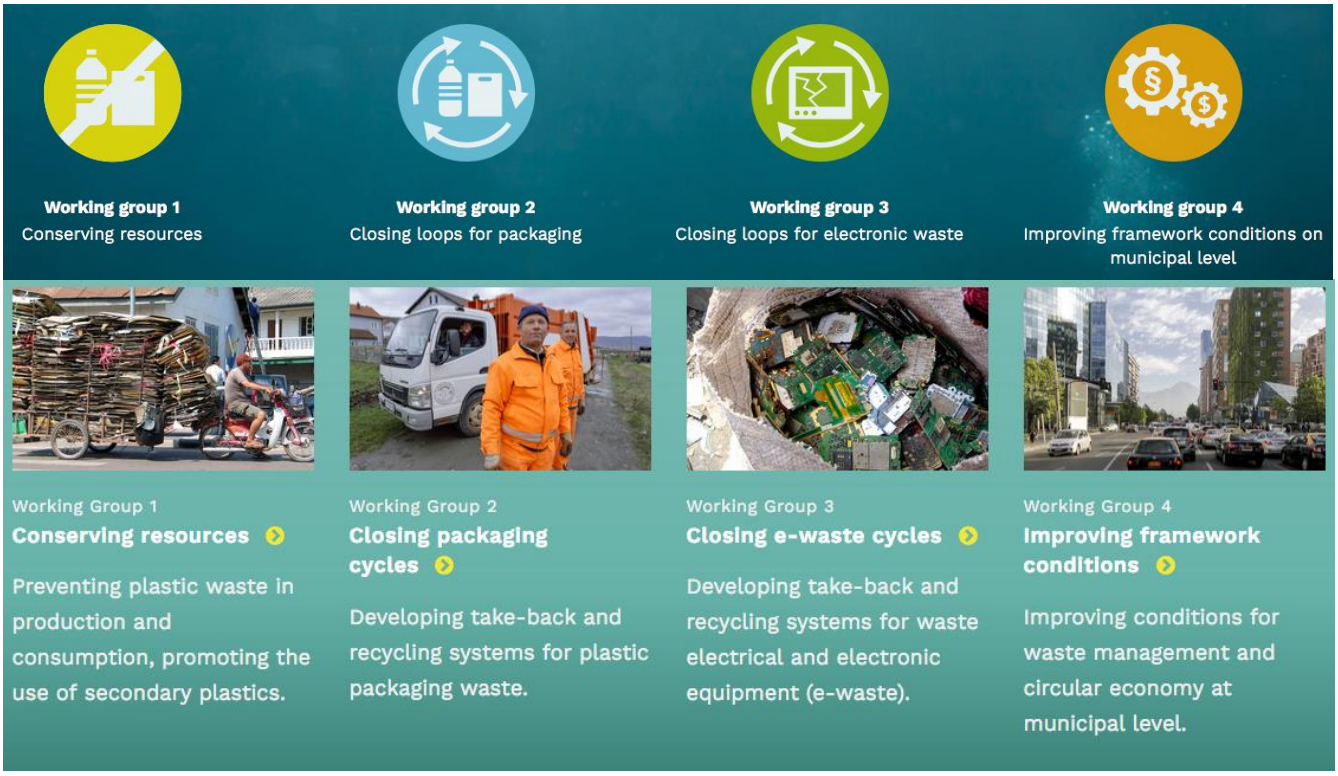
Figure 3 Overview of the governance structure



Source: PREVENT Waste Alliance (2020)

A steering committee makes strategic decisions and publicly represents the PREVENT Waste Alliance. All organisations involved are part of the plenum, which meets annually. The members and partners of the Alliance are further involved in thematic working groups. The working groups (Figure 4) define their own goals and implement activities together. Every working group is supervised by co-leads with support from the secretariat. The secretariat organises and supports committees and working groups and is responsible for the communication and public representation of the PREVENT Waste Alliance. Renowned experts and stakeholders, in particular international initiatives and organisations, form the advisory board, which provides technical advice and ensures that activities of the alliance and international initiatives are coherent.

Figure 4 Working groups of the PREVENT Waste Alliance

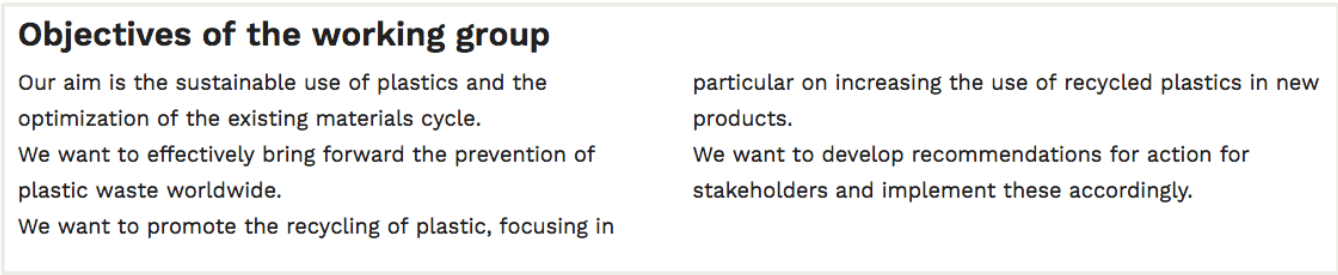


Source: PREVENT Waste Alliance (2020)

Working Group "Conserving resources"

This study was carried out in the context of the PREVENT working group on "Conserving resources". The task of this working group is to develop and implement strategies to reduce, recycle, reuse plastic and, where possible, replace it with alternative materials. Representatives from business, civil society, politics and science work together to develop best practices for the prevention of plastic waste and guidelines for the use of secondary plastics and alternative materials. The aim is to implement these measures in pilot projects with the partner countries of the PREVENT Waste Alliance.

Figure 5 Objectives of working group "Conserving resources"



Source: PREVENT Waste Alliance (2020)

The working group draws up specific guidelines and recommendations for action. To this end, it collects and documents research results and experiences from various perspectives relating to plastic prevention, secondary raw materials and alternative materials.

3 Plastic waste prevention

Food packaging, clothing, electrical appliances and toys – a world without plastics is hardly imaginable these days. Plastics began their success story in the 1950s, and by 2018 the global production of plastics had reached almost 360 million tonnes (PlasticsEurope, 2019).[1] Although plastics can help to conserve resources if used sensibly, they are often only used once and disposed of quickly.

3.1 Waste prevention

This study addresses the prevention of plastic waste from packaging and single-use products by multi-actor partnerships. For this purpose, the members of the working group "Conserving resources" of the PREVENT Waste Alliance have agreed on a common definition of the term '*prevention*' for their joint work. This also served as a basis for selecting the examples in this study.

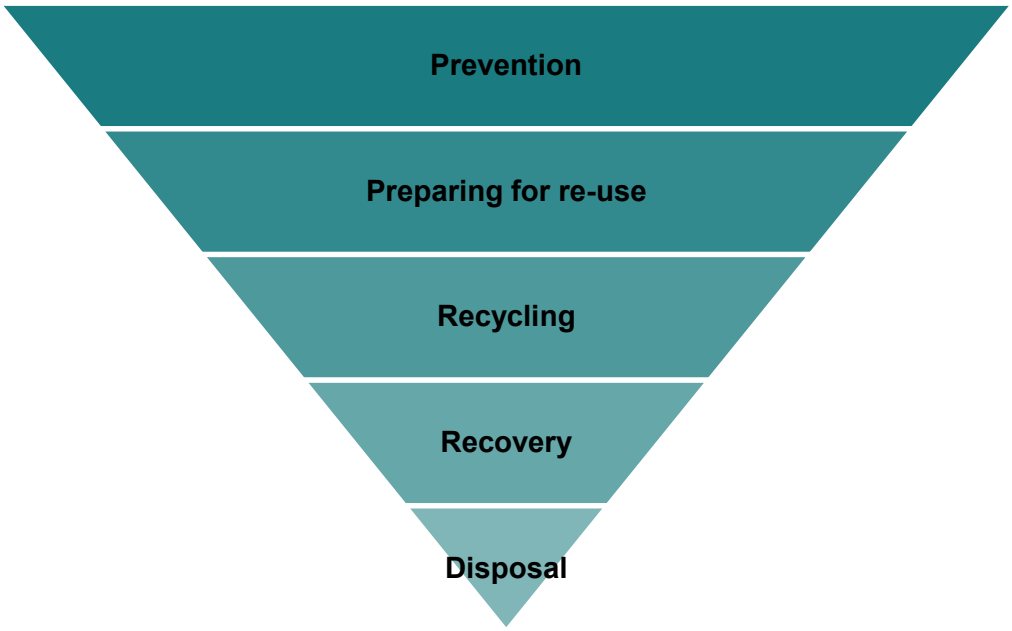
The definition follows the EU Waste Framework Directive and its waste hierarchy (Directive 2008/98/EC on waste). The hierarchy covers prevention, preparing for reuse, recycling, recovery and disposal. '*Prevention'* is defined as

> "measures taken before a substance, material or product has become waste, that reduce:
>
> a) the quantity of waste, including through the re-use of products or the extension of the life span of products;
> b) the adverse impacts of the generated waste on the environment and human health; or
> c) the content of harmful substances in materials and products"

(European Parliament and Council, 2008).

[1] Includes thermoplastics, polyurethanes, thermosets, elastomers, adhesives, coatings and sealants, and polypropylene-fibers. Does not include the following fibers: PET-, PA-, PP- and polyacryl-fibers.

Figure 6 Waste hierarchy



Source: Own figure based on European Parliament and Council (2008)

The preferred option is prevention (Figure 6), while the least desirable option is disposal. However, it may be necessary to deviate from this hierarchy if the overall impacts along the life cycle justify this.

In this context, it is also necessary to consider trade-offs. These may include the fact that reducing material could impair the recyclability of packaging or a product; reducing packaging could affect the protective function and thus, for example, lead to increased food waste; substituting plastic with other materials could increase the environmental impacts of the product during its life cycle. To achieve marketable solutions, aspects such as product requirements, machinability, trade and market requirements (e.g. portion size, affordability) should also be considered.

Specifically, prevention refers to measures such as

- Reducing single-use plastics, e.g. by
  - using reusable and refillable options
  - offering/buying products in bulk
- Reducing the amount of packaging, e.g. by
  - using less material
  - eliminating unnecessary packaging, e.g. layers
- Replacing products through services, e.g. by
  - implementing reusable coffee cups as product-service system solutions
  - establishing product-service systems to reduce the consumption of bottled water
- Designing for prevention, e.g. by
  - promoting research and development

  - sensitizing and educating designers and decision-makers
  - shifting the focus from recycling to waste prevention
- Knowledge transfer and awareness raising, e.g. by
  - sensitizing different stakeholder groups
  - sharing insights, experiences and best practices
  - creating synergies between stakeholders

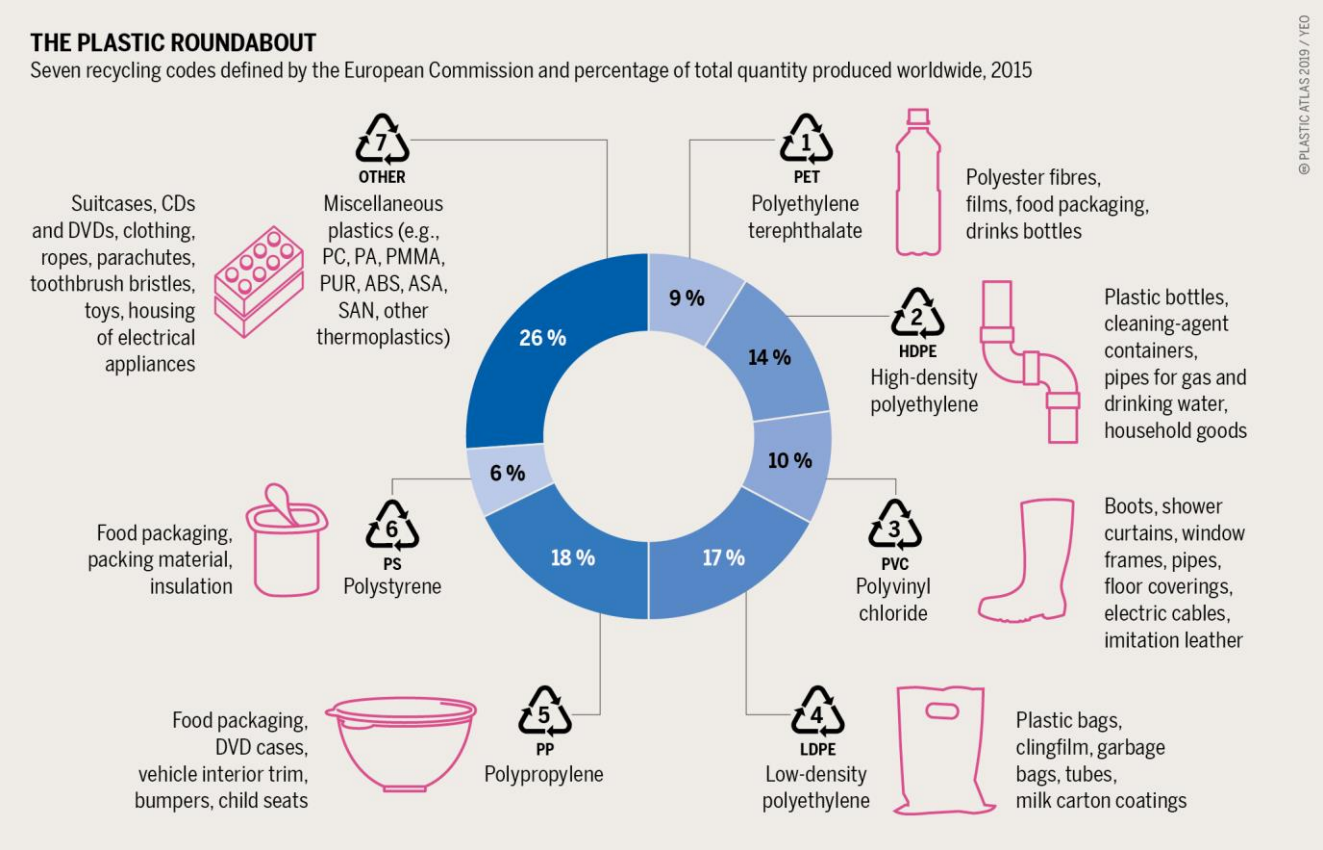
The following three stages of the waste hierarchy (preparing for reuse, recycling and recovery) are not dealt with in this study but will be addressed in further research by the working group.

3.2 Types and applications

Plastics have many advantages – they are versatile, light, durable and cost-effective. Thus, they are suitable for numerous applications. Plastics comprise a large number of different materials with specific characteristics for individual purposes. Depending on what properties a plastic is supposed to have, such as high flexibility, durability or heat resistance, certain additives (like plasticisers, fillers, flame retardants or pigments) are added during production. Some examples of plastics and their properties are (see also Figure 7):

- low-density polyethylene (LDPE), a lightweight, low cost and flexible material that is used e.g. for plastic bags, coating of juice and milk cartons, food packaging films and computer components packaging
- high-density polyethylene (HDPE), a stiff and hardwearing material that is resistant to many solvents and used e.g. for jerricans, toys, household goods, shampoo bottles and food wrapping material
- polypropylene (PP), a tough and rigid material that is used e.g. for food packaging, household appliances, outdoor furniture and in the automotive industry
- polystyrene (PS), a material that can be foamed or solid and is used e.g. for disposable plastic cutlery, building insulation, takeaway containers and packing material
- polyvinyl-chloride (PVC), a material that can be produced in rigid form as well as in flexible form by adding plasticiser and is used e.g. for window frames, pipes, flooring and cable insulation
- polyethylene terephthalate (PET), a strong, light and transparent material that is used e.g. for water and soft drinks bottles, food packaging, consumer goods and fabrics

Figure 7 Plastic recycling codes and percentage of total quantity produced worldwide



Source: Appenzeller/Hecher/Sack (2019), CC BY 4.0

Polyethylene, polypropylene and polyvinyl-chloride are the most widely used plastics today. Regarding the quantities of non-fibre plastics produced, Geyer et al. (2017) state that the largest groups are PE (36%; 20% thereof LDPE/LLDPE and 16% HDPE), PP (21%), and PVC (12%), followed by PET (10%), PUR (8%), and PS (8%).[2] The most commonly used additives are plasticisers (34%), fillers (28%) and flame retardants (13%). The majority of primary plastic production, approximately 45%, is used for packaging. This is followed by the building and construction sector with a 19% share and consumer and institutional products at 12%.

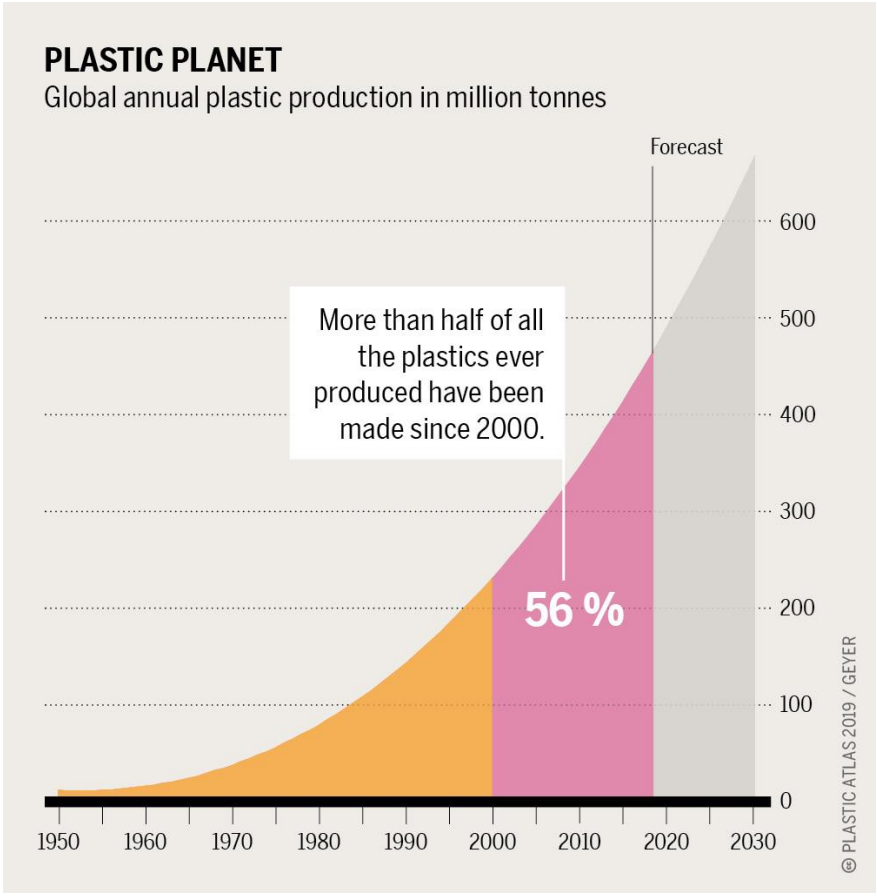
3.3 Plastic production and plastic waste generation

While the annual global production of polymer resins and synthetic fibres in 1950 was around 2 million tonnes, it had increased to 381 million tonnes by 2015.[3] The total production from 1950 to 2015 is estimated at 7800 million tonnes. Including additives, this amounts to 8300 million tonnes of virgin plastics (Geyer et al., 2017). More than half of the total volume of plastic has been produced since 2000 (Figure 8).

[2] Geyer et al. (2017): Share of total polymer resin production according to polymer type and industrial use sector calculated from data for Europe, the United States, China, and India covering the period 2002–2014.

[3] Annual global polymer resin and fiber production.

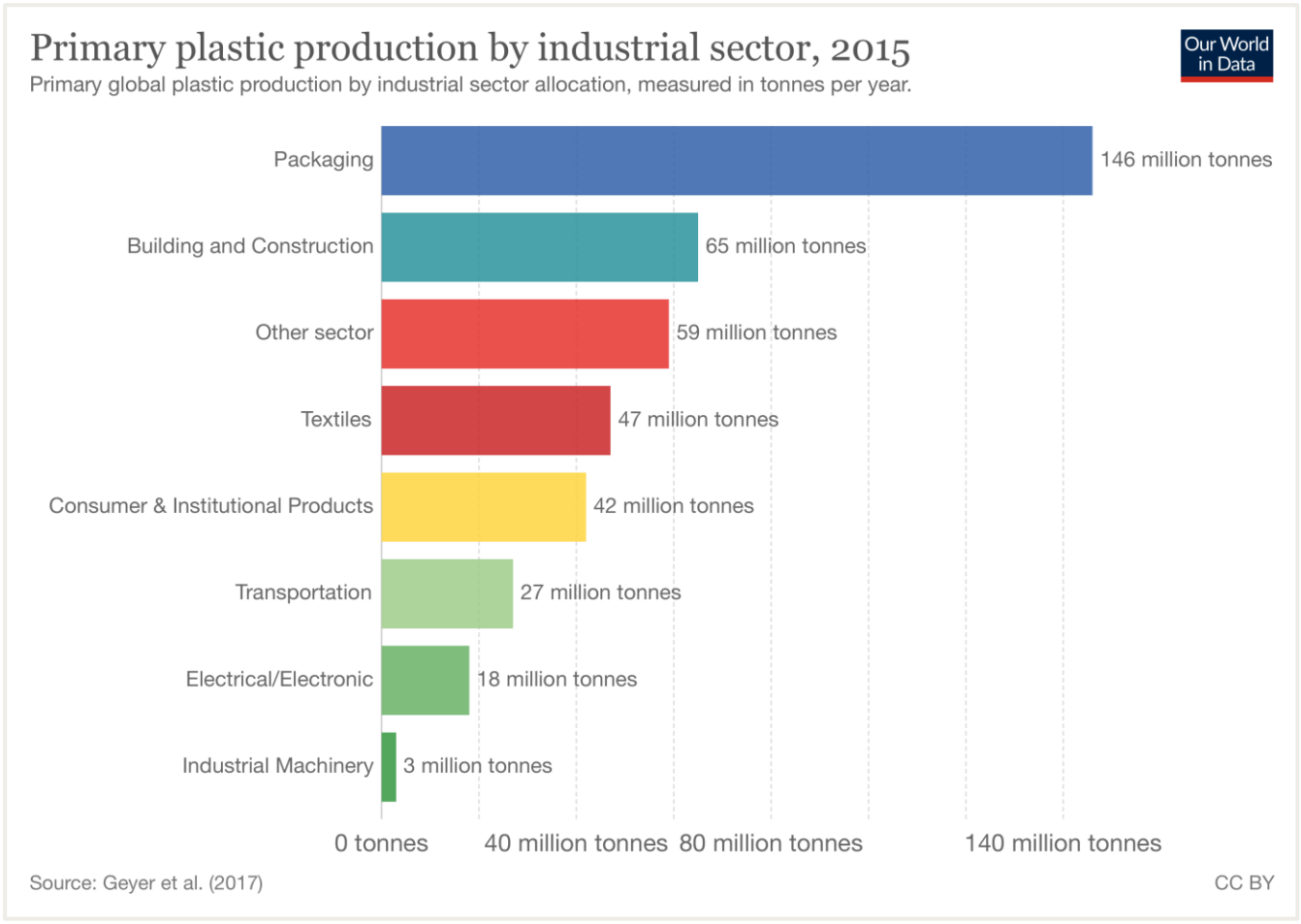
Figure 8 Global annual plastic production



Source: Appenzeller/Hecher/Sack (2019), CC BY 4.0

Of the 407 million tonnes of plastic produced in 2015 (including 25 million tonnes of additives), the largest proportion was used to manufacture packaging, estimated at 146 million tonnes (Geyer et al., 2017). This is followed by the building and construction sector at 65 million tonnes. Textiles account for 47 million tonnes and consumer and institutional products for 42 million tonnes (Figure 9).

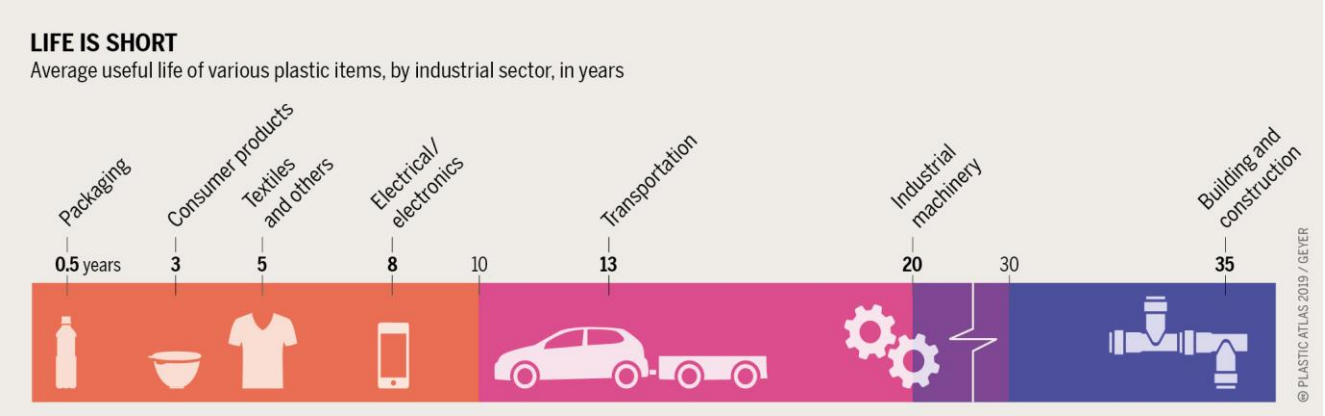
Figure 9 Primary plastic production by industrial sector



Source: OurWorldInData (2018) based on Geyer et al. (2017)

Most packaging plastics are used for less than one year. While an average product life-time of 35 years is assumed for plastic products used in the building and construction sector, the average for consumer products is 3 years and 0.5 years for packaging (Geyer et al., 2017).

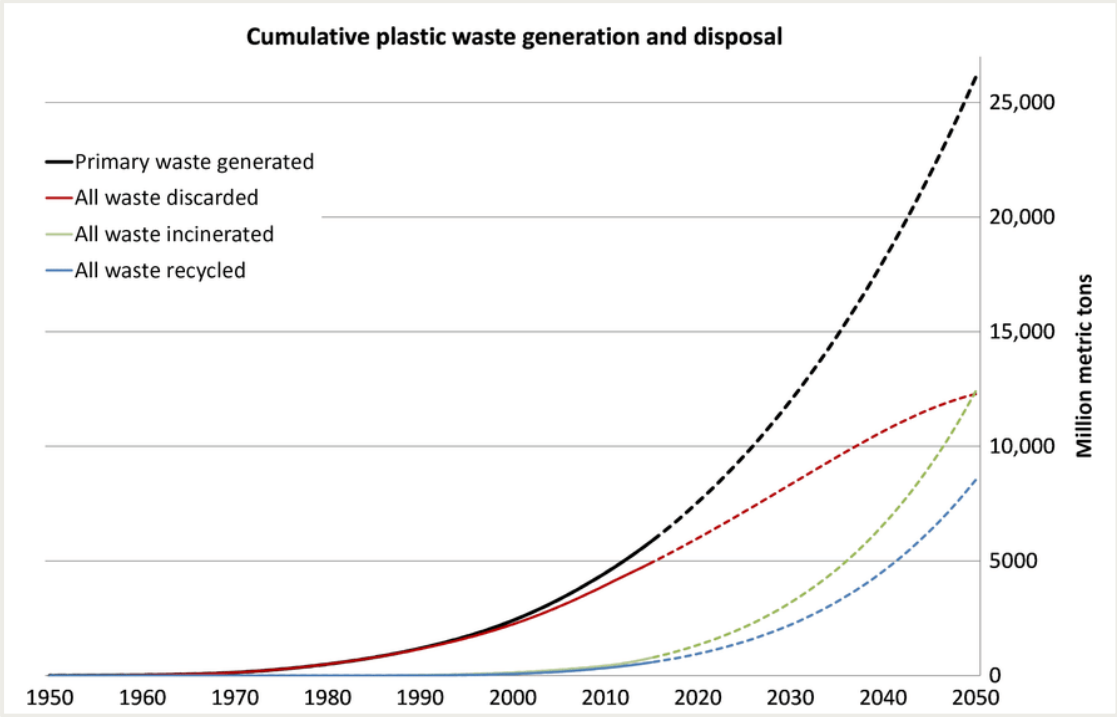
Figure 10 Average useful life of various plastic items



Source: Appenzeller/Hecher/Sack (2019), CC BY 4.0

Approximately 6300 million tonnes of plastic waste were generated between 1950 and 2015. About 9% of this amount was recycled, while 12% was incinerated and 60% ended up in landfills or the environment. Geyer et al. (2017) assume that, by 2050, about 12,000 million tonnes of plastic waste will end up in landfills or in the environment if current trends in production and waste management do not change. Figure 11 gives an overview of the primary plastic waste generated, all discarded plastic waste, all incinerated plastic waste and all recycled plastic waste.

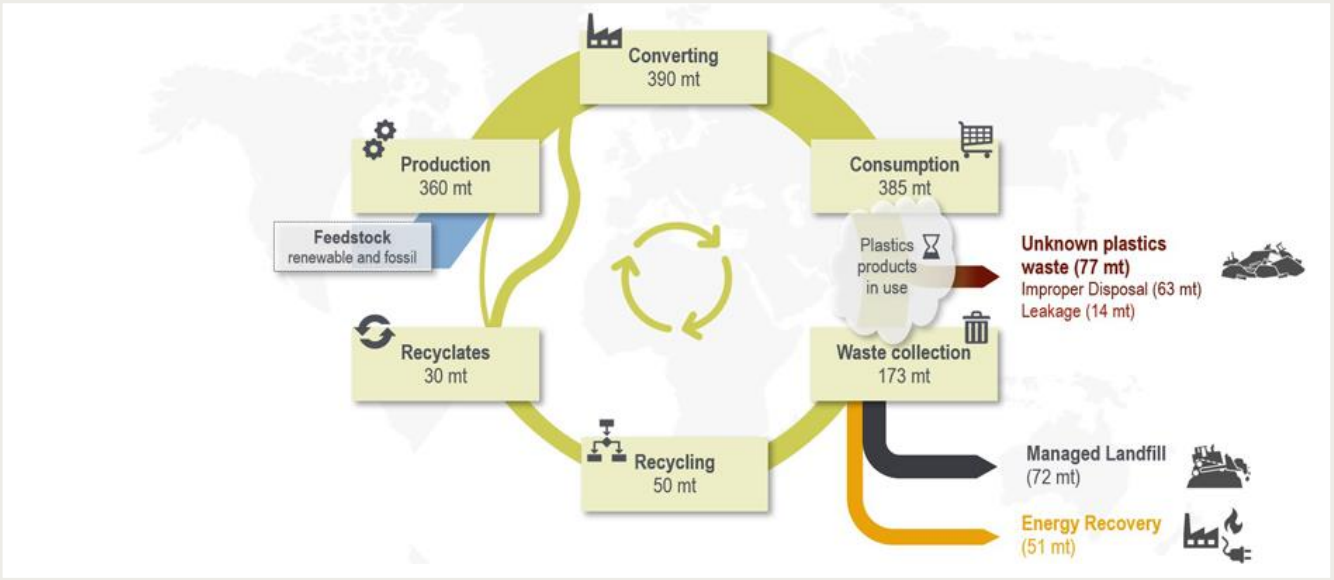
Figure 11 Cumulative plastic waste generation and disposal



Source: Geyer et al. (2017).

Another study examining global post-consumer plastics flows (Conversio, 2019) found that, in 2018, approximately 360 million tonnes of virgin plastics were produced and 390 million tonnes of plastics (including 30 million tonnes of recycled materials) were converted into plastic products (Figure 12). In 2018, a total of approximately 250 million tonnes of post-consumer plastic waste were generated worldwide. 173 million tonnes of waste were collected, of which 72 million tonnes were disposed of in managed landfills (29% of all post-consumer plastic waste generated), 51 million tonnes were used for energy recovery (20%) and 50 million tonnes were collected and sorted for recycling (20%). The authors assume a process loss of approximately 40%, which means that about 30 million tonnes of plastics were recycled. The waste collection was carried out both formally (through municipal waste collection or contracts with private companies) and informally. Regarding informal waste collection, the authors point out: "In less developed countries, informally collected plastic waste contributes a high share to overall plastics recycling (e.g. India). Waste pickers usually collect plastics directly from the source, e.g. through door-to-door collection or recovery of marketable plastics fractions from dumpsites" (Conversio, 2019, p. 14). However, 77 million tonnes (31%) of global plastic waste were not properly collected: "Around [...] 63 mt of plastics waste were disposed of under improper conditions (i.e. unsanitary landfills, improper burning or burial of waste). Around 14 mt of plastics waste leaked into the environment (i.e. dispersion of plastics waste caused by flooding, wind or individual mismanagement)" (Conversio, 2019, p. 14).

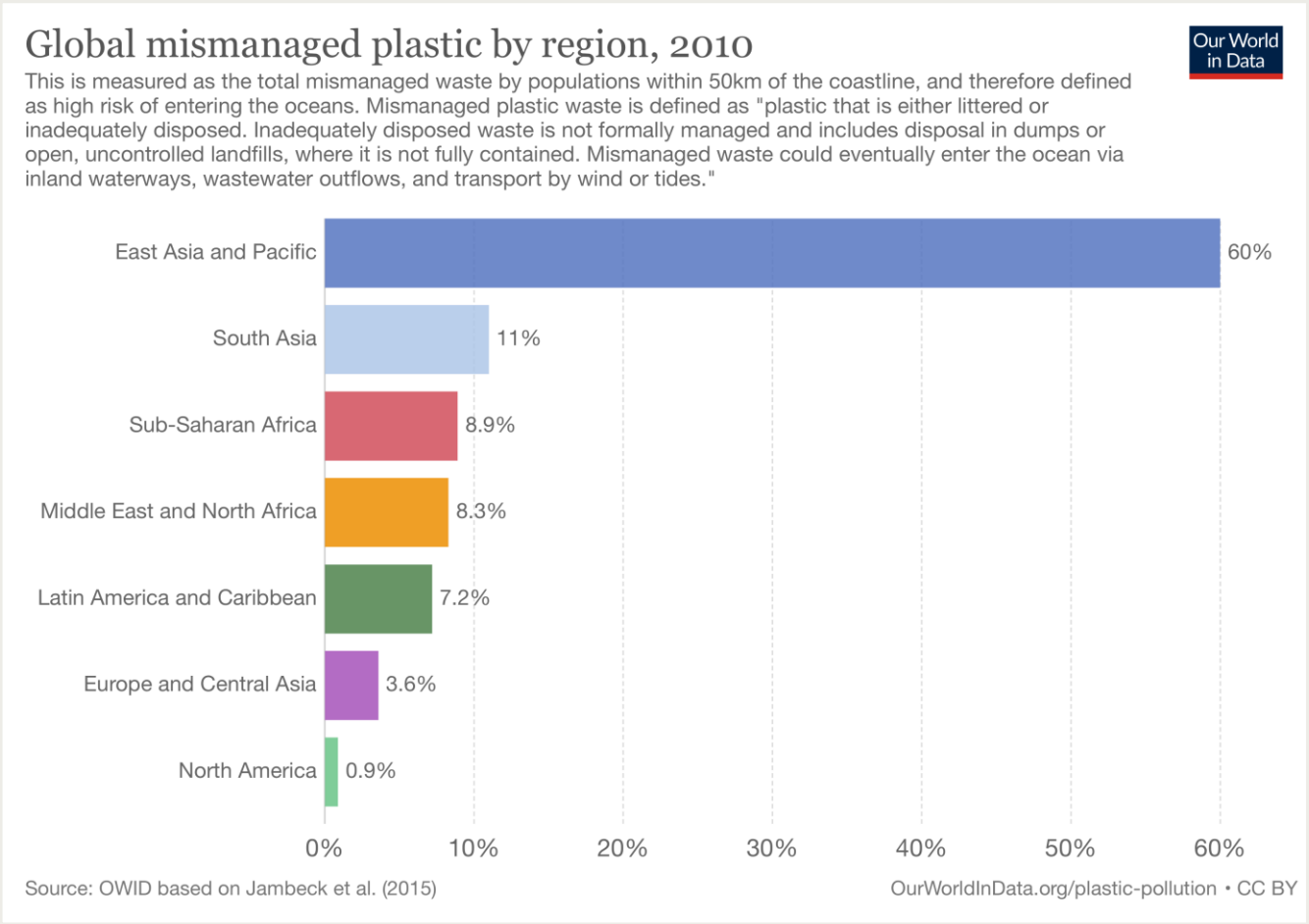
Figure 12 Global post-consumer plastics flows



Source: Conversio Market @ Strategy GmbH (2019)

Plastic waste that is improperly disposed of or littered is at risk of entering and harming the surrounding environment, including rivers and oceans. Jambeck et al. (2015) have calculated that, in 2010, between 4.8 and 12.7 million tonnes of plastic waste from 192 coastal countries entered the ocean. The top 20 countries for mismanaged plastic waste were responsible for 83% of the entries (Jambeck et al., 2015). At 60 percent, the East Asia and Pacific region accounted for the largest share of the global total volume of improperly disposed plastic waste (Figure 13). In their predictions for 2025, these proportions differ only slightly.

Figure 13 Global mismanaged plastic by region



Source: OurWorldInData (2018) based on Jambeck et al. (2015)

The European Environment Agency (EEA) (2018) outlines the main sources of marine litter:

- Land-based: landfill, rivers and floodwaters, industrial outfalls, discharge from storm water drains, untreated municipal sewerage, littering of beaches, coastal areas (tourism).
- Sea-based: fishing and aquaculture, shipping (e.g. transport, tourism), offshore mining and extraction, illegal dumping at sea.

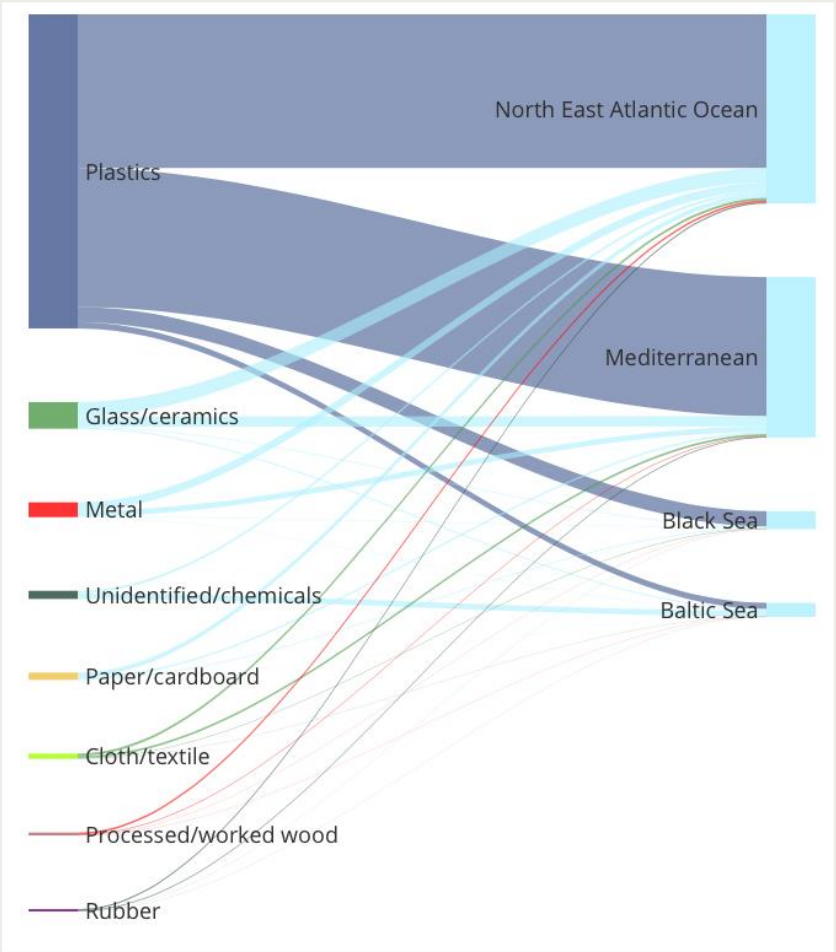
Based on various studies, Ritchie and Roser (2018) estimate that "it's likely that marine sources contribute between 20-30 percent of ocean plastics, but the dominant source remains land-based input at 70-80 percent." While in high-income countries the amount of plastic waste per capita is high, in countries without effective waste management the risk of plastic pollution is severe. Improving waste management systems, as well as reducing plastic waste and increasing the recycling and use of recyclates in high-income countries, are therefore important issues: "Nevertheless, high volumes of waste exports for recycling from developed countries to emerging countries with improper waste management and recycling infrastructures could be identified. Developed countries need to invest in robust domestic recovery and recycling solutions to cope with their own waste" (Conversio, 2019, p. 15).

3.4 Environmental impacts and risks to human health

Plastics can contribute to conserving resources and decreasing harmful effects on the environment if, for example, in comparison to the use of other materials, energy consumption and greenhouse gas emissions can be reduced (Pilz et al., 2010). Packaging can also help to reduce food waste by extending the shelf life of food products, thereby reducing negative environmental impacts (Wohner et al., 2019). However, plastic is often produced and used for only a short life cycle, which can lead to resources being wasted and unnecessary greenhouse gas emissions. The burning of plastics at incineration plants that do not meet the latest technical standards, poorly managed landfills as well as improper disposal and littering have negative effects on the environment and human health.

As shown in Figure 14, so-called disposable plastic represents the largest share of publicly reported marine litter on beaches (2018).

Figure 14 Distribution of marine litter by material type reported by the public



Source: EEA (2018)

The top 10 most commonly found items on beaches according to data collected by the International Coastal Cleanup in 2019 are cigarette butts, food wrappers, straws and stirrers, cutlery, plastic beverage bottles, plastic bottle caps, plastic grocery bags, other plastic bags, plastic lids and plastic cups and plates (Ocean Conservancy, 2019). Veiga

et al. (2016, p. 16) indicate that in “areas with intensive bottom-trawl fishing activities, such as the Southern North Sea, ropes and nets (including fragments) are the most common items found during surveys of macrolitter on beaches.” There are five known offshore plastic accumulation zones in the oceans. The biggest one is the Great Pacific Garbage Patch (GPGP) between Hawaii and California at around 1.6 million square kilometres (The Ocean Cleanup, 2019).

Plastic that gets into the environment either on land or at sea endangers animals. Marine animals and birds can become entangled or swallow it, which can injure or kill them or cause plastic to enter the food chain.

Chemicals contained in plastics and additives (Zimmermann et al., 2019) as well as microplastics (small pieces of plastic litter < 5 mm) may pose risks to the environment as well as to human health. Veiga et al. (2016) point out that it is difficult to determine the origins and paths of microplastics.

> “Major sources include fragmentation of larger items in the environment, release of abrasive additives from cosmetic and other products, release of fibres from the washing of textiles and the spillage of pre-production pellets or powders that are in transit or process prior to being made into everyday plastic items. In addition to microplastics it has recently been suggested that there may also be substantial inputs of other synthetic particles, for example as a consequence of tyre wear on roads (Essel et al., 2015)” (Veiga et al., 2016, pp. 12–13).

A report by Science Advice for Policy by European Academies (SAPEA) based on a comprehensive analysis of studies “establishes that microplastic particles are present in air, soil and sediment, freshwaters, coastal waters, seas and oceans, in biota, and in several components of the human diet” (SAPEA, 2019, p. 107). The authors point out that there is little robust evidence on the environmental and health risks of micro- and nanoplastics and that what is known is subject to considerable uncertainty. They conclude that it is currently more likely that ecological risks due to microplastics are rare. However, there may be a risk in some selected specific locations and if the emissions of microplastics into the environment continue at the current rate, there could be widespread ecological risks caused by microplastics within a century (SAPEA, 2019).

3.5 Rethinking and improving plastics

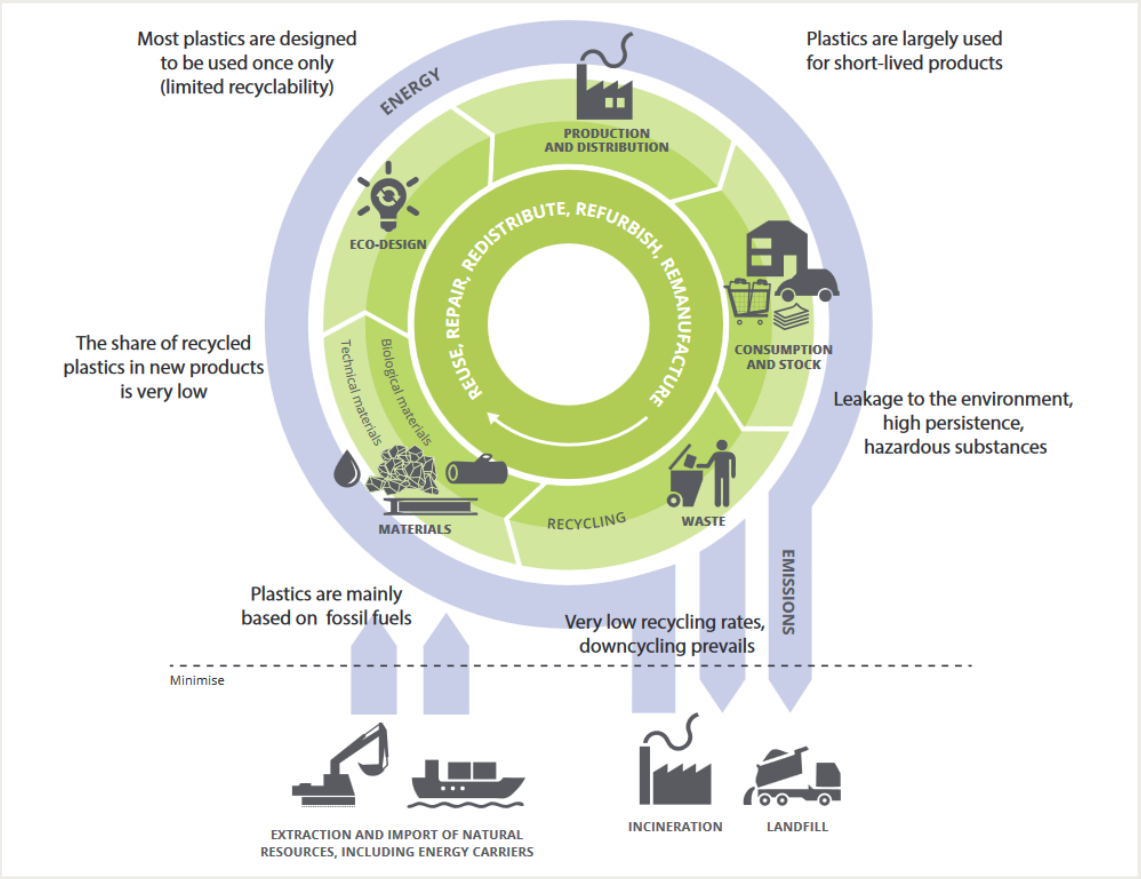
As shown in Figure 15, in many cases plastics are currently designed for a short-lived period of use. They often follow the linear economy approach of "take-make-dispose". However, to protect resources and the environment it is necessary to rethink and improve the use of plastics. The focus in a circular economy is on the prevention of waste and the reuse, repair, redistribution, refurbishment and remanufacturing of products.

Regarding the prevention of plastic waste, this includes aspects such as:

- promoting a product design that generates as little waste as possible
- considering the entire life cycle of products when selecting materials
- avoiding the use of (potentially) hazardous substances
- encouraging reusable options

- expanding and improving the separate collection of plastic waste
- introducing and expanding deposit and return systems
- designing recyclable products
- expanding the markets for recycled and renewable plastics.

Figure 15 Environmental issues arising along the plastics value chain



Source: Wilts & Bakas (2019); EEA

Countries around the world have enacted or are considering legislation to reduce waste from packaging and single-use plastics. The EU adopted a plastics strategy in 2018 to strengthen a circular economy for plastics, including curbing plastic waste and littering and increasing the recycling of plastics (European Commission, 2018). From July 2021, certain single-use plastic products such as plates, cutlery, straws and plastic cotton buds will be banned from the EU market (European Parliament and Council, 2019). In addition, countries and regions in Europe have taken their own measures to reduce plastic waste (Wilts & Bakas, 2019). In March 2020, the European Commission adopted a new Circular Economy Action Plan (European Commission, 2020), announcing that mandatory requirements for packaging will be reinforced "[in] order to ensure that all packaging on the EU market is reusable or recyclable in an economically viable way by 2030" (European Commission, 2020). Other priorities include adressing microplastics and the announcement to propose mandatory requirements for recycled content and waste reduction measures, i.e. for plastic packaging. Laboy et al. (2020) provide an overview of further measures by countries around the world: In the USA there is no national legislation addressing the prevention of plastic waste, though in some states there are

individual restrictions such as plastic bag bans. Canada announced a plan to ban single-use plastics by 2021. Latin American countries are currently focusing mainly on banning plastic bags. Banning or restricting single-use plastics is also the target of many Asian countries. In addition, some countries have introduced (temporary) import bans on plastic waste after large quantities of plastic waste were redirected to them due to the implementation of China's ban. Seven of Australia's eight territories and states either have a container deposit system or plan to introduce one within the next two years. New Zealand has banned single-use plastic shopping bags. In Africa, as of May 2019, 34 countries have banned single-use plastic bags or other single-use plastics.

It is evident that measures to reduce waste from single-use plastics consist in particular of banning plastic bags. Some countries are also tackling further single-use plastics. A number of countries have already introduced deposit-return systems for beverage bottles. So far, however, no approach can be identified that comprehensively addresses the prevention of single-use plastic waste and plastic waste from packaging and is backed up by corresponding measures.

4 Plastic waste prevention by multi-actor partnerships

In 2015, the United Nation member states adopted the Sustainable Development Goals (SDGs) (United Nations, 2020). One of the targets they set is to substantially reduce waste generation by 2030 through prevention, reduction, recycling and reuse (SDG 12.5). They emphasise the importance of multi-actor partnerships and the need to promote these to achieve the SDGs (SDG 17):

> "A successful sustainable development agenda requires partnerships between governments, the private sector and civil society. These inclusive partnerships built upon principles and values, a shared vision, and shared goals that place people and the planet at the centre, are needed at the global, regional, national and local level" (United Nations, 2020).

Multi-actor partnerships bring together people from practice and science as well as other actors to jointly tackle challenges. They have the advantage of connecting partners with complementary types of knowledge. In addition, cooperation like this can help to gain new insights together, facilitates the implementation of these findings and thus has a greater impact. It is particularly relevant when dealing with complex issues such as the prevention of plastic waste, where isolated solutions fail.

Therefore, practical examples of how to prevent plastic waste from packaging and single-use products contributed by the members of the PREVENT Waste Alliance and their partners and networks are presented below. The focus is multi-actor partnerships that involve stakeholders from various sectors such as businesses, civil society, science and governmental institutions. What was important when selecting the examples was their transferability to other countries.

Education & consulting

1 | Environmental education in Indonesian primary schools
2 | Reduction of airline passengers' waste. A gamification experiment
3 | Promoting circular solutions in the gastronomy sector

Establishment of reusable and low packaging options

4 | Zero waste stores
5 | Reusables for the sea. Exemplary deposit system
6 | Lending reusable bags
7 | Deposit system for reusable coffee-to-go cups

Development of waste prevention infrastructure

8 | Ethical recovery and processing of plastic waste using a social inclusion model
9 | Environmental citizenship approach to developing and implementing a zero-plastic waste strategy
10 | Litter traps to retrieve floating plastic

Innovative products

11 | An ocean friendly straw
12 | Reusable packaging service for e-commerce
13 | Device deposit for modular smartphones

Studies on plastic waste prevention

14 | Zero waste flights
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Education & consulting

4.1 Environmental education in Indonesian primary schools

Submitted by Project Management Jülich

© *https://green-indonesian.org/*

FACTS

Type: practical example

Waste type addressed: beverage packaging, food packaging, packaging for on-the-go consumption, drugstore products packaging, transport packaging, single-use products

Approach: behavioural, systemic and organisational change

Regional context: Flores, Bali and Saparua (Maluku), Indonesia

Stakeholders: primary schools, teachers, primary school students, their parents and siblings, the community, local government (environmental and education departments), Indonesian Plastic Recycling Association, plastic producers

The "Green Indonesia" environmental education programme was developed for Indonesian primary schools to raise environmental awareness at the early stages of education. Teachers introduce children to the impact of waste on the environment, waste reduction and the principles of a circular economy, the importance of waste separation and the establishment of school waste banks[4].

For this purpose, teachers attend 2-day training courses in collaboration with local governmental education departments and receive learning materials that have been adapted for Indonesia in cooperation with the Happy Green World Foundation.

LESSONS LEARNT:

Success factors: Schools are a central point in any community. A “school waste bank” can therefore serve as a collection point for recyclables for both the school and the community. Children act as multipliers and future knowledge bearers. One example is: The program includes handing out tumblers for refilling and installing water filters in

[4] „Waste banks – or “bank sampah” as they are called in Indonesian – can be found in neighborhoods across Indonesia – on Sulawesi, Kalimantan, Java. At waste banks, the waste created by the household is divided into two categories – organic and non-organic. Organic waste gets turned into compost, while non-organic waste is divided further into three categories: plastic, paper, plus bottles and metal.“ (Salim, 2013)

schools. These water filters are affordable for low-middle income households. Subsequently communities ask where they can purchase these water filters for use at home.

Impact/Economic assessment: To date, no data are available on environmental effects or for an economic evaluation due to the lack of funding for detailed monitoring.

KEY FINDINGS & TRANSFERABILITY

The lack of local waste infrastructure is a challenge – Green Indonesia collaborates with local governments to improve the collection system and set up waste bins. In 2019, the Indonesian Waste Platform (IWP) team established collection points for recyclable plastics in 15 schools in Labuan Bajo and collaborates with the plastic recycling sector to transport these materials to Java. Meanwhile, the IWP explores opportunities for the development of local up-cycling technology. Thus, the program contributes to a change of mindset about using single-use plastics and the importance of reusing and recycling for a circular economy and motivates the students to spread their gained knowledge.

The learning materials can be adapted for any country. They have already been adapted to local conditions in a number of countries. Green Indonesia is happy to share the format for the 2-day teacher training course and the concept of school waste banks.

FIND OUT MORE:

https://green-indonesian.org/

For further information please contact:
contact@prevent-waste.net

Education & consulting

4.2 Reduction of airline passengers' waste. A gamification experiment

Submitted by University of Kassel

© *Katharina Raab*

FACTS

Type: study

Waste type addressed: food packaging, single-use products

Approach: behavioural change

Regional context: Paderborn Airport, Germany

Stakeholders: University of Kassel, flight passengers at Paderborn Airport

Airline passengers generate an average of 1.43 kilograms of waste per flight, amounting to around 6.7 million US tons of waste for slightly over four billion passengers each year. The study provides empirical evidence of how gamification motivates airline passengers to behave in a more environmentally friendly way. Gamification is the use of game elements in a real-world context. It is used to trigger behavioral changes without provoking reactance. Using gamification, passengers can compete each other by achieving credits, e.g. for sustainable behavior and decisions for single-use plastic reduction. To analyse the effect, a field experiment with 62 air flight passengers was carried out at Paderborn Airport in Germany. In an innovative, gamified experience using a mobile app, passengers learned about cabin food waste in a fun way. A mixed-method approach with a questionnaire and a complementary experiment were used for data gathering. The results reveal that intrinsic motivation outperforms extrinsic motivation among airline passengers in terms of reducing on-board waste.

LESSONS LEARNT:

Success factors: gamification for awareness creation and behaviour change, customisation of flight meals, hedonism (arising from the gamified experience), environmental awareness creation

Impact: From the business perspective, the results revealed that 55% of the passengers would like to continue the gamified experience if an airline provides it. Playing the game, passengers better understood the consequences of their actions and their attention was drawn to environmental issues.

KEY FINDINGS & TRANSFERABILITY

In summary, it can be stated that passengers who are intrinsically motivated are more likely to protect the environment and tend to maintain their pro-environmental behaviour for a longer period of time, probably because they gain satisfaction from it. Passengers who are extrinsically motivated have an increasing probability of pro-environmental behaviour if the consequences are positive, e.g. rewards. They are more likely to fall back in "old patterns" when the incentive vanishes and/or they do not see any advantages in their changing behaviour.

Transferability remains to be evaluated.

FIND OUT MORE:

Salatto, A., Raab, K., and Wagner, R. (2020). Airline Passengers' Motivations in Sustainable Tourism: A Gamification Experiment. 4th Ocean, Marine and Environmental Science International Conference (OMESIC 2020), 13-15 March 2020, Krabi, Thailand

For further information please contact:
contact@prevent-waste.net

Education & consulting

4.3 Promoting circular solutions in the gastronomy sector

Submitted by: CRCLR

© Schön wie wir

FACTS

Type: practical example

Waste type addressed: beverage packaging, food packaging, packaging for on-the-go consumption, single-use products

Approach: behavioural change, organisational change

Regional context: Neukölln district of Berlin, Germany

Stakeholders: initiated by the district authority of Neukölln and two companies (CRCLR and coopolis), the target groups are primarily local catering businesses using on-the-go-packaging as well as civil society

"Schön wie wir" ("As beautiful as us") is a project initiated by the district authority of Neukölln to reduce waste. The "Mehrweg-Beratung" (consulting on reusable options), which is implemented by the local businesses CRCLR and coopolis, is a central part of this portfolio. The idea is to minimise food and packaging waste by consulting with local catering businesses to bring forward zero waste solutions and sustainable "to-go" packaging.

This is done by offering advice to café owners, restaurants and late-night shops regarding their "to-go" practices.

Over 200 shops were consulted within the first round, 21 implemented small-scale changes of practice (e.g. Recup system, Better World Cup or other waste reduction measures). So far, 26 have continued with more in-depth consultation through which 10 smaller and 6 bigger pilot projects have been realised, including deposit systems for reusable cups. 8 projects are currently still in the planning and implementing process.

LESSONS LEARNT:

Success factors: CRCLR has the research capacity many local small and medium-sized enterprises (SMEs) lack. They gather expertise on various fields of the circular economy and design consultations with a low threshold. CRCLR considers the specific possibilities

for each business, enabling them to find distinct solutions adapted to their economic scope and clientele.

Impact: Single-use food packaging increased tremendously and has highly damaging environmental impacts. In Germany, they add up to roughly 350,000 tonnes of waste annually. In Berlin, 20,000 cups are used per hour, while their average life cycle is 15 minutes and their recycling remains problematic.

Economic assessment: In the long-term, the costs of single-use packaging add up. Deposit systems, therefore, bring a financial benefit in many cases. There could also be financial benefits from improved customer relationships by implementing sustainable solutions. However, costs are higher in the short-term, which creates a critical bottleneck for many SMEs.

KEY FINDINGS & TRANSFERABILITY

SMEs need support in identifying workable and high-impact solutions, which means somebody else needs to conduct that research for them. Only then, within the constraints of each business, are SMEs open to implementing new solutions and processes they can afford (financially, operationally etc.). Small, individually adapted methods often work better than large-scale systemic approaches. Customer awareness is especially crucial for small-scale businesses because their financial resources are limited. A larger analysis will be conducted by the end of the operational period.

CRCLR believes that this project could be transferred to many other urban and suburban areas where on-the-go food and beverages are common. What is important is creating a network of cafés and shops as well as a community that is actively involved in the effort to save resources by implementing innovative and fun solutions. That way, these changes offer real added value for everybody involved.

FIND OUT MORE:

https://www.schoen-wie-wir.de/machen/mehrweg-beratung-1

https://www.crclr.org

For further information please contact:
contact@prevent-waste.net

Establishment of reusable and low packaging options

4.4 Zero waste stores

Submitted by ISOE – Institute for social-ecological research, gramm.genau

© *Kathi Krechting k.fotografie&artdesign*

FACTS

Type: business model

Waste type addressed: food packaging, packaging for on-the-go consumption, drugstore products packaging, transport packaging, single-use products

Approach: behavioural, organisational and systemic change

Regional context: Germany

Stakeholders: Zero waste stores are usually run by entrepreneurs who are motivated to offer a more environmentally friendly consumption alternative. They need to involve suppliers who use reusable packaging. The target groups are retailers, suppliers and customers who have yet to learn how to supply their goods/do their shopping in ways that generate less waste.

The objective of zero waste stores is to reduce (plastic/single use) packaging and food waste as well as to promote a zero waste lifestyle by following a sufficiency strategy. The idea is to develop a business model that uses as little single-use packaging as possible for the products as well as along the supply chain, and offers customers the option of buying exactly as much as they need. In many cases, deposit systems are also introduced. In order to promote a zero waste lifestyle, education materials are developed and workshops and public events are organised.

In recent years, a zero waste store opened in almost every city in Germany. The first one opened in 2014 and to date there are around 150 stores across the country. The zero waste store gramm.genau is located in Frankfurt and includes a zero waste café.

LESSONS LEARNT:

Success factors: Central success factors for zero waste stores are:

- establishing a regular customer base that is successful in adapting alternative consumer practices and
- recruiting suppliers that support packaging-free procurement of products.

Impact: Zero waste stores fundamentally reduce the amount of packaging waste in food supply chains with exemplary explorations having found packaging waste reduction rates that exceed 80%. However, representative data on waste reduction rates and environmental effects are still lacking.

Economic assessment: Investments need to be made for deposit systems and storage containers for wholesale food items. Savings are made on reduced waste disposal and the procurement of wholesale goods, which are often cheaper. In the zero waste café, there is no food waste, which limits loss due to overproduction.

KEY FINDINGS & TRANSFERABILITY

Even though there is a lot of interest in the zero waste concept, it is still a niche phenomenon. Barriers to up-scaling zero waste stores remain with regard to market demand, user preferences and infrastructure requirements. In order to expand the concept, information and specific support (e.g. universal deposit system) need to be provided to make unpacked shopping a part of everyday life.

Zero waste stores exist in many countries around the world and are spreading fast. The central idea of zero waste stores is easily transferable, but specific concepts and business models differ from country to country around the world. This is also dependent on political regulations and food cultures.

FIND OUT MORE:

https://unverpackt-verband.de/

https://www.grammgenau.de/

https://www.isoe.de/en/nc/research/projects/project/plastx-packaging-consumption/

Kramm, Johanna/Lukas Sattlegger/Jenny Fuhrmann/David Steinwender (2018): Sustainable Transformation of Food Distribution Systems – Research and Practice in a Transdisciplinary Discussion. Results from a conference session on "Sustainable Food Systems". ISOE-Materialien Soziale Ökologie, 53. Frankfurt am Main

For further information please contact:
contact@prevent-waste.net

Establishment of reusable and low packaging options

4.5 Reusables for the sea. Exemplary deposit system

Submitted by Veolia

FACTS

Type: practical example

Waste type addressed: packaging for on-the-go consumption

Approach: behavioural, organisational and systemic change

Regional Context: Island of Fehmarn, Germany

Stakeholders: NGO NABU, environmental council of Fehmarn, more than 20 catering businesses, Veolia, tourists visiting the island

The "Mehrweg fürs Meer" ("Reusables for the sea") NABU pilot project aims to reduce the high amount of disposable packaging used by take-away-restaurants in coastal communities. According to various beach litter monitoring schemes, take-away items account for a significant proportion of marine litter in Europe and worldwide. Participating restaurants are encouraged to offer refillable dishes too, giving the customers the opportunity to choose between the usual disposable take-away and the new re-usable dishes. The overall goal of the project is to develop and implement a multi-cycle system that serves as a model and can also be adopted by other communities in the future.

The project was launched in 2016 by the island community of Fehmarn (Baltic Sea, Federal State of Schleswig-Holstein, Germany).

LESSONS LEARNT:

Success factors: Propose attractive multi-use packaging, establish a deposit system with as many food catering partners involved as possible and replace the relevant single-use packaging with the new model.

Impact: To date, 1,050 multi-use cups and 770 lids have been provided to 20 different partner facilities. Each can be used up to 200 times. Thus, the system will replace up to 200,000 single-use cups.

Economic assessment: An economic evaluation has not been carried out yet.

KEY FINDINGS & TRANSFERABILITY

After its initiation phase, project acceptance and publicity has grown rapidly. Having started with only three partners, the project is now in place across the entire island of Fehmarn. Nevertheless, project promotion is still challenging because of the short but busy tourist season and the limited capacity of partners. “Mehrweg fürs Meer” (“Reusables for the Sea”) is now established and will be passed over to local partners in 2020.

Other coastal municipalities have already started similar projects and initiatives using the Faircup system (deposit system for reusable cups).

FIND OUT MORE:

https://www.nabu.de/natur-und-landschaft/aktionen-und-projekte/meere-ohne-plastik/21122.html

For further information please contact:
contact@prevent-waste.net

Establishment of reusable and low packaging options

4.6 Lending reusable bags

Submitted by Ernährungsrat Frankfurt/ISOE – Institute for Social-Ecological Research

© Feyza Morgül

FACTS

Type: practical example

Waste type addressed: single-use products

Approach: behavioural change

Regional Context: Frankfurt am Main, Germany

Stakeholders: initiated by the food policy council (Ernährungsrat) Frankfurt and the Konstablerwache producers' market; concept and idea by the Bornheim-Mitte trade association and the NGO Lust auf besser leben (LABL); the target group is visitors to the market

The "pick up stations" for bags work like lending bookshelves. Customers can take out a clean, used bag free of charge before shopping and put others back in on their next visit. The aim is to reduce the consumption of new plastic bags at the market and to encourage the reuse of carrier bags. At the Konstablerwache producers' market (Frankfurt, Germany), 6 of these stations have been set up at strategic central locations such as entrances and vegetable stands. Each of the stations is supervised by a market stand and set up on market day.

LESSONS LEARNT:

Success factors: Finding caretakers for the stations (individual producers who are each responsible for one station and look after it), changing shopping habits to ensure that the reusable bags are actually used.

Impact: The project has the potential to significantly reduce the number of bags handed out, but is still in the implementation phase, so no conclusions can be drawn yet.

Economic assessment: The acquisition costs for the stations are low. Saving on disposable bags leads to small savings in everyday life.

KEY FINDINGS & TRANSFERABILITY

Most citizens bring their own bags to the market. The aim is to eliminate the need for plastic bags. In the first few weeks, the “pick up stations” were used by consumers who picked up bags and also re-filled the station. The information plates had to be replaced and need to be weatherproof.

The concept already exists in other regions. The idea is transferable to other markets or shops, especially to shopping streets where the potential for reducing the number of disposable shopping bags is particularly high.

FIND OUT MORE:

https://erzeugermarkt-konstablerwache.de/home/taschenstationen/

https://www.isoe.de/en/nc/research/projects/project/plastx-packaging-consumption/

http://www.plastx.org/

For further information please contact:
contact@prevent-waste.net

Establishment of reusable and low packaging options

4.7 Deposit system for reusable coffee-to-go cups

Submitted by RECUP

© *Marco Entchen*

FACTS

Type: practical example

Waste type addressed: packaging for on-the-go consumption

Approach: systemic change

Regional context: Germany

Stakeholders: (product) design, cooperation with a cup manufacturer, distribution, cooperation with cities and municipalities; the target groups are bakeries, cafés, restaurants and canteens (B2B) and coffee consumers (B2C)

RECUP is the first comprehensive deposit system for coffee-to-go cups in Germany and offers a sustainable alternative to disposable cups. RECUP is comprised of three product and system components: the deposit system consisting of the network of RECUP partners, the reusable RECUP deposit cups with matching purchasable reusable lids and the free RECUP app.

The deposit system is based on the idea of offering a sustainable solution to the environmental problem of disposable cups while remaining as convenient and practical as possible for all parties involved.

LESSONS LEARNT:

Success factors: RECUP intends to avoid isolated solutions and focuses on a solution that provides a uniform deposit system throughout Germany. Cities and municipalities can cooperate to support the introduction of the deposit system. Specially designed skyline editions strengthen the users' identification with the reusable cup and attract more attention during the introduction.

Impact: According to calculations by Environmental Action Germany from 2015, 2.8 billion disposable coffee-to-go cups are consumed annually in Germany alone. By completely replacing disposable cups with reusable cups, the following resource consumption could be avoided each year: 43,000 trees, 1.5 billion litres of water, 320 million kWh of electricity and 22,000 t of petroleum as well as 111,000 t of CO_2 emissions and 40,000 t of waste.

Economic assessment: RECUP partners benefit from positive economic effects by attracting new customers, more customer traffic and savings on purchasing disposable cups. The monthly system fee of EUR 30 pays off financially, starting from an average of ten coffees-to-go sold per day.

KEY FINDINGS & TRANSFERABILITY

Design is an important key to success. Through an appealing cup design, a fresh communication style and a young, dynamic appearance, RECUP has been able to create a likeable brand that represents a sustainable and at the same time modern, pragmatic lifestyle. Because the idea is revolutionarily simple, RECUP can easily be transferred to other countries. To this end, RECUP is currently in contact with players from many different countries who want to implement the deposit system. In 2019, the first cooperation started in South Africa.

FIND OUT MORE:

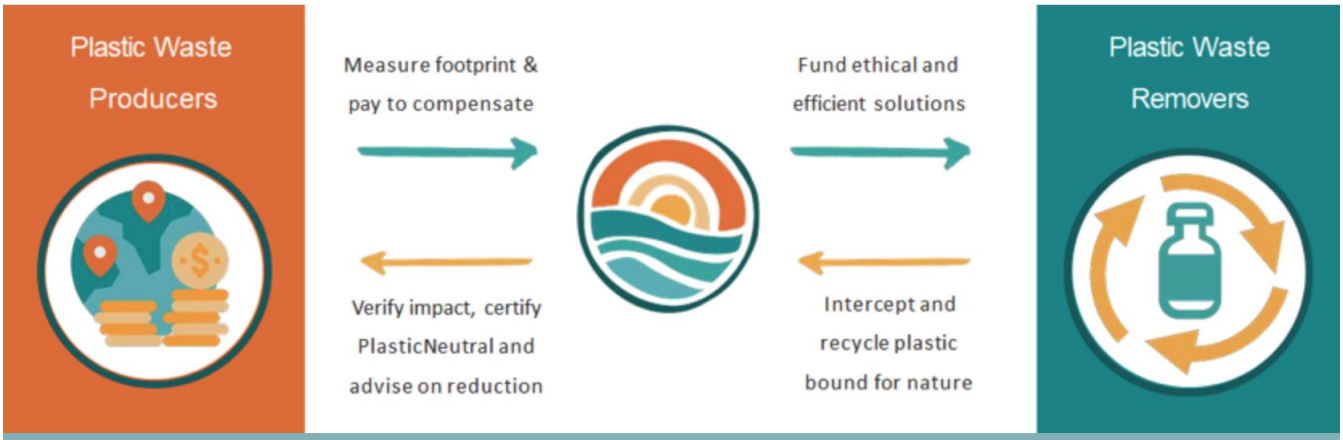
www.recup.de

For further information please contact:
contact@prevent-waste.net

Development of waste prevention infrastructure

4.8 Ethical recovery and processing of plastic waste using a social inclusion model

Submitted by: rePurpose Global



FACTS

Type: practical example

Waste type addressed: beverage packaging, food packaging, packaging for on-the-go consumption, drugstore products packaging, transport packaging, single-use products

Approach: behavioural, systemic and organisational change

Regional context: India; rePurpose is also working with waste management partners in South East Asia, Latin America and Sub-Saharan Africa

Stakeholders: plastic waste generators, rePurpose Global, plastic waste recycling organisations, waste workers; vetted waste management partnerships with Saahas (Bangalore), Aasra (Mumbai), Waste Ventures India (Hyderabad), CARPE (Mumbai), V Recycle (Goa) and Green Worms (Kerala)

rePurpose is a social enterprise committed to building a global community of products, brands, workplaces and consumers going #PlasticNeutral by measuring, offsetting and reducing their plastic footprint.

rePurpose's PlasticNeutral certification is a first of its kind solution that delivers environmental and socioeconomic impacts in tandem, supported by guaranteed, verified claims to help their customers communicate their achievements effectively.

On the environmental side, rePurpose's projects create economic incentives for the recovery and processing of low-value plastic waste that would not have been intercepted in the absence of the projects. Additionally, the projects create new waste collection and recycling infrastructures, as well as entrepreneurial opportunities for waste workers in the value chain, delivering sustainable health and livelihood opportunities.

LESSONS LEARNT:

Success factors: creating economic incentives for the collection, recovery and ethical disposal of ocean- and landfill-bound low-value plastic; creating a new waste management supply chain in regions where such infrastructure was absent in the baseline scenario; supporting and funding interventions that demonstrate a 100% "additionality", i.e. guaranteeing that the intervention would not have happened in the absence of the PlasticNeutral projects, and that said funding improves plastic waste collection compared to the baseline scenario; creation of an ethical supply chain and robust material traceability using technology-enabled systems

Impact: Through rePurpose's projects and partners, rePurpose currently processes over 100 tonnes of low-value plastics from oceans and landfills. Given the clients' commitment and interests, rePurpose expects this impact to grow to 400-500 tonnes by the end of this year through new and ongoing projects.

Economic assessment: Though the cost of achieving PlasticNeutral certification varies depending on the size, scale and geography of a project, on average it costs between $0.5 and $0.75 to offset one kilogram of the subject's plastic footprint, which is achieved through rePurpose's recycling partners in India who recycle an equivalent amount of plastic on their behalf.

KEY FINDINGS & TRANSFERABILITY

rePurpose's unique plastic credit model galvanises action and awareness among new-age brands and organisations. rePurpose also implements circular economy innovations and scales their impact on the ground.

rePurpose's business model is designed to fund formal waste management companies in any developing country.

FIND OUT MORE:

https://repurpose.global/

For further information please contact:
contact@prevent-waste.net

Development of waste prevention infrastructure

4.9 Environmental citizenship approach to developing and implementing a zero-plastic waste strategy

Submitted by Malteser International

FACTS

Type: practical example, study, project

Waste type addressed: plastic waste in general

Approach: behavioural, organisational and systemic change

Regional context: Province of North Samar, Philippines. The province includes numerous islands, 24 towns and 569 villages.

Stakeholders: local cooperation partners are the city administration including the “Municipal Solid Waste Management Board” and the departments of education and environment; the University of Eastern Philippines, primary and secondary schools; communities and citizens; youth groups and scouts; the Diocese of Catarman and church groups; (informal) waste collectors, second-hand goods dealers; environmental and "zero-plastic-waste" initiatives; waste collection and recycling companies

The aim of the project is to recover the ecological value of a coastal area by gradually reducing plastic waste from its shores through a collaborative undertaking among local citizens by developing and implementing a Zero-Plastic Waste Strategy (ZPWS). To this end, the following measures will be carried out:

- develop a zero-plastic-waste-strategy through participative planning processes
- build capacities in the responsible administrations at the governmental, city and local level in the areas of circular economy, collection points and waste management
- establish a social programme for informal waste collectors
- launch awareness and education campaigns
- mobilise the population to collect and separate waste and adopt more environmentally friendly behaviour

- document and publish lessons learned, success factors of innovative approaches and training manuals on both traditional and social media
- organise local, regional and national workshops to influence policy makers in order to improve institutional and legal frameworks

LESSONS LEARNT:

Success factors: The participatory approach (joint planning and implementation of a zero-plastic-waste-strategy with all stakeholders) and the multi-level approach (training, educating state and municipal employees, behavioural change among the population, active involvement of science and research) are regarded as key success factors.

Impact: The project aims to contribute to the protection of marine resources in coastal areas by adopting best practices for the reduction and management of plastic waste by cities and municipalities. In addition, socio-economic impacts are expected through social and fair economic participation of informal waste collectors, socio-cultural impacts through the establishment of a partnership for environmental sustainability between local government and the community as well as supra-regional and global impacts through improved global and regional cooperation to reduce plastic waste through networking and partnership of diverse stakeholders and exchange on lessons learnt and innovative approaches.

KEY FINDINGS & TRANSFERABILITY

The project is in the planning and inception phase. A study was conducted in August 2019, which proved the relevance and feasibility of the approach. A community-based solid waste project is under implementation, the above-mentioned project is planned to be implemented in 2020/2021.

FIND OUT MORE:

www.malteser-international.org

For further information please contact:
contact@prevent-waste.net

Development of waste prevention infrastructure

4.10 Litter traps to retrieve floating plastic

Submitted by Recycled Island Foundation

FACTS

Type: practical example

Waste type addressed: plastic waste in general, floating plastic

Approach: behavioural and organisational change

Regional context: Brussels, Belgium; Rotterdam, Netherlands; Ambon, Indonesia

Stakeholders: Audi Environmental Foundation (Brussels), municipally of Rotterdam (Rotterdam), local partners and organisations (Ambon), student teams (Ambon)

The Recycled Island Foundation has developed passive litter traps to retrieve floating plastic in ports, rivers and harbours before it enters the seas and oceans. The litter traps effectively retrieve marine litter without using any energy. Changing weather conditions like wind and stream direction have no negative impact on the entrapment system. The system is strong and sturdy enough to withstand tough harbour conditions. It is mainly constructed from recycled plastic, making it a durable and circular product. The foundation is currently developing more versions of the litter trap; traps with a larger capacity for marine litter so they can be emptied less frequently and a modular litter trap that can easily be transported anywhere in the world to prevent floating plastics from entering the seas and oceans.

LESSONS LEARNT:

Success factors: The Recycled Island Foundation believes that solving the plastic waste problem can best be achieved by creating awareness among the public, companies and governments, by offering opportunities to collect the plastic waste, organising cleanup initiatives along rivers and in ports and by recycling the collected waste. This makes the Recycled Island Foundation one of the few non-profit organisations that offers a total (end-to-end) solution.

Impact: The litter traps in Rotterdam and Brussels catch around 1.5 cubic meters of plastic every week.

Economic assessment: Local parties are involved in installing the litter trap; afterwards they are responsible for the emptying process. Therefore, the foundation creates jobs at the litter trap location. In addition to that, the collected plastic can be used to produce circular products, which also creates jobs.

KEY FINDINGS & TRANSFERABILITY

During this pilot project, the Recycled Island Foundation was able to further develop the litter trap to make sure that it worked properly. They also found out that the overall approach, including retrieving floating plastic from rivers using the litter trap, cleanups, creating circular products and educating people, was well received.

The idea is transferable. The Recycled Island Foundation is already working on projects in Sri Lanka, Vietnam and Ghana.

FIND OUT MORE:

https://www.clearrivers.eu/litter-traps

For further information please contact:
contact@prevent-waste.net

Innovative products

4.11 An ocean friendly straw

Submitted by Sulapac®, winner of the 2017 Green Alley Award

© Sulapac

FACTS

Type: practical example

Waste type addressed: single-use products

Approach: systemic change

Regional context: Research and development was conducted in Finland; the material has been tested successfully with multiple production lines around the world.

Stakeholders: research and development team at Sulapac®; straw manufacturers and brands that sell straws

The Sulapac® material is microplastic-free, fully biodegradable and designed to be a safe and sustainable alternative to traditional plastics throughout the value chain.

The life-cycle sustainability performance of the Sulapac® material encompasses several aspects:

- no emissions and migration of harmful chemicals
- no release of microplastics
- low carbon footprint
- sustainably sourced renewable raw materials (certified wood and natural binders)
- promotion of circular bioeconomy

Sulapac is introducing a marine biodegradable straw made from non-toxic and sustainably sourced materials, compliant with the European food contact material legislation. The material is a plug-in solution for plastic straw manufacturers. If a Sulapac® straw accidentally ends up in the ocean, it doesn't harm the ecosystem. Naturally occurring microorganisms can digest and transform it into CO_2, H_2O and biomass.

LESSONS LEARNT:

Success factors: The straw is free of microplastic, sustainable and biodegradable. In addition, it is mass producible (drop-in solution using existing machinery at a competitive price), user-friendly (it can be used just like plastic straws) and has a unique look and feel.

Impact: The straw can replace disposable plastic straws, thus preventing them from accidentally ending up in the wrong place, like oceans for example.

Economic assessment: The Sulapac® straw material has been developed so that straw manufacturers can use their existing production lines with it, so no massive investments into factories are needed.

KEY FINDINGS & TRANSFERABILITY

The Sulapac® straw is a non-toxic and sustainable alternative to plastic straws. The preferred recycling method for Sulapac® straws is industrial composting or anaerobic digestion. It doesn't interfere with plankton growth nor does it have any adverse effects on the ocean ecosystem.

It is possible to produce the straw in different locations from local materials. The material has been tested successfully with multiple production lines around the world.

FIND OUT MORE:

https://www.sulapac.com/sulapac-straw

For further information please contact:
contact@prevent-waste.net

Innovative products

4.12 Reusable packaging service for e-commerce

Submitted RePack, winner of the 2014 Green Alley Award

© *RePack*

FACTS

Type: business model, practical example

Waste type addressed: transport packaging, single-use products, e-commerce packaging

Approach: systemic change

Regional context: Nordic countries, German speaking countries, Benelux countries, the UK and France are currently the main target regions.

Stakeholders: a core team of ten experts with a proven track record in packaging, design, e-commerce and sustainability, supported by a knowledgeable board of directors. Three groups of partners: postal operators provide the logistical backbone, packaging manufacturers, and mainly online retailers and RePack users. Early adopters are brands that share the values regarding sustainability and are not afraid of making a statement; especially outdoor brands and sustainable fashion brands.

For many of us, online shopping has become a part of everyday life, as has the associated packaging waste. In e-commerce, there is still a lack of sustainable packaging solutions. In Europe alone, more than 4 billion single-use packages were delivered in 2014. This behaviour is wasteful from the perspective of consumers, webstores and society. RePack is a globally unique, reusable packaging service for e-commerce where delivery packaging can be easily returned and then reused. A sustainable packaging service costs 30% less, creates 78% less CO_2 and reduces landfill waste by 92%.

LESSONS LEARNT:

Success factors: RePack is more sustainable and cheaper than single-use packaging. It increases store traffic with empty returns directly to the stores and is a concrete sustainable solution for e-commerce to reduce packaging waste. It increases customer loyalty with a returnable experience and reward system. It generates new sales via a voucher system and connects brands with a pool of RePack users from other shops. It reduces single-use packaging costs by 20-30%, makes customers' returns easier and improves the customer experience.

Impact: RePack packaging is designed to be used at least 20 times. When reused once, RePack already has a smaller carbon footprint than two cardboard boxes or plastic bags. It has also removed the need for 19 single-use bags or boxes. When used 20 times, one RePack has an 80% smaller carbon footprint than 20 single-use cardboard boxes or plastic bags.

The CO_2 emissions from returning RePack by post are 0.037 kg CO_2 per delivery. Manufacturing a new plastic bag generates CO_2 emissions of 6 kg CO_2 per kg of plastics produced. Returning the empty bag really matters.

Economic assessment: The key to scalability is bringing down the cost of the sustainable solution to be on par with the current single-use solutions. RePack is working to bring the cost per delivery down from the current €2 to less than €0.20. With consolidated returns, the economies of scale start working in their favour.

KEY FINDINGS & TRANSFERABILITY

RePack is proven to work on a pilot scale with over 50 web stores in 14 countries. The early adopters come from the Nordic countries but it has been proven to work for e-commerce all over the world.

RePack can potentially be offered to all e-commerce customer segments who ship goods smaller than furniture.

FIND OUT MORE:

https://www.originalrepack.com

For further information please contact:
contact@prevent-waste.net

Innovative products

4.13 Device deposit for modular smartphones

Submitted by SHIFT

© *SHIFT GmbH*

FACTS

Type: practical example

Waste type addressed: plastic components of smartphones

Approach: systemic change

Regional context: Germany and Europe, subsequently adopted by partners in New Zealand, Canada and Nigeria

Stakeholders: design, production and sales, retail, consumers, public authorities, businesses, civil society, research, waste management

Shiftphone is a modular smartphone. Each Shiftphone is delivered with a device deposit of €22. This is the minimum amount to be paid out upon returning the phone. For intact devices, the customer receives a higher refund. Returned devices are refurbished, resold or the parts are used to repair other devices. Parts that no longer function are separated as far as possible and handed over to recycling partners. SHIFT also reuses its packaging.

LESSONS LEARNT:

Success factors: The modularity makes it easier for customers to repair and upgrade their smartphone. With the deposit system, customers have an incentive to return unused devices. This in turn guarantees a supply of spare parts over a longer period of time.

Impact: So far, the impact can only be estimated as the deposit was introduced in 2016 and most devices are still running. Since its introduction, however, noticeably fewer spare parts have had to be produced.

Economic assessment: Economic factors are currently being analysed by the MoDeSt research project, funded by the German Ministry of Education and Research (BMBF).

KEY FINDINGS & TRANSFERABILITY

Customers perceive the deposit system positively. It has the effect that fewer spare parts have to be produced and devices can be supported with spare parts for longer.

The deposit system can be implemented anywhere. By buying back the equipment from the customer, it is declared as used equipment and not as electronic waste. This makes it easier to export it if there is no adequate recycling infrastructure in the respective country.

FIND OUT MORE:

https://www.shiftphones.com/en/deposit

For further information please contact:
contact@prevent-waste.net

Studies on plastic waste prevention

4.14 Zero waste flights

Submitted by University of Kassel

© *Katharina Raab*

FACTS

Type: study

Approach: behavioural change

Waste type addressed: food packaging

Regional context: Mauritius, France, Germany, India

Stakeholders: University of Kassel, Air Mauritius, Mauritius Airport, Beachcomber Catering; the target group is flight passengers

The total amount of passenger waste summed up to 5.7 million tonnes in 2017. Therefore the need to reduce single-use plastics during long haul flights becomes evident. To this end, a survey was conducted among 133 passengers departing from Mauritius Airport after their holiday. Aim of this study was to highlight passengers' awareness about on-board waste, their meal preferences, and the importance of sustainability in the aviation industry.

LESSONS LEARNT:

Success factors: customisation of flight meals, participation in sustainability programmes, communication of environmental care

Impact: The environmental impacts of prevention were not examined in this study.

Economic assessment: There are cost savings to be made by not producing, not transporting and not disposing of uneaten meal components (the amount depends on the airlines).

KEY FINDINGS & TRANSFERABILITY

Passengers are demanding that the amount of waste generated during a flight is reduced. Waste handling and airline participation in sustainable programmes substantially influence passenger booking decisions. 52% of the passengers claim that it is very important for them, and 33% say it is important to them. Passengers want to configure their own on-board meals and are ready to make a change for the well-being of our environment.

The example is transferable to all flight destinations where catering companies can customise passenger meals.

FIND OUT MORE:

Raab, K., Wagner, R. (2019) Can God Save Our Environment from Waste? – An Exploratory Study of International Flight Passengers, Proceedings of the 18th Cross Cultural Research Conference, San Juan, Puerto Rico.

For further information please contact:
contact@prevent-waste.net

Studies on plastic waste prevention

4.15 Reducing the use of stretch film. Success factors of eco-innovations

Submitted by ISOE – Institute for Social-Ecological Research

© *Lukas Sattlegger*

FACTS

Type: practical example, study

Waste type addressed: transport packaging

Approach: organisational change

Regional context: Huntlosen, Lower Saxony, Germany

Stakeholders: Organic wholesale company Kornkraft Naturkost, accompanying research by Lukas Sattlegger (ISOE – Institute for Social-Ecological Research); the target group includes both internal warehouse staff and other companies in the food industry

The project accompanies and supports the organic wholesale company Kornkraft Naturkost in its conversion from disposable stretch film to reusable cords to secure pallets when delivering empty containers.

On the one hand, the aim was to massively reduce plastic film consumption at the company and, on the other hand, to identify success factors and barriers for this kind of logistical conversion process in retail companies.

LESSONS LEARNT:

Success factors: Technologies generate constraints and established working practices generate material needs. Therefore, close coordination of practices and technologies is essential for successful innovation. This includes a willingness to acquire new infrastructures and learn new skills.

Innovations require actively putting the work in and taking responsibility. They are dependent on promoters as well as time and financial resources. In addition, work on innovations must be flexible and adapt to practical process requirements.
Work on innovations and the resource investment must be legitimised and promoted by shared values and objectives. The importance of innovation must be legitimised internally and externally to maintain commitment and resilience.

Impact: Reduction of film consumption from between six and eight rolls per week to one roll per week. This corresponds to a reduction in film consumption to approx. 15% of the initial consumption.

Economic assessment: The reduced film consumption saves approx. €1,000 per year in material costs (6 rolls at €4 each per week) and approx. 1 hour of work per day.

KEY FINDINGS & TRANSFERABILITY

Even apparently banal and everyday innovations based on existing technologies are not guaranteed to succeed but rather represent uncertain transformations. Material idiosyncrasies of technologies (e.g. tangling/knotting of cords), tenacity of everyday practical routines (e.g. learning effort for employees) and different values (e.g. avoiding plastics is exaggerated, the main issue is that the load is properly secured) need to be considered.

Transfer is possible but has to be adapted to the respective conditions. For example, the film-free securing of empty containers is dependent on an existing and functioning return system.

FIND OUT MORE:

https://www.isoe.de/en/nc/research/projects/project/plastx-packaging-consumption

http://www.plastx.org

https://www.kornkraft.com/2019/07/10/plastikfrei

For further information please contact:
contact@prevent-waste.net

Guidelines and overviews of best practice examples

4.16 Best practice guide for reducing marine litter

Proposed by Project Management Jülich

© *Nardine Stybel, EUCC-D*

FACTS

Type: practical example, guideline

Waste type addressed: beverage packaging, food packaging, packaging for on-the-go consumption, drugstore products packaging, transport packaging, single-use products

Approach: behavioural, systemic and organisational change

Regional context: Europe

Stakeholders: the MARLISCO project consists of 20 partners in 15 European countries; the target group is national governments, local authorities, commerce, industry, civil society organisations, citizens' groups and educators

Within the EU-funded MARLISCO project, 73 best practices were identified that aim to reduce the amount of marine litter in Europe's seas. These include economic and market-based instruments, practices for implementing policies and regulations, campaigns and other activities. The solutions were then assessed in terms of their strengths and weaknesses and finally, the best practices offering the greatest potential were examined in more detail.

Based on these examples, "The MARLISCO Guide for Reducing Marine Litter: Get Inspired and Become Innovative Through Best Practices" presents best practices in 14 categories as well as activities that different actors can implement.

LESSONS LEARNT:

Success factors: The guideline states that it does not intend to reinvent the wheel. Therefore, it is based on a collection of best practices from all over Europe. It points out that local specificities should be taken into account. The guideline outlines the most important options for action and points out further sources of information. Thus, it serves as a starting point for anyone who wants to help reduce marine litter. Specific success factors are presented for all best practices.

Impact: Individual results are provided for each best practice. For example, the results of the "plastic bag levy" in Ireland are as follows:

"There has been a considerable decrease in the consumption of plastic bags since March 2002. The reduction has been estimated at 90%. [...] Importantly, the levy has influenced the behaviour of consumers: in 1999, 40% of those surveyed were not willing to pay for plastic bags, whereas in 2003 91% of those surveyed believed the plastic bag levy was a good idea." (Orthodoxou et al., 2014, p. 12)

Economic assessment: Some examples provide detailed information on their funding. The above example from Ireland indicates:
"Initial funding of €1.2 million (purchase of new computer systems and additional resources needed to administer the levy). An additional annual cost in the order of €350,000 goes on administration and a further €358,000 went on publicity for promoting the plastic bag levy. But, since the introduction of the levy over €196 million revenue has been collected" (Orthodoxou et al., 2014, p. 12).

KEY FINDINGS & TRANSFERABILITY

MARLISCO points out that, in order to successfully reduce marine litter, it is necessary to (1) understand the problem, (2) become efficient, (3) implement a mixture of actions and practices, (4) collaborate and (5) evaluate & monitor the progress (Orthodoxou et al., 2014, p. 70).

For the guideline, only examples that are very transferable were selected. In some cases, local conditions must be taken into account. The transferability is described in more detail for each example.

FIND OUT MORE:

http://www.marlisco.eu/best-practice-guide.en.html

For further information please contact:
contact@prevent-waste.net

Guidelines and overviews of best practice examples

4.17 Guideline for the eco design of plastic packaging

Proposed by Wuppertal Institute

FACTS

Type: guideline

Waste type addressed: beverage packaging, food packaging, packaging for on-the-go consumption, drugstore products packaging, transport packaging, single-use products

Approach: organisational and systemic change

Regional context: Germany

Stakeholders: the "Eco Design of Plastic Packaging" round table is an initiative by experts from companies operating along the entire supply chain for plastic packaging as well as scientists and consumer organisations. The guideline's target group consists of senior managers, product managers, marketing directors, packaging developers and designers in the development of modern plastic packaging.

As a practice-oriented tool, the guideline for the eco design of plastic packaging intends to assist companies in integrating eco design decisions into their packaging development.

It covers strategy elements for the development of an eco design strategy as well as the integration of eco design procedures into the management process. The guideline is based on the following concept:

"Eco Design of plastic packaging:

- Aims to minimise the environmental impacts of plastic packaging and packed goods over their entire life cycle
- Is part of the decision-making process for developing and marketing a packaged product
- Includes a holistic view of the entire packaging system (primary, secondary and tertiary packaging)
- Ranges from incremental product improvements (e.g. material reduction) to process innovations (e.g. optimised goods logistics and waste recycling)
- Addresses conflicting goals at different levels, such as various environmental factors (e.g. using less material versus recycling) as well as other factors (e.g. functionality, consumer protection and costs)."
  IK Industrievereinigung Kunststoffverpackungen e.V. (2019, p. 7)

LESSONS LEARNT:

Success Factors: The guideline focuses on a comprehensive understanding of Eco Design aspects and takes the entire life cycle of packaging into account. To develop the guideline, stakeholders along the entire value chain contributed their experience.

Specific checklists, practical examples and a toolbox that contains links to the latest collection of additional guidelines, useful tools and helpful information accompany the guideline.

KEY FINDINGS & TRANSFERABILITY

"Eco Design of plastic packaging aims to minimise the environmental impacts of plastic packaging and packed goods over their entire life cycle. In order to achieve this, Eco Design must become an integral part of management decision-making concerning the development and marketing of goods and their packaging" (IK Industrievereinigung Kunststoffverpackungen e.V. (2019, p. 8).

Although the guidelines were developed with European countries in mind, they are in principle applicable at a global level.

FIND OUT MORE:

https://ecodesign-packaging.org/en/guidelines/overview

For further information please contact:
contact@prevent-waste.net

5 Recommendations

Based on the impressive number and range of ongoing projects, policy measures and strategies that aim to prevent plastic waste and related environmental impacts, the following aims to draw conclusions with regard to the following questions:

- What can be considered crucial success factors for effective and efficient plastic waste prevention?
- What additional measures and activities will be necessary? What role might the PREVENT Waste Alliance play?
- Where are the gaps with regard to necessary policy frameworks on the national, European and global level?

5.1 Success factors

Plastic waste and, in particular, its prevention have become an important policy issue, highlighting the growing role of waste prevention in the transition towards a circular economy. In its plastics strategy, the European Commission notes that plastic recycling has not kept pace with the increasing global production of plastics and that plastic waste leaking into the environment poses a severe threat, not only to marine ecosystems but also to economic activities such as fishing and tourism. These environmental burdens can to some extent be managed by end-of-pipe measures in developed countries with sufficient financial resources; these options are clearly unrealistic for most developing and emerging countries.

The challenge of implementing plastic waste prevention is significant. The plastic family consists of thousands of materials used in wide-ranging applications that span across various economic sectors. Some of these applications even help implement waste prevention, for example by reducing food waste or enabling lightweight design solutions. Moreover, prevention is expected to overcome inherent technical barriers, consumption patterns, established value chains and economic barriers.

Against this background, the good practice examples identified by the PREVENT Waste Alliance members and partners clearly highlight the opportunities to move beyond waste prevention norms in Europe. The analysis conducted in this study also reveales opportunities to make preventing plastic waste more effective. Efforts to increase plastic waste prevention need to become focused, better coordinated and more explicit in terms of scope and ambition. The types and uses of plastic can be differentiated: priority for prevention should be given to the most impactful plastic types, to plastic products that are designed to be used once and for a very short time and to non-recyclable plastic products. Such prioritisation would help direct and structure prevention efforts, reduce environmental impacts more quickly and also bear significant results in terms of reducing the waste generated. The mapping of plastic waste prevention initiatives in this study shows that the scope of national initiatives is often well defined and targeted (e.g. plastic carrier bags, single-use plastics or packaging). However, in many cases, the scope of a planned intervention is too generic, which can result in reduced effectiveness. For example, with regard to the often-mentioned support for the waste-light design of plastic products, it remains unclear how such an objective might actually be achieved. Here the PREVENT Waste Alliance network offers excellent opportunities to make prevention efforts more specific and easier to communicate. This study should be used as a starting point to

move beyond the generic approval of waste prevention and instead to highlight the very specific opportunities and challenges associated with to it.

5.2 Necessary next steps

Looking at the current discourse on plastic waste prevention, the classification of existing good practice examples in this study and others (e.g. Wilts & Bakas, 2019) according to types of instruments reveals that very few refer to financing. The EU plastics strategy and the Single Use Plastics Directive (including establishing extended producer responsibility schemes) both call for financial stimuli for more sustainable production and consumption patterns for plastic products.

Given the effectiveness of financial instruments in shaping waste policies, countries could make better use of available financial instruments to reduce plastic consumption and contribute to waste prevention. These instruments could explore using state funds and involving voluntary public-private partnerships, for example to provide eco-modulated packaging fees that not only promote recycling but also prevent packaging waste at source.

Beyond public measures and initiatives, the different good practice examples raise the question of financial sustainability: Where does waste prevention actually pay off, where does it require additional investments and what are the amortisation periods? Looking at the good practice examples listed in this study, an initial hypothesis could be that waste prevention and related innovative business models clearly offer significant market potentials, while at the same time requiring management of more complex interactions within companies and with external stakeholders. It would also appear that, in many cases, waste prevention is linked to higher capital intensity, thus higher financial risks – requiring more courageous entrepreneurs who are willing to explore waste prevention as a business model.

The PREVENT Waste Alliance with its diverse group of stakeholders from SMEs to global companies, researchers from different disciplines and policymakers could be the perfect platform to reduce these uncertainties, exchange relevant experiences and thus make the prevention of plastic waste a reality.

A second possible intervention point with specific relevance for the PREVENT Waste Alliance could be qualitative waste prevention, which is often overlooked even though it is part of the official definition of waste prevention: Reductions in hazardous substances lead to cleaner supply chains. It is thus important for all stakeholders to address these aspects and focus more on qualitative prevention. Waste prevention is still too often approached as an isolated area, while links and synergies with other efforts (e.g. the circular economy) are still in their infancy. The identification and processing of these links would increase the effectiveness and efficiency of the measures implemented and facilitate a more comprehensive approach to environmental issues, for example burden shifting between plastic packaging and packaging made of extremely resource-intensive aluminium, or trade-offs between packaging waste prevention and food waste prevention.

5.3 Conclusions with regard to required policy frameworks

The waste prevention policy domain in general lacks initiatives that include specific targets, and plastic waste prevention is no exception. Very few countries have put in place quantitative targets, although some have adopted qualitative ones. These include plans to decouple waste generation from economic growth or targets on reuse. On the other hand, most countries have decided to collect data and information to develop indicators and monitor progress towards implementing waste prevention. Again, a lot of the indicators are related to the consumption of plastic carrier bags, which in turn is related to the corresponding EU legislation.

Another aspect is the lack of evaluation of measures implemented and targets agreed. Unfortunately, there are very few cases in which the initiatives adopted have been properly evaluated; therefore, most of the good practices identified lack the evaluation element that could help draw conclusions on their effectiveness. Without proper evaluation, we cannot draw conclusions on the effectiveness of measures and the ambition of targets. Most of the initiated measures showcased in this study and national waste prevention programmes are still ongoing and have not yet been evaluated. In the coming years, such evaluations will help achieve a better understanding of which of the implemented measures, specifically which types of targets and incentives, have proven to be most effective.

The PREVENT Waste Alliance could play an important role in highlighting the fact that successful plastic waste prevention will not be achieved by single actors; neither companies, NGOs nor countries. The diverse network of PREVENT Waste Alliance members should emphasise the role of international coordination in order to create level playing fields, to avoid unnecessary administrative burdens from scattered regulation and to create synergies between the different ongoing activities and strategies that are currently developed alongside the plastics value chain.

6 How your organisation can participate

Are you active in the field of waste management or a stakeholder in plastic and/or electronics value chains? Do you already have activities and partnerships on an international level? Do you want to intensify your cooperation with partners in low- and middle-income countries to make value chains suitable for the circular economy and improve local waste management?

Then you are welcome to participate in the PREVENT Waste Alliance.

In case of question please contact: *contact@prevent-waste.net*.

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