

Materials, Resources and Sustainability series

Reading time: ~20-25 minutes



How we can use plastic responsibly



Image: a “plastic whale” on display in Marina Bay, Singapore (taken by self)

Introduction

This paper is part of a series on **materials and resources**. In this series we ask how we can use risk management approaches, techniques and tools to improve the way we source, develop, use and dispose of the materials, resources and products that power our modern economy, and to support everyone involved in their value chains. The series uses [the United Nations Sustainable Development Goals](#) (the SDGs) as a common thread to discuss diverse sustainability and risk aspects and elements to each subject.

Plastic, plastic, everywhere...

Plastic is an intrinsic part of the world economy – it is virtually everywhere we look. Indeed, we have seen its value to us, as the world has had to respond to the COVID-19 pandemic, whilst recognising that there are aspects of plastics production and consumption that need to change.

I tried a little experiment when I began writing this paper, in late 2019. I visited my local supermarket with the express aim of seeing what produce and products I could buy that do not have any hint of plastic at least visibly connected to them (as the end product in the shop, at least). Try this yourself at your local supermarket – see if you can do better than I did.

Before I entered the shop, I made sure to take a reusable plastic bag with me to carry my items home, so although this is reusable, I'm already using plastic before I have started my shop (I cover more about plastic bags later in this paper).

As it stands today, it is fair to say that most items at a supermarket have plastic associated with them in some way – particularly for packaging. Whether it is for refrigerated produce, washing products, healthcare products...the list goes on. Even for the minority of products that have no visible direct association with plastic, there could well have been plastic used somewhere along the way in it getting to the store.

Plastic is everywhere in today's modern life. That is not necessarily a bad thing – if we produce and use this material responsibly and sustainably rather than treat it as a throwaway material.

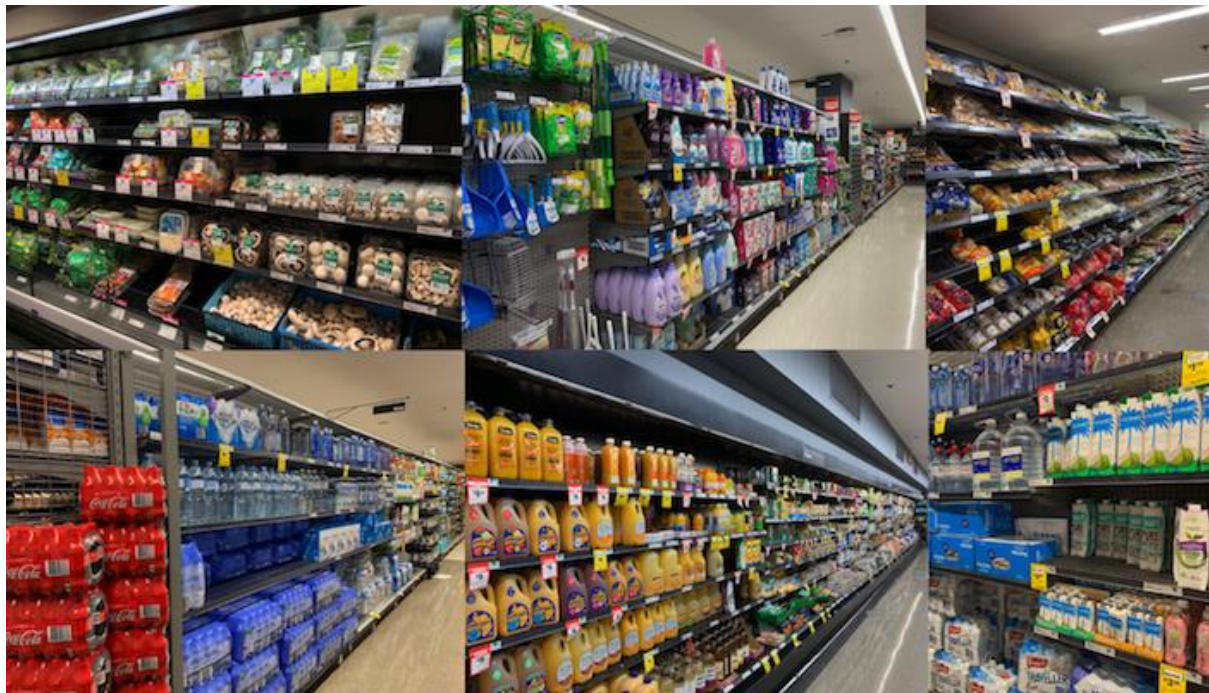


Image: a trip to my local supermarket to look at how prevalent plastic is (collage taken and produced by self)

The origins of plastic

“Unless I am very much mistaken, this invention will prove important in the future.”

Leo Baekeland, 11 July 1907

The initial beginnings of plastic, one could argue, could be traced back to Bakelite, a substance made of formaldehyde & phenol. The invention of this synthetic substance in the early 1900s by Leo Baekeland was revolutionary for its electrical nonconductivity and heat-resistant properties. It was used in electrical insulators, radio and telephone casings and diverse products including kitchenware, piping, children's toys, and firearms. It was developed into polystyrene (packaging) and nylon (stockings) and polyethylene (plastic bags).

By the 1930s and 1940s, other forms of plastic were proving cheaper and simpler to manufacture than Bakelite. The modern polymer industry was effectively created by [Wallace Carothers](#) at DuPont in the 1930s. His detailed work on polyamides led to the commercialisation of nylon, as a wartime shortage of silk forced women to look elsewhere for stockings.

Polymers – long chain synthetic molecules of which the term plastic is our everyday name to describe them – began to be produced during World War II. Since this time, the commercial industry for polymers, and our use of them, has grown, and continues to grow, rapidly.

Plastic has perhaps become a somewhat misguided term we all use to describe polymers. Most of today's plastic that we use is “*thermoplastics*”, which describes polymeric materials that can be shaped and reshaped using heat. Typically derived from petroleum or natural gas, polymers are long-chain molecules, with hundreds or thousands of links in each chain. These long chains provide important physical properties, such as strength, durability and toughness, that short-chain molecules cannot match. This durability also means that they take a long time to decompose.

What sort of plastic is produced and used around the world today?

The production of synthetic polymers which we turn into plastic is currently dominated by the “polyolefins” – mainly polyethylene and polypropylene.¹

There are a number of reasons why polyolefins currently rule the market. First, they can be produced from oil and natural gas through a process of polymerisation, which is relatively inexpensive. Second, they are light in weight, minimising handling and transportation costs. Third, they are highly resistant to damage by many agents, such as water, air, grease, and many cleaning solvents.¹

However, polyolefins pose challenges to sustainable consumption. They degrade very slowly – once disposed of, they will survive in most environments for decades if not centuries. Also, they are mechanically abraded by wave and wind action, which generates microparticles that can be ingested by fish and animals. It harms them, and it makes its way through the food chain.

The two charts below show, as of 2015, the prevalence of polypropylene (PP) and polyethylene (PET); LDPE is low-density polyethylene; PP&A is polyphthalamide, a subset of the nylon family; HDPE is high--density polyethylene and PVC is polyvinyl chloride; PUR is polyurethane; PS is polystyrene.

Plastic around the globe

The term "plastic" covers many different types of polymers, each produced in many millions of tons in 2015.

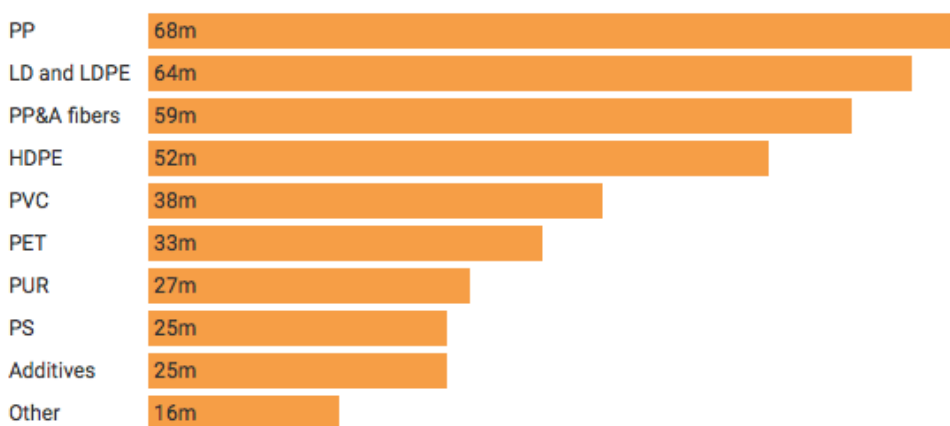


Chart: The Conversation, CC-BY-ND Source: [Science Advances \(2017\)](#) [Get the data](#)

What are plastics used for?

More than one-third of the plastic polymers produced in 2015 were used for packaging. That category also generated the most waste.

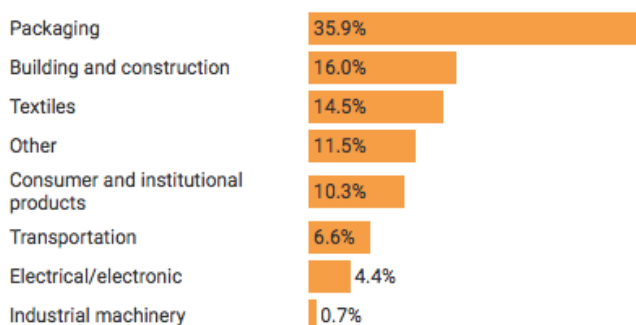


Chart: The Conversation, CC-BY-ND Source: [Science Advances \(2017\)](#) [Get the data](#)

The plastic we produce today – the times, they are a changin’...?

It is estimated that approximately 350 million tonnes, perhaps more, of plastic are currently being produced annually. Although in 2020, plastic production (of certain types) is forecast to fall as a result of certain industries being negatively impacted by the economic fallout of the COVID-19 pandemic ⁶⁷, the overall trend in plastics use is currently that demand for it will keep growing, unless we choose to take a different approach to how we use this material (detailed reports about the industry size and our consumption of plastic are available from various sources). ^{2, 3, 4}

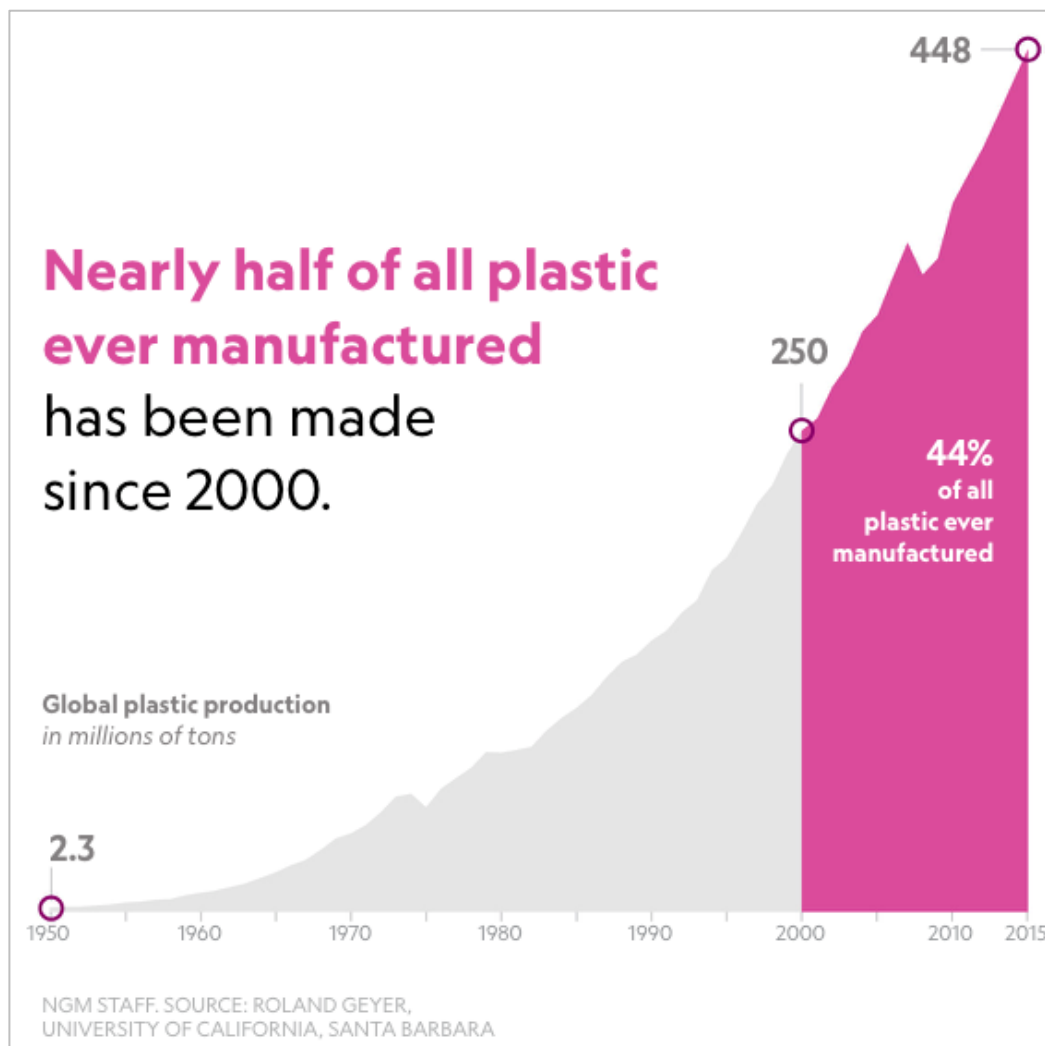
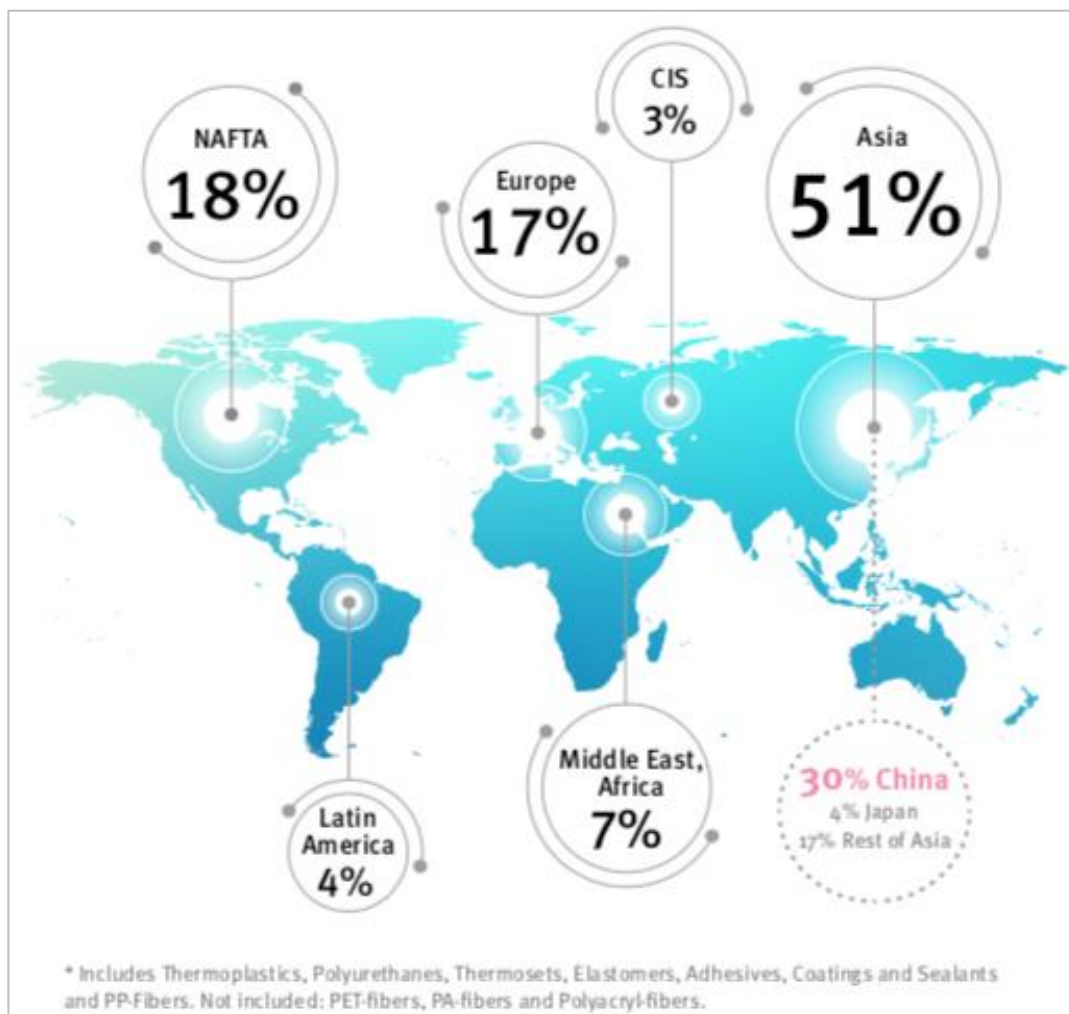


Chart obtained from [National Geographic](#)



Plastic production proportions around the world. Chart obtained from [Plastics Europe](https://www.plastics-europe.eu/)

As well as the amount of plastic being produced, more and more of it is being added to the ever-growing amount of landfill waste that is being dumped – on land and at sea – all around the world. The damage to marine life and fisheries, the impact on tourism, plus the impact of greenhouse gases produced in manufacturing, exceeds the industry's US\$40 billion in annual profits, according to a global study led by the Ellen Macarthur Foundation. ³

Now, after decades of a prevailing attitude of “produce plastic, throw it away and produce more”, the environmental damage we all see from the inappropriate use and dumping of plastic waste is changing our approach, and our behaviours. The need to be more responsible with plastic has gone from being an after-thought for many to a genuine concern and cause for action. This change in mindset is creating opportunities as well as threats for many stakeholders in the plastics industry. Attitudes and government policies regarding plastic consumption and disposal continue to differ in different places around the world, from Abu Dhabi to Australia.

Our global plastic footprint

Here are a few points about our production and use of plastic, seen through the lens of the SDGs. Looking at materials consumption and responsible use and disposal through the SDGs helps to give a balanced snapshot. Whilst plastic provides many benefits and is of significant importance to how we live today, our use of this material has a significant impact on the planet:



3. Good Health & Wellbeing

The use of plastic provides benefits that contribute positively towards good health.

Just recently, for example, we have seen how plastic is helping as the world has responded to the COVID-19 pandemic (examples are provided later in the paper).

Plastic plays an important role in keeping our food fresh in a low-cost and effective manner. Incredibly, a third of food is wasted between it being grown and making it to a plate, according to the UN. ⁵

Because plastic, from sealed containers to vacuum packing, helps to keep food fresh for longer, it helps to reduce waste. It may be argued to be a safer material to use than glass, for example, and it is also lighter, which saves on fuel in transportation. Plus, the emissions from producing plastic packaging are less than those associated with food waste.

However, studies are being carried out to investigate the potential harm that some forms of plastic may be doing to our health.

For example, BPA (Bisphenol A) is a chemical found in many forms of plastic, including food packaging (some 3.6 billion tonnes of it are produced each year), and it is being investigated for potential health impacts, particularly to the young. ⁶

The impact of microplastics on our health (and the health of many animals) is another topic of much debate. There are tiny bits of plastic – fibres, fragments, microbeads – in much of the fish and shellfish that humans around the world eat. Scientists are trying to figure out what it may mean for our health, and the animals. ⁷

The United Nations Food and Agriculture Organisation (UN FAO) produced a detailed report in 2017, concluding that we consume a negligible amount of microplastic in our consumption of seafood. ⁸ The UN FAO agency reminds us that eating fish is still good for us: indeed, fish food is often wrapped in plastic to keep it fresh.

6. Clean Water & Sanitation

Plastic currently has a valuable role to play in plumbing systems around the world. As described in the World Health Organisation guidelines, the most commonly used materials for drinking-water supply piping are galvanised steel or iron, copper, polybutylene, unplasticised polyvinylchloride (PVC), chlorinated polyvinylchloride (CPVC) and polyethylene (PE). Plastics currently play a major role in drinking-water supply piping. ⁹

As described by the Plastics Pipe Institute, plastic piping systems can provide an environmentally responsible choice, through a low carbon footprint, a long service life and recycling options (when recycling is taken on board). ¹⁰

7. Affordable and Clean Energy

Today, roughly six per cent of global fossil-fuel consumption goes into making plastic, and it is thought it may increase to 20 per cent by 2050, according to the International Energy Agency. ¹¹ The energy that goes into producing plastics will be a close watching point in the years to come (and it is further emphasised by the situation with global energy as we deal with the COVID-19 pandemic).

8. Decent Work & Economic Growth

Plastic is of course used in so many components, which includes being included in many new economic developments.

The plastics industry, and the extractive industries behind it, is a major employer around the world. For example, in Europe as of the time of writing it directly employs 1.6 million people working for over 60,000 businesses (most of them SMEs). ¹²

It plays a role in the developing world, in lifting people in less developed geographies out of poverty through employment.

9. Industry Innovation & Infrastructure

Plastic is used in many industries, and it is part of the infrastructure that we use to live. Much of how it is used is not seen in our daily lives.

A great deal of research is being conducted into the sustainable use of plastics, by various groups including industry, academic researchers and scientists. For example, designers of plastic packaging are working on ways to make it more sustainable, reusable and easier to recycle.

3D printing technologies, which have been improving for years, include the ability to create structures using polymers, a form of plastic, with minimal waste.

An interesting field that is being researched and used in society is bioplastics. According to European Bioplastics, a plastic material is defined as a bioplastic if it is either bio-based, biodegradable, or features both properties. There are two major advantages of bio-based plastic products compared to conventional plastic: they save fossil resources by using biomass which regenerates (annually) and provides the potential of carbon neutrality. Second, biodegradability is an add-on property of certain types of bioplastics. It offers additional means of recovery at the end of a product's life. ¹³



Source: [European Bioplastics](#)

How we deal with plastic waste is a critical consideration. More and more ways to handle plastic waste responsibly are being found. The Plastic Bank, a business formed in 2013 in Vancouver, Canada that has a global reach, offers communities around the world that have high levels of poverty an above-market rate for their plastic waste. Plastic that is collected can be traded for money, items or services. Local entrepreneurs can get help setting up their own local shop, where plastic waste is the currency. Plastic collected through Plastic Bank is then recycled and sold at a premium as Social Plastic®. Blockchain is being used to track the entire cycle of recycled plastic from collection, credit and compensation through delivery to companies for re-use. ^{14, 15}

Various research and development initiatives are underway on how to re-purpose plastic waste. For example, investigations are in progress to look at re-using plastic bags for batteries. Scientists have devised a new method for converting plastic bags into carbon chips that serve as anodes in lithium-ion batteries. It has long been known that “the polyethylene in plastic bags could be an inexpensive source of energy-storing carbon,” they note. ¹⁶

12. Responsible Consumption & Production

Our general attitude to how we consume plastic, and how we produce it to cater for our demands, is a key determinant of how we will responsibly use plastic in future – and how we minimise plastic waste.

There has been a lot of discussion about the use of plastic in the first half of 2020, as the world has grappled with the COVID-19 pandemic. As mentioned earlier, plastic has proven to be a valuable material for many reasons (such as for medical purposes). However, the first half of 2020 saw a rise in single-use plastic. The return to disposable cups in coffee shops, for example, which are lined and lidded with polymers, and our increased use of plastic containers for takeaway meals are just two of examples of how the COVID-19 pandemic has created setbacks to phasing out single-use plastics. In the UK, a country which has done much commendable work to phase out single plastics, plastic shopping bag charges were waived for online deliveries, and a ban on the use of plastic straws and stirrers was delayed by six months because of supply chain problems said to be caused by COVID-19. Plus, a decision on the way forward for a “plastic packaging tax” was delayed by three months. ⁶⁴

The price of various types of plastic has fallen in the first half of 2020, in line with falling prices for oil, which has put pressure on the price of recycled plastic. ⁶⁴ Despite these examples, it is hoped that continued public sentiment for the responsible use of plastic will prevail over the long term.

As mentioned earlier, plastic does not break down easily. When it is thrown away it results in nanoparticles which pollute our oceans, the air and the environment. Evidence of this pollution ranges from Mount Everest (which, incidentally, has introduced a ban on single-use plastic from January 2020) to the Arctic and its sea-ice.

It must also be said that alternatives to plastic are not a panacea for sustainability. Glass, metal or paper/cardboard can create higher greenhouse gas emissions through their production and their heavier weight when used in transportation. Plastic is light, versatile, cheap and durable - it maximises shelf life and minimises manufacturing and transportation costs, which in turn help consumers to pay less for the goods they buy.

Packaging, which has been mentioned earlier, is a key area of focus. About 25 per cent of the almost 350 million tons of annual plastic production worldwide is for packaging, according to Plastics Europe and the Ellen MacArthur Foundation.¹² Packaging is the biggest use of the plastic, ahead of its use in buildings, textiles or transportation. We need to work out how to be smarter and more responsible and sustainable with packaging.

We are not nearly as good at reusing and recycling plastic as we should be. Only a small amount of the single-use plastic we use is collected for recycling (some estimates put it at around 15%). A very small amount is recycled at high quality for reuse (some estimates put the figure as low as 2%) – most of it either goes to landfill or is burnt. In fact, the waste plastic which makes its way to recycling centres doesn't always get recycled!

Plastic bags are a subject of much debate today, and rightly so as they are an "obvious candidate" that everyone around the world can focus on.

The Swedish engineer, Sten Gustaf Thulin, is credited with creating the plastic bag in 1959. It was developed as an alternative to the paper bag, which was considered bad for the environment because it resulted in forests being chopped down. People saw that plastic bags were significantly stronger than paper bags, which meant they could be used many times. However, our lazy use of single-use plastic has meant that this early vision did not transpire into reality in the consumable society.⁵³

It is thought that people around the world currently use as many as five trillion plastic bags each year. The argument goes that they are efficient and low-cost to make, requiring only a low amount of energy. However, when disposed of irresponsibly, they pose serious problems, from the threat to marine life to being breeding grounds for malaria-carrying mosquitoes. When they are dumped in landfill sites, they can take centuries to decompose.

It is worth noting that other types of bags can also be harmful to the environment. Paper carrier bags, for example, require more water to be produced, and transport is still required to the point of use / sale. It is claimed that a paper bag needs to be used 3 times to compare with a reusable plastic bag. Cotton bags are even more energy-intensive, as cotton production requires a large amount of water. By some estimates, a cotton tote bag needs to be used 131 times to generate less greenhouse gas emissions than a reusable plastic bag.¹⁷

One thing just about everyone agrees on is that we need to get much better at how we use and dispose of plastic, to avoid scenes like this:



Rubbish on the beach in Sihanouk, Cambodia. Photo credit: [Niamh Peren / The Guardian](#)

13. Climate Action

In 2019, the production and incineration of plastic is estimated to have produced greenhouse gases equivalent to 189 coal power stations of 500 MW capacity, according to the Center for International Environmental Law. It says that the only sure way to reduce the climate impact from the plastics industry is to stop production growing and to keep fossil fuels in the ground.

Plastic is also mixed into greener transportation. The energy company Exxon Mobil points out that the production of electric vehicles (EVs) requires plastics to be used for various components, which amongst other things keeps the cars as light as possible, thus extending battery range. ¹⁸

14. Life Below Water

The abundance of life underwater and how plastic is impacting it is a critical concern around the world for how we dispose of plastic.

Huge floating islands of plastic are known to exist in the ocean. It has become so widespread that it is thought to have now entered into just about every element of nature's food chain underwater. In 2019 an expedition by Challenger Deep to the Mariana Trench, the deepest place on earth, found traces of plastic waste there – at depths of almost 11,000 metres below sea-level. ¹⁹

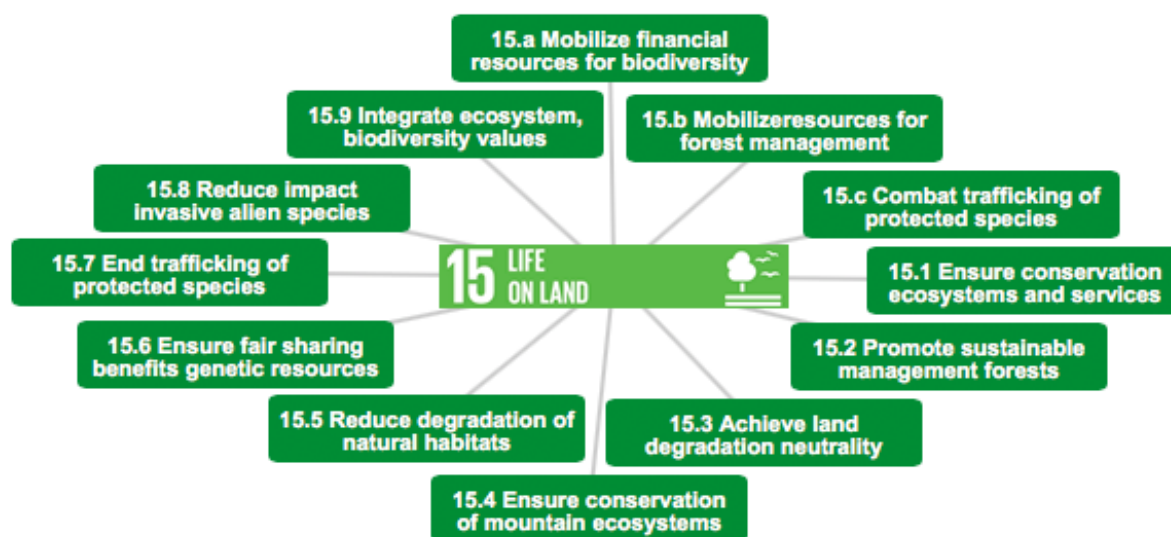
As an example of the sheer size and scale that we are talking about, consider that in 2019 some 400 million pieces of debris – much of it plastic – were found to litter the coastline of the remote Cocos (Keeling) Islands, which lie about 2,000km north of Australia. The layers of rubbish on the Indian Ocean archipelago weighed an estimated 238 tonnes and included almost one million shoes and some 373,000 toothbrushes. ¹⁹

Experiments show that microplastics – defined as pieces of plastic that are smaller than 5mm – damage creatures that live in water and those that exist in and out of it, such as turtles and birds. Microplastics can block their digestive tracts, diminish the urge to eat, and alter feeding behaviour. Some species starve and die. Research is indicating that the fish and shellfish we enjoy are suffering from the ingestion of this plastic. ⁷

In addition, microplastics have chemical impacts, caused by free-floating pollutants that wash off the land and into our seas and oceans. Chemicals include polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and heavy metals, which tend to adhere to their surfaces. ⁷

15. Life On Land

When we look at the detail of SDG 15, it is clear that how we use and dispose of plastic plays an important part in achieving global SDG 15 targets, particularly for reducing the degradation of natural environments, as outlined below:



Source: [UN Environment Programme](https://www.un.org/sustainabledevelopment/)

How we use and dispose of plastic will have a valuable role to play in these targets – the question is, how will we use plastic responsibly, and sustainably.

Are we changing our attitudes? It looks like it...

Various factors are driving a change in how we produce, use, reuse and dispose of plastic in a responsible way. These factors are having an impact on the views and actions of many stakeholder groups.

Today, for example, there is a much greater awareness and appreciation of [the circular economy](#), and this influences how we can and should all play a part in ensuring more responsible and sustainable use of plastic.

Companies, scientists and entrepreneurs all agree that change is happening, yet their views on how to tackle our current challenges with plastic differ – it depends on their perspective and what they are focusing on in or amongst the plastics value chain. Some stakeholders are focusing on how to make the plastic we consume more recyclable. Others are looking at reducing the amount of plastic we produce – pointing to different materials, such as coated paper, fibre and cardboard, that could replace plastic for certain needs. Others are focusing a broad transformation of how we buy and consume products made from or incorporating plastic.

Different approaches to the problems we face have radically different implications in costs, benefits and ease of implementation. Many problems are complex, and complexity thinking can help us to deconstruct them. Diverse views are important to appreciate, and tools and techniques to consider risks (threats and opportunities) can help stakeholders to make responsible long-term, sustainable decisions.

The role that plastic is playing as we tackle the COVID-19 pandemic

As mentioned earlier, as we consider how to ensure our use of plastic is responsible and sustainable, we should acknowledge its role in global efforts to overcome the COVID-19 pandemic. For example:

- Plastics are providing an affordable and effective solution for hospitals and their medical equipment, and to protect frontline workers during the pandemic with protective gear, including PPE.
- Cross-industry collaboration to combat the SARS-CoV-2 coronavirus and COVID-19 is leveraging plastic. For example, the sports car maker Ferrari announced that it will produce thermoplastic components required for respiratory valves, and the IT firm Apple has designed plastic face shields for medical professionals and has been shipping millions of them across the United States.⁶⁰

As mentioned earlier, the drop in oil prices in 2020 has led to a dramatic decrease in the value of plastics. Companies that use plastic in their manufacturing process and/or products face difficult decisions about whether recycling is currently an economically viable option – whilst balancing it against sustainability targets. Many businesses that sell consumer goods, such as beverage companies for example, could face difficulty meeting commitments to adopt sustainable practices which includes replacing all or portions of their products with recycled plastic. Is there a risk that companies may feel forced to return to producing / using new plastic as a result of economic pressure brought on by the pandemic?⁶⁰

The attitude of the public will be key to how this situation unfolds.

There are many other factors to this complex situation that relate to our future use of plastic. Examples include social distancing protection of various sorts in our work environments, and how we can continue to ensure the recycling of plastic is viable in a changing economic environment.

The general public

Public attitude and opinion, across all demographics, towards plastic is continuing to help create change. There has been a major shift in the past five to ten years with regard to what people accept in how they personally use and dispose of plastic.

For example, many people around the world now see single-use plastic as socially unacceptable. Indeed, many young people wince merely on hearing the word “plastic” – they would no sooner buy a plastic water bottle than wear a mink coat.

The public’s prevailing attitude to how we produce, use and dispose of plastic is key to the long-term responsible and sustainable use of this versatile product.

Governments, States, Cities and International public policy

Ever more governments around the world – national and local – are taking note of the environmental, economic and social costs of plastic, and making changes to their laws and policies. Government policy in many jurisdictions is now making it financially expensive for businesses that generate waste plastic. They are looking at phasing out single-use plastic ²⁰, and at how to tax companies that do not use enough recycled plastic in things such as packaging. The actions of governments have major ramifications on what we do with plastic, and plastic waste. The challenge is not simple (and it has been made more complicated by the economic events as the world deals with the COVID-19 pandemic).

Take cheap, disposable plastic bags as an example of changing government policy, and of social attitudes. As mentioned earlier, the inventor of the plastic bag, the Swedish engineer Sten Gustaf Thulin, never intended for it to be a throwaway item when he announced it in 1959. Yet that’s what happened in the decades that ensued. Policy are now changing to be in line with public attitudes and social awareness. As of July 2019, more than 90 countries had put in place some form of ban of disposable plastic bags, and a further 36 had imposed levies and fees on their use. ¹⁷

By way of a few examples from around the world, in Tanzania, since 1 June 2019 it has not been allowed to produce, import, sell or use plastic bags. ²⁴ In July 2019, Panama became the first Central American nation to ban single-use plastic bags. ²⁵ The European Parliament has agreed to ban throwaway plastics by 2021. ²³

As an example of States and cities taking action, single-use plastic is increasingly being targeted. New York State (which includes New York City) implemented a ban on single-use plastic bags from 1 March 2020 (they are currently one of only eight States in the US to have done so).⁶³ It is estimated that New Yorkers use an incredible **23 billion** plastic bags each year. Studies show that, across the US, some 50 percent of single-use plastic bags end up as waste.²⁶ In January 2020, Jakarta joined the ever-growing number of cities to ban on single-use plastic bags.²⁷ The south Indian state, Tamil Nadu, has done so since 1 January 2020.²⁸

There is still more to do. Many countries regulate just one part of the plastic-bag lifecycle, such as manufacture, distribution or disposal. A commonly adopted approach is to charge shoppers at the till, yet we still use a huge quantity of them each year.¹⁷



The use of single-use plastic bags has been complicated as a result of the COVID-19 pandemic. As the pandemic has changed life for everyone around the world, people are being forced into making compromises – and plastic bags are part of this. In many countries domestic recycling programs were stopped or reduced because of the increased cost (the economic situation as a result of COVID-19 may make this even more challenging).

With plastic production already projected to increase by 40 percent over the next decade, there is a threat that the pandemic could unwind hard-fought measures to pare back the huge amount of plastic that is generated and enters the ocean every year. How the situation unfurls in the coming years, we will have to wait and see.⁶²

Positive action is still being taken, though. New UN rules are set to come into effect in January 2021 that will effectively prevent the US and EU from exporting any mixed plastic waste, as well plastics that are contaminated or unrecyclable. This change is anticipated to result in a big reduction in the global plastic waste trade.¹⁹

As changes occur around the world, unintended consequences may arise. China once accepted a large amount of the world's plastic waste. Their position changed in 2017 and 2018, when the country stopped accepting certain waste imports.²¹ The number of countries exporting plastic waste to China fell from 90 in 2017 to just over 40 by September 2018. However, other countries in Asia have since increased their acceptance of plastic waste from overseas, which is leading to environmental concerns about their ability to handle large volumes of recyclables. For example, Thailand and Malaysia saw an increase in imports after China's ban, but they also are looking at how much they can and should accept.

Bans on plastic waste are not always as far-reaching as they first seem to be, either. In the UK, for example, in the run-up to the December 2019 General Election the ruling Conservative Party pledged in their manifesto to ban plastic waste exports to non-OECD countries. Yet this only accounts for one third of this waste, and the biggest buyer of its waste, Turkey, is under scrutiny about how it handles it.²²

NGOs, Environmental campaigners and Not for Profit Foundations

The New Plastics Economy Global Commitment, led by the Ellen MacArthur Foundation, has gained more than 350 signatories since its launch in October 2018, including several financial institutions. It aims to create a "circular economy" for plastics, in which they never become waste. Reports from the Foundation receive global coverage and are playing an important part in highlighting the challenge to improve our use of plastic around the world.

Activists such as Greenpeace want to see plastic reduction targets enshrined in laws around the world.

Not for Profit Foundations are doing their part. For example, Minderoo Foundation, a global philanthropic organisation, announced in a US\$300 million commitment to an industry-focused initiative called "Sea the Change" to end worldwide plastic waste. "Industry, fully supported by governments and regulators, is the only sector that can drive the urgent, global shift needed to save our oceans from plastic waste," said Andrew Forrest AO, founder and chairman of Minderoo Foundation.²⁹

Academic Research and Scientists

Scientific studies are key to ensuring that we understand the impact that plastic is having on all manner of things.

Various academic institutions around the world have centres dedicated to research into plastics and how to reduce plastic waste, and its impact.

For example, the University of Cambridge has a Creative Circular Plastics Centre (CirPlas). The Centre acts as a nucleus for a global network of partners and coordinates a range of research projects, workshops and forums to tackle contemporary challenges from the manufacturing of more sustainable materials to driving innovations in plastic recycling.

The University's Chemistry Department is conducting research into alternatives to fossil-based materials for plastics, the complex factors involved in the lifecycle of plastic materials (including the behaviours of businesses and consumers) and investigating ways of using technology to reclaim or break down plastics.³⁰

The Plastic Waste Innovation Hub is being led by University College, London. Financed by the UK Research and Innovation (UKRI) and the Engineering and Physical Sciences Research Council (EPSRC), it brings together a team of UCL researchers to look into solving the UK's plastic waste problem. Their aim is to develop new ways to design-out waste from plastic packaging and create new business opportunities.³¹

An Australian federal government funded micro-factory at the University of New South Wales in Sydney, Australia (UNSW) is helping to deliver technologies that include turning discarded plastic into high-quality 3D printing filaments.³²

In a linked example, a team of researchers led by physicists at the Johns Hopkins Applied Physics Laboratory is working on a new type of lithium-ion battery that could be a game-changer for batteries. It involves mixing the electrolyte with a polymer – a material resembling a very soft plastic.¹⁶

Investigations are ongoing into microbes that could eat plastic. In 2016, scientists from Japan tested bacteria from a bottle recycling plant and found that bacteria called *Ideonella sakaiensis* 201-F6 could digest the plastic used for single-use drinks bottles, polyethylene terephthalate (PET). The bacteria was found to secrete an enzyme (a type of protein that can speed up chemical reactions) known as PETase, which splits up some chemical bonds in PET, to leave smaller molecules that the bacteria can absorb, even using the carbon contained within them as a food source. More research is being conducted to see if this could provide part of a solution to the world's mounds of plastic waste.⁵¹

And regarding innovative alternatives to plastic, the French think-tank Atelier Luma is investigating whether treated algae can be used as an alternative material.⁵⁶

Financiers and Investors

From a financial investor standpoint, there is increasing evidence that these bodies want to see evidence of well-thought-out plans to reduce carbon emissions, and to tackle all other aspects of sustainability. Plastics are part of this.

Investors in the plastics industry, and industries in which plastic is used, are demanding and expecting to see action on responsible use of this material.

The Plastic Investor Working Group, consisting of 29 global investors and convened by the UN Principles for Responsible Investment, is looking at the risks and opportunities associated with plastics.

The Plastic Solutions Investor Alliance, set up in 2018 by US non-profit As You Sow, is concentrating its engagement with consumer goods companies Nestlé, Pepsi Co, Procter & Gamble and Unilever. Nearly 40 investors have signed up, including Aviva, Axa, Candriam, Hermes, the Local Authority Pension Fund Forum and Robeco. The focus is to move from single-use plastic to reusable, recyclable or compostable plastic packaging. The alliance is asking for more transparency from the industry: for example about the extent of leakage into the environment of plastic pellets, used to make nearly all plastic products.⁵²

BlackRock, the world's largest asset manager, created a new circular economy fund in October 2019 to invest in companies which focus on sustainable business. Examples include Adidas, which has committed to using recycled plastic and recycled polyester in its products.³³

Financial institutions themselves are also making commitments about how they use plastic. For example, Barclays references its drive to remove or replace single use plastics from its business operations by 2020.³⁴

Plastics industry associations and producers

There are some very big players in the plastics industry. [Major plastics manufacturers](#) around the world are working out how to move forward with purpose, and they are working with users of plastic to make its use more sustainable.²¹

There are many [smaller, local plastic production businesses](#) around the world as well, that have an important a role to play in the future of plastic use in a sustainable and balanced way. How can all businesses involved in plastic production (including the extractive industry) and its use play their part in helping the world to tackle its economic needs whilst also meeting collective sustainability needs?

Industry associations, such as the Plastics Industry Association, provide clear information about how they are playing their part to encourage and realise sustainable use of plastic.

In their [Sustainability Statement](#), “The Plastics Industry Association encourages all companies engaged in plastics manufacturing to make sustainability a guiding principle at all levels of operation.”³⁵

Plastics Europe has [a strategy for 2030](#), which has set out targets and initiatives to prevent the leakage of plastics into the environment and maximise the reuse and recycling of plastic packaging waste.³⁶ Global industry events such as “K” (held most recently in 2019 in Dusseldorf) and Bioplastics conferences encourage innovation and new thinking.

Businesses

The role that private sector businesses play is crucial to making sustainable change in our use of plastic.

The World Business Council for Sustainable Development (WBCSD) is a founding partner for the Alliance to End Plastic Waste (AEPW), which was formed in January 2019. This Alliance consists of companies that make, use, sell, process, collect and recycle plastics. It is an initiative stretching across the value chain and provides a framework for companies to combat plastic waste in the environment.⁵⁸

The Alliance has a goal of initially funding US\$1.5 billion over five years to develop and accelerate solutions that minimise and manage plastic waste and to promote solutions such as reuse, recycling and recovery. Various projects are underway.^{58, 59}

Many individual businesses are taking action to be sustainable with their use and re-use of plastic. Many are launching positive action plans, in part driven by the demands of governments and their investors, plus campaigners and their customers. Here are just a few examples (many others exist):

A few large scale business examples include the following:

- Coca-Cola has pledged to collect and recycle the equivalent of every bottle or can it sells, globally, by 2030. The firm states that it is working to increase the recycled content in the materials it uses to make its drinks bottles, developing plant-based resins and reducing the plastics used in packaging.³⁷
In January 2020, Coca-Cola reiterated that it will not stop the use of single-use plastic bottles because consumers still want them, according to the firm's head of sustainability. The business produces some three million tonnes of plastic packaging a year - equivalent to 200,000 bottles a minute.⁵⁵
- The Danish brewer Carlsberg unveiled in October 2019 a prototype Green Fibre Bottle, which is made from sustainably-sourced wood fibres and is fully recyclable.⁴⁵
- In a further development involving both of these companies, in May 2020 the biochemicals company Avantium, based in the Netherlands, announced that it hopes to be a catalyst for investment in a pioneering project aiming to make plastics from plant sugars rather than fossil fuels. Coca-Cola, Carlsberg and Danone are all backers of it.⁶¹
- The dairy business Arla planned that by the end of 2019, they will have made 600 million fresh milk cartons renewable, and 560 million yogurt pots recyclable, which they calculate will cut 7,330 tonnes of carbon emissions. They also want to move towards 100% recyclable packaging by 2025.⁵⁴
- The toymaking giant, LEGO announced plans in September 2018 to stop the production of plastic blocks by 2030. LEGO is seeking to make its famous blocks from plant-based materials as part of reducing plastic waste.⁴²

- In October 2019 the consumer goods giant Unilever (which is part of [the SDGs](#) [“Business Avengers”](#)) announced that it would reduce the amount of plastic packaging it produces annually by about 14 per cent by 2025 across all its brands from Dove soap to Lipton tea, and to halve its reliance on non-recycled plastics.^{38, 39}
- Unilever also announced in late 2019 that it is to cut its use of virgin plastic by creating greener versions of its household products, a shift that could encourage shampoo refill stations, cardboard deodorant sticks and toothpaste tablets at supermarkets.⁶⁵ They further announced in June 2020 that they are reviewing the sourcing of materials, their manufacture and transport.⁶⁶
- The consumer goods giant Nestlé has a 2025 packaging strategy to make 100% of its packaging recyclable or re-usable by 2025. It has opened a research centre in Lausanne, Switzerland, that is focusing on the development of what the company calls “functional, safe and environmentally friendly” packaging.^{40, 41}
- The vehicle manufacturer, Volkswagen, is using recycled plastics in various components, including spare wheel compartment covers, floor coverings and wheel arch inserts (as part of a broader sustainability and recycling strategy).⁴⁴
- The energy giant BP has developed an enhanced recycling technology, BP Infinia. This technology takes what are currently unrecyclable polyethylene terephthalate (PET) – one of the most common types of plastic used for things like food packaging, as we described earlier – plastic waste and transforms it back into new, virgin-quality feedstocks, thus preventing it going to landfill or incineration. BP describes chemical recycling as a “game changer”. It plans to commercialise its technology by 2025.⁴³
- The British retail chain, Asda, has linked up with some of the UK’s best-known food and drink brands to create a “sustainability” store, in an effort to find and test new ways to eliminate unnecessary plastic and packaging.⁵⁰
- The global fast-food chain McDonalds has announced that it is expecting to remove over 3,000 metric tons of plastic from the business from 2021 by abolishing plastic “happy meal” toys.

On a smaller but equally as important scale:

- Carbios of France and Loop Industries of Canada are working on breaking down plastics into their constituents, which are converted into new materials.⁴⁶
- In the Philippines, a social enterprise called Green Antz Builders has developed a system to turn the small plastic sachets that wash up and litter the archipelago’s beaches into dark grey bricks, which can then be used to build schools and homes.⁴⁷ The start-up pays people from local communities to gather up the empty single-use packets of shampoo, toothpaste, detergent and coffee that have become a waste scourge and turns them into something useful. The Green Antz project is built on the principles of the circular economy.

- In India, where the country's environment ministry estimates that 25,000 tonnes of plastic waste each day (with an estimated 14,000 tonnes of it collected), The Garbage Café in Ambikapur, in the state of Chhattisgarh, provides food in exchange for plastic waste. The cafe's concept of bartering food for plastic waste is catching on elsewhere in the country. ⁴⁸

Small-scale activities are as worthy as large-scale ones, to make a difference together. They need to be combined with just as much effort from industry giants in all industries so that a genuine sustainable difference can be achieved.

Business opportunities exist around the world in activities such as plastic recycling and reuse. For example, we mentioned Plastic Bank earlier – a business that was founded in May 2013 with a mission to reduce the amount of plastic waste in the environment and helping to alleviate poverty in developing countries. ¹⁵

How are people responding to these initiatives?

Whilst there are many examples of commitments being stated and actions being taken by businesses, many campaigners and academics say that more needs to be done, and faster.

Will the level of innovation, including the significant push towards better and more recycling, make a real difference? There will be a continued focus on this in the years to come, and rewards will come to those who succeed.

Also, solutions to making plastic more sustainable, and reducing our consumption of it, are not always simple. It is unrealistic to expect a complete ban against the use of all plastic. We should remember that when it is used in a responsible way, it offers many benefits to society as a whole. For example, as an article in The Conversation has described, the challenge facing a company like LEGO (who are mentioned above) is to reengineer large parts of their production process and supply chain. That isn't easy, or simple, or quick to put in place. ⁴⁹ The same is true for the major consumer goods companies and how they use plastic.

What can Risk and Operations teams in various industries do?

Risk Managers and Risk Advisors in all organisations can play a valuable role in working out how they can achieve their sustainability objectives, and how to take and manage risks to do so. This is all the more important as organisations face difficult decisions as they respond to the COVID-19 pandemic. Risk professionals can be trusted advisors who can help people to think through problem-solving to achieve objectives, with the aid of risk-informed decision-making and risk tools and techniques (such as workshops, scenario analysis, risk appetite, decision trees and controls management with tools such as bow-tie analysis).

With regard to an organisation's use of plastic, Risk Managers and Risk teams should work with their colleagues in Sustainability and Operations to think through how, for their organisation's particular circumstances, they can and will use this material in a sustainable and responsible way, as part of achieving their sustainability objectives (and including how they are responding to their business requirements as a result of COVID-19).

Below are a couple of example pointers to consider. Using good Risk tools and thinking carefully through your operations can help you to find out what is most feasible and impactful to you.

Consideration	Ideas and thoughts for consideration
1. What exactly do you do?	- What do you design and / or produce, and how do you use plastic as part of your design and / or production? Whether it is physical assets or information-based assets, what can you do to help people and businesses to think through how to ensure their use of plastic is sustainable? - In your use of materials, what is your appetite for risk and how does this affect how you use different types of plastic? Do you know how much plastic you use, and how much is sent to waste? What would it take to start tracking this?
2. Where do you operate in the world?	If you operate in fast-growing emerging economies (for example, Asia, Africa and India), how can you play a part in helping people and businesses to think through how to ensure sustainable plastic use? Some parts of the world are still consuming lots of single-use plastic. Can you help to stop it?
3. Does your business use, procure or "own" a lot of plastic, in one form or another?	- How is efficient design being achieved? - How can you reduce waste, including for packaging? Wastage is a big issue to be tackled. - Are you pushing for innovation, not just "accepting traditional ways" of doing things? - Can and should you be procuring more recycled plastic than you do today? - Can bioplastics be used to meet some of your needs, in a cost-effective way? - Can you get involved with organisations such as the Plastic Bank? - As you respond to COVID-19, how does or may this impact your use of plastic – and how can your use of plastic in your response measures be responsible and sustainable?

Consideration	Ideas and thoughts for consideration
4. How much plastic packaging do you use and / or are you supplied with?	• Whatever the industry you are in, you will be supplied with goods that are packaged in plastic. Do you know how your suppliers ensure sustainability of what you receive so that plastic packaging is minimised? Do you ask them about this? • If you produce goods, are you doing enough to reduce the amount of plastic you use in their packaging? And for the packaging that you procure and use, is it easily recyclable or biodegradable? • Ensure that the plastic packaging you use is reusable. Get ahead of government changes that introduce single-use plastic bans – take the initiative and be a leader in this. • And for your packaging needs, can you avoid complex mixtures of materials that are more difficult to recycle?
5. Do you own / operate large operational sites / assets?	• Even for small things such as the food you order and stock for staff canteens and coffee shops, ensure your facilities maintenance team is procuring goods with the sustainable use of plastic in mind. Do not give out plastic spoons on your premises. • Supply the people that work at your premises – including contractors and suppliers – with “keep cups” rather than disposable ones for tea and coffee. • Consider having separate plastic recycling bins.
6. What training do you provide to your employees?	• No matter how large your organisation is, do you provide them with an overview about sustainability, including how to be responsible with the use of plastic? • Do you embrace the Circular Economy in your communications with your employees?
7. What does your supply chain look like?	• In our modern world, we have spent years, decades, honing our supply chains to be as real-time and efficient as possible. However, we have often not focused on all the materials involved, including plastics. Do you have a good understanding of how your supply chain uses plastic? • If you are responsible for producing physical assets, do you fully understand how plastic is used through your supply chain? As an example, how do they use packaging? Do you have certain policies in place as part of your Ethical Supplier Code of Conduct or similar overarching Code / Agreement? • Professional services teams can have a major influence and bearing on the production of physical

Consideration	Ideas and thoughts for consideration
	assets; considering sustainable solutions for perhaps designs or specifications of requirements has a major bearing on how we end up using plastic. Whether you are a professional services business, or you work with them, can you ask how they can play their part in the responsible use of plastic?
8. Do you partner with any academic institutions?	- Do you have any partnerships with academic labs that would be directly relevant to what you do? - If not, could you look into this?
9. Do you support funding into R&D?	- Do you provide funding into certain bodies of research or other efforts to improve how the world uses plastic? - If so, do you count this in your Sustainability reporting and contribution to the SDGs?
10. Do you know your investor expectations, for sustainability and how plastic fits into the plans?	- Presumably you are asking your investors about their expectations for sustainability, and engaging with them in how you can make a real difference to your use and reuse of plastics, and the positive impact it can have for their funds? - Do you provide them with specific examples that would be useful to them?
11. Do you know how government policy is changing where you operate, and how it could affect what you do?	- Government policies around the world towards the use of plastic for various purposes are changing. - Are you aware of the regulations that currently exist and how they could change? What risks – threats and opportunities – does this present for your organisation?

The importance of research and trying new things collectively

As we see with many types of initiatives for sustainability, collaboration between academic research, government, industry and NGOs can reap dividends. The diversity of thought from bringing different people with different perspectives together should be encouraged.

Governments can help, with policies that can encourage sustainable materials to be used. The Standards associations that determine usage specifications need to be open to different ways of achieving good outcomes in a high-quality manner.

More research in various solutions to replace plastic, change its production process, and improve the recycling of what is already produced, is continually being undertaken.

In a project led by the Ellen MacArthur Foundation to create a true “circular economy” in which plastic does not end up as waste, consumer goods companies, packaging producers, retailers and companies in the recycling industry are taking part. Currently there are about 400 companies represented.

Companies pay to join this group to help fund its work. The regular workshops they get involved in have created groups with diverse views and objectives – which is the type of group where good risk management can thrive.



Conclusion

This paper has discussed how organisations large and small, and across numerous industries, and many stakeholder groups are working to improve how the world produces and uses plastic for the betterment of the planet, and how it must be disposed of in a responsible manner, including a move away from single-use plastic.

There are many innovations taking place for the responsible and sustainable use of plastic, which we can all learn from and apply to what we do in our personal and professional activities. These innovations continue to be vital as we adapt to different ways of living as a result of the COVID-19 pandemic.

Businesses in all industries can, and should, play a part in improving responsible and sustainable plastic production, use and recycling in order to minimise waste.

Governments and policy makers also have a critical role to play.

We can all play our part. All of us, as consumers, must continue to act in a responsible manner with our use of plastic, and continue to ensure that as a society, we produce, use, dispose of and recycle plastic responsibly, in line with the SDGs.

A few things that we can all do, as individuals

There are many things we can all do, as consumers. Here are just a few examples:

1. Be responsible as an individual with your personal use of plastic. Avoid buying things that are overpackaged, or items that cannot be recycled.
2. Make the most of your reusable plastic bags (whilst appreciating any temporary restrictions in place as a result of COVID-19). People in Denmark manage to get by with just four plastic bags a year. Can everyone do likewise?
3. When you purchase packaged meals, can the packaging be recycled? If it can't, write to the producer to ask why. The more of us who ask, the more pressure there will be to be responsible.
4. Do your bit for your recycling bins. Rinse containers properly before you put them in and make the time to separate things properly (it doesn't take long).
5. Look at what some "zero waste" advocates are doing. You probably won't be able to adopt everything they advocate, but hopefully they will inspire you with some ideas to try out.

Further suggested reading and watching

The Ellen Macarthur Foundation has formed the [New Plastics Economy](#) portal to address plastic waste. Its vision includes (1) **Eliminate** all problematic and unnecessary plastic items, (2) **Innovate** to ensure that the plastics we do need are reusable, recyclable, or compostable and (3) **Circulate** all the plastic items we use to keep them in the economy and out of the environment.

Various Newspapers, including [The Guardian](#) and The Financial Times have produced some excellent series on plastic. Links to specific articles from various sources that are referenced in this paper are provided below.

National Geographic has some excellent material on plastic. Their [Planet or Plastic](#) series is well worth reading, as is [this Fast Facts page](#).

The BBC has produced some good material, including video clips, on plastic.

For example, [this short video](#) helps us to understand the subtleties of our use of plastic bags.

The Financial Times article, "[Can we break our addiction to plastic? The future of packaging](#)" is an insightful read (note: access restrictions apply).

[This article from One Green Planet](#) about an individual's drive to eliminate waste may inspire you with some ideas.

About the author

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