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The Tourism Industry and Plastic Waste Policies – Comparative Perspectives from the Portuguese Experience

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Abstract

This paper investigates the correlations between the tourism industry and plastic waste. It starts by evidencing that increase in tourism is likely to enhance the volume and improper destination of waste, including plastic, which has become a major environmental concern in touristic cities. The paper suggests that, on the other hand, negative environmental impact caused by plastic may disincentivize tourism, due to pollution in beaches and seas. As tourism grew in Portugal, the country experienced an increase in plastic waste and has taken measures to deal with the problem. Portugal passed federal legislation to ban single-use plastic tableware as of 2020. Companies, NGOs, and the government are also joining forces to reduce plastic waste and increase recycling initiatives. These are examples to follow as the European Union and internationally-recognized NGOs, such as WWF, put fighting plastic waste as one of the main goals to cities' environmental sustainability in the forthcoming decades.

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I – Introduction

In recent years, the tourist industry experienced exponential growth. Worldwide international tourist arrivals (overnight visitors) grew 4% in the period from January to September 2019 compared to the same period in 2018. This data, offered by the World Tourism Organization (UNWTO), encompasses the Middle East, Asia, the Pacific, Africa, Europe, and the Americas. In 2019, all of those regions experienced growth in tourism.⁴

That includes Portugal, one of the fastest growing destinations in the world. According to the World Travel & Tourism Council (WTTC), in 2019, Portugal was expected to experience a 5.3% in tourism growth, more than twice the average European rate of 2.5%. According to a survey conducted by WTTC in 2018, one out of each five Euros in revenues generated in the country came from the tourism industry, which was also responsible for 21.8% of the jobs.⁵

This paper focuses on the relationship between this growing worldwide tourism industry and an increased trend to reduce plastic waste, building from the Portuguese experience. The purpose is to discuss causes, consequences, and how to fight increase in plastic waste generation as one of the major negative externalities linked to tourism industry cities usually experience: plastic waste generation.

Plastic's commercial production dates back to the 1930s and 1940s. Since then, it has become increasingly dominant in the consumer marketplace.⁶ Due to its strength, low weight, impermeability, and malleability, plastic is a worthwhile option for a wide range of uses that benefit human living,⁷ from packaging (being of sum importance for the food industry by keeping food safe for consumption), to civil construction, manufacturing of medical equipment, toys, footwear, electronics, automobiles, and even aircrafts. Despite these advantages, plastic has a range of negative environmental and social impacts that must be properly managed.

Plastic pollution is a relatively new environmental problem with poor data produced thus far. The first reports of plastic pollution in the oceans, for example, appeared in the scientific literature in the early 1970s.⁸ Yet, currently, there are no precise estimates of the amount and origin of plastic debris entering the marine environment. Researchers also highlight that levels of disclosure on plastic waste are poor,⁹ which hinders the establishment of an accurate picture of this global environmental problem.

⁴According to the World Tourism Organization (UNWTO). Available at <https://www.e-unwto.org/doi/pdf/10.18111/wtobarometereng.2020.18.1.1> Accessed in February, 2020.

⁵ Information reproduced at <https://www.e-unwto.org/doi/pdf/10.18111/wtobarometereng.2020.18.1.1https://expresso.pt/economia/2019-10-04-Portugal-esta-a-ter-o-maior-crescimento-turistico-da-Europa>.

⁶ Jambeck, Jenna R. et al. Plastic waste inputs from land into the ocean, *Science*, 347(6223), 768–771 (2015).

⁷ UNEP. Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry (2014). Available at <http://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuing%20plastic%3a%20the%20business%20case%20for%20measuring%2c%20managing%20and%20disclosing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y>. Accessed in February, 2020.

⁸ Jambeck, Jenna R. et al. Plastic waste inputs from land into the ocean, *Science*, 347(6223), 768–771 (2015).

⁹ UNEP. Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry (2014). Available at <http://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuing%20plastic%3a%20the%20business%20case%20for%20measuring%2c%20managing%20and%20disclosing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y>.

However, this is likely to change fast in the years to come, calling for immediate action in many different fields, including the tourism industry. For instance, as a downside of tourism growth, the city of Lisbon experienced a 10% increase in waste generation from 2015 to 2018, with plastic packages playing a main role. In response, the city decided to fiercely fight the use of plastic in services vacationed to tourism. As part of this policy, as of 2020, bars and restaurants in Lisbon are banned from giving patrons beverages in single-use, plastic containers. This measure is part of the city's Urban Waste Management, Hygiene and Cleanliness strategy,¹⁰ and is aligned with the national ban on single-use plastic tableware in the country approved by the Republican Assembly, which entered into force in September 2020. And, the problem is experienced beyond Lisbon. News based upon a report from the World Wildlife Fund (WWF) on plastic inform that plastic was 72% of the waste found in Portuguese beaches as of 2018.¹¹

This paper intends to draw attention to the plastic waste problem in touristic cities. The hypothesis behind the argument is that plastic waste is already a major concern worldwide, and touristic cities are likely to experience great negative externalities if the problem is not addressed properly. Besides reviewing the literature and data on plastic waste and tourism, the paper uses the Portuguese experience as a case study.

The main message this paper addresses is that regulating both the use and waste of plastic in urban areas is of utmost importance within a well-planned tourism policy, even more so for cities experiencing the threats of over tourism, such as Lisbon, Portugal. The country is moving ahead with its "Tourism Strategy 2027," under which it intends "to reaffirm tourism as a tool for economic, social and environmental development in Portugal as well as to position Portugal as one of the most competitive and sustainable tourism destinations of the world."¹²

In order to detail the causes and consequences of plastic waste in touristic cities, this paper is divided as follows. Section II presents evidence of positive correlation between increase in tourism and increase in plastic waste. Section III focuses on the adverse consequences that plastic causes to population and the need of regulation to deter increase of this type of waste. Section IV details the problem by focusing on the damages caused to sea life by microplastics, which impacts the tourist production chain that relies on natural sea attractions, such as beaches and sea life watch (such as dolphin, whale, and shark observation). Section V presents initiatives to deal with plastic waste. Section VI comments on regulatory strategies in this regard. Section VII calls for environmental education, awareness building, and voluntary education as part of the solution to reduce plastic waste originated from the tourism industry. At the end, we summarize the main findings of the research.

[osing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y](#). Accessed in February, 2020.

¹⁰ Lisbon declares war on plastic waste, The Portugal News, January 14, 2019, <https://www.theportugalnews.com/news/lisbon-declares-war-on-plastic-waste/48025>. Accessed in March, 2020.

¹¹ Plastic makes up 72 percent of waste on Portuguese beaches, The Portugal News, June 14, 2018, <https://www.theportugalnews.com/news/plastic-makes-up-72-percent-of-waste-on-portuguese-beaches/45896> Accessed in March 2020.

¹² Portugal leading the tourism of the future, One Planet Network, February 4, 2019, <https://www.oneplanetnetwork.org/initiative/portugal-leading-tourism-future>. Accessed in March 2020.

II – The Risk of Over Tourism and the Plastic Industry

The underlying reasons for current, fast-growing rate in tourism are manifold. They include the rising of sharing economy, such as new sources of more affordable accommodations (e.g. Airbnb) and transportation (e.g. Uber); expansion of the airfare market, with diversification of routes; decrease of rates and easement for booking procedures; and a rising prosperity in countries like China and India, creating a huge demand for tourism,¹³ among others. Some will also stress climate change effect as a potential variable explaining the growing tourism rates worldwide. Climate change would extend summer, which would, in result, expand the travel period.¹⁴

As a result of the growing tourism industry, city planning gains even greater importance in an urbanized world. Emphasizing tourism as part of a city's policy is likely to mean more people circulating and residing for short periods of time. As a result, the cities suffer the risks of gentrification, affordable housing deficits, and precarious urban infrastructure. Over tourism in saturated urban areas can be a source of many other externalities, both positive and negative, on hotels, renting venues, and hostels; street circulation enjoyment and public transportation; and public waterworks, waste management and sewage systems. These are all examples of urban infrastructure and services impacted by a growing tourism industry.

The natural environment is also a source of both opportunities and preoccupation due to the overflow of tourists. On the one hand, natural wonders, such as forests, beaches, rivers, and mountains, because they translate into great tourist attractions in many destinations, can be a good source of revenue. With proper legal and institutional design, those natural environmental tourist attractions can generate enough revenues to fund their preservation costs. On the other hand, however, if left uncontrolled and poorly managed, tourism can result in negative environmental and urban impacts. A vast range of impacts can be cited as examples: growth of greenhouse gas emissions and other types of air pollution as a result of tourists' demands for transportation; pressure on water resources to supply the increased demand; increased use of the public sewage system in high seasons; high waste generation and illegal disposal in visited sites; visual and noise pollution, among others.

Thus, a healthy environment (urban or natural), which is central for touristic activities, is many times negatively impacted by these same activities when destinations are not adequately prepared for receiving touristic flows, and when tourists and locals lack consciousness on the need of environmental safeguard. In Portugal, during Study Space Lisbon in 2019, we were able to learn from different experts how over-tourism is becoming a great source of preoccupation in different European cities, mainly the capitals, on issues such as affordable housing, waste generation, gentrification, and urban disturbance.¹⁵

¹³ According to the World Tourism Organization (UNWTO), China is the world's largest spender, with one fifth of international tourism spending. Available at <https://www.e-unwto.org/doi/pdf/10.18111/9789284421152>. Accessed in February, 2020.

¹⁴ Lisa Abend, *Europe Made Billions from Tourists. Now It's Turning Them Away*, TIME, July 26, 2018, <https://time.com/magazine/south-pacific/5349687/july-26th-2018-vol-192-no-5-international/>. "Even climate change plays a role, as warmer temperatures extend summer seasons and open up previously inaccessible areas."

¹⁵ For further information, see: Stone, Rebecca, *Lisbon's Overtourism Lesson: Living Like a Local is Not Enough*, Skift, May 31, 2018, available at: <https://skift.com/2018/05/31/lisbons-overtourism-lesson-living-like-a-local-is-not-enough/>; Ko Koens, Albert Postma, & Bernadett Papp. (2018). *Is Overtourism Overused? Understanding the Impact of Tourism in a City Context*. Sustainability, (12), 4384. <https://doi.org/10.3390/su10124384>, available for download at: <http://www.maestro-tdc.com/is-overtourism-overused-understanding-the-impact-of-tourism-in-a-city-context/>; Burgen, Stephen, *How tourism is killing Barcelona – a photo essay*, The Guardian, August 30, 2018, available at:

Notwithstanding, tourism brings about many positive externalities. This industry is a great source of revenue for cities and countries. In August 2019, for example, Portugal has received 3020.03 EUR million in revenue from tourism.¹⁶ According to the World Tourism Organization (UNWTO), revenues from international tourism reached a total US\$1.7 trillion in 2018. This accounts for 29% of global service exports and 7% of overall exports of goods and services. This data consolidates international tourism among the top five economic sectors in the world, behind chemical manufacturing and the fuel industry, but ahead of the food and automotive industries. Tourism creates direct and indirect jobs fostering the local economy.¹⁷ It can also revitalize degraded areas (as the population of traditional neighborhoods grow older and younger people move to the suburbs looking for more space and modern living conditions), refresh the life of cities (with events, shows, and activities in public spaces) and bring awareness for the need of protecting historical heritage.¹⁸

In such a complex scenario of pros and cons of tourism growth, increase of plastic waste has become a major concern. Indeed, plastic has become one of the world's biggest sources of environmental preoccupation. As the United Nations' Environment Program (UNEP) stresses, "if growth in plastic production and incineration continue, cumulative emissions by 2050 will make up between 10 and 13 percent of the total remaining global carbon budget. As a result, the implications of plastic overconsumption extend even further than the litter that is visible in the ocean." To fight this trend, UNEP launched the Global Tourism Plastics Initiative, which aims "to bring the tourism sector together under a common vision to transition to a circular plastic economy and sustainability in the sector."¹⁹ This is great evidence that environmental and urban-touristic policies must be aligned to reduce plastic and to improve recycling and other conservative measures.

As outlined in the introduction, the rise in tourism can most definitely result in great social and economic benefits. However, if this industry is not properly regulated, it can also be

<https://www.theguardian.com/travel/2018/aug/30/why-tourism-is-killing-barcelona-overtourism-photo-essay>; Sinking City: How Venice is Managing Europe's Worst Tourism Crisis, The Guardian, April 30, 2019, available at: <https://www.theguardian.com/cities/2019/apr/30/sinking-city-how-venice-is-managing-europes-worst-tourism-crisis>; O'Sullivan, Feargus, Their Street is Famous on Instagram, and They Can't Take it Anymore, CityLab, March 5, 2019, available at: https://www.citylab.com/life/2019/03/rue-cremieux-paris-instagram-tourists-where-to-take-pictures/584164/?utm_campaign=citylab-daily-newsletter&utm_medium=email&silverid=%25%25RECIPIENT_ID%25%25&utm_source=newsletter; Boffey, Daniel, 'We must act now': Netherlands tries to control tourism boom, The Guardian, May 6, 2019, available at: https://www.theguardian.com/world/2019/may/06/we-must-act-now-netherlands-tries-to-control-tourism-boom?CMP=share_btn_link; Airbnb listings in Japan rebound after regulatory freeze, June 6, 2019, available at: <https://www.japantimes.co.jp/news/2019/06/06/business/airbnb-listings-japan-rebound-regulatory-freeze/#.XPlvYkc1RWA>

¹⁶ Portugal Tourism Revenues, Trading Economics, <https://tradingeconomics.com/portugal/tourism-revenues>. Accessed in March, 2020.

¹⁷ <https://www.unwto.org/global/press-release/2019-06-06/exports-international-tourism-hit-usd-17-trillion>. Accessed in March, 2020.

¹⁸ As noted by Ko Koens, Albert Postma, & Bernadett Papp. (2018). Is Overtourism Overused? Understanding the Impact of Tourism in a City Context. *Sustainability*, (12), 4384. <https://doi.org/10.3390/su10124384>, available for download at: <http://www.maestro-tdc.com/is-overtourism-overused-understanding-the-impact-of-tourism-in-a-city-context/>. Accessed in March, 2020.

¹⁹ Tourism to tackle plastic pollution with new commitment, UN environment programme, January 29, 2020, <https://www.unenvironment.org/news-and-stories/story/tourism-tackle-plastic-pollution-new-commitment>. Accessed in March, 2020.

a source to many negative externalities. In general, governments stimulate the tourism industry with uncoordinated and unplanned policies. Sometimes, those policies lead to over-tourism. Whenever that is the case, the downside of over-tourism cannot be undervalued.

Against this background, one major environmental challenge lies over the high production, use, and disposal of plastics. The overwhelming rise of plastic pollution is a negative externality that has been standing out in national and international agendas. Plastics make already for a strong presence in modern societies. In touristic spots, however, use and disposal of plastic items are amplified by the increase in the population, mainly in high seasons. With that, the risks of illegal or unsuitable disposal of this dangerous material rise proportionately.

Nevertheless, because of its complexity, the topic already occupies an important space in governmental agendas and is the subject of many discussions among civil society organizations. In a recent World Economic Forum Annual Meeting in Davos, plastics made for a recurrent topic, sharing space with major environmental issues of past years, like, for instance, climate change.²⁰ As part of the 2030 Agenda for Sustainable Development adopted in 2015 by all United Nations Member States, 17 Sustainable Development Goals (SDGs)²¹ were defined as needing urgent call for action. Out of 17 goals, 2 are directly linked to plastic pollution: Goal 12 – to ensure sustainable consumption and production patterns; and Goal 14 – to prevent and significantly reduce marine pollution of all kinds. Committed to act at a global level, and seeking implementation of the SDGs, in May 2018, the European Commission proposed rules to target the ten single-use plastic products mostly often found on European beaches and seas.²²

Tackling tough plastic pollution has become part of the international sustainable development agenda. Considering over-tourism can be one significant contributor to plastic waste generation, policies designed to regulate this industry must address this issue seriously. The regulatory caveat is that under a tourism policy, plastic control measures shall be construed at all levels of government, from international soft and hard laws, to national and local legislation and rules. Evidence of such need to address plastic waste from international trends to local policies is illustrated by the case of the Mediterranean Sea.

Yearly, more than 200 million tourists visit the Mediterranean countries. According to WWF, “Every year, 0.57 million tons of plastic enters Mediterranean waters - the equivalent of dumping 33,800 plastic bottles into the sea every minute.” The NGO forecasts that plastic waste generation in the region is expected to quadruple by 2050.²³

Portugal is the first country to experience the consequences of this scenario, as it is in the route to the sea’s mouth. The report from WWF mentions that 20% of fish in Portugal have microplastic in their stomachs, and that plastic represents 72% of all waste found in Portuguese

²⁰ As noticed by Robin Pomeroy in <https://www.weforum.org/agenda/2020/01/how-to-save-the-planet-davos-climate-pollution-what-to-know/>. See also <https://www.weforum.org/agenda/archive/plastics>. Accessed in February, 2020.

²¹ For information on UN Sustainable Development Goals, see <https://sustainabledevelopment.un.org/>. Accessed in February, 2020.

²² For information, see https://ec.europa.eu/environment/waste/plastic_waste.htm. Accessed in February, 2020.

²³ Flawed plastic system hits the Mediterranean Sea and its economy, WWF, June 7, 2019, http://www.wwfmmi.org/newsroom/latest_news/?uNewsID=348053. Accessed in March, 2020.

beaches and industrial zones - the worst areas being Lisbon and Vicentine, due to their proximity to the Tagus' and Sado's estuaries.²⁴

As tourism grows, so does waste and plastic consumption. In 2019, an initiative congregating companies, NGOs, and the government – called the “Transformar Project” – reported having collected 2.6 tons of plastic during the summer season on the Portuguese beaches, almost twice the amount that had been collected in the preceding year (1.5 tons).²⁵

III – The Overall Impacts of the Plastic Industry (manufacturing, consumption, and disposal) and the Need for Tighter Regulation

Although the most apparent form of plastic pollution materializes in the images of plastic bags and straws damaging sea life, many stages of the plastic lifecycle pose risks to the environment and to human health.

Plastic is a petroleum-based product. In addition, plastic manufacturing is energy intense. In most countries, electricity still relies on fossil fuel sources, mainly coal. Furthermore, approximately 4% of oil production is used in plastic products, and another 4% is used to fuel the manufacturing process.²⁶ Therefore, plastic itself and its manufacturing process are directly linked to all negative externalities associated with the fossil fuel industry. The most notable one, of course, being climate change due to greenhouse gas emissions associated to the use of fossil fuels.

Another relevant impact of the plastic industry relates to the use of chemical additives in fillers, plasticizers, stabilizers, flame retardants and colorings.²⁷ Chemicals are largely used to improve performance of the final product. Relevant studies also demonstrate that transformation of oil into plastic resins is responsible for the release of carcinogenic and other toxic substances into the air, water, and soils.²⁸ The scientific disclosure of those serious environmental and health risks serves to further demonstrate the wide array of negative impacts of the plastic chain.

For its heavy reliance on fossil fuels and processed chemical substances, the plastic industry is disheveled with the global sustainable development goals. More specifically, with SDG goal 7 of ensuring access to sustainable energy for all and with SDG goal 13 calling for

²⁴ TSF Radio Noticias. <https://www.tsf.pt/sociedade/ambiente/portugal-e-o-primeiro-pais-a-sofrer-consequencias-do-lixo-no-mediterraneo-9421626.html>. Accessed in March, 2020.

²⁵ Mais de duas toneladas de plástico recolhidas das praias durante o verão, <https://www.sabado.pt/portugal/detalhe/mais-de-duas-toneladas-de-plastico-recolhidas-das-praias-durante-o-verao> Accessed in March, 2020.

²⁶ UNEP. Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry (2014). Available at <http://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuing%20plastic%3a%20the%20business%20case%20for%20measuring%2c%20managing%20and%20disclosing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y>. Accessed in February, 2020.

²⁷ UNEP. Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry (2014). Available at <http://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuing%20plastic%3a%20the%20business%20case%20for%20measuring%2c%20managing%20and%20disclosing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y>. Accessed in February, 2020.

²⁸ See David Azoulay et. al. Plastics and Health: the hidden cost of a plastic planet. Center for International Environmental Law, 2019. Available at <https://www.ciel.org/wp-content/uploads/2019/02/Plastic-and-Health-The-Hidden-Costs-of-a-Plastic-Planet-February-2019.pdf>. Accessed in February, 2020.

urgent action to combat climate change. Contemporary approaches call for products with reduced environmental impacts. Based on its current manufacturing process, this is not the case of plastics for the above-described environmental footprints.

Once we turn to the consumption aspect of the plastic industry, environmental negative impacts are still just as relevant as those of the manufacturing process. Once plastic products hit the market, current uses suggest an unsustainable consumption pattern. The *Financial Times* reported recently that the demand for plastic in the past 50 years has grown more than any other material used in large scales such as steel, aluminum, and cement. The numbers revealed almost double a consumption increase since the beginning of the 2000, according to the International Energy Agency, as cited by the *Financial Times*.²⁹

The largest market share for plastic products is still packaging. This is highly problematic because packaging confers to plastics just a very short lifespan, prone for immediate use and disposal.³⁰ When we link that to the tourism industry, limited areas, such as parts of a city (like downtown Lisbon), environmental scenic places, or historical sites overcrowded by seasonal influx of tourists, can aggravate the packaging problem (use and disposal of). This preoccupying aspect of the tourism industry matches the data on the lifecycle of plastics packaging. Most of the plastic used for packaging leaves the economy the same year it is produced.³¹ In other words, the worst of all scenarios: negative environmental impacts in the manufacturing stage, extremely short consumption lifecycle, and the negative environmental impacts of disposal. To fight a product's negative externality, policymakers must regulate it efficiently. In places prone to over-tourism, a well-designed plastic regulation becomes even more important.

But, packaging is only part of the problem. An important one, but not the only one. In 2018, the word "single-use" was elected by Collins Dictionary as the word of the year.³² In many places, during the summer of that same year, plastic straws became a hot topic for environmentalists.³³ Plastic bags are also representative of this issue, being described as the world's number one consumed item.³⁴ In 2010, 92% of the 95.5 billion plastic bags placed on the EU market were single-use.³⁵ These numbers reveal that managing the disposal of such

²⁹ Michael Pooler, Surge in plastics production defies environmental backlash, *Financial Times*, February 12, 2020, <https://www.ft.com/content/4980ec74-4463-11ea-abea-0c7a29cd666e>. Accessed in February, 2020.

³⁰ Jambeck, Jenna R. et al. Plastic waste inputs from land into the ocean, *Science*, 347(6223), 768–771 (2015).

³¹ David Azoulay et. al. Plastics and Health: the hidden cost of a plastic planet. Center for International Environmental Law, 2019. Available at <https://www.ciel.org/wp-content/uploads/2019/02/Plastic-and-Health-The-Hidden-Costs-of-a-Plastic-Planet-February-2019.pdf>. Accessed in February, 2020.

³² <https://edition.cnn.com/2018/11/06/health/word-of-year-scli-intl/index.html>. Accessed in February, 2020.

³³ Morath, Sarah, Our Plastic Problem (February 22, 2019). 33 *Nat. Resources & Env't* 45 (2019); U of Houston Law Center No. A-1. Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3340072. Accessed in February, 2020.

³⁴ UNEP. Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations (2018). Available at <https://www.unenvironment.org/resources/publication/legal-limits-single-use-plastics-and-microplastics-global-review-national>. Accessed in February, 2020

³⁵ UNEP. Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry (2014). Available at <http://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y>. Accessed in February, 2020.

extremely high volumes of plastic properly is a challenge that lawmakers will have to confront immediately.

Inadequate plastic waste discharge in uncontrolled open landfills,³⁶ open burning, disposal in waterways and in poorly managed disposal sites can lead to pollution of fields, streets, beaches, forests, waterways, and even reach the ocean, impacting marine life that often die after consuming plastic, mistaking it for seaweed or other sources of feeding. This has a huge impact in Açores, for instance, where young marine turtles usually go to search for food. According to WWF, around 80% of turtles eat waste, which, in most cases, is plastic waste.³⁷

In urban areas, plastics can clog drainage systems and impair the sewage treatment infrastructure, contributing to problems, such as floods and creating habitats for disease-carrying vectors like mosquitoes. For touristic matters, visual pollution (aesthetic) caused by plastic trash can represent a significant negative impact in touristic activities in natural and cultural landscapes. Over-tourism, especially in developing countries with poor waste management infrastructures, can constitute a relevant source of the plastic disposal problem.

IV – Plastic Pollution – Reaching the Natural Sea Environment and the Problems of Microplastics

When plastic materials reach the environment, controlling them becomes much harder. Some plastic additives do not fix to the polymer matrix and spread into the surrounding environment,³⁸ becoming available again for direct or indirect human and environmental exposure. Besides mismanaged waste, either littered or inadequately disposed, eventually can reach oceans through waterways, wastewater outflows, or wind and tides. That is why marine wildlife is particularly vulnerable to plastic pollution, making the marine environment a subject of increasing concern.

Plastic represents up to 80% of total waste in marine litter surveys³⁹ and has been found on coastlines, in Arctic sea ice, at the sea surface, and on the seabed.⁴⁰ To highlight the importance and urgency of the nature of this pollution, one study forecasts that by the year 2050 there will be more plastic in the ocean than fish.⁴¹ Plastics loose in the oceans can harm several levels of the biological chain, beginning at the very top with big mammals, like whales,

³⁶ A World Bank research points that more than 25% of plastic waste is dumped openly. Kaza S, Yao LC, Bhada-Tata P, van Woerden F. *What a Waste 2.0: A global Snapshot of Solid Waste Management to 2050*. Washington, DC, 2018). Available at <https://openknowledge.worldbank.org/handle/10986/30317>. Accessed in February, 2020.

³⁷ <https://www.tsf.pt/sociedade/ambiente/portugal-e-o-primeiro-pais-a-sofrer-consequencias-do-lixo-no-mediterraneo-9421626.html>. Accessed in March, 2020.

³⁸ See Thomas Roy Crompton, *Additive Migration from Plastics Into Foods: A Guide for Analytical Chemists*. Smithers Rapra Technology Limited (2007).

³⁹ UNEP. *Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry* (2014). Available at <http://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuing%20plastic%3a%20the%20business%20case%20for%20measuring%2c%20managing%20and%20disclosing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y>. Accessed in February, 2020.

⁴⁰ Jambeck, Jenna R. et al. Plastic waste inputs from land into the ocean, *Science*, 347(6223), 768–771 (2015).

⁴¹ EMF. “The new plastics economy: Rethinking the future of plastics & catalysing action” (2017). Available at: https://www.ellenmacarthurfoundation.org/assets/downloads/publications/NPEC-Hybrid_English_22-11-17_Digital.pdf. Accessed in March, 2020.

going all the way down to bivalves, grasses, and corals. In between, turtles, fishes, and mollusks are also greatly impacted by the overabundance of plastics in the oceans.

Whenever plastics are broken down into smaller pieces, they become even more dangerous. This process happens when plastic debris undergoes fragmentation into smaller pieces. The resulting plastic waste is generally known as microplastics.⁴² In this microformat, plastics may be ingested by small marine invertebrates and pose a serious and concrete threat to the ecosystems of coral reefs, shallow bays, and estuaries.⁴³ Microplastics can also seep into soil, water, and air. Small-size plastic debris spreads out in the marine environment globally, is extremely difficult to remove, and usually untraceable to its source. Without a known source, construing liability laws, even internationally, becomes an unsurmountable obstacle for lawmakers.

Microplastics are also a source of great human health risks. When introduced at the very bottom of the food chain, particles of plastics and chemicals used in the manufacturing process can navigate upstream all the way into the food chain reaching humans by the ingestion of seafood. This health risk is currently under scrutiny of the scientific community, but concerns arose already. Potential human health risks include physical damage leading to cellular necrosis, inflammation and lacerations of tissues in the gastrointestinal tract,⁴⁴ and concerns related to the bioaccumulation and biomagnification of chemicals into the human body.⁴⁵

The potential negative impacts are not only related to environmental and human health aspects. Plastic pollution in oceans raises serious economic concerns as well. Studies assessing the costs of the potential harm caused by plastic waste are important for building an overall understanding regarding the magnitude of the economic impacts. One study estimates losses of approximately US\$8 billion annually linked to plastic waste in oceans, including revenue losses from fisheries, aquaculture, and marine tourism industries, in addition to the cost of cleaning up litter on beaches.⁴⁶ Another study by the Asia-Pacific Economic Cooperation

⁴² According to the Group of Experts on the Scientific Aspects of Marine Environmental Protection “There is no internationally agreed definition of the size below which a small piece of plastic should be called a microplastic. Many researchers have used a definition of <5 mm, but this encompasses a very wide range of sizes, down to nano-scales. Some microplastics are purposefully made to carry out certain functions, such as abrasives in personal care products (e.g. toothpaste and skin cleaners) or for industrial purposes such as shot-blasting surfaces. These are often termed ‘primary’ microplastics. GESAMP. “Sources, fate and effects of microplastics in the marine environment: a global assessment” (2015). (Kershaw, P. J., ed.). (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 90, 96 p.

⁴³ Rochman, C. M. et al. Anthropogenic debris in seafood: Plastic debris and fibers from textiles in fish and bivalves sold for human consumption. *Sci. Rep.* (2015), 5.1434010.1038/srep14340.

⁴⁴ See David Azoulay et. al. *Plastics and Health: the hidden cost of a plastic planet*. Center for International Environmental Law, 2019. Available at <https://www.ciel.org/wp-content/uploads/2019/02/Plastic-and-Health-The-Hidden-Costs-of-a-Plastic-Planet-February-2019.pdf>. Accessed in February, 2020.

⁴⁴ Surge in plastics production defies environmental backlash, <https://www.ft.com/content/4980ec74-4463-11ea-abea-0c7a29cd66fe>. Accessed in February, 2020; Rochman, C. M. et al. Perceived and demonstrated ecological impacts of marine debris. *Ecology, in review*. in press; GESAMP. “Sources, fate and effects of microplastics in the marine environment: a global assessment” (2015). (Kershaw, P. J., ed.). (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 90, 96 p.

⁴⁵ Rochman, C. M. et al. Anthropogenic debris in seafood: Plastic debris and fibers from textiles in fish and bivalves sold for human consumption. *Sci. Rep.* (2015), 5.1434010.1038/srep14340.

⁴⁶ UNEP. *Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry* (2014). Available at <http://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuing%20plastic%3a%20the%20business%20case%20for%20measuring%2c%20managing%20and%20disc>

(APEC) found that in 2008, marine debris was estimated to have directly cost the 21 member economies approximately US\$1.265 billion.⁴⁷

In Scotland, the economic cost of marine litter has been estimated at around US\$28 million annually. In the UK, the annual costs local authorities incur to clean up plastic litter from beaches add to around US\$24 million. In the U.S., west coast communities spend more than US\$520 million per year to handle the detrimental impacts of littering.⁴⁸ Those high estimates, though, are not only borne by national governments and local communities. Because they have the potential to impair assets of great touristic values, costs can be much higher as other industries, such as tourism, are impacted.

Ocean pollution by plastic is closely linked to tourism, given that beaches and marine activities (seawater and freshwater angling, sailing and boating, water sports, and inland cruises) constitute an important part of this business. An UNEP study estimated that 3% of global marine tourism revenue was lost because of marine litter, representing a yearly revenue loss of US\$4 million.⁴⁹ For Portugal, a country that currently relies very heavily on its high touristic attractiveness (tourism represented 9% of Portugal's GDP in 2018⁵⁰), the plastic pollution impact is of utmost concern.

A 2018 report requested by the European Parliament's Committee on Transport and Tourism (TRAN) lists the impacts caused by excessive tourism in several countries. Of the 18 types of impacts listed, pollution or waste-related problems were found in 51% of the 41 cases studied.⁵¹ In Maya Bay in Phi Phi Leh, Thailand, for example, biologists concluded that 80% of the coral reefs surrounding the bay have been destroyed by boat traffic and pollution; marine life is virtually non-existent as a result.⁵² Another research study found that booming tourism is responsible for an increase of solid waste generation in Palau, a country in the North Pacific. The country's waste system has been inundated with waste, out of which 32% is plastic.⁵³

[osing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y](https://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuing%20plastic%3a%20the%20business%20case%20for%20measuring%2c%20managing%20and%20disclosing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y). Accessed in February, 2020.

⁴⁷ Mcilgorm, A., Campbell, H. and Rule, M. 2008. Understanding the Economic Benefits and Costs of Controlling Marine Debris in the APEC Region. [report] Coffs Harbour: APEC Marine Resources Conservation Working Group.

⁴⁸ UNEP. Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry (2014). Available at <http://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuing%20plastic%3a%20the%20business%20case%20for%20measuring%2c%20managing%20and%20disclosing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y>. Accessed in February, 2020.

⁴⁹ UNEP. Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry (2014). Available at <http://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuing%20plastic%3a%20the%20business%20case%20for%20measuring%2c%20managing%20and%20disclosing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y>. Accessed in February, 2020.

⁵⁰ <https://forbes.com.br/listas/2018/05/15-paises-onde-o-turismo-mais-impulsiona-a-economia/>. Accessed in March, 2020.

⁵¹ Peeters, P. et al., 2018, Research for TRAN Committee - Overtourism: impact and possible policy responses, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels.

⁵² Peeters, P. et al., 2018, Research for TRAN Committee - Overtourism: impact and possible policy responses, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels.

⁵³ Kaza S, Yao LC, Bhada-Tata P, van Woerden F. What a Waste 2.0: A global Snapshot of Solid Waste Management to 2050. Washington, DC, (2018). Available at <https://openknowledge.worldbank.org/handle/10986/30317>. Accessed in February, 2020.

By being a coastal country, attracting tourists for major beach spots such as Algarve and even Lisbon (the oceanside of the lower Lisbon area), fighting nationally and locally against plastic pollution, without undermining regional (EU) and international initiatives, result in direct environmental, human and economic benefits for Portugal, its citizens and its tourism and fishery industries. All in all, despite the necessity of further scientific investigation on the causal relationship between plastic pollution and some of the risks detailed herein, plastic pollution is most certainly calling for concerted efforts towards considering and designing some degree of control through legal and regulatory tools.

V – Handling Plastic Waste

In 2014, a broad research study supported by the United Nations Environment Program (“UNEP”) and the Global Partnership on Marine Litter (“GPML”) aimed at providing an overall assessment of the scale of the impacts of plastic waste and at highlighting the importance of handling plastic waste properly. The UNEP/GPML report quantified the physical impacts of plastic use translated into monetary terms in order to reveal the costs companies would incur if the damages caused by plastic waste were internalized by them.

The study stressed the need for businesses to measure, manage, and disclose information on their annual use and disposal of plastics as a first step for a thorough and accurate assessment. It also enumerated and described risks and opportunities facing companies that are intensive users of plastic:

“Risks include the impact of tougher environmental legislation such as bans on disposable plastic bags, carbon pricing schemes and chemicals regulation, damage done to the reputation of brands targeted by campaigners over their association with plastic litter, clean-up costs and disruption to the plastic supply chain caused by resource scarcity and price volatility. Opportunities include cutting costs through more efficient use of plastic, developing new revenue streams through ‘closed loop’ business models that recover plastic as a useful resource, and winning customers by demonstrating more sustainable products.” Based on its key findings, the research provides recommendations for companies to cut costs in its process by using fewer inputs and achieve the same economic output with less waste.⁵⁴

The UNEP/GPML findings summarized above reveal that handling plastic waste properly must climb the priority list of any environmentally responsible corporation. Greater awareness throughout nations and consumers of the risks associated with plastic wastes have called for corporate action. The handling of plastic waste is now part of the regulatory, reputational, and financial risks due to the strengthening in restrictions and to consumer preferences. Once a part of these categories of risks, handling plastic waste properly is no longer an option.

Once plastics are disposed of, various methods of handling the waste are employed. Among them worth noticing are combustion technologies. Those include incineration, co-

⁵⁴ UNEP. *Valuing Plastics: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry* (2014). Available at <http://wedocs.unep.org/bitstream/handle/20.500.11822/9238/-Valuing%20plastic%3a%20the%20business%20case%20for%20measuring%2c%20managing%20and%20disclosing%20plastic%20use%20in%20the%20consumer%20goods%20industry-2014Valuing%20plasticsF.pdf?sequence=8&isAllowed=y>. Accessed in February, 2020.

incineration, gasification, and pyrolysis.⁵⁵ While these methods may be efficient in eliminating plastic waste, they are also a source of environmental preoccupation due to their greenhouse gas emissions. And, if poorly managed, combustion technologies can be a relevant source of local pollution due to the release of toxic metals like lead and mercury, organic substances like dioxins and furans acid, as well as gases and other toxic substances that can contaminate air, water, and soil.⁵⁶

Recycling is often cited as the best method to handle plastic waste. Although promising with well-known environmental benefits, the recycling of plastic faces limitations. Estimates show that between only 14 to 16% of global plastic waste is recycled.⁵⁷ In 2015, over 400 million metric tons of plastic was produced worldwide, but less than 20% of the correspondent waste was recycled; more than 25% of the total were incinerated, and around 55% ended up in landfills, rivers and oceans.⁵⁸

Considering plastics are usually small items, such as bags and straws, and many of those frequently used in touristic spots, the disposal of those materials is not often done properly. When tourists, or even local residents, dispose of plastic materials on the streets, as described above, that plastic ends up reaching rivers and oceans. On the one hand, that constitutes an additional barrier for any successful recycling policy. On the other, however, this is a scenario that calls for stricter regulation, as relying solely on educational campaigns is of limited results in light of the environmental problem we face.

Because plastic waste is also persistent, filling up landfills with it is not a sound solution as well. Even if we could expand the world's landfill capacity indefinitely, that would not solve all other problems associated with the plastic industry: manufacturing's negative impacts and improper disposal behavior. Consequently, tackling the negative externalities of the plastic industry is not a simple task for lawmakers. A number of factors must be weighed, such as the scale and complexity of supply chains and impacts, limitations of risk assessment systems, poor data, unknown cumulative effects, and stakeholders' willingness to maintain the status quo, among many others. Against this challenging scenario before policymakers, we explore in the following section some of the most important regulatory initiatives that could serve as an initial guideline for lawmakers. Some of them can be quite appropriate and quickly implemented by places threatened by over-tourism, such as Portugal.

VI – Regulatory Approaches to Tackle the Plastic Waste Problem

Regulatory initiatives to tackle the problems of plastic waste are being designed at different levels, from global to local. Those initiatives are being construed as an attempt to mitigate the adverse impacts of plastic pollution without undermining the social costs associated with any regulatory intervention in an important industry like the plastic one. Governments are using traditional regulatory tools, including command and control, to impose

⁵⁵ David Azoulay et. al. *Plastics and Health: the hidden cost of a plastic planet*. Center for International Environmental Law, 2019. Available at <https://www.ciel.org/wp-content/uploads/2019/02/Plastic-and-Health-The-Hidden-Costs-of-a-Plastic-Planet-February-2019.pdf>. Accessed in February, 2020.

⁵⁶ Lisa Anne et. al. *Plastic & Climate: the hidden costs of a plastic planet*. Center for International Environmental Law, 2019. Available at <https://www.ciel.org/wp-content/uploads/2019/05/Plastic-and-Climate-FINAL-2019.pdf>. Accessed in February, 2020.

⁵⁷ Michael Pooler, *Surge in plastics production defies environmental backlash*, Financial Times, February 12, 2020, <https://www.ft.com/content/4980ec74-4463-11ea-abea-0c7a29cd66fe>. Accessed in February, 2020.

⁵⁸ Hannah Ritchie and Max Roser, *Plastic Pollution*, Our World in Data, <https://ourworldindata.org/plastic-pollution>. Accessed in March, 2020.

bans on certain plastic products, as well as incentive-based mechanisms, such as taxation and broad liability rules.⁵⁹

Starting with the latter, within liability rules, a concept that is gaining greater attention more recently is the circular economy. Initially discussed within the academic community in the 1970s, the circular economy has become a hot topic.^{60,61} The term “circular” arose from the evolution of the historical conception of Linear Economy. It basically suggests the replacement of the traditional linear logic (“take, make, waste”) with new circular flows, in which wastes are reduced and the costs of disposal are internalized by those parties responsible for manufacturing the products in the first place. In a circular economy, products are designed and optimized for a cycle of disassembly and reuse or recycle, extending the consumables’ lifespan, reducing wastes, and thus minimizing the environmental impact of final disposal.^{62,63,64}

Liability rules can assist in promoting a circular economy. In this sense, if manufacturers are, for example, responsible for how their consumers dispose their products, liability rules can create an incentive for better product designs that will facilitate disposal and recycling after end usage. For the plastic industry, this could entail more research and development of environmentally sound materials, like biodegradable ones. In Brazil, this example is already a reality. In 2010, a federal law⁶⁵ determined that packaging must be made of materials that are conducive to reuse or recycling. The same law established the concept of reverse logistics as one of the instruments for implementing the shared responsibility for the life cycle of products. The concept, further detailed by a decree,⁶⁶ aims at enabling the collection and restitution of solid waste to the business sector for reuse (in its cycle or in other productive cycles) or other environmentally appropriate final disposal. Pesticide and lube oil packaging are two examples of solid waste, usually made of plastic, which now must return to

⁵⁹ For an overview on the progress of countries in passing laws and regulations limiting manufacture, import, sale, use and disposal of single-use plastics and microplastics, see UNEP. *Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations* (2018). Available at http://wedocs.unep.org/bitstream/handle/20.500.11822/27113/plastics_limits.pdf?sequence=1&isAllowed=y. Accessed in February, 2020.

⁶⁰ Silpa Kaza, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden noted that in “December 2015, the European Commission adopted a European Union Action Plan for a circular economy (EU 2015). In 2018 the European Union adopted a set of measures that support the implementation of the Action Plan and the European Union’s vision of a circular economy (EU 2018a)”. Kaza S, Yao LC, Bhada-Tata P, van Woerden F. *What a Waste 2.0: A global Snapshot of Solid Waste Management to 2050*. Washington, DC, 2018). Available at <https://openknowledge.worldbank.org/handle/10986/30317>. Accessed in February, 2020.

⁶¹ Since 2014, Portugal has adopted a variety of concrete action in national level to promote circular economy. For data and information, see *The Environmental Implementation Review 2019 - COUNTRY REPORT PORTUGAL* (European Commission, 2019). Available in https://ec.europa.eu/environment/eir/pdf/report_pt_en.pdf. Accessed in February, 2020.

⁶² Kaza S, Yao LC, Bhada-Tata P, van Woerden F. *What a Waste 2.0: A global Snapshot of Solid Waste Management to 2050*. Washington, DC, 2018. Available at <https://openknowledge.worldbank.org/handle/10986/30317>. Accessed in February, 2020.

⁶³ Morath, Sarah, *Our Plastic Problem* (February 22, 2019). 33 *Nat. Resources & Env’t* 45 (2019); U of Houston Law Center No. A-1. Available at SSRN: <https://ssrn.com/abstract=3340072>.

⁶⁴ Ellen MacArthur Foundation. 2014. *Circular Economy* - Ellen MacArthur Foundation. [online] Available at: <https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy>. Accessed in February, 2020.

⁶⁵ Federal Law n. 12.305 of 2010.

⁶⁶ Federal Decree n. 7.404 of 2010.

the business sector for reuse or adequate disposal by law.⁶⁷ Noncompliance with obligations and goals established by each type of waste for the reverse logistics is subject to administrative and criminal penalties, as well as compensation as stipulated by law.⁶⁸

Because plastic products are very versatile and durable, liability rules have the potential to incentivize a circular economy by fostering manufacturers to invest in creative solutions to collect the waste generated by consumers and to design plastic materials that can be reinserted into the economy after recycling.

Better and sounder technology is an expected positive externality one can hope arises from liability rules designed to foster a circular economy, since technology is a path that can be explored to address the plastic problem. Silpa Kaza *et al* highlighted the development of platforms designed to create a marketplace for used goods,⁶⁹ as well as the development of software “that allows manufacturers to take waste into consideration in the product design process and to choose materials that have the least impact on the environment.”⁷⁰ Those are good examples of technological tools aligned with the principles of the circular economy.

With proper incentives and liability rules, companies can create greater processes for incentivizing the use of waste materials as inputs for other products, or even for other industries such as the fashion industry, that can rely on recycled plastic and textile materials to create new garments.⁷¹

Command and control, the most popular regulatory tool, can also be used effectively to impose bans on particular plastic products. A comprehensive report published by the UN in 2018 showed that out of the 192 countries reviewed, 127 had adopted some form of legislation to regulate plastic bags. Eighty-three of these countries have adopted a ban on free retail distribution, and 61 have implemented bans on manufacturing and importation. Twenty-seven countries have enacted laws imposing some type of ban on single use plastics, and eight have established legally binding bans of microbeads through national laws or regulations.⁷² These numbers reveal a worldwide preoccupation with the negative environmental impacts of plastic waste.

⁶⁷ Article 33 of Federal Law n. 12.305 of 2010.

⁶⁸ Federal Law n. 12.305 of 2010 and Federal Law n. 9.605 of 1988.

⁶⁹ Kaza S, Yao LC, Bhada-Tata P, van Woerden F. What a Waste 2.0: A global Snapshot of Solid Waste Management to 2050. Washington, DC, 2018. Available at <https://openknowledge.worldbank.org/handle/10986/30317>. Accessed in February, 2020.

⁷⁰ Kaza S, Yao LC, Bhada-Tata P, van Woerden F. What a Waste 2.0: A global Snapshot of Solid Waste Management to 2050. Washington, DC, 2018. Available at <https://openknowledge.worldbank.org/handle/10986/30317>. Accessed in February, 2020.

⁷¹ According to the United Nations (<https://news.un.org/en/story/2019/03/103516>), around half a million tons of microfibre, which is the equivalent of 3 million barrels of oil, is now being dumped into the ocean every year. A report from 2017 shows that less than 1% of material used to produce clothing is recycled into new clothing. Ellen MacArthur Foundation, A new textiles economy: Redesigning fashion’s future, (2017, <http://www.ellenmacarthurfoundation.org/publications>). For further information, see Fletcher, K. (2008). Sustainable fashion and textiles: design journeys. London ; Sterling, VA: Earthscan; Rissanen, T. (2011). Shaping sustainable fashion: Changing the way we make and use clothes. London: Earthscan; and UN Alliance for Sustainable Fashion, available at <https://unfashionalliance.org/>. Accessed in February, 2020.

⁷² UNEP. Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations (2018). Available at <https://www.unenvironment.org/resources/publication/legal-limits-single-use-plastics-and-microplastics-global-review-national>. Accessed in February, 2020.

At the subnational level, plastic regulation is also spreading fast. In federative countries, such as Brazil and the U.S., for instance, plastics bags are the subject of state or municipal regulation. Worthy of notice is the Rio de Janeiro case in Brazil. Rio de Janeiro State Law n. 5.502/2009,⁷³ amended by State Law n. 8.473/2019,⁷⁴ gradually banned commercial establishments from distributing disposable plastic bags composed of polyethylene, polypropylene, and/or similar materials. State law required a gradual replacement and collection of plastic bags made of those materials to revert them to recycling. Failing to comply with those legal requirements subjects commercial establishments to fines from R\$ 355.5 (around US\$81.7) up to R\$ 35,550.0 (around US\$8,172.40).

The city of São Paulo constitutes another good example. The largest city in Brazil enacted City Law n. 15.374/2011,⁷⁵ later regulated by the Decree n. 55.827/2015,⁷⁶ barring the distribution or sale of plastic bags in commercial establishments. In addition to the cases of the two richest state and city in Brazil, several draft bills, aimed at controlling plastic disposal,⁷⁷ plastic bags,⁷⁸ other single use plastics⁷⁹ and microbeads,⁸⁰ are currently sitting before the national and state Congresses and municipal assemblies awaiting deliberation.

In the U.S., San Francisco enacted a law in 2007 implementing a ban on plastic bags. This law was later amended in 2012. The San Francisco ban led to a 72% decrease in plastic litter on local beaches from 2010 to 2017, according to data from the Coastal Clean-up Day.⁸¹ Other coastal cities in the U.S., such as Malibu and Berkeley, have been discussing deterring restaurants from giving out plastic straws, utensils, and stirrers.⁸² The numbers achieved by San Francisco are inspiring for local lawmakers committed to reducing the impacts of plastic waste in touristic spots. Portugal is marching in the exact same direction.

Taking the lead in such perspective, in September 2019, the Portuguese Republican Assembly approved statute No. 76/2019, which prohibits the use of single-use plastic tableware in restaurants, pubs, and grocery shops, as well as in kiosks and movable sales points, such as food trucks. The law shall come into force in September 2020.

⁷³ Available at <http://alerjln1.alerj.rj.gov.br/CONTLEI.NSF/c8aa0900025feef6032564ec0060dfff/4157ea791e38b02a832575fb00642460?OpenDocument> Accessed in February, 2020.

⁷⁴ Available at <http://alerjln1.alerj.rj.gov.br/CONTLEI.NSF/c8aa0900025feef6032564ec0060dfff/d55626c82b24c91a83258446006187fc?OpenDocument>. Accessed in February, 2020.

⁷⁵ Available at <http://legislacao.prefeitura.sp.gov.br/leis/lei-15374-de-18-de-maio-de-2011/>. Accessed in February, 2020.

⁷⁶ Available at <http://legislacao.prefeitura.sp.gov.br/leis/decreto-55827-de-06-de-janeiro-de-2015/>. Accessed in February, 2020.

⁷⁷ For instance, Draft Bill n. 1405/2019, being processed in the Senate.

⁷⁸ For instance, Draft Bill n. 501/2019, being processed in Vitória state legislative branch.

⁷⁹ For instance, Draft Bill n. 931/2020, being processed in city of Belo Horizonte's legislative branch.

⁸⁰ For instance, Draft Bill n. 263/2018, being processed in the Senate.

⁸¹ Success! California's first-in-the-nation plastic bag ban works, *The Mercury News*, November 13, 2017, <https://www.mercurynews.com/2017/11/13/editorial-success-californias-first-in-the-nation-plastic-bag-ban-works/>. Accessed in February, 2020.

⁸² Daniel Víctor, Bans on Plastic Straws in Restaurants Expand to More Cities, *New York Times*, March 3, 2018, <https://www.nytimes.com/2018/03/03/climate/plastic-straw-bans.html>. Accessed in February, 2020.

In 2006, Palau developed a national Beverage Container Recycling Program in response to increasing plastic waste. The program established a deposit refund system in which the national government charges consumers with a US\$0.10 deposit fee for plastic, glass, and metal containers. Once a container is returned to a redemption center, the amount collected is partially returned to the customer (US\$0.05), and the remaining is channeled to Koror State and the national government to cover administrative costs. As a result, about 8% of beverage containers were removed from the waste stream, and about 98% of aluminum containers were recycled. The national government has used the program's profits to purchase heavy equipment to fix the slope of the local landfill, and the State has used proceeds to buy balers and other equipment to improve the efficacy of the redemption center.⁸³

At the European level, in June 2019, the European Parliament and the Council published Directive No. 240/2019 ruling on the reduction of the impact of certain plastic products on the environment. The European Union decided to ban the use and trade of single-use plastic articles – such as straws, swabs, and cutlery – by 2021. Production and sale of recipients made of expanded polystyrene will also be banned. By 2029, 90% of plastic bottles must be recycled, and its composition shall include at least 25% recycled raw material by 2025, and 30% by 2030.⁸⁴

In common, all the venues examined above share an enormous touristic appeal to both domestic and international visitors. The impacts caused by the aforementioned problems associated with the plastic industry can hurt the tourism industry of those places.

On the flip side, however, over-tourism in cities like San Francisco and Lisbon constitute a relevant source for the problem of plastic waste generation. Tackling the problem through regulation mitigates the risks presented by over-tourism, while also preserving the historic and natural environments that make those places prone to host a great number of visitors every year.

VII - Environmental Education, Awareness Building, and Voluntary Action

Just as important as regulatory intervention, investment in environmental education and awareness building can have positive impacts on fostering voluntary action.⁸⁵ Combining

⁸³ Kaza S, Yao LC, Bhada-Tata P, van Woerden F. *What a Waste 2.0: A global Snapshot of Solid Waste Management to 2050*. Washington, DC, 2018). Available at <https://openknowledge.worldbank.org/handle/10986/30317>. Accessed in February, 2020.

⁸⁴ <https://www.otempo.com.br/interessa/uniao-europeia-banira-plastico-de-uso-unico-a-partir-de-2021-1.2184706>. Accessed in February, 2020.

⁸⁵ According to the International Environmental Education Programme of United Nations Environment Programme, environmental awareness is “the growth and development of awareness, understanding and consciousness toward the biophysical environment and its problems, including human interactions and effects. Thinking “ecologically” or in terms of an ecological consciousness” (<https://www.eionet.europa.eu/gemet/en/concept/2778>. Accessed in March, 2020). The importance of environmental awareness and education is worldwide recognized and was included among the 17 Sustainable Development Goals of United Nations Agenda (<https://sustainabledevelopment.un.org/topics/education>. Accessed in March, 2020). For further information, see MWM Kuijper, Marine and coastal environmental awareness building within the context of UNESCO's activities in Asia and the Pacific: *Marine Pollution Bulletin* [Mar. Pollut. Bull.]. Vol. 47, no. 1-6, pp. 265-272. Jan-Jun 2003 (describing how UNESCO addresses the need for awareness building in a variety of settings under different programmes and sectors); Timothy, D. (2000). Building community awareness of tourism in a developing country destination. *Tourism Recreation Research*, 25(2), 111-116. <https://doi.org/10.1080/02508281.2000.11014916> (pointing the argument that, as entrepreneurial endeavours and public awareness increase, residents will be in a better position to participate in tourism development); Jacobi, Pedro Roberto. (2005). Environmental education: the challenge of constructing a

regulatory intervention with education and awareness building can lead to even greater results in plastic control policies. The focus shall be on local residents, but specific policies targeted at tourists shall highlight the importance of their commitment in preserving and maintaining the historical or natural beauties that make up for a touristic hot spot.

There are most certainly many education and awareness building campaigns spread out around the world. We highlight here some of those initiatives from well-known organizations. In June 2018, McDonald's announced it would test alternatives to plastic straws at some of its restaurants in the U.S.⁸⁶ In the same year, the International Olympic Committee (IOC) announced an ambitious plan to eradicate single-use plastics from the organization and events around the world.⁸⁷ Walt Disney Co. informed its plans to eliminate straws and stirrers from all its locations by 2019.⁸⁸ Kroger, one of the largest grocery store chains in the U.S., announced its intention to ban the use of plastic bags by 2025.⁸⁹ Other huge companies, such as Walmart, IKEA, and Coca-Cola agreed to reduce plastics as part of their commitment to the G7 Ocean Plastics Charter.⁹⁰

The Netherlands, in 2000, through the North Sea Directorate of the Dutch Government and the fisheries association, created the Fishing for Litter program. It aimed at encouraging fishermen to collect litter from the ocean while fishing and return it to the shore for proper disposal. To reach the goal of reducing marine litter, the program articulates different stakeholders, such as harbors and ports, for waste storage space, and non-profit organizations and businesses for collection and transfer to recycling and recovery facilities.⁹¹

Voluntary actions, through education and awareness, are not limited to banning policies. They can also tackle production and consumption. Initiatives on those fronts have been included under the umbrella term known as "Sustainable Consumption and Production," or simply "SCP." The original concept, created in 1994, is evolving following discussions at political, business, and academic forums.

SCP's definition was carved in an Oslo Symposium in 1994 as "the use of services and related products which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste

critical, complex and reflective thinking. *Educação e Pesquisa*, 31(2), 233-250. <https://doi.org/10.1590/S1517-97022005000200007>.

⁸⁶ Zlati Meyer, McDonald's to test plastic-straw alternatives in U.S. later this year, USA Today, June 15, 2018, <https://www.usatoday.com/story/money/2018/06/15/mcdonalds-test-plastic-straw-alternatives-u-s-later-year/703297002/>. Accessed in February, 2020.

⁸⁷ Lorraine Chow, International Olympic Committee Makes 'Biggest Commitment Ever' to Fight Plastic Pollution, EcoWatch, June 5, 2018, <https://www.usatoday.com/story/money/2018/06/15/mcdonalds-test-plastic-straw-alternatives-u-s-later-year/703297002/>. Accessed in February, 2020.

⁸⁸ Disney to eliminate plastic straws, stirrers at all resorts by 2019, Fox News, July 26, 2018, <https://www.foxnews.com/travel/disney-to-eliminate-plastic-straws-stirrers-at-all-resorts-by-2019>. Accessed in February, 2020.

⁸⁹ Rodney McMullen, Kroger, America's largest supermarket chain, bids farewell to the plastic shopping bag, USA Today, August 23, 2018, <https://www.usatoday.com/story/opinion/2018/08/23/kroger-plastic-bag-ban-reusable-recycle-straws-environment-column/1061723002/>. Accessed in February, 2020.

⁹⁰ For the list of all business and government partners, see <https://www.canada.ca/en/environment-climate-change/services/managing-reducing-waste/international-commitments/ocean-plastics-charter.html>. Accessed in February, 2020.

⁹¹ <http://www.fishingforlitter.org.uk/what-is-fishing-for-litter>. Accessed in February, 2020.

and pollutants over the life-cycle so as not to jeopardize the needs of future generations."⁹² In 2008, the European Commission had already approved an Action Plan on this same topic aimed at developing concrete policies to reach SCP goals.⁹³ As a result, SCP was included as one of the seventeen Sustainable Development Goals.⁹⁴

Those voluntary initiatives are very successful and efficient complementary tools to the traditional command and control regulatory approach. While improving policy results, voluntary initiatives have the capacity to promote education and awareness. All stakeholders who get involved with voluntary initiatives are educated in the process and have the potential to educate and engage others. It creates a virtuous cycle with long-lasting, positive results.

In Portugal, a commitment among companies (including huge industrial plastic users), the government through the Environment and Climate Action Minister, the Sea Minister and the Minister for Economy and Digital Transition, as well as the Ellen McArthur Foundation, with several NGOs led by Smart Waste Portugal aims at promoting a transition towards a circular economy for plastic in the country. The agreement signed in February 2020 puts Portugal ahead of the European Union regarding plastic recycling goals. The Plastic Portuguese Pact intends to ensure that, by 2025, which is five years in advance of the European Union, all plastic packages in Portugal will either be reused, recycled, or composted.⁹⁵

VIII – Conclusion

Like many other environmental problems, plastic waste is not bound by geopolitical borders. It is certainly a matter of local pollution, but because plastics are largely used for manufacturing products, they travel around the globe through regular international commercial activities (imports and exports). Whenever improperly discarded and reaching the oceans, handling plastic waste becomes an international problem. Lastly, due to the high dependence on fossil fuels for its production, plastics are the source of a climate change negative externality, a topic also within the realm of the international community's agenda.

Even though the traditional command and control regulatory type of tool imposing limitations to the use and disposal of plastics has been prevailing worldwide, the plastic waste problem, due to its complexity, requires a more elaborated and thorough policy approach.

The regulation of the tourism industry is an important piece of the comprehensive approach proposed by the bibliography reviewed in this manuscript. On the one hand, tourism can be a relevant source of plastic waste generation, but, on the other, this industry is highly sensitive to poorly planned, waste management policies.

In Section VI, we compiled examples of plastic waste regulation from important touristic cities, namely Rio de Janeiro, São Paulo, San Francisco, and Lisbon. The latter was the subject of our experience during the 2019 Study Space Program, organized and sponsored

⁹² Pogutz, Stefano, and Valerio Micalé. Sustainable Consumption and Production: An Effort to Reconcile the Determinants of Environmental Impact. *Society and Economy*, vol. 33, no. 1, 2011, pp. 29–50. JSTOR, www.jstor.org/stable/90002240.

⁹³ Pogutz, Stefano, and Valerio Micalé. Sustainable Consumption and Production: An Effort to Reconcile the Determinants of Environmental Impact. *Society and Economy*, vol. 33, no. 1, 2011, pp. 29–50. JSTOR, www.jstor.org/stable/90002240. Accessed in February, 2020.

⁹⁴ Goal 12 to Ensure sustainable consumption and production patterns. See <https://sustainabledevelopment.un.org/sdg12>. Accessed in February, 2020.

⁹⁵ Further information available at <http://m.smartwasteportugal.com/pt/atividades/pacto-portugues-para-os-plasticos/>. Accessed in March, 2020.

by the Center for the Comparative Study of Metropolitan Growth of the Georgia State University College of Law in Atlanta, U.S.A., and the Law School of the University of Lisbon. Portugal and Lisbon have been hot touristic spots in the recent years, and, because of that, plastic waste management policies became one important aspect to promote sustainable growth, so that the country and city can both take the most advantage of this industry.

A sustainable tourism industry is a relevant source of income and job generation. A well-structured and thought-out policy strategy is of utmost importance for any given city or nation to take the most advantage of this industry, while guaranteeing a healthy environment for its permanent and seasonal inhabitants.

The Portuguese experience, which illustrated several arguments raised throughout this paper, evidences that touristic destinations must channel efforts towards improving their capacities to deal with the environmental impacts caused by the higher number of people resulting from tourism activities. Portugal seems to be tracing a meritorious path in regards to dealing with plastic waste. An illustration of this is the approval of national legislation banning single-use plastic tableware from restaurants, pubs, and similar places by September 2020. The country is also experiencing multi-stakeholders' initiatives, with government, companies, and civil society joining efforts to reduce plastic waste.

Environmental scholars highlight that this is an era where solutions are multimodal.⁹⁶ For plastic waste, that means approaching the problem by assessing the full lifecycle span and considering thoroughly the scope of potential negative impacts on human health and the environment. David Azoulay *et al.* states that, "measures that succeed at a local level or address a single product stream are often undermined or offset by the emergence of new kinds of plastic, new exposure pathways, and new additives."⁹⁷ That is why a more comprehensive approach, one that considers different regulatory tools, education, awareness building, and foments voluntary action within the entire lifecycle of plastic products and materials, is more prone to succeed.

⁹⁶ Arnold, Craig (Tony) Anthony, Fourth-Generation Environmental Law: Integrationist and Multimodal (September 17, 2010). William & Mary Environmental Law and Policy Review, Vol. 35, No. 3, p. 771, 2011; University of Louisville School of Law Legal Studies Research Paper Series No. 2011-07. Available at SSRN: <https://ssrn.com/abstract=1678654>.

⁹⁷ David Azoulay et. al. Plastics and Health: the hidden cost of a plastic planet. Center for International Environmental Law, 2019. Available at <https://www.ciel.org/wp-content/uploads/2019/02/Plastic-and-Health-The-Hidden-Costs-of-a-Plastic-Planet-February-2019.pdf>. Accessed in February, 2020.