NOSS RETHINKING PLASTIC POLLUTION

VOLUME 1

SINGLE-USE PLASTIC IN BRAZIL: CONTEXT AND ENVIRONMENTAL IMPACTS

ESCOLA DE ARTES CIÊNCIAS E HUMANIDADES

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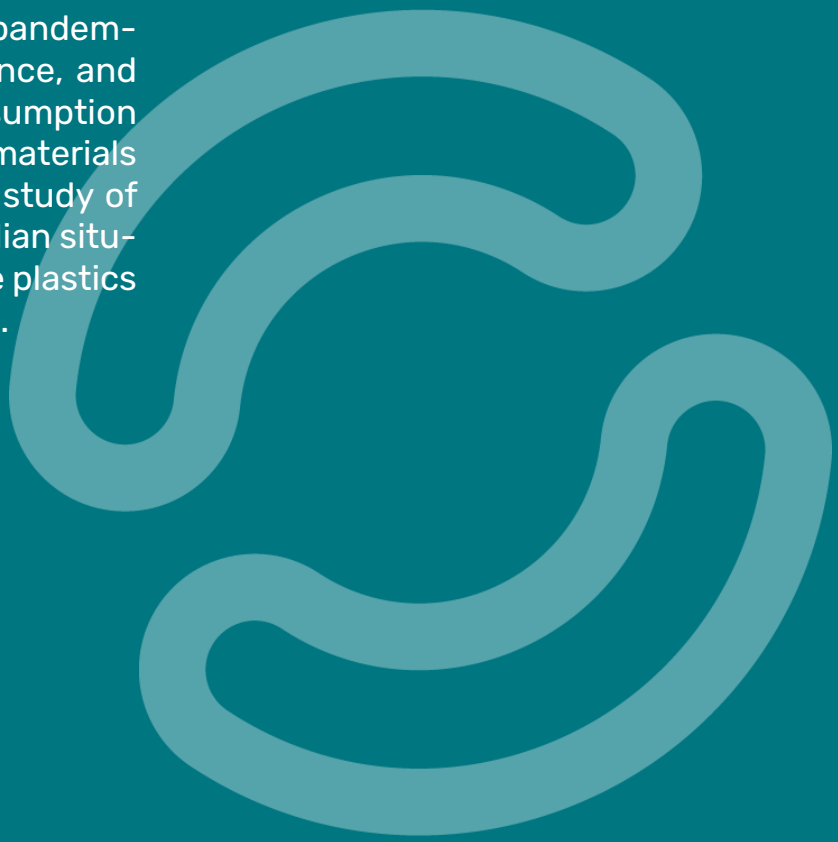
FOREWORD

This collection is one of the results of the project "*Rethinking Plastics Governance in a Post-Covid World*", funded by the University Global Partnership Network (UGPN). This project is a collaboration between researchers from the University of São Paulo, the University of Surrey and the University of Wollongong, who together form part of the *UGPN Rethinking Plastics Network*.

Through an interdisciplinary team, the project aimed to verify policies on plastic pollution before, during and after the Covid-19 pandemic. To this end, regulations, governance, and oversight structures that affect consumption and society's perception of plastic materials were examined. This is a qualitative study of secondary data that brings the Brazilian situation in the governance of single-use plastics in the face of the Covid-19 pandemic.



SINGLE-USE PLASTIC IN BRAZIL: CONTEXT AND ENVIRONMENTAL IMPACTS

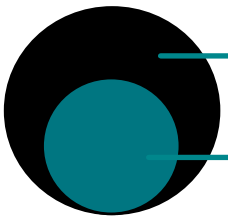
LAST **65** YEARS

PLASTIC WAS THE MOST PRODUCED MATERIAL IN THE WORLD

In the last 65 years, plastics production in the world has been greater than any other type of material. Following this trend, the consumption and disposal model predicted for 2050 indicates that global production will reach 26 billion tons of plastic resins and 6 billion tons of plastic fibers while only 9 billion tons of these materials will be recycled (GEYER; JAMBECK; LAW, 2017). This reinforces the importance of studies on the subject, so that strategies can be formulated to reduce consumption and improve plastics recycling.

2019

79 MILLIONS OF TONS OF HOUSEHOLD WASTE



13.5% PLASTIC

35% SINGLE-USE PLASTIC

11,8% RECYCLED (ABIPLAST)

2050

PRODUCTION ESTIMATE

26 BILLIONS OF TONS — PLASTIC RESINE

\+ **6** BILLIONS OF TONS — PLASTIC FIBER

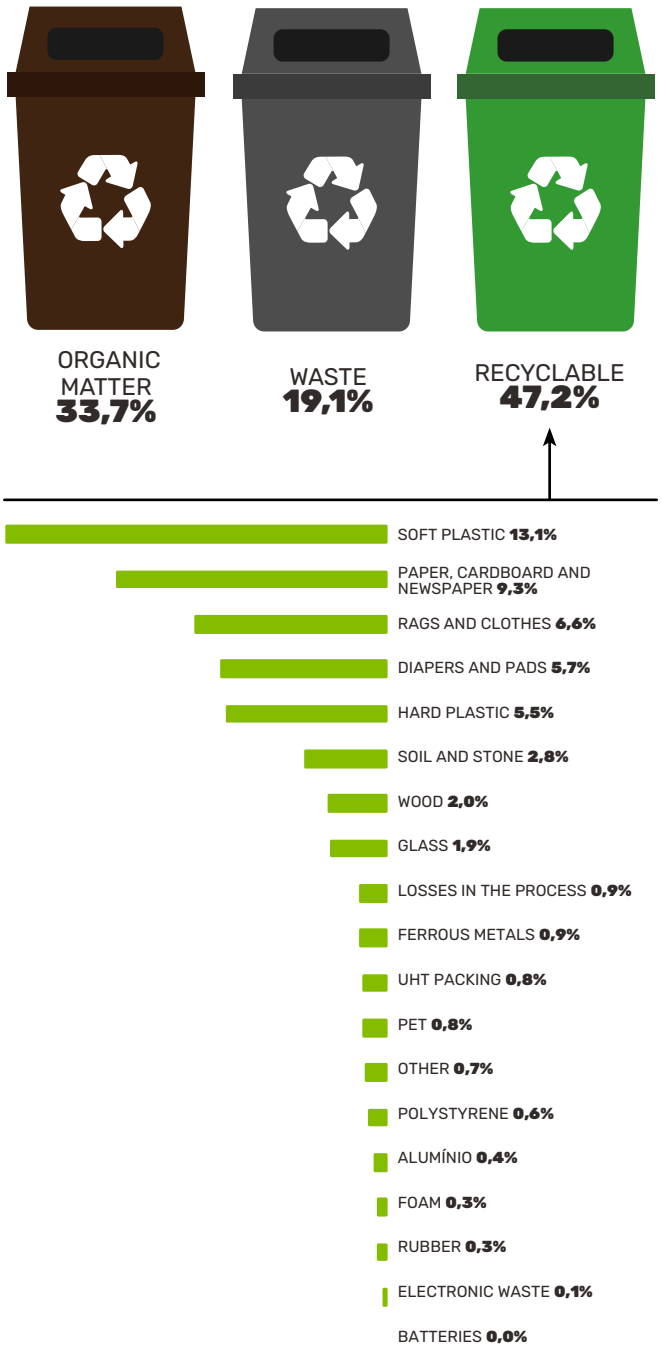
9 BILLIONS OF TONS — RECYCLED

In Brazil, plastics accounted for 13.5% of the 79 million tons of municipal solid waste from households in 2019 (CEMPRE, 2019), with 35% of plastics classified as single-use (VASCONCELOS, 2019). For example, in the city of São Paulo plastics have the highest percentage in the gravimetric characterization of urban solid waste generated in the city, as shown in Figure 1.

As seen in Figure 1, the sum of the types of plastics (films, rigid and PET) results in 19.4% of household waste, the highest percentage of material in the gravimetric characterization. Despite presenting a significant projection at the federal and local levels, recycling rates of plastics from households in the country are still low: only 1.28% (145 thousand tons) are effectively recycled (FUNDAÇÃO HEINRICH BÖLL BRASIL, 2020). On the other hand, ABIPLAST (2020) indicated that 838,500 tons of plastics were recycled in 2019, which would represent 11.8%. However, it is worth mentioning that even with this data presented by ABIPLAST, plastics recycling rates in the country are still low and do not show a tendency to increase in volume.

Due to an immense variety of plastics on the market and the large volume discarded, plastics waste management is complex, and the end-of-life pathway chosen will depend on several factors, such as the type of polymer or product discarded, among others (HOPEWELL; DVORAK; KOSIOR, 2009). However, in a more accurate analysis of the recycling chain in Brazil, it is identified that even though only 17% of Brazilian cities have selective collection for recyclables,

FIGURE 1: Composition of household waste from regular collection in the city of São Paulo in 2019.



[1] Gravimetric characterization is understood as the "determination of the components and their respective percentages in weight and volume, in a sample of solid waste, which may be physical, chemical and biological" (NBR 10,007/2004).

industries recycle 56% of PET plastic packaging, which makes the country to have higher recycling rates than the USA, England, and Portugal for that material (RUTKOWSKI & RUTKOWSKI, 2017).

In addition, plastics represent 17% of all waste that is processed by the recycling chain and 38% of the value sold by waste pickers (FUNDAÇÃO HEINRICH BÖLL BRASIL, 2020). Regarding packaging recycling (plastics or paper), 9 out of 10 kg arrive at the recycling industries through the waste pickers (RUTKOWSKI & RUTKOWSKI, 2017). Therefore, the agents who are most responsible for the reintroduction of plastics into the recycling chain in Brazil are the collectors (RUTKOWSKI & RUTKOWSKI, 2017).

Despite their important role, waste pickers do not have adequate working conditions: low wages; precarious work environment; lack of appropriate machinery and equipment; among others. Added to these difficulties, the inexistence or limitation of recycling chains for plastics beyond PET and the scarcity of appropriate selective collection programs, make it difficult to collect plastics in greater quantities, causing a significant part of it to be sent to landfills (RUTKOWSKI & RUTKOWSKI, 2017).

More than 2.4 million tons of plastics are irregularly disposed of, and 7.7 million tons are disposed of in sanitary landfills, a number that represents 68% of post-consumer plastics (FUNDAÇÃO HEINRICH BÖLL BRASIL, 2020), as shown in Figure 3.

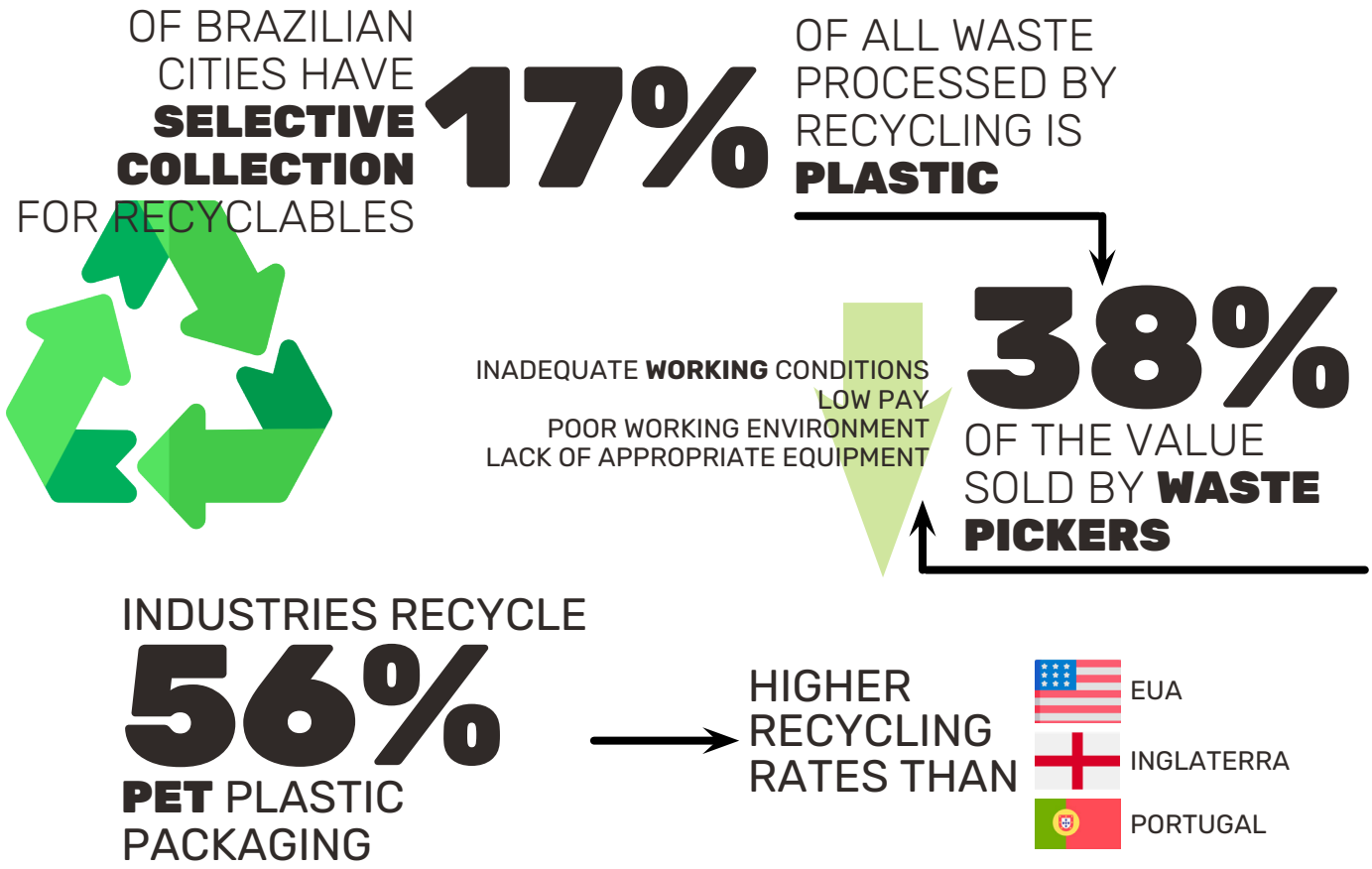
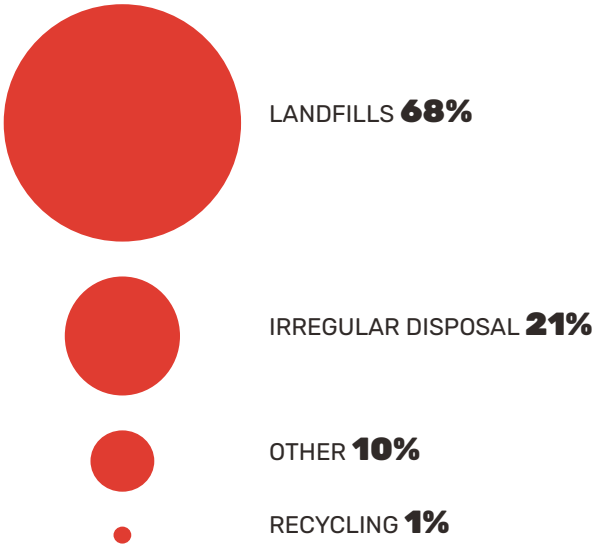


FIGURA 2: End-of-life pathways of plastics waste in Brazil (2018).



The packaging sector is the one that mostly uses plastics raw materials, being responsible for the disposal of more than half of all plastics waste generated world-wide (CHAMORRO, 2020). The production of plastics packaging uses 36% of the total plastics resins manufactured in the world (VASCONCELOS, 2019). About 65% of the packaging used by the food sector is made of plastics (COLTRO et al., 2008). Table 1 shows the main types of plastics used by the Brazilian food industry.

26%
OF ALL THE PLASTIC IN THE WORLD IS USED BY THE **PACKAGING INDUSTRY**

TABLE 1: Main plastics packaging in the food sector and applications by the Brazilian industry. Adapted from FABRIS; FREIRE; REYES (2006).

POLYMER	APPLICATION EXAMPLE
 	• Bottles of different volumes for carbonated drinks, mineral water, oils, edibles, sauces, seasonings, mayonnaise. • Laminated films for coffee, biscuits, flexible laminates, bag-in-box, meat products, frozen fruits, and vegetables. • Thermoformed packaging (crystallized PET-28-30%) for trays and pots for use in microwave ovens and conventional ovens in ready-to-eat products, soups, and sauces.
 	• Moisture sensitive foods: breakfast cereals, dehydrated products. • Dairy products: sterilized and pasteurized milk, liquid yogurt. • Vegetable oils in institutional packaging, cans and crates in industries. • Rice and ready-to-eat frozen meals, “boil-in-bag” rice.

POLYMER		APPLICATION EXAMPLE
3 PVC		• Rigid packaging: edible oils, water, mayonnaise, vinegar. • Thermoformed packaging: jelly blister, paste candies. • Wrap films for confectioners, stretch films: fruits, meat and poultry, cheese and vegetables.
4 LDPE		• Flexible multilayer packaging: dehydrated fruits and vegetables, fish. • Flexible stapled packaging: fresh and ricotta cheeses. • Bags: grains, salt, sugar, baked goods, pasteurized milk. • Jars: Ice cream, mustards.
5 PP		• Laminated structures: sweets, cookies, pasta, snacks, chocolates. • Blown bottles: mineral water, juices. • Monolayer films: minimally processed fruits and vegetables. • Co-extruded blown packaging: tomato sauces, mayonnaise. • Blown and bioriented packaging: dehydrated products, dehydrated fruits and vegetables. • Thermoformed packaging: water, margarine, condiments, cheese, ready meals, lids. • PP copolymer: bakery products, perishable products.
6 PS		• Multilayer: Vacuum packaging for processed meats. • Laminates for pasta, meat. • Rigid packaging for candy, ice cream. • Rigid trays for cream cheeses.
7 OTHER		• Number 7 means that the plastic in question cannot be characterized as any of the other six types mentioned above. • One of the most common types of plastics in this category is BOPP (Bi-Oriented Polypropylene), a plastic type that requires a complex process to be recycled and for that reason is not actually recycled.

The presence of the resin identification symbol on the packaging does not guarantee or imply that it is suitable for recycling, but it facilitates separation and recycling (COLTRO et al., 2008).

According to ABRELPE (2020), in April 2020 there was a 25% increase in the generation of disposable plastics waste. Likewise, in the following months, in May and June, the increase was 28% and 30%, respectively.

During the Covid-19 pandemic, between January and May 2020, there was an increase of approximately 95% in the demand for food delivery in the country, compared to 2019 data (FUNDAÇÃO HEINRICH BÖLL BRASIL, 2020). The delivery alternative is focused on disposable packaging and it was adopted by bars and restaurants to deal with social distancing, causing businesses that previously did not have the service to offer it.

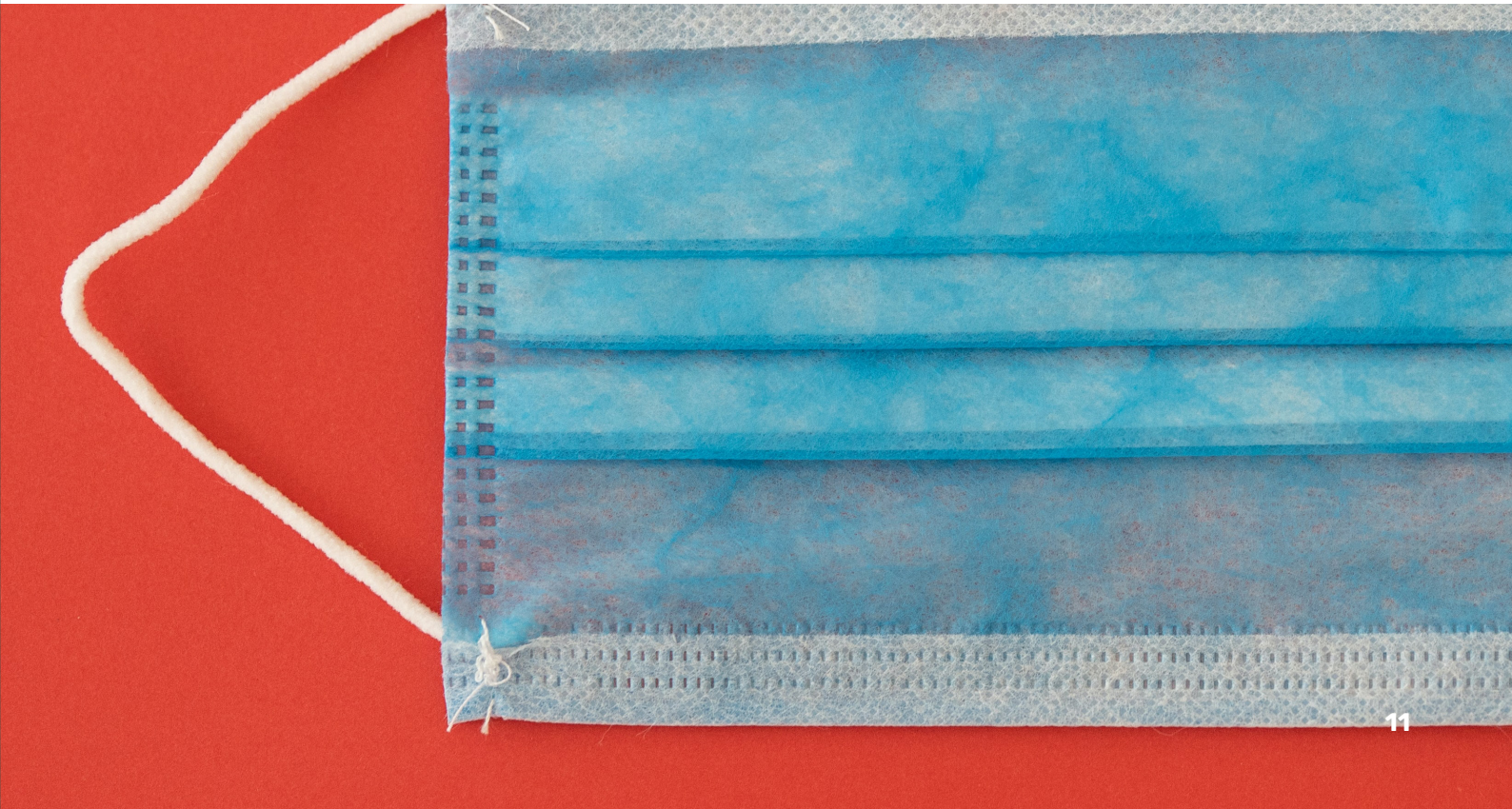
2020

JANUARY-MAY
INCREASE OF
95%
DEMAND FOR FOOD DELIVERY
(COMPARED TO 2019)

JUNE
INCREASE OF
30%
IN THE GENERATION OF DISPOSABLE PLASTICS WASTE

JULY-DECEMBER

107,000
PIECES OF PPE (MASKS, GLOVES, FACE SHIELDS AND SANITARY WIPES) FROM BEACHES AND WATERWAYS FROM ALL AROUND THE WORLD



The sharp increase in the production and disposal of single-use plastics packaging may be directly related to this new consumption pattern (DEMAJOROVIC, 2021). In addition, even though establishments such as bars and restaurants have remained open, in São Paulo they have opted for the full use of disposables, whether for delivery or in person format, from the perspective of greater sanitary control, which contributed to the increase in the generation of plastic packaging waste (FOSTER, 2020).

Although it has been reported that washing glass, metal and porcelain with hot water and soap is enough to destroy any trace of the virus, the speech in favor of disposable plastics had great repercussion (FUNDAÇÃO HEINRICH BÖLL BRASIL, 2020). However, the discourse of representatives of the plastics sector does not match the reality of the Brazilian standard of packaging development. According to Demajorovic (2021), such a standard is defined by a packaging paradox: while there is development of lighter packaging, with less chemical additives and losses, contributing to collection, recycling and reuse, this is not the reality of most packaging available in the Brazilian market.

Packaging composed of only one type of plastic material has more structured recycling chains, as collection and separation are easier (ABIPLAST, 2018). Rigid packaging, due to its greater thickness, is more resistant to mechanical action, therefore generating greater profit in post-consumption sales, which favors its recycling (ABIPLAST, 2018). Flexible packaging, on the other hand has less resistance, has greater difficulty in collection and segregation, and a lower sales value (ABIPLAST, 2018). In addition, the development of multilayer packaging is increasingly encouraged in the country, which makes its reintegration into the recycling chain impossible (DEMAJOROVIC, 2021).

According to ABIPLAST (2018), the limiting factors for recycling plastics packaging waste are: the amount of printing ink in packaging; presence of pro-degrading additives (this additive accelerates the degradation and total fragmentation of plastic materials, preventing its mechanical recycling); mixture of materials and using similar densities resins.

In Brazil, there are no recycling industries and buyer markets for certain types of plastics, such as multilayers, causing many plastics to be classified as waste and sent to sanitary landfills (FUNDAÇÃO HEINRICH BÖLL BRASIL, 2020). In this sense, the increase of single-use plastics packaging consumption did not represent an increase in the recycling of these materials. This is the case of personal protective equipment (PPE), such as masks and gloves, which for the most part was disposed of in an environmentally unsound way or landfilled.

PLASTIC **PERSONAL PROTECTION EQUIPMENT**

INCREASE OF
3800%
IN THE PRICE OF MASKS

In 2020, the global market for masks went from 5 billion units per year to 100 billion units per year, demonstrating the influence of the pandemic on the sector (LSI, 2020). In Brazil, because of the high demand for PPE, the prices increased significantly. In March 2020, the Federation of Hospitals, Clinics and Laboratories of the State of São Paulo (FEHOE-SP) reported an increase of more than 1000% in the prices of equipment and medication used in hospital services.

As an example, in February 2020 masks cost R$ 0.10 per unit, while in April 2020 it increased to R$ 3.90 per unit, representing a 3,800% increase in the price of the product (FEHOESP, 2020). The same happened to disposable gloves, as shown in Table 2.

TABLE 2: Comparison between the prices of products used in hospital services in the period February-March 2020. Source: FEHOESP (2020).

	PRODUCT	PRICE IN FEBRUARY 2020	PRICE IN MARCH 2020
	**MASK BOX** 50 UNITS	R$ 4.50	R$ 300.00
	**GLOVE BOX** 100 UNITS	R$ 14.70	R$ 35.00
	**PFF2 MASK** UNIT	R$ 9.00	R$ 44.00
	**HAND SANITIZING GEL** 480mg UNIT	R$ 5.79	R$ 20.25
	**DISPOSABLE LONG SLEEVE APRON** UNIT	R$ 1.03	R$ 3.51

In Brazil, the local production of PPE is restricted, which creates a strong relationship of dependence on international supply chains of plastics. Approximately 80% of masks used in the country come from Asia (RIVERA, 2020).

Because of the increased demand for PPE, the World Health Organization (WHO) (2020) recommended rational use through three procedures: proper use of equipment, reducing the need to use them, and coordinating its supply chain. Despite this, the lack of PPE was immediate and urgent and became a challenge for Brazilian health units (hospitals, outpatient clinics, medical clinics). The lack of PPE made working hours of health professionals to intensify to make up for the lack of equipment and to continue care, they were exposed to greater risks of contamination (LUCIANO & MASSARONI, 2020).

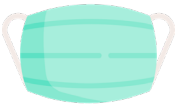
Based on this scenario, the Public Services International (ISP in Portuguese) developed the campaign "Protected Workers Save Lives" with the aim of addressing impacts of the Covid-19 pandemic on the daily lives of workers in essential services. Data from a report by the ISP from March to June 2020, in which 3,636 essential workers from all over Brazil were interviewed, show that 63% of professionals responded that the amount of PPE provided by their workplace was not enough for changing and cleaning (Figure 3) (ISP, 2020).

FIGURE 3: Analysis of whether the amount of PPE provided by the workplace was sufficient for the exchange and cleaning of health professionals (March to June 2020). Source: ISP (2020).

According to the ISP, 76% of the masks were purchased by hospitals in the Southeast of the country and 53% in the state of São Paulo alone (RIVEIRA, 2020). This indicated that Brazil's social inequality was reflected in the distribution of PPE across the country's regions. As the acquisition of masks became more difficult, as a way of guaranteeing the supply of these products to professionals, the Ministry of Health carried out a campaign in April 2020 to encourage the population to make their own fabric masks.

It is important to note that masks are mostly composed of plastic components with different weights in the compositions of the masks (see Table 3).

TABLE 3: Plastic composition of the different types of masks. Source: Elaborated from an article published on the website of the Minas Gerais State Health Department and Rodriguez et al (2021).

	TYPES OF MASKS	DESCRIPTION	PLASTIC IN ITS COMPOSITION (WEIGHT IN GRAMS)
	**FABRIC MASKS**	Industrially or manually produced, it varies in its composition. Currently in Brazil it is the most used model. It can be reused.	-
	**SURGICAL MASK**	Industrially produced, it uses specific materials. It has filter elements and wire for better fit in the nose. It is not reusable.	Polypropylene: 1.8 g Polyester: 1.28 g
	**FILTERING FACEPIECE MASK (FFP)**	Industrially produced with specific materials, they have greater rigor in their manufacturing, having seals from Brazilian quality and sanitation agencies Inmetro or Anvisa. It can be reused, if taken sufficient care.	Polypropylene: 5 g
	**FFP MASKS WITH VALVE**	Similar to FFP masks with the difference that it has a valve that filters the air that enters the mask.	Polypropylene: 10 g Polyurethane: 0.05 g

Masks that have the most impact the environment contain the greatest amount of plastics in their composition, such as: propylene, polyethylene and polyurethane (PRATA et al, 2020; URBAN, NAKADA, 2021). Reflecting on environmental impacts, an Ocean Conservancy report (2021) indicates that NGO volunteers collected approximately 107,000 pieces of PPE (masks, gloves, face shields and sanitary wipes) from beaches and waterways from all around the world between July and December 2020.

In this sense, an estimation by the Heinrich Böll Foundation (2020) points out that in a scenario where all people in the world used disposable masks, 129 billion masks would be needed per month to meet this demand. Considering Brazil, the report indicates that there would be a monthly consumption of 3.5 billion masks. It also estimates that when considering that each product weighs approximately 3 grams, more than 387,000 tons of plastics would be disposed of worldwide, where 10,500 tons of plastics of this would be disposed of in Brazil alone (FUNDAÇÃO HEINRICH BÖLL BRASIL, 2020). This reveals the complexity of the issue, if on the one hand there is a greater guarantee of health protection by the Covid-19 virus, on the other hand disposable masks generate a considerable environmental impact.

Brazil is considered the 16th largest country in terms of marine plastic pollution (FUNDAÇÃO HEINRICH BÖLL BRASIL, 2020). Improper disposal of PPE in the ocean can have serious impacts as marine organisms have the potential to ingest and entangle themselves in these materials. According to Alexandre Turra, coordinator of the UNESCO for Ocean Sustainability, in the long term microplastics generated by the fragmentation of PPE can be easily ingested by various marine animals: "The ingestion of these residues usually leads to a false sensation that the organism is satiated in terms of food and this leads to a process of starvation that often ends up in death" (OLIVEIRA, 2020). In addition to the aquifer environment, plastic pollution can impact the soil and atmosphere, as shown in Table 4.

TABLE 4: Impacts by type of environment. Sources: Santos (2012); Foundation Heinrich Böll (2020); Oceana (2020).

ENVIRONMENT	IMPACTS
 **SOIL**	• Contamination from the decomposition of by-products, such as other polymers, additives, fillers, colorants, metals, oligomers, which are not necessarily absorbed by environmental cycles and natural processes; • Microplastics affect soil structure and the natural habitat of microorganisms responsible for soil fertility.
 **WATER**	• Contamination from the decomposition of by-products, such as other polymers, additives, fillers, colorants, metals, oligomers, which are not necessarily absorbed by environmental cycles and natural processes; • Cause death of fauna by ingestion; • Decomposed into microplastics, ingested by animals, and consequently ingested by humans who consume these animals.
 **ATMOSPHERE**	• Throughout its production chain, it emits various polluting compounds and greenhouse gases (GHG); • In post-consumption, its incineration pollutes even more, also emitting several polluting compounds and GHGs.

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