Bachelor thesis

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Title:

“Assessment of different EU policies to reduce the environmental impact of single-use plastics: a German perspective”

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Abstract

Plastic is a lightweight, flexible and durable material, whose once innovative characteristics have turned it into a nightmare for ecosystems, biodiversity and potentially human health. In the last decades the worldwide production of plastics has increased significantly and, consequently, the amount of plastic waste has also increased. However, the life span of plastic products stretches far beyond their disposal, so that every plastic product which cannot be brought back into the economy turns into litter and becomes a huge problem, especially to marine environments. In this context, the global awareness of the negative effects of plastic waste have encouraged governments to take action against this problem. The European Union as a forerunner in terms of environmental policies, has adopted several measures to address the steps of the plastic waste stream, including the recently enacted EU 2019/904 Directive on the reduction of the impact of certain plastic products on the environment.

Focusing on Germany, this thesis provides an analysis of the EU 2019/904 policy instrument mix and thereafter assesses its effectiveness, efficiency, its capability of providing incentives for producers to keep investing in new environmentally friendly products, practicability, flexibility and its acceptance by society and by plastic producers, also considering the Directive`s main purposes of reducing the environmental impact of single-use plastics and of promoting the transition to a more circular economy.

Besides the limited available data, the effects of the Directive on the environment and on circularity of plastics seem to be positive for Germany and the European Union, so that the instrument seems suitable for achieving its objectives, although empirical evaluations in the future may be needed for confirming the results.

Keywords:

Single-use plastic, plastic waste, plastic pollution, negative externalities of plastic, environmental policies, assessment of environmental policies

JEL classification:

Q51, Q53, Q58

I Outline

II List of figures and tables

III List of abbreviations

EC	European Commission
ECJ	European Court of Justice
EFBW	European Federation of Bottled Waters
EP	European Parliament
EU	European Union
EPR	Extended Producer Responsibility
IEEP	Institute for European Environmental Policy
PET	Polyethylene terephthalate
PwC	PricewaterhouseCoopers
SME	Small and medium-sized enterprises
SUP	Single-use plastic
TFEU	Treaty on the Functioning of the European Union
TEU	Treaty on European Union
UNESDA	European Soft Drinks Industry
VerpackG	Verpackungsgesetz
WAFG	Wirtschaftsvereinigung alkoholfreie Getränke
WP	White Paper on Environmental Liability

1. Introduction

1.1 Research problem

Plastics play an important role in our economy and daily lives, however, the way they are currently produced, used and discarded has a huge impact on the environment, causing pollution which might have an impact on the ecosystem and human health. Besides, valuable material that could be brought back into the economy is lost, once littered. Moreover, plastics utilization has substantially increased since the 50s, but its consumption patterns remain inefficient and linear, following a “take-make-consume-dispose” lifecycle. Since most of the impact caused by plastics could be avoided by having a more circular plastics economy, it is essential to first address todays plastics linearity in order to later comprehend its effects on marine and land pollution, focusing on pollution caused by single-use plastics (in the following “SUP”).

Furthermore, plastic pollution results in economic and environmental costs to society, but these costs are mostly not included in market prices, being therefore externalised, what leads to misallocations that result in over-demand, overuse and over-exploitation of natural resources. Such effects, which are prejudicial to a collective good, are referred to as negative externalities and need to be explained and applied to SUPs before discoursing about a solution for them, through the implementation of environmental policies.

In order to cope with this SUP pollution problem in Europe, the European Union (in the following “EU”) has adopted the EU 2019/904 Directive, which aims at decreasing the quantity of plastic waste generated in its Member States, reducing the impact of SUP products on the environment and promoting a transition to a more circular economy. This Directive can be considered as pioneering in the world, especially because of its wide field of action, addressing different steps of the plastic waste stream for specific SUP products. If successfully implemented, it will make the EU a standard setter for the world in this area.

Still, for having a better understanding of the general working mechanisms, strengths and weaknesses of this policy instrument mix, and also to enable a subsequent detailed and reliable assessment of the mentioned Directive, its specific measures have to be first explained in detail, not forgetting to enlighten the environmental policy principles which guided its creation and its possible application into the German

territory, since this is the regional focus of this thesis. As a forerunner in Europe regarding environmental policies, in general, but also as a pioneer concerning rules and strategies related to plastic waste, Germany may be the suitable country to start with an analysis and evaluation of the impacts of such an EU policy.

The question remaining from the analysis of the EU 2019/904 Directive is whether those measures are environmentally effective, economic efficient, capable of providing incentives for producers to continuously invest in technology for their products, practicable, flexible and acceptable by society and plastic producers. These criteria, which are not fixed, were chosen by the majority of the researched authors and seem to be adequate for evaluating the Directive from different perspectives. The policy effects on Germany should also be highlighted.

Therefore, the aim of this bachelor thesis is to describe, analyse and evaluate the EU 2019/904 Directive, regarding its effects on the EU and especially on Germany, based on the effectiveness, efficiency, dynamic incentive effects, practicability, flexibility and acceptance criteria, and also considering its main purposes of reducing the environmental impact of SUPs and of promoting the transition to a more circular economy.

1.2 Course of investigation

This thesis describes, analyses and evaluates the EU 2019/904 Directive regarding its main purposes of reducing the environmental impact of SUPs and of promoting the transition to a more circular economy, but also considering further evaluation criteria as effectiveness, efficiency, dynamic incentive effects, practicability, flexibility and acceptance. It will focus on its outcomes for the EU and especially for Germany and apply a literature based theoretical approach.

Based upon the research question presented in chapter 1.1, the second chapter will commence addressing plastics linear economy general effects on pollution, before dealing specifically with pollution caused by SUPs to marine and land environments.

The third chapter will clarify the general topic of negative externalities, defining the term itself and explaining its impacts on market efficiency. Then, this concept will be applied to SUPs and a solution for this problem, in form of environmental policies, will be discussed.

Continuing to chapter four, the EU 2019/904 instrument mix will be analysed in detail, as part of the EU strategy to reduce the negative externalities of SUPs explained in chapter three. Its application into the German territory will be also taken into consideration.

Chapter five will make an assessment of the EU 2019/904 Directive by first explaining and then applying the effectiveness, efficiency, dynamic incentive effects, practicability, flexibility and acceptance criteria to the policy instrument mix. Its effects on Germany will also be taken into account and the chapter will be finished with a critical appraisal of the results.

Concluding with chapter six, the findings of chapters two to five will be summarised and an answer to the research question, presented in chapter 1.1, will be provided.

2. Environmental impacts of single-use plastics

2.1 Plastics linear economy effects on pollution

In order to better understand the reasons why the EU and also the rest of the world are committed to reducing the production and consumption of plastics, especially of SUPs, it is necessary to show SUP`s impact on the global environment. However, since most of the impact caused by plastics could be avoided by having a more circular plastics economy, it is essential to first address today`s plastics linearity in order to comprehend its effects on pollution.

Plastic is a versatile and innovative material that can be customized to fulfil a wide variety of needs in products, applications and sectors (PlasticsEurope, 2018, p. 16). Its unique combination of characteristics, durability, water-resistance and light-weight, make plastic adequate for manufacturing many consumer products (Horton et al., 2017, p. 129). This bachelor thesis will not address further physical and chemical aspects of the different types of plastics, as this is not relevant to the understanding of the following arguments.

While the plastic industry plays an important role in the economy, having reached a turnover of 355 billion euros in 2017 and directly employing more than 1.5 million people only in Europe, plastics growing use in short-lived applications, inadequate end-of-life treatment, low recyclability and reusability rates make its production and

consumption patterns increasingly inefficient and linear (EP, 2019, p. L155/1; Gionfra, 2018, p. 4; PlasticsEurope, 2018, p. 11).

The plastics` linear model follows a “take-make-consume-dispose” lifecycle of intended obsolescence, where products are designed to be thrown away immediately after use (EC, 2018a, p. 52; UNEP, 2018a, p. 9). This type of model has been dominant since the onset of the Industrial Revolution and is grounded on the assumption that resources are abundant, cheap and available (EC, 2018a, p. 52; WEF, 2014, pp. 3,13).

However, natural resources restrictions and climate change are starting to become reality (EC, 2018a, p. 52; WEF, 2014, pp. 3,13). Over 90 percent of the plastics` world production is derived from virgin fossil feedstocks, what represents 6 percent of global oil consumption and increases the exposure of companies to resource prices and supply disruptions risks (WEF et al., 2016, p. 17). Furthermore, improper plastic waste disposal leads to air, soil and marine pollution, which result in economic and environmental costs to society (Rogall, 2008, p. 38; Smet et al., 2019, p. 8).

The world plastic production almost reached 359 million tonnes in 2017, of which 64,4 million tonnes were produced only in Europe (PlasticsEurope, 2018, p. 18). Since the 1950s, 70 percent of the 8300 million tonnes of plastics the humankind has produced, have become waste, of which 84 percent or 4900 million tonnes have been placed in landfills or in the environment (Smet et al., 2019, p. 14). Besides that, the plastic world production and consumption have been rapidly rising in the last decades, prognosticated to reach 619 million tonnes of plastic by 2030 (Ogunola et al., 2018, p. 9293). Consumption patterns and waste management practices have not considerably changed in the last years, making it possible to forecast that by 2050 there will be approximately 12 billion tonnes of plastic litter in landfills and on the environment (UNEP, 2018a, p. 5).

Self-cleaning forces of nature and carrying capacity of the earth are not enough to absorb the rapidly growing plastic waste the world produces without consequences (Schmidt-Bleek and Klüting, 1994, p. 161,162). Plastic is an all-pervading environmental pollutant as its biodegradation cannot be achieved under normal conditions in the natural environment (Gionfra, 2018, p. 10). Plastic will not biodegrade, but degrade, what means it will break down into microplastics after many years, releasing toxic chemicals used to shape and harden the plastic into our food

and water supply (EP, 2019, p. L155/1). Therefore, it is possible to affirm that the majority of plastic ever produced is still present in the environment in some form and its impacts on human health are not yet known (Horton et al., 2017, p. 129; UNEP, 2018a, p. 5).

It has become clear that the plastics economy needs to change from a linear system that produces waste by design to a regenerative circular model, which recognises that resources are limited and should be used in an efficient way that preserves the value and benefits of plastics, eliminating waste generation as much as possible (Smet et al., 2019, p. 6; EC, 2018a, p. 52). In practice this means that re-using, repairing, refurbishing and recycling of existing materials and products should be encouraged. What used to be considered waste should be returned into a valuable resource (WEF et al., 2016, p. 32).

Rethinking and improving the operation of such a complex value chain requires efforts and cooperation by all its key players, from plastics producers to recyclers, retailers and consumers (Smet et al., 2019, p. 6). The EU as an example, demonstrates an important ambition in changing the way plastic is treated around the world. Since 2015, the European Commission (in the following “EC”) has been implementing measures to encourage Europe moving towards a circular economy under its Circular Economy Action Plan (EC, 2019, p. 1). In chapters 4 and 5 one of these measures, named the EU 2019/904 Directive of June 2019, will be explained, analysed and evaluated, also taking into consideration its pollution fighting efforts.

2.2 Single-use plastics and marine pollution

After addressing plastics linear economy general effects on pollution, the next both subchapters will discourse about pollution specifically caused by SUPs to marine and land environments, since this is the prevailing sort of plastics regulated by the EU 2019/904 Directive.

At the present moment, there is no legal definition for SUP. However, the EC established some criteria for what should be pointed as relevant SUP items. These items have 4 specific characteristics: they are susceptible to littering and usually ending in the marine environment; have a short use phase before being disposed of; are consumed predominantly away from home and there is already reusable or non-plastic alternatives for them (EC, 2018a, p. 62). SUPs include a wide variety of

packaging and non-packaging items like plastic bags, straws, coffee stirrers, cutlery, water bottles and most food packaging (Eunomia et al., 2018, p. 15).

Besides, approximately 50 percent of worldwide plastics are used to manufacture SUP items (Hopewell et al., 2009, p. 2115). The top 10 most frequently found SUPs make up 86 percent of all SUPs in beach litter and more than 50 percent of plastic marine litter (EC, 2018b, p. 4). Furthermore, approximately one third of the world`s plastic packaging ends up in the marine environment (EC, 2018a, p. 3).

SUP waste arrives at the ocean through different pathways and stems, mainly from land-based sources, due to waste mismanagement and illegal dumping (ibid.). This problem is bigger in densely populated areas, especially in Asia and Africa, where the portion of mismanaged waste is very high (Simon et al., 2018, p. 6). The mismanaged waste flows into waterways ending up into the sea (ibid.). A recent study has shown that rivers transport between 0.41 and 4 million tonnes of plastics every year to the oceans (Smet et al., 2019, p. 15).

Moreover, tourism activity is also responsible for SUP marine pollution, since many popular tourist destinations are coastal (GESAMP, 2016, p. 22). Despite the fact that these destinations have to deal with a high concentration of people, what increases waste production, tourists may be less concerned about environmental impacts in locations where they do not live and also tend to use more SUPs on vacation, where they have less access to non-disposable utensils (ibid.). The GESAMP report (2016, p. 86) also mentions commercial shipping as an important source of marine litter, suggesting that this sector should be responsible for 12 to 20 percent of global discharges of waste into the ocean.

The fact that there are millions of tonnes of SUP in the world`s marine environment has an impact not only in the marine`s ecosystem but also on the fishing industry and most likely on human health. Irregularly discarded plastic bags for example, may aggravate natural disasters by blocking waterways and providing breeding grounds for mosquitos and pests, increasing the transmission of diseases like malaria (Nizzetto et al., 2016, p. 10777). Moreover, many animal species, including birds, turtles and dolphins mistake SUP items for food, what may lead to their death or at best, to contamination of the food chain (EC, 2018b, p. 26).

Furthermore, evidence shows that toxic chemicals present in plastic transfer to animal tissue, finally entering the human food chain (Nizzetto et al., 2016, p. 10777). A recent EU-funded project found an average of 1.3 grams plastic litter in 85 percent of the analysed turtles (EC, 2018b, p. 7). Another research suggests that Europeans currently consume up to 11.000 pieces of plastic in their food every year, due to microplastics in fish and crustaceans (EC, 2018a, p. 28). However, the impacts of microplastics on human health are not well documented and the knowledge about the toxicity of plastic particles for humans is still unknown (GESAMP, 2016, p. 77; also Smet et al., 2019, p. 28).

With regard to marine litter`s impact on fisheries, this is at one hand due to the reduction of catches, as a consequence of the ingestion of macro- and microplastics by marine animals and, on the other hand, due to damage to fishing vessels and equipment by floating objects that affect the engine`s cooling systems and become trapped in propellers (GESAMP, 2016, p. 84).

Lastly, tourism and recreational activities like diving and snorkelling are also affected by marine SUP litter, since the psychological well-being of tourists is affected by costal pollution, reducing the number of visitors, revenues and consequently jobs in the local economy (ibid., p. 87). After this brief exposure of SUP`s problems in relation to marine pollution, it is already possible to understand why Europeans are significantly concerned about environmental plastics and its impacts on human health and consequently, why the EU is starting to deal with this subject more incisively (EC, 2018b, p. 26).

2.3 Single-use plastics and land pollution

After having discoursed about SUP pollution in the marine environment, the section below will concentrate on the problem of SUP pollution in terrestrial environments. Although plastic pollution on land is responsible not only for contamination and damage to soil, but also for 80 percent of plastic waste transferred by rivers to aquatic systems, there is still lack of knowledge about this subject, compared to what is known and the volume of information available about marine pollution (Gionfra, 2018, pp. 1,5; Horton et al., 2017, p. 127).

In the EU between 473.000 and 910.00 metric tonnes of plastic waste are released and retained to land annually, what is equivalent to 4 to 23 times the amount estimated to be released to the oceans (Gionfra, 2018, p. 1; also Horton et al., 2017, p. 130,134). As it has already been mentioned in the previous chapters, mismanaged plastic waste tends to turn into microplastics, raising the possibility of plastic contamination in the soil by chemicals often added to this material (Gionfra, 2018, p. 1; Horton et al., 2017, p. 130,134).

Besides, in her report for the Institute for European Environmental Policy (in the following “IEEP”), Susanna Gionfra (2018, pp. 4,6) classifies microplastics in two types: primary microplastics, intentionally manufactured in small sizes of less than 5mm, which enter the environment through drainage systems, wastewater treatment streams and through the use of sewage sludge as agricultural fertiliser, including production pellets, controlled-release fertiliser and microbeads used in cosmetics and household cleaners; and secondary microplastics, formed from the break-up of plastic waste due to weathering degradation and also linked to the use of plastics in agriculture, including polytunnels, silage bailing, plastic mulches, packaging and netting left on the soil. Therefore, according to the SUP`s characteristics mentioned on chapter 2.2, numerous primary microplastics and several secondary microplastics that are accumulating in our soils, are originated from SUP products.

In addition, the building, construction and demolition sectors are also an important source of land pollution caused by plastics, including SUPs frequently used as packaging for construction components (GESAMP, 2016, p. 21). This segment is responsible for 20 percent of new plastic consumption of all shapes, sizes, colours and polymers in Europe and the separation, sorting and recycling of those plastic items it still problematic (GESAMP, 2016, p. 22; PlasticsEurope, 2018, p. 24). Informal shelters and shanty towns give an additional contribution to the plastic waste mismanagement problem (GESAMP, 2016, p. 22).

Having discoursed in the last two chapters about how SUP pollution may affect marine and land environments, it is possible to conclude that this topic embodies a complex challenge, which is very interdependent, interconnected and difficult to structure (Smet et al., 2019, p. 14). Not only proper waste management remains essential for prevention of plastic litter, but also promoting interdisciplinary research and collaboration, combining environmental, engineering and behavioural sciences

knowledge with policymaking, in order to change the way our society deals with plastic waste effectively.

3. Environmental policies as a strategy to deal with negative externalities

3.1 Definition of negative externalities

This chapter will focus on explaining what negatives externalities are, taking into consideration the economic concepts of market and market equilibrium, in order to further understand why there is a need for environmental policies to regulate the production, consumption and disposal of SUPs, so as to reduce the impact of this type of plastic on society and the environment.

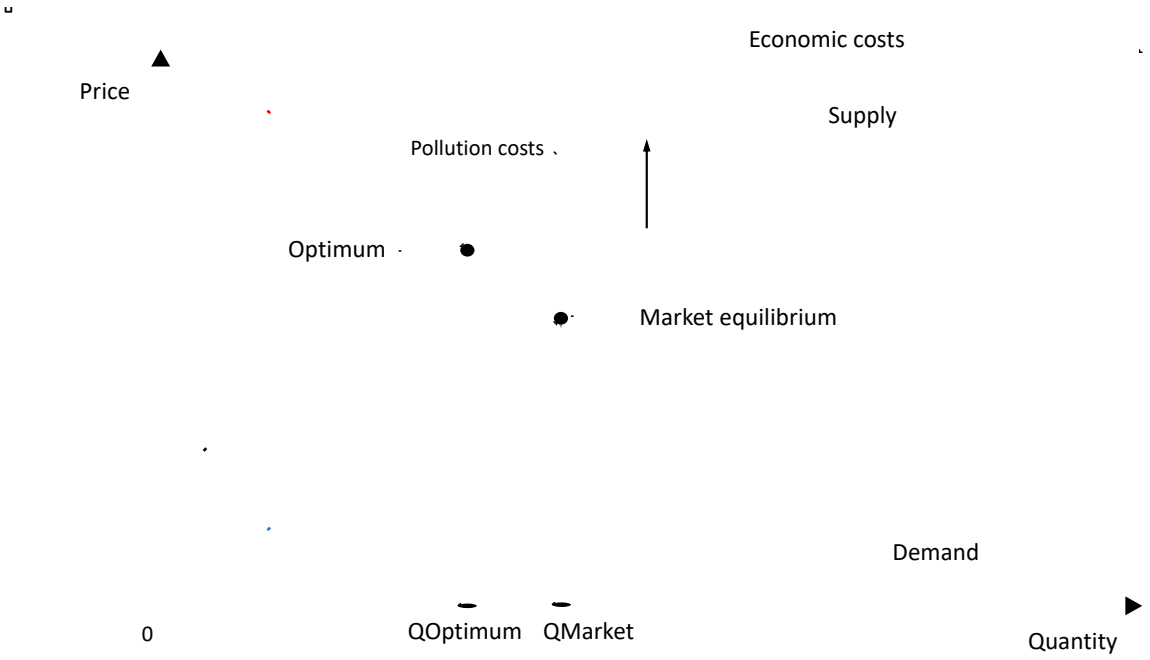
In economics, a market consists of groups of potential buyers and sellers of a good, where the group of potential buyers determines the demand for this good and the group of sellers determine the supply of this same good (Mankiw et al., 2008, p. 73). The market equilibrium point, where the supply and demand curve intersect, defines the amount of goods to be produced and the market price for these goods. Concerning the market price, it maximizes the overall benefits that buyers and sellers may achieve and leads to an efficient allocation of resources (ibid., pp. 88, 159, 175).

For this mechanism to work, all costs incurred must be reflected in the product price, otherwise there will be misallocations (Rogall, 2008, p. 60). However, in reality, the cost for the use of natural resources is mostly not included in market prices, nor do these prices take into consideration the fact that the current regenerative power of natural cycles is not anymore sufficient to maintain ecological balance. As a result, natural resources are over-demanded, overused and thus over-exploited and the environmental costs of using these resources externalized (ibid., pp. 60-62).

Therefore, it is possible to realize that market results do often not only affect buyers and sellers in that market, but also people who are not market participants (Mankiw et al., 2008, p. 178). Such side effects of private actions that are detrimental to a collective good are referred to as negative externalities (Huppes, 2001, p. 13). Since negative externalities are not taken into consideration by the decision making of buyers and sellers and the damage caused on the welfare of the uninvolved third party is not payed or otherwise compensated, the achieved market result may be inefficient, characterizing market failure (Mankiw et al., 2008, pp. 178, 229).

The graphic below illustrates the discrepancy between the optimum in an efficient market and market equilibrium in a market where external effects have not been internalized. The demand curve shows the willingness of consumers to pay certain prices for a product and the supply curve represents the manufacturers' costs (ibid, p. 231). The economic costs curve is above the supply or so-called private costs curve, since it includes the costs for negative externalities; the difference between both supply curves expresses the costs of pollution (Mankiw et al., 2008, p. 232). Consequently, the new optimum illustrates the real quantity of goods that should be produced in the market.

Figure 1: Market inefficiencies due to negative externalities



Source: own source based on Mankiw et al., 2008, p.232

When market failure occurs, governments may take corrective action to improve market outcomes and increase efficiency, in order to achieve the optimum discussed in the previous paragraph, also protecting environmental goods and making them available to future generations (Mankiw et al., 2008, pp. 178, 229; Rogall, 2008, p. 62). This subject will be further discussed in chapter 3.3.

3.2 Negative externalities in the context of single-use plastics

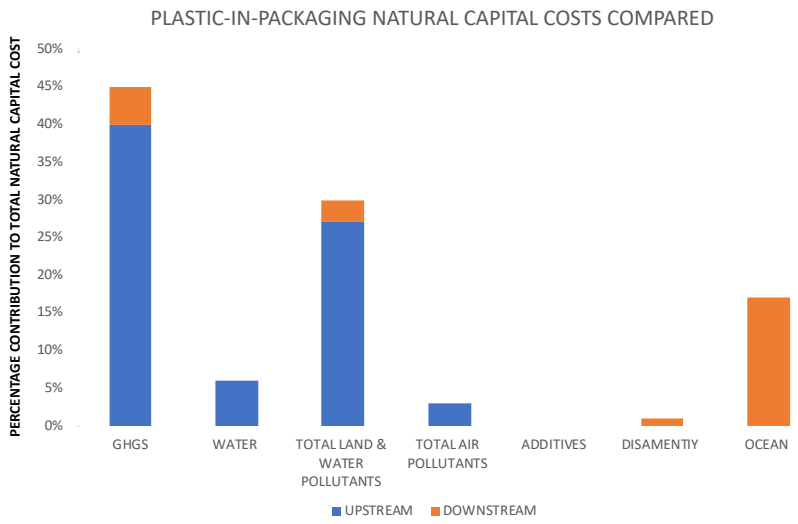
After defining negative externalities and explaining its impact on market efficiency, this chapter will apply the concept to SUPs, trying to quantify SUP`s external costs. Chapters 2.2 and 2.3 have already exposed the impacts of SUP`s pollution on marine and land environment, also showing in how far plastic pollution affects other industries, like the fishing, tourism and agriculture industries, as well human beings who have already been ingesting microplastics without knowing its consequences for their health. According to chapter 3.1, these side-effects of pollution may be categorized as negative externalities of SUPs and need to be quantified, in order that governments may apply the right measures for internalizing or compensating them. However, it is very difficult to monetize all the costs of overusing natural resources, since besides the usual underestimation of environmental impacts, there are evaluation and data collection problems, as well as complex interrelations that make it hard to present consistent results (Rogall, 2008, p. 76). Still, this chapter will give an overview of external costs related to SUPs in the EU.

Externalities related to plastics in general, including SUPs are concentrated in three main areas: greenhouse gas emissions resulting from production and incineration of plastic waste; degradation of natural systems as a result of leakage; and health and environmental impacts from substances of concern (WEF et al., 2016, p. 28). However, 75 percent of the known and quantifiable plastic impacts are generated from the extraction of raw materials to the manufacturing of plastic feedstock, that means, upstream in the supply chain (UNEP, 2014, p. 30).

The total natural capital costs of plastics in the consumer goods industry are estimated in 75 billion dollars, of which 40 billion dollars are related to plastic packaging, a type of SUP (Smet et al., 2019, pp. 28, 29; also World Economic Forum et al., 2016, pp. 17, 28). These costs already exceed the profit pool of the plastic packaging industry (WEF et al., 2016, p. 28). Over 30 percent of the natural capital costs in value of almost 23 billion dollars, come from greenhouse gas emission released upstream in the supply chain (UNEP, 2014, p. 12; WEF et al., 2016, p. 29). Marine pollution, which corresponds to the most significant downstream impact, occurred once the product has been discarded, has an estimated natural capital cost of 13 billion dollars (UNEP, 2014, p. 12). These numbers become even more important, when the projected increase in consumption is taken into consideration

(WEF et al., 2016, p. 29). The graphic in the next page illustrates the weighted distribution of the total natural capital costs of packaging by impact:

Figure 2: Plastic-in-packaging natural capital costs compared



Source: own source based on UNEP, 2014, p.32

Regarding external costs arising from the degradation of natural systems as a result of leakage, also known as plastic pollution, these may be direct or indirect costs, where the costs for beach clean-ups, for example, would be considered direct costs, and the loss of revenue in consequence of the decline of tourists visiting polluted beaches, as another example, would be considered an indirect cost (Smet et al., 2019, p. 28,29; Simon et al., 2018, p. 7).

In the case of the EU, marine litter, which is mostly constituted of SUPs, costs its fisheries between 1 and 5 percent of its total revenues from catches (EC, 2018b, p. 3). Furthermore, direct costs for costal and beach cleaning-ups in Europe are estimated in 695 million dollars per year (UNEP, 2018a, p. 5; WEF et al., 2016, p. 29; Simon et al., 2018, p. 7). It is also important not to forget that marine litter from Europe may affect citizens in countries outside the EU due to the cross-border nature of pollution and marine littering, causing these countries external costs (EC, 2018b, p. 26). The same is true for marine litter originated from other countries that cumulates on Europe`s coast (ibid.).

Regarding the external costs of SUP`s pollution related to human health, these are difficult to measure or estimate, since as explained in chapter 2.2, scientific evidence on the exact implications of plastics` chemical substances on human health and on the environment are not yet conclusive, especially due to the difficulty of assessing long-term exposure effects. (WEF et al., 2016, p. 17)

Finally, it is necessary to mention plastic product`s problematic regarding material value los. Due to a low worldwide recycling rate of 14 percent and improper waste treatment, about 95 percent of the material value of plastic is lost to the economy after a short use cycle (WEF et al., 2016, p. 12; Smet et al., 2019, p. 29). This loss was valued in 2016 at approximately 80-120 billion Dollars, or 1100 to 1600 Dollars per plastic tone (WEF et al., 2016, p. 12; Smet et al., 2019, p. 29). Creating an effective after-use plastic economy is therefore fundamental to capture extra material value and increase resource productivity (WEF et al., 2016, p. 13).

Having discussed the subject of negative externalities and roughly estimated the some of the external costs related to them, it is possible to conclude that the substantial negative environmental, health and economic impact of SUPs and of plastics in general needs to be reduced. Measures to diminish negative externalities, could result in benefits for businesses, consumers and governments, lowering costs and administrative burden from plastic littering (Rogall, 2008, p. 76). The next chapter will deal with this type of measures in detail.

3.3 Environmental policies for the internalisation of external costs

As it has already been discussed in chapter 3.1, resource allocation will be efficient if decision makers take externalities into account. This may be achieved voluntarily or as a result of formal or non-formal measures that align an incentive structure with conditions for reaching the overall social optimum, therefore making external costs to be taken into consideration (OECD, 2008, p. 56,57). In the case of negative externalities caused by SUP`s pollution, such measures are called environmental policies and will be explained in detail in this chapter. Initially, it will be necessary to define what environmental policies are and later on to explain why parties are usually not able to internalize environmental costs, making this type of policy necessary. Later on, its cross-border effect will be mentioned and a brief history of the development of environmental policies in Germany and the EU will be made.

Environmental policies are public measures that aim to eliminate, reduce or avoid environmental impacts through structured actions intended to change other activities in society towards environmental goals (Jänicke et al., 2003, p. 14; Huppes, 2001, p. 8). These measures are supposed to ensure a fair distribution of natural resources for all individuals and subsequent generations (Rogall, 2008, p. 192). According to the Coase theorem, such policies would not always be necessary, since the parties would be able to negotiate a mutually beneficial and efficient solution, when market inefficiencies resulting from externalities occur (Mankiw et al., 2008, pp. 236, 249). However, in reality, mostly no satisfactory result can be achieved this way, even if there would be benefits for both sides, because already the oversized number of participants could make negotiations difficult (ibid. pp. 239, 249).

Moreover, Rogall (2008, pp. 63, 64, 67, 235) explains that when specifically dealing with subjects related to the overuse of natural resources, social-economic factors may influence individuals and determine their behaviour, so that it turns hard for people to sustain themselves sustainably. Three of these factors are relevant for understanding the public goods` set of problems: Free-rider syndrome, as the observable behaviour of people that try to escape the collective financing of social costs, by expecting other economic agents, for example other taxpayers, to take over these costs; “grazing land” problem, a term that refers to the Middle Ages shared grazing land, which points out the problem that people often treat common property less carefully than they treat private property; and prisoner`s dilemma, which notes the difficulty for individuals to do something for their community that affects their own benefit, if they cannot be sure that all other people will do the same, since an individual resignation would not change the problem.

Consequently, government intervention through environmental policies is necessary for the economic costs of pollution not to be disregarded, but also to avoid the common property problem, solve the prisoner`s dilemma and prevent the free-rider syndrome mentioned in the previous paragraph (Mankiw et al., 2008, p. 240; Huppes, 2001, p. 14). Control and possible sanctions have to be strong enough to assure individuals that almost all other people will behave the same way (Rogall, 2008, p. 67).

However, it is also important to reflect on how in a globalized world government interference that is restricted to a country's borders can lead to a competitive disadvantage for the economy or certain industries of that country, since international competitors would not have to internalize external costs in the same way (Krugman et al., 2010, p. 595). In Germany, for example, national environmental policy requirements caused an increase in production costs for its companies in the short and medium term (Jörgens and Saerbeck, 2017, p. 6). In order not to face a disadvantage in relation to other European competitors, the German Federal Government started to pressure the EU to align its environmental standards with the German ones (ibid.). Therefore, for environmental policy to be effective, it has to be thought of in terms of a combination of domestic and foreign policy.

To conclude this chapter, it is pertinent to provide a short overview of the development of environmental policies in Germany and the EU. Starting with Germany, where legal environmental regulations and government environmental measures have a long tradition, environmental policy has become a crucial subject since the 1960s (Jörgens and Saerbeck, 2017, p. 4). In 1971 the German Federal Government launched its first environmental programme, in 1974 the German Environmental Agency was created and by the beginning of the 1980s, Germany had developed into a forerunner in European and international environmental policy (ibid., pp. 4, 6).

Moving on to the EU, environmental policies began developing at the beginning of the 1970s, after the first United Nations Conference on the Environment in Stockholm in 1972 and because of the growing public and scientific concerns on the limits to growth (Scheuer and European Environmental Bureau, 2005, p. 18). By way of the European Council commitments in 1972 to establish a Community environmental policy, its first "Environmental Action Programme" was decided in 1973 (ibid.). The adoption of the Single European Act in 1987 has officially attached environmental targets, principles and decision-making techniques in the European Community Treaty (Jörgens and Saerbeck, 2017, p. 4). Since then, the EU`s scope for environmental action has continued to be extended, for example, through the establishment of the European Environmental Agency in 1990 and features, nowadays, a multiplicity of different principles and instruments (ibid., p. 5). Recently, in 2015, the EC adopted the "Closing the loop – an EU action plan for the Circular

Economy" aiming to help Europe`s transition towards a circular economy, boost global competitiveness and promote sustainable economic growth (EC, 2015).

In relation to the specific subject of plastics, including SUPs, the EU has adopted since January 2018 a new plastics strategy called "European Strategy for Plastics in a Circular Economy", aimed to reduce the leakage of plastics into the environment and visioning a new circular plastics economy (EC, 2018c; Simon et al., 2018, p. 16). The EU 2019/904 Directive of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment is part of this strategy to reduce negative externalities of SUPs and will be analysed and evaluated in subsequent chapters.

4. EU 2019/904 Directive as an environmental policy instrument mix

4.1 EU environmental policy principles

Before starting with the analysis of the EU 2019/904 environmental policy instrument mix, this subchapter will give an overview of the EU environmental policy principles which guided its creation. After introducing the subject and showing its importance to policy-making, the applicable principles will be briefly individually explained.

There is no legally agreed definition of what environmental principles are, especially considering the multiple jurisdictions in which they have legal roles (UK DEFRA, 2018, p. 3; Scotford, 2017, p. 3). However, these principles have been fundamental to concretize and operationalize environmental policy models and objectives around the world, offering direction to policy-making, since they represent goals of environmental protection and sustainable development to be achieved by environmental measures (Costanza et al., 2001, p. 242; UK DEFRA, 2018, pp. 2-3; Scotford, 2017, p. 3).

In the EU, environmental principles are reflected in the EU Treaties and environmental legislation (UK DEFRA, 2018, p. 2). They are also applied by EU courts to examine the legality of EU and Member State action concerning EU environmental matters (Scotford, 2017, p. 116; also UK POST, 2018, p. 1). Furthermore, this is also an important issue for candidate countries wishing to join the EU, since their national laws have to be improved to adapt to current EU environmental standards (von Seht and Ott, 2000, p. 4).

EU environmental core principles are expressed in article 191(2) of the Treaty on the Functioning of the European Union (in the following “TFEU”). These are the precautionary, prevention, correction at source and polluter pays principles, but the list must be nowadays extended to the principle of sustainable development, contained in article 11 of TFEU (Rogall, 2008, p. 192). Additionally, this same article requires environmental protection measures to be integrated into all EU activities and article 5 of the Treaty on European Union (in the following “TEU”) refers to the subsidiarity principle, which is not only applied to environmental policy, but to all fields of regulation (von Seht and Ott, 2000, p. 4).

The above-mentioned principles will be explained in detail in the following paragraphs. However, the precautionary and prevention principles will be explained together, since precaution and prevention may be considered exchangeable expressions and both principles are closely linked to one another (von Seht and Ott, 2000, p. 27; also UK POST, 2018, p. 3).

The precautionary principle developed out of the German *Vorsorgeprinzip*, which plays a central role in German environmental policy-making (von Seht and Ott, 2000, pp. 7–8). It was first defined in the 1992 Rio Declaration and is applied to manage risk in the case of scientific uncertainty (UK POST, 2018, pp. 1–2). The principle states that public authorities should not wait for certain insights, but anticipate potential environmental damage, taking precautionary measures to prevent it (Costanza et al., 2001, p. 264). In addition, the prevention principle affirms that public authorities should prevent, rather than react to environmental damages, but unlike the precautionary principle, this principle should be applied when the risk of environmental destruction is clear (UK POST, 2018, p. 3). Still, as for the other four core principles, there is no detailed definition for them in the TFEU (von Seht and Ott, 2000, p. 7).

Moreover, the principle of correction at source pursues to prevent pollution at its source rather than remedy its effects, encouraging the development of environmentally friendly technologies and products to prevent negative environmental outcomes at the earliest stage possible (UK POST, 2018, pp. 1, 3). This principle is based on the fact that it is much cheaper to prevent damages, than spending money on expensive measures to correct them (von Seht and Ott, 2000, p.

16). In German, it can be translated as *Ursprungsprinzip* and is seen as part of the above mentioned *Vorsorgeprinzip* (ibid.).

Furthermore, the polluter pays principle asserts that those causing environmental damage should also bear the environmental and social costs of their actions, thus internalizing external costs (Jänicke et al., 2003, p. 187; UK POST, 2018, p. 1; von Seht and Ott, 2000, p. 13). This principle developed out of the German *Verursacherprinzip* and is very important for the effectiveness of national environmental protection, as it motivates potential polluters not to pollute (von Seht and Ott, 2000, pp. 12–13). However, attributing costs to those persons causing environmental damages may be a complex task (UK POST, 2018, p. 1). The principle remains therefore mostly internationally ineffective, since identifying cause and effect of environmental harms outside the borders of a country is generally not viable (Schmidt-Bleek, 1993, p. 67).

Besides, according to article 11 of the TFEU, sustainable development can also be considered an official principle of EU environmental policy. Although there is still no internationally agreed definition of the term, the most accepted description appears to be the one developed by the so-called Brundtland Commission, the World Commission on Environment and Development, headed by the former Prime Minister of Norway in 1987 (von Seht and Ott, 2000, p. 18; also Kolstad, 2000, p. 32; also UK POST, 2018, p. 1). The commission defined sustainability as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987, p. 32). This should be an obligation the present generations owes to future generations (Kolstad, 2000, p. 32). However, in 2002, the EU extended the definition of the term in a document called “Towards a Global Partnership for Sustainable Development”, including three dimensions of goals to be considered: environmental, economic and social, therefore no longer limiting sustainable development to ecological aspects (EC, 2002, p. 3; Farmer, 2012, p. 10; UK POST, 2018, p. 3).

With regard to the principle of integration, it was first included among the general principles of EU environmental policy through the 1986 Single European Act, which revised the TFEU and settled up the European Economic Community (EP, 1987; Farmer, 2012, p. 2). Nowadays, the principle is contained in article 11 of TFEU and requires environmental protection measures to be “integrated into the definition and

implementation of the Union`s policies and activities", in order to promote sustainable development (*TFEU*, 2012). This principle places environmental objectives and concerns in the centre of the decision-making process of all types of EU policies, including non-environmental ones, since the environment is not only affected by environmental measures, but also by other sectoral policies such as energy, agriculture, fisheries and transport (Farmer, 2012, p. 2; von Seht and Ott, 2000, p. 25). Environmental integration is therefore achieved, by modifying sectoral policies that cause environmental impacts (Farmer, 2012, p. 2).

To conclude this subchapter it is necessary to mention the subsidiarity principle, which is applied to all fields of EU regulation, limiting EU`s scope for action (von Seht and Ott, 2000, p. 4). Article 5 of TEU not only mentions but also briefly explains what to expect from the application of this principle by the EU, elucidating that in areas where the EU does not have exclusive competence it shall only act "if and in so far the objectives of the proposed action cannot be sufficiently achieved by the Member States, either at central level or at regional and local level" (*TEU*, 2012). This principle was included in the TEC due to pressure from Germany, which had already established the subsidiarity principle in its territory for a long time (von Seht and Ott, 2000, p. 4). However, this fact does not reduce the importance of this principle, since leaving many decisions to the regional and local levels could increase the risk of having too many different provisions for one same subject, making it more time consuming and difficult for economic agents to take decisions (ibid., p.24).

After specifying and succinctly explaining EU`s environmental policy principles guiding the creation and control of EU environmental measures, it is time to analyse in detail one specific environmental policy, the EU 2019/904 Directive.

4.2 Analysis of the EU 2019/904 policy instrument mix

4.2.1 General aspects

After briefly discoursing in the previous chapter about the EU environmental policy principles, chapter 4.2 will explain, classify and analyse the EU 2019/904 policy instrument mix.

Policy instruments have been employed by governments for influencing the behaviour of citizens and businesses, however deciding about the right kind of instrument to be used, in order to achieve a specific goal, is usually not a simple task (Bouwma, I.M. et al., 2015, p. 19). Regarding environmental protection, the generally most effective approach is based on the use of a mix of available policy instruments, which should work alongside, with some of them having an effect in the long run and others in the short run (Giljum et al., 2005, p. 42). Still, the instrument mix should not only take into account environmental, but also economic and social objectives, and should also able to be changed over time (ibid.).

With respect to the EU 2019/904 directive, its objectives laid down in article 1 are “to prevent and reduce the impact of certain plastic products on the environment, in particular the aquatic environment, and on human health, as well as to promote the transition to a circular economy…thus also contributing to the efficient functioning of the internal market”. In order to achieve these objectives, the directive sets out specific measures for SUP products, products made from oxo-degradable plastic and to fishing gear containing plastic (EC, 2018b, p. 1; EP, 2019, p. 2). The directive`s focus lies on plastic production prevention and prevention of plastic becoming waste, since these both approaches complement each other: if less plastic is produced, then less plastic becomes waste and if more plastic is reused or recycled, then plastic production from virgin plastic will decrease (Smet et al., 2019, p. 34). This thesis will only focus on the measures to be applied for SUP products.

The next subchapters cluster the different policy instruments into 4 groups, according to the type of instrument and the SUP products affected by its measures. Distinction will be made based on a policymaker`s perspective, between regulatory, economic and information instruments.

4.2.2 Ban on selected single-use plastic products

Article 5 of the EU 2019/904 Directive explicit prohibits the placing on the market of plastic cotton bud sticks, cutlery, plates, straws, beverage stirrers, sticks to be attached to and to support balloons and of food containers, beverage containers and cups for beverages made of expanded polystyrene. Its purpose is to provide environmental relief through a clear incentive to purchase and produce significantly more environmentally friendly products (Rogall, 2008, p. 259).

A prohibition or ban, like the one described in the previous paragraph is a type of regulatory instrument, generally targeting national authorities, producers or retailers and which aims at influencing consumer behaviour through laws, directives and regulations (Sonigo et al., 2012, p. 42). Such instruments are also known as command-and-control instruments, since they set binding requirements, to be controlled by the competent authorities and which, in case of nonconformity, will be followed by sanctions (Bouwma, I.M. et al., 2015, p. 20; Boyer and Porrini, 2002, p. 261). Because of its binding character, regulatory instruments have the advantage of having a high degree of coerciveness, as they impose stakeholders to comply with them, even if they do not want to do so (Bouwma, I.M. et al., 2015, p. 20). Besides, such instruments prevent actors from arbitrary government decisions, since they must be equally applied to all parties affected by them (ibid.).

Additionally, regulatory instruments are based on the polluter pays and precautionary principles, therefore being everywhere essential, where direct environmental damage and environmental hazards are to be avoid and a response to identified threats is needed (Rogall, 2008, p. 240; Jänicke et al., 2003, pp. 102–103). They are the appropriated instruments to be used, when there are clear environmental goals to be followed, for which there is general political consensus, similar abatement costs for the actors involved and when its implementation may be easy and effective (Costanza , et al., 2001, p. 246).

In the EU, environmental policy approach has been predominantly based on regulatory instruments and a hierarchical relation between the EU, acting as regulator, and its member states, accepting and implementing its regulations, may be observed, what differs from most governmental relations regarding environmental policies in bilateral and multinational treaties (Bouwma, I.M. et al., 2015, p. 20; Huppes, 2001, p. 33). Furthermore, European citizens fully support EU policy intervention in environmental issues, especially when related to climate change, air and waste pollution, as in the case of the here analysed Directive (EC, 2018). According to the 2017 special Eurobarometer, 94 percent of Europeans think protecting the environment is important and 83 percent see the EU as best guarantee that EU environmental laws are correctly applied (ibid.). The previous Eurobarometer in 2016 concluded that 67 percent of Europeans would like the EU to do more on

environmental protection (EC, 2016, n. pag). Still, subjects related to the acceptance of the EU 2019/904 Directive will be further discussed in chapter 5.2.5.

4.2.3 Consumption reduction measures for selected single-use plastic products

After examining article 5 of the EU 2019/904 Directive in the previous chapter, this chapter will analyse the instruments described in articles 4, 7 and 10, which specifically aim at influencing consumer behaviour towards a more sustainable consumption. Since plastic is omnipresent and abundant in our daily lives, consumers tend to view plastic as a material with no value of its own, what leads to littering and hinders recycling (UNEP, 2018a, p. 10). Consumers need to learn to value plastic and to have more information about the consequences of its inadequate disposal into the environment, in order to reduce its consumption and increase its reutilization and recycling quotes (ibid.). Environmental policy instruments like the ones described in this chapter, can be used for reaching this objective.

Article 4 imposes Member States to take the necessary measures to achieve a “measurable quantitative reduction” in the consumption of cups for beverages, including their covers and lids and of specific food containers made of plastic by 2026, leading to a “substantial reversal of increasing consumption trends”. These measures to be prepared, adopted and notified to the EU Commission by July 2021 may be, however, freely chosen by the Member States applying them, although an “implementing act laying down the methodology for the calculation and verification” of the consumption reduction results will be adopted by the EU Commission by January 2021.

The compulsory instructions depicted in the above cited article 4 may be per se also classified as regulatory instruments, since they directly affect the behaviour of the actors involved (Rogall, 2008, p. 240). In this specific case, however, different possible measures, which could fit in different categories, will be used for changing consumer behaviour and reaching reduction targets. As it is not yet possible to predict which methods will be used for realising the article`s objective and since regulatory instruments were already explained in chapter 4.2.2, no further remarks will be made regarding this subject in the next paragraphs.

Turning now to article 7 of the EU 2019/904 Directive titled “marking requirements”, Member states are compelled to ensure that sanitary towels, tampons, tampon applicators, wet wipes, tobacco products with filters, filters marketed for use in combination with tobacco products and cups for beverages made of or containing plastic bear “a conspicuous, clearly legible and indelible marking on its packaging or on the product itself”, in order to inform consumers of the appropriate waste management options, waste disposal means to be avoided, the presence of plastic in those products and the resulting negative impact of littering or inappropriate waste disposal of those products on the environment. Furthermore, harmonized specifications for the marking of the referred products shall be established by the EU Commission by July 2020.

The reason why this article was inserted in the here analysed directive is because the above-mentioned SUP products are often inappropriate disposed through the sewer system or otherwise incorrect release into the environment, what leads to pollution and economic damage to sewer networks by the obstruction of pumps and the blocking of pipes (EP, 2019, p. L155/5, recital 20). Moreover, there is currently substantial lack of information about the material characteristics and the appropriate way of waste disposing those products, so that effective and easily understandable marking requirements could be a reasonable solution for this problem (ibid.).

From the wording of article 7 it is still not possible to affirm if what is meant by “marking on package” is a symbol or a written text to be placed on the packaging of the products specified in the previous paragraph. Still, regardless of the type of marking, labels and marks have been commonly used to provide information regarding, for example, safety, health, energy efficiency, environmental issues or proper methods of recycling and disposal of a product to market surveillance authorities, importers, distributors and end-users (ITA, 2019, n. pag.). Such an information tool has been used with the intention of influencing consumer and producer behaviour through product information, environmental education and the development of environmental ethics (Rogall, 2008, p. 244; Sonigo et al., 2012, p. 45). It may help fostering market-oriented solutions to environmental issues (Stavins, 2003, p. 411).

Instruments like the ones described above, which aim at changing the behaviour of the actors involved by means of incentives or information, may be classified as indirect-acting instruments, which usually have a high level of acceptance, but tend to be ecological ineffective (Rogall, 2008, p. 69). Besides the fact that they depend on the consumer reacting voluntarily, the limitations of information measures also reveal that consumers rarely search out, read or are able to absorb all the information available to them, when making a decision (ASCEE, 2008, p. 16; Sonigo et al., 2012, p. 45). Still, such instruments can help to support and reinforce other policy measures within the framework of an instrument mix and are an important tool to promote sustainable consumption (Harrison, 2014, p. 365; Rogall, 2008, p. 69; Sonigo et al., 2012, p. 45).

Nonetheless, although the intention behind the wording of article 7 and its compulsory labelling seems to be informing and educating consumers about environmental topics in order to avoid inappropriate waste disposal of specific SUP products, the marking of these products also tend to reduce its consumption, encouraging consumers to purchase environmentally friendly products (Harrison, 2014, p. 365). Furthermore, it may even have a third result, providing incentives to manufacturers for taking into account the environmental impact of their products, thereby motivating innovation (Rubik, 1995, p. 6).

Lastly, article 10, which is also an information instrument and for this reason, may have the same characteristics and limitations as the ones described in the previous paragraphs, focuses on increasing consumer awareness and incentivizing responsible consumer behaviour for specific SUP products like, some sorts of food containers, packets, wrappers, beverage containers, cups for beverages, tobacco products with filters and filters marketed for use in combination with tobacco products, wet wipes, balloons, lightweight plastic carrier bags, sanitary towels, tampons and tampon applicators. It intends to make information available to consumers about re-usable alternatives, re-use systems and waste management options, as well as about the impact of littering and inappropriate waste disposal of those products on the environment and on the sewer networks (EP, 2019, p. L155/13). Therefore, it is possible to observe that articles 7 and 10 complement each other, having similar objectives and being important factors for changing consumption patterns.

4.2.4 Extended producer responsibility schemes

Having explained and analysed the consumption reduction measures laid down in articles 4, 7 and 10 of the EU 2019/904 Directive in the previous chapter, this chapter will discuss the extended producer responsibility schemes indicated in article 8 of the same regulation.

The first part of article 8 is a general provision for Member States to ensure that extended producer responsibility schemes are established for some sorts of food containers, packets, wrappers, beverage containers, cups for beverages, lightweight plastic carrier bags, wet wipes, balloons, tobacco products with filters and filters marketed for use in combination with tobacco made of plastic. However, paragraphs 2 and 3 of the same article specifically indicate which costs to be covered by which producers of the above mentioned SUP products, including “the costs of the awareness raising measures referred to in article 10” of the here analysed Directive, the costs of waste collection, transport and treatment of waste regarding some of the above mentioned products, the costs of cleaning up litter and the subsequent transport and treatment of litter resulting from some of these products and the costs of data gathering and reporting related to specific SUP products.

The aforementioned costs are in accordance with the EC environmental liability regime adopted since 2000 through the implementation of the EC “White Paper on Environmental Liability” (in the following “WP”), which aims at implementing the polluter pays principle enshrined in article 191(2) of the TFEU and already explained in chapter 4.1, ensuring that the costs of restoration of environmental damage are paid by the causer of the damage and not by the State or the taxpayer. (EC, 2000, p. 5,7,13,14). The WP establishes which specific types and forms of environmental damage should be remedied through liability, paying attention to the fact that damages should be concrete and quantifiable, the polluters identifiable and a causal link between the damage and the polluter(s) detectable (Boyer and Porrini, 2002, p. 254; EC, 2000, p. 13).

However, fault of the actors does not need to be proven, since the EC liability regime is based on strict liability, so that the fact that an act caused the damage would be enough for the imposition of liability to the party responsible for this damage, taking into account the fact that it is very difficult to establish and prove fault in environmental liability cases and that the party carrying out an inherently hazardous

activity should bear the risks of the damages caused by this activity (Boyer and Porrini, 2002, p. 254; EC, 2000, p. 18). Moreover, in the case of article 8, it is possible to identify the sources of waste coming into the environment, specially the marine environment, and to measure SUP items in marine litter, since an impact assessment survey has been made by the EC regarding SUP beach litter in the EU (EC, 2018b).

The intention behind the use of liability instruments like the ones described in article 8, is to make polluters act with more precaution, avoiding risks and damages and encouraging investment in research and development for improving technologies (EC, 2000, p. 14). Since the originator of a damage will not be able to relocate some of the social costs of his actions to third parties or consumers, it will be encouraged to develop products that are appropriate for multiple use, technically durable and suitable for proper and safe recovery, as well as environmentally compatible disposal (EP, 2008, p. L312/12; Siebert, 1991, p. 183). Insofar, extended producer responsibility (in the following “EPR”) may create an incentive for producers to consider post-consumer waste-management costs when making decisions about product design and marketing, compared to other policy instruments (OECD, 2005a, p. 4).

Besides that, the stimulus generated by those instruments may be particularly important for tobacco product filters containing plastic, since these are the second most found SUP items on beaches in the EU, causing a huge environmental impact as they are frequently directly discarded into the environment (EP, 2019, p. L155/4, recital 16). Innovation and product development could provide better alternatives for such products (ibid.).

Moving on now to consider a broader definition of the here mentioned liability instruments, it is imperative to attempt to the fact that these would be also qualified as economic instruments, since they provoke a change in the behaviour of the economic agents involved, through the modification in the incentive structure faced by these agents, imposing the internalization of environmental and depletion costs (Panayotou, 1995, p. 7). They are intended to change the basic conditions of the economic actors, so that the misallocation that is taking place today can be prevented in the future and sustainability objectives can be achieved by economically

disadvantaging environmental harmful products (Rogall, 2008, p. 250). Besides, they often contain regulatory components, creating an instrument mix (ibid.).

Still, economic tools like the ones described in this chapter, will only have the capability of influencing consumer purchasing decisions if they are set at a sufficiently high level and assuming that producers would incorporate the additional costs for the treatment of the post-consumer product into the price of this product, therefore changing the demand for those products (OECD, 2001, p. 60; Sonigo et al., 2012, p. 43). For the adoption of this instrument to be effective, the economic advantage of polluters must be reduced, turning polluting more expensive than environmentally friendly behaviour (OECD, 2001, p. 60). Thus, environmental protection must be cost-effective for polluters (ibid.).

4.2.5 Requirements and targets for design, manufacturing, collection and recycling of plastic bottles

The last articles to be analysed in subchapter 4.2 of this thesis are articles 6 and 9 of the EU 2019/904 Directive. Both articles also describe EPR policy approaches, however, the instruments here presented differ from those of subchapter 4.2.4, since they belong to the regulatory instruments category already explained in subchapter 4.2.2, though the take-back requirements of article 9 may be converted in market-based deposit refund systems schemes.

As it has already been explained in the previous subchapter, EPR is an environmental policy approach which intends to reduce the economic and environmental costs of waste management, by extending the responsibility of producers for their products to include the social costs of waste management and the environmental impact of waste disposal (OECD, 2005a, p. 4,6). Therefore, producers should bear financial and/or physical responsibility for the treatment and discarding of post-consumer products (OECD, 2001, p. 9). The intention behind EPR schemes is to motivate producers to improve the design of their products, optimizing environmental performance and minimizing end-of-life management costs (Gionfra, 2018, p. 12).

EPR systems in operation tend to have three common elements: obligation on the producer regarding the collection or “take-back” of product packaging or end of life products; rules or targets concerning the methods of waste management of

recovered products, including minimum re-use or recycling rates; and responsibility for the costs of appropriate waste management of the collected products (OECD, 2005a, p. 10). In the case of the EU 2019/904 Directive, the rules concerning the last element can be found in article 8, already explained in the previous subchapter. Articles 6 and 9 deal with both other elements, as will be seen in the next paragraphs.

Starting with article 6, entitled “product requirements”, Member States shall ensure that beverage containers with a capacity of up to three litres have its caps and lids made of plastic attached to them during the products` projected use stage. The reason for such a design-standardisation ruling, is the fact that caps and lids made of plastic used for beverage bottles are among the SUP items that are most found on the beaches in the EU (EP, 2019, p. L155/5, recital 17).

Besides, the same article in its paragraph 5, also establishes minimum recycled content requirements to be achieved in 2025 and 2030 for beverage bottles manufactured from polyethylene terephthalate (in the following “PET”) with a capacity of up to three litres. Such measures tend to deal with both, resource efficiency issues related to the product`s production phase and recycling issues related to the post-consumption phase of these same products, encouraging taking back of materials for recycling or re-use (OECD, 2001, pp. 39, 40, 44).

To conclude this section, article 9 should be briefly examined. It requires Member States to take the necessary measures to ensure by 2025 and 2029 separate collection for recycling of beverage bottles with a capacity of up to three litres, of an amount equal to 77 percent and 90 percent, respectively, of those products placed on the market in a given year by weight. The mentioned measures may include deposit-refund schemes and separate collection targets for relevant EPR schemes. Since the forecited type of beverage bottles are also one of marine litter items most found in EU beaches, due to ineffective separate collection systems and low consumer participation in those systems, the rulings contained in this article are, therefore, of particular importance for reducing the impact of these products on the environment (EP, 2019, p. L155/6, recital 27).

4.3 Application of the EU 2019/904 Directive in Germany

After analysing the different policy instruments of the EU 2019/904 directive and since this thesis intents to focus on its effects for Germany, it turns necessary to proof the directive`s applicability into German territory, considering that Germany is a Member State of the EU. First, the competence of the EU for passing law that is binding on its Member States will be examined. Subsequently, the application and enforcement of EU directives into the German territory will be verified.

The treaty of Rome, signed in 1957, established a cluster of organisations and a set of rules to support exchange across national borders, with the intention to link national economies, in order to fasten the generation of wealth and make war among members unthinkable (Sandholtz and Stone Sweet, 1998, p. 2). Therefore, it created a social and political space that purposely privileged transnational economic interest and which promoted movement towards increased supranational governance (ibid.). Since then, the EU has developed into a supranational regime, where Member States agreed to transfer some of their powers to the EU institutions in specific policy areas (De Wet et al., 2015, p. 444,446). In these areas, the EU has the permission to pass law that is binding on its Member States (Neumann, 1996, p. 81).

Under article 288 of TFEU, the EU institutions “shall adopt regulations, directives, decisions, recommendations and opinions” in order to exercise its competence. With respect to environmental policies, including the EU 2019/904 Directive, EU competence for passing law stems from articles 114 and 192 (1) of TFEU (EC, 2018b, p. 32).

Still, according to the wording of article 288 of TFEU, EU directives are not necessarily directly applicable law, but binding as to the results to be achieved, leaving Member States with the choice of form and methods for its national implementation (Farmer, 2012, p. 3; also De Wet et al., 2015, p. 448; also Neumann, 1996, p. 81). It is though the most frequently used kind of EU legislation, especially for environmental matters, and an appropriate instrument for harmonising Member States law (Farmer, 2012, p. 3; De Wet et al., 2015, p. 453; Neumann, 1996, p. 81).

Nevertheless, since the effectiveness of EU environmental directives are mainly determined by its implementation at local levels, enforcement remains an important issue and monitoring crucial (Farmer, 2012, p. 3; Kostelac Bjegovic et al., 2016, p.

21). Article 17 (1) of TEU stipulates that the EU Commission, under the control of the European Court of Justice (in the following “ECJ”), should supervise the application of EU law and articles 258 to 261 of TFEU give the Commission authorization to commence infringement proceedings against Member States that have breached their obligations under EU law. As the ECJ has consistently applied the principle of supremacy of EU law over national law and the doctrine of “direct effect” of directives, it is possible to assume that even when directives have not been transposed into national law, they may have legal effects in the EU Member States (De Wet et al., 2015, pp. 456–457; Farmer, 2012, p. 3; ECJ, 1963, 1974).

Turning now to Germany, article 24 (1) of its Basic Law (“*Grundgesetzt”*) promulgated in 1949, allows the Federal Republic to generally transfer by law sovereign powers to international organisations and article 23 (1) of the same law explicitly provides for the German Membership in the EU. Insofar, it may be assumed that the German legal system has accepted relevant rules of EU law (De Wet et al., 2015, p. 466).

For the above-mentioned reasons, it is possible to conclude that the EU 2019/904 Directive has to be implemented into Germany`s legal system and therefore applied in Germany. The next chapter will then concentrate on evaluating the mentioned directive under different criteria.

5. Assessment of the EU 2019/904 Directive and its effects on Germany

After explaining the environmental impact of SUPs, attempting to quantify negative externalities related to them and analysing the EU 2019/904 policy instrument mix, developed to internalize part of the external costs of SUP waste, the following subchapters will make an assessment of the mentioned Directive based on different criteria according to Busch, since the criteria for evaluating environmental instruments are not fixed and may vary according to different authors and the impacts to be checked (Busch, cited in Rogall, 2008, p. 239).

The referred assessment is not going to be quantitative, because of the lack of data available for analysis, since the EU Member States still have until July 2021 to come up with the laws, regulations and administrative provisions necessary to comply with the EU 2019/904 Directive and also considering the fact that a first official evaluation of this Directive is going to be carried out by July 2027 (EP, 2019, p. L155/15-L155/16). Moreover, the focus of the evaluation will be on environmental

effectiveness, followed by economic efficiency, dynamic incentive effects, practicability, flexibility and acceptance. The analysis will focus on the Directive`s effects on the EU as a whole, but also on its possible impacts on Germany.

Since there are almost no regulations dealing with the effects of the same kind of SUP regulated by the here analysed Directive, as this subject is still new worldwide, the here presented results may use the outcomes of the few studies and evaluations regarding SUP bags as the basis for forecasting possible future results for the mentioned regulation.

5.1 Environmental effectiveness

This first subchapter will evaluate the extent to which the EU 2019/904 Directive meets its intended environmental objective, that means, its environmental effectiveness. The effectiveness assessment will be made for the different types of instruments contained in the mentioned directive, but taking into account the interaction between these instruments, which may affect the effectiveness of the instrument mix as a whole.

Effectiveness is a central criterion for evaluating environmental policies and which takes into account not only the instrument`s capacity of meeting environmental objectives accurately, but also in a timely manner (Costanza et al., 2001, p. 240). Being effective also means eliminating the causes of ineffectiveness for the long run, not only moving the problem temporally (Jänicke, et al., 2003, p. 64). National and international effects on the environment may also be important when assessing effectiveness, since, for example, shifting production to locations abroad may cause pollution reductions nationally, but will not encourage changes in technologies or solve the problem effectively (Huppes, 2001, p. 9). In relation to the EU, where national policies may directly affect the competitiveness of other Member States, international effects may become significant (ibid.).

With regard to the EU 2019/904 Directive, article 1 reveals its two main objectives to be reached, namely the prevention and reduction of “the impact of certain plastic products on the environment, in particular the aquatic environment, and on human health” and promoting “the transition to a circular economy with innovative and sustainable business models, products and materials”, therefore contributing “to an efficient functioning of the internal market” (EP, 2019, p. L155/8). Effectiveness will

be here evaluated based on these objectives, however, in this subchapter the focus will be on the first objective, since the second one will be better addressed in chapter 5.3.

Starting with a general evaluation of effectiveness of regulatory instruments, it is possible to affirm, in theory, that these instruments are supposed to be highly effective, besides the fact that producers and consumers would probably rapidly react to and comply with the proposed measures, due to its binding character (Rogall, 2008, p. 242). That is why they are usually used for eliminating imminent danger (ibid.). However, successful enforcement of regulatory instruments may involve high level of control and implementation costs (Costanza , et al., 2001, p. 246). Moreover, the motivation for product innovations is low (ibid.).

Regarding the effectiveness of the ban imposed by article 5 of the EU 2019/904 Directive, it seems reasonable to extend the results for SUP bags bans around the world to the SUP items hereby regulated. Although the here provided answers may seem highly hypothetical, it would be very difficult to otherwise check effectiveness of the analysed instrument, since there is no quantitative data available for now. Furthermore, there is still little academic literature assessing effectiveness of interventions for SUP in general, including plastic bags (Xanthos and Walker, 2017, p. 22).

Plastic bags have been banned by some countries in order to regulate marine pollution, although these bans do mostly not cover the entire life cycle of these bags, what means that in most countries partial bans related to material content and thickness exist (UNEP, 2018b, p. 84). France and Italy are examples of EU countries adopting partial bans for plastic bags (Excell, 2019). Still, the objective to be reached by these bans is very similar to the above-mentioned EU 2019/904 Directive`s first objective.

In theory, bans should be effective in terms of environmental impact, since they should produce a 100% drop in the usage of a specific product, but especially in the case of the EU, they might impose extra administrative burden (Mudgal et al., 2011, p. 81; Nielsen et al., 2019, p. 433). Furthermore, the ban on the SUP products cited in the EU 2019/904 Directive could shift demand towards other products and carrying materials, which also have environmental impacts, instead of causing a change in consumer habits (Mudgal et al., 2011, p. 81). A recent study with plastic bags has

shown that some customers have only replaced their consumption of banned carryout bags for allowed trash bags made of plastic (Taylor, 2019, p. 263). These customers were, therefore, willing to pay for the trash bag services they have previously gained from free plastic bags (ibid.). However, in the case of plastic bags, the quantity of resources necessary for its production, including land, water and greenhouse gases emissions, is less than the quantity of resources necessary to produce paper, cotton or reusable bags (Excell, 2019, n. pag; also Taylor, 2019, p. 267). This may be also true for other SUP products.

Nevertheless, it may be easier to quantify and evaluate energy-related impacts, like the ones described above, than quantifying issues related to marine litter, toxicity of materials and its impacts on wildlife, since the upstream relation between plastic production and carbon footprint is well comprehendible and studied, while the downstream relationship between SUP litter and marine ecosystem is less studied and more difficult to understand (Taylor, 2019, pp. 267–268). Insofar, SUP bans, like the one described in article 5, may be effective in reducing the most visible form of plastic pollution, thereby creating benefits for tourism and other sectors (Excell, 2019; Mudgal et al., 2011, p. 96), besides the fact that the Directive`s main objective of reducing environmental impact may be hereby fulfilled.

Moving on now to evaluate the effectiveness of the design requirements of article 6 of the EU 2019/904 Directive, the measures proposed should be able to fulfil their objective of reducing the propensity for bottle lids to be littered (EC, 2018, p. 24). Since bottle lids are more frequently found in litter counts than bottles, this fact suggests that they are either more frequently littered or less effectively collected by litter clean up services, besides the fact that consumers may see smaller items as less impactful for the environment, contributing for the littering of these objects, what justifies intervention for design adjustments in this area (ibid., p. 24-25).

Through the application of article 6, the EC (2018, p.47) estimates a unit weight increase of plastic bottles by 2 %, which represents the increased material requirement for connecting caps and lids to bottles and cups. However, littering rates are thereby supposed to reduce by 5% and collection rates should have an increase of 5% for plastic bottles and of 25% for cup lids by 2030, assuming that there are limits to how many consumers may acquire integrated lid versions. Still, although this measure may not be efficient in terms of costs, what will be better explained in

chapter 5.2, its environmental effectiveness will probably be able to be confirmed by future measurements and studies.

Turning now to the effectiveness assessment of indirect-acting instruments, like the information measures contained in articles 7 and 10 of the EU 2019/904 Directive, these instruments have been used as policy tools to change behaviour, based on the primary idea that individuals are supposed to be purely rational decision-makers, which have access to perfect information, are motivated by self-interest and have the ability to precisely weigh the costs and benefits of an action (Sonigo et al., 2012, p. 47). However, in reality, consumer decision-making is subject to internal and external factors which influence choices and change preferences, so that specific notion of psychology, sociology and cultural studies is necessary for trying to influence it (ibid.).

Since behavioural change remains in the freedom of choice of the actors involved and the success of information and awareness raising measures is limited, because they depend not only on the consumers reacting voluntarily, but also on them properly searching out, reading and digesting all the information available when making a choice, effectiveness regarding those instruments tends to be low (Rogall, 2008, p. 248; ASCEE, 2008, p. 16; Sonigo et al., 2012, p. 45). Therefore, these instruments are alone unable to change the framework conditions for producers and consumers, needing to be combined with other measures to be more effective (Rogall, 2008, p. 249; ASCEE, 2008, p. 16). Still, they may increase the acceptance of other more far-reaching actions and help keeping environmental issues public (Rogall, 2008, p. 249; OECD, 2007, p. 25).

Nonetheless, in an instrument mix like the one analysed in this thesis, such instruments are not to be neglected. Mandatory labelling of commonly littered items could help deliver messages more directly to customers and its effectiveness would depend on how clearly the message is transmitted and on how much of an impact such message may have on those who litter the labelled items (EC, 2018, p. 24). Combining the information-based instruments of articles 7 and 10 with measures that more directly focus on environmental externalities, like the consumption reduction measures of article 4 of the EU 2019/904 Directive, could make both instruments more effective.

Lastly, according to the OECD (2007, p. 25), mutual reinforcement among instruments may, however, be more important where there are private benefits related to the change in behaviour. In the case of labelling of energy-efficient products, for example, consumers get a direct private benefit from using these products, since they would have lower operating costs, so that labels would primarily inform consumers about such benefits. Conversely, there are almost no private benefits associated with buying items just because they are part of a recycling system, so that such labelling is less likely to increase the effectiveness of other instruments in an instrument mix.

Having discussed the effectiveness of indirect acting instruments, the next paragraphs will address the effectiveness of the EPR measures listed in articles 6, 8 and 9 of the EU 2019/904 Directive.

Economic instruments, like the ones covered by article 8, tend to be highly ecological effective, since they can, under certain conditions, initiate a self-reinforcing process, not usually leading to an immediate, but long-lasting effect (Rogall, 2008, p. 259). However, as factors such as depth of intervention, frequency of tightening measures, state of technical development or existing substitution techniques are to be taken into account when designing such instruments, mixing such tools with regulatory instruments, like bans, may also have a direct impact on its effectiveness (ibid., p. 260). This is what happened in the case of the here analysed legislation, where the ban described in article 5 was combined with EPR schemes for substitute products. Still, since EPR schemes tend to be only part of a broader instrument mix to address waste and also because of lack of data, it is very difficult to assess its effects and specially difficult to distinguish its impacts from those of other measures, so that empirical evaluations become necessary (Watkins et al., 2017, p. 9,19).

Nevertheless, EPR measures have helped with the financing and improvement of the structure for the separate collection of plastics, as well as with the capturing of a bigger proportion of plastics through waste management channels, which contributed to reduce the amount of landfilled plastic and of plastic lost to the environment (ibid. p. 27). Besides, the separate collection targets of article 9 of the EU 2019/904 Directive may help providing the necessary supply of secondary raw materials for possible markets. Moreover, the minimum recycled content specified in article 6, may

support the development of such markets, ensuring the circular use of plastic aimed by the Directive (EP, 2019, p. L155/5, recital 17).

Nonetheless, the surpluses of collected material may still create a negative effect on trade, if there would be not enough carrying capacity for them, making these materials to be disposed internationally below market prices (OECD, 2001, p. 21). Furthermore, it is also necessary to observe if an increase in recycling rates would not have been reached because of the decrease on the usage of re-usable and refillable containers (Watkins et al., 2017, p. 20), what would go against the Directive`s objectives to be reached.

Still, different studies have shown that the development of EPR in Europe has contributed to enhancements in waste prevention, reuse and recycling in the past 15 years, although recycling is still often impeded by the shape, colour and material composition of plastic products, what will not be changed without investment in eco-design (ibid., p.5-6). Nevertheless, the EPR measures covered by the EU 2019/904 Directive have a good chance of being effective in reducing the environmental externalities of SUP waste and promoting the transition to a more circular economy.

The general effect to be expected from the application of the Directive in the EU is very positive. The EC expects to reduce SUP marine litter by half in comparison with other measures already in force, probably also reducing terrestrial littering, improving waste prevention and leading to changes in production that could have a positive impact on greenhouse gas emissions (EC, 2018a, p. 52). However, in practice, the effectiveness of the instrument mix will also depend on appropriate monitoring and on enforcement mechanisms being in place (OECD, 2007, p. 174). The EU should not only evaluate and review the information reported to the EC by Member States, but also monitor litter in the coastline, sea surface and seabed (EC, 2018b, p. 74), in order to ensure that Member States are correctly fulfilling their duties and if not, applying the appropriated penalties to them.

As far as Germany is concerned, the effects to be expected from complying with the EU 2019/904 Directive are the same as the ones described in the previous paragraphs. Still, regarding some of the measures, it may be easier for Germany implementing them than for other Member States, since they already have similar rules being applied to plastic products or a structure that allows timely and maybe less costly implementation of the required policies.

The German Federal Government was the one making resource efficiency and marine littering the topic of international summits for the first time in the world through its G7 and G20 presidency in 2015 and 2017, respectively (BMU, 2018, p. 9). Moreover, in 2018 the German Federal Environment Minister Svenja Schulze presented a 5-point plan comprising a mix of legal and voluntary measures to avoid superfluous plastic and to encourage more plastic recycling in the country, already covering recommendations contained in the European plastics strategy (ibid., pp. 2-11). In 2019 the new German Packaging law (in the following “VerpackG”) entered into force, which takes ecological criteria into account when measuring its license fees and already applies EPR schemes to the so called “service packaging” referred to in its paragraph 3 (BMU, 2018, p. 5; *VerpackG*, 2017, p. 2), anticipating the measures imposed by article 8 of the EU 2019/904 Directive. Such attitudes make Germany pioneer in Europe regarding subjects related to plastic waste and also highlights the importance of this issue for the German government.

However, Germany has already experienced saturation of its secondary materials markets in the past, after overachieving the targets of its former packaging ordinance, having had to “dump” the excess material on the international markets at below market prices, since there was not enough capacity and technical capability to treat them (OECD, 2001, p. 34). Once again anticipating the Directive`s measures and in order to find a better solution for the above mentioned problem, the VerpackG aims to encourage EPR schemes to promote recycled content (Watkins et al., 2017, p. 30). The German rules contained in paragraph 21 of the VerpackG are even more general than those enacted by the EU, encompassing many types of plastic packaging, while article 6 (5) of the EU 2019/904 Directive only rules about beverage bottles. Additionally, the BMU *“Rezyklat”* initiative should bring together all actors along the production chain, making them dialog and work to increase the quality and acceptance of secondary raw materials (BMU, 2018, p. 7).

Regarding the separate collection targets for bottles described in article 9 of the EU 2019/904 Directive, Germany has not only achieved all of these targets, but has also exceeded them (EC, 2018a, p. 70). With a 97% return rate for bottles (ibid.), Germany may share its expertise with other Member States in order to speed up the implementation of deposit-refund schemes in the EU (EP, 2019, p. L155/13). Nevertheless, although it was possible to show that there are good chances for the

EU 2019/904 Directive to be effective in Germany, achieving its environmental objectives without major difficulties, the volume of German residual waste remains an important issue to be addressed by public authorities and reflected about, since the country remains not only the EU top exporter of plastic waste, but also one of the biggest polluters despite of its high recycling rates (Zero Waste Europe, 2018, pp. 23, 26).

5.2 Economic efficiency

Moving on now to the efficiency assessment of the EU 2019/904 Directive, it is first of all necessary to define this term and to explain what outcomes to expect from the evaluation to be made in the next paragraphs.

Economic efficiency regarding the EU 2019/904 Directive aims to verify whether the environmental objectives of article 1 may be achieved with the lowest possible cost and the highest possible benefit. Another important issue would be whether the environmental gains from this policy are enough to justify the costs of operation (OECD, 2005a, p. 7). If the costs outweigh the sum of all the benefits of additional improvements, a re-examination of the policy would be appropriated (OECD, 2007, p. 219).

However, it is far beyond the scope of this thesis to make a comprehensive quantitative efficiency assessment, since there is still not enough information available for making a cost-benefit analysis. Nonetheless, even when there is more available data, it may be very difficult to make such an assessment, since it is technically difficult to value environmental impacts (OECD, 2007, p. 202). Therefore, the next paragraphs will focus on more general costs and benefits to be expected from the use of the chosen environmental instruments and on the results presented on the EC impact assessment documents, which assisted the lawmakers by the making of the here analysed Directive. Nevertheless, administrative and compliance costs to the public authorities for “implementing, monitoring and enforcing” the Directive`s measures and the costs incurred by the private sector in complying with these measures (OECD, 2005b, p. 43), as well as social costs to society will be also addressed, when possible.

Starting with the efficiency analysis of regulatory instruments in general, when not combined with other instruments, these tend to be economic inefficient, since the maximum damage reduction per unit of money is not realized, and as they may involve high level of control and implementation costs (Rogall, 2008, p. 243; Costanza et al., 2001, p. 246; Jänicke et al., 2003, p. 308). It is also criticized that the use of such instruments may lead to distortions of competition at the expense of small and medium-sized firms (Jänicke et al., 2003, p. 308).

However, in some situations, regulatory instruments like bans may be preferred by the legislator, as in the case of single-use plastic bags, here used as standard comparison for the ban of article 5 of the EU 2019/904 Directive, when there is lack of waste collection and treatment systems and an urgent need of addressing the problems caused by litter (Mudgal et al., 2011, p. 94). In this case, enforcement has to be eased, and a ban could be, despite of the higher costs, the better solution for the problem (ibid.). Regarding the Directive`s SUP ban, the costs for most of the existing 50.000 small and medium-sized EU plastic converters will be determined by whether their business is dependent on SUPs and also by their ability to change production for manufacturing other plastic or non-plastic items, as well as on consumer consumption decisions (EC, 2018b, p. 58; Mudgal et al., 2011, p. 96). Therefore, the ban could be destructive for specialized producers, leading to considerable job losses (Nielsen et al., 2019, p. 434).

Regarding the global plastic production, half of it is located in Asia and 19 percent in Europe, however, although production seems to be mostly outside of the EU, in terms of employment and turnover, plastic converters are very important in the EU economy (EC, 2018, p. 54). Still, whilst detailed production information is not available explicitly for SUPs, the preliminary EC analysis and some empirical research suggest that most SUP items are produced outside the EU, since the EU`s positive trade balance in plastics tends to be in higher added-value products (ibid. pp. 54, 56). Nonetheless, the negative changes in employment related to decreased turnover as a result of the application of the EU 2019/904 Directive are not expected to exceed the positive employment impacts of a switch to more labour-intensive practices (EC, 2018b, p. 58; Eunomia et al., 2018, p. 6). Besides, there is even the possibility of some social benefits to occur, for example, regarding activities related to

refill schemes, which may provide employment to people who are otherwise unable to work or unwanted by firms (Eunomia et al., 2018, p. 87).

Yet, the ban of article 5 may still provide cost benefits for retailers and consumers. Food and drink related items, like, for example, cutlery offered free of charge by the food service industry to customers, is normally bought by retailers and its value covered in the overall price paid by consumers (EC, 2018b, p. 56). A shift to reusable items may require a single upfront purchase by the retailer but avoid future costs of regularly buying SUP products, what may lead to a saving, if the costs for the non-plastic single use alternatives are passed on to consumers (Eunomia et al., 2018, p. 85).

In relation to other SUP items, like cotton buds, which are sold directly to the customers, the EC impact assessment document (2018b, p.57) explains that the costs or benefits related to these items will vary according to the difference between the wholesale price and the retail price of the alternative product. Although the number of sales of the non-plastic single use alternative will be lower, depending on the margin per item, profits may be made. For consumers, there may be some additional costs from having to wash reusable products after use (Eunomia et al., 2018, p. 86). However, since they will no longer have to purchase the SUP items, the overall costs tend to fall (EC, 2018b, p. 57).

According to Eunomia (2018, p. 79), savings related to the implementation of the EU 2019/904 Directive to consumers may be up to EUR 6.5 billion and they might lead to expenditure elsewhere in the economy. For public authorities, savings will come from the reduced quantities of litter, which will lead to less costs of litter collection, treatment and management (EC, 2018b, p. 57).

In Germany, the plastic industry counts as one of its most important industry sectors, generating sales of more than EUR 91 billion every year and employing around 390.000 people (GTAI, 2017, p. 3). Germany is also Europe`s largest producer of plastics and Europe`s leading market, accounting for approximately 25 percent of plastics demand (ibid., p. 2-3). Still, regarding the costs and benefits of a ban on specific SUP products, the results to be expected may be similar to those for the EU as whole, since Germany`s plastic industry does mainly provide innovative and high-quality plastic products for key industries and not a large number of low unit value SUP items (GTAI, 2017, p. 2).

Moving on now to discuss the possible costs related to the design requirements of article 6 of the EU 2019/904 Directive, the European soft drinks industry (in the following “UNESDA”) and the European Federation of Bottled Waters (in the following “EFBW”) both harshly criticize the EU mandatory rules to attach caps and lids made of plastic to beverage containers, arguing that a study conducted by the consulting firm PricewaterhouseCoopers (in the following “PwC”) estimates substantial environmental burden and billions Euros in costs for complying with those measures (UNESDA, 2018, n. pag.). The cited PwC report not only estimates that tethered caps and lids could require more than 50.000 to 200.000 tonnes of extra plastic to produce conforming beverage bottles, what would create up to 381 million kilograms of extra CO_2, but also highlights the disruption to be caused to the 1.350 bottling production lines in the EU, requiring a minimum of EUR 2.7 billion up to EUR 8.7 billion on costs to adapt them to the new regulation (ibid.).

Moreover, the German Business association of non-alcoholic beverages (in the following “WAFG”) gives support to the criticism made by the UNESDA and EFBW regarding the Directive`s design requirements, also sustaining that in countries with functioning collection or deposit-refund schemes, like Germany, beverage packaging would be largely returned with its associated closures (WAFG, 2018, p. 2). According to a survey cited by the WAFG, around 95 percent of the returned bottles in Germany contain their lids and caps, so that this would not be a relevant environmental problem for the country and the extra costs for complying with the new rules, therefore, not justified (ibid.).

Turning now to the costs and benefits analysis of ERP schemes, some of the extra costs to be covered by producers of specific SUP products are already stipulated in articles 6, 8 and 9 of the EU 2019/904 Directive, like the costs of waste management, clean up litter and awareness raising measures and, although they are not quantified, these expenses should not exceed the necessary costs to offer those services in a cost-efficient way (EP, 2019, p. L155/5, recital 21). One important reason for implementing such EPR schemes is trying to reduce the costs of waste management for municipalities and other public authorities, since waste volumes have been increasing over the years and, accordingly, the costs of handling each tonne of waste have also been rising (OECD, 2005a, p. 9). As a consequence of EPR schemes, producers tend to be encouraged to optimise the cost efficiency of collection and

recycling processes, thus leading to lower waste management expenses (Watkins et al., 2017, p. 18). Besides, EPR may incentive producers to reduce the quantity of resources utilized in products or to reduce the quantity of material considered problematic to recycle in these products, in order to lower sorting and collection costs (ibid.).

The above-mentioned cost savings may vary substantially across Member States due to factors like the type of products produced and collected, type of waste stream, proximity to waste management facility, technology and capacity (OECD, 2001, p. 20). Moreover, the development of the waste and recycling industry triggered by EPR schemes may also contribute to local job creation (Watkins et al., 2017, p. 19). In the EU, recycling is expected to create 80.000 new direct jobs by 2025, which might have an impact in the wider economy generating an additional 120.000 indirect jobs (ibid.).

On the other hand, efficiency in relation to the clean-up activities from article 8 of the EU 2019/904 Directive, may be difficult to address (Smet et al., 2019, p. 34). Although such measures may bring extra benefits regarding public awareness and environmental citizenship, only 5% of marine plastic litter accumulates on the beaches, so that, at the end, it may address the symptoms instead of addressing the sources of plastic pollution (ibid.). However, the EC intends to double the unit cost of litter clean-ups in order to half the amount of uncollected litter (EC, 2018, p. 47). Still, positive social impacts and overall improvement of levels of societal wellbeing may be expected from those beaches clean-ups (Eunomia et al., 2018, p. 86).

Lastly, regarding administrative costs for complying with the EU 2019/904 Directive, the proposed measures may entail some compliance costs on the public and private sectors, which may be passed on to consumers, in order to ensure implementation and enforcement (EC, 2018b, p. 53). The amount of costs will depend on the choice of the measures to be implemented (ibid.). In Germany, bureaucratic costs are to be determined by the use of the “standard-cost-model” (*Standard-Kosten-Modell*), but since they do not include content-related obligations and changes caused by a new law or regulation, compliance cost regarding citizens, businesses and the public administration were added to the calculation of these costs (NKR, 2018). The compliance costs should be determined based on the same principle as for determination of bureaucratic costs (ibid.).

Finally, the overall the benefits of the application of the EU 2019/904 Directive for both Germany and the EU seem to outweigh the costs, so that positive results may be expected from further quantitative efficiency assessments. In such big markets there will be always winners and losers, but, according to Eunomia (2018, p.5) in this case, the environmental benefits seem to be far greater than the total losses in sales to producers.

5.3 Dynamic incentive effects

After examining costs and benefits aspects of the EU 2019/904 Directive, this chapter will check whether the proposed measures are capable of providing incentives for producers to continuously invest in technology for their products, in order to improve their environmental condition and resource consumption.

Environmental instruments should be designed to incentivize polluters to continuously pursue a greater and more cost-effective prevention of pollution, to be achieved through technological innovation and changes in investment patterns and production processes (Costanza et al., 2001, p. 240; OECD, 2005b, p. 43). This goal to be followed has been internalized in article 1 of the EU 2019/904 Directive, where it is stated that the Directive has the objective to promote “the transition to a circular economy with innovative and sustainable business models, products and materials” (EP, 2019, p. L155/8).

Starting with the general effects to be expected from the use of the different policy instruments, regulatory instruments, in particular bans, like the one described in article 5 of the Directive, generate low motivation for product innovations, although they tend to be very environmental effective (Costanza et al., 2001, p. 246). Such instruments are normally used as a reaction to solve problems immediately, but with the consequence that they are rarely able to initiate development processes, cementing the state of art (Rogall, 2008, p. 243). As a result, it may be necessary for new regulations to come into force in order to correct old regulatory deficits, although these instruments may turn more dynamic through its combination with other environmental tools (ibid.).

On the other hand, economic instruments, including EPR liability instruments are more dynamic and aim to achieve environmental improvements though the product life cycle (Watkins et al., 2017, p. 4). They may encourage continuous enhancement

of environmental technologies and can be more easily adjusted to trends and new developments than regulatory measures (Rogall, 2008, p. 260). Moreover, EPR schemes may provide incentives for producers to design more resource efficient, sustainable, recoverable, recyclable and reusable products, since the intention behind this approach is to establish feedback loops, where product design helps optimizing environmental performance and minimizing the costs of end-of-life management (Watkins et al., 2017, pp. 4, 18).

However, is has been difficult for EPR measures in the EU to meet circular economy objectives other than recycling, which has been successful increased by the use of this instrument, and some of the reasons for this may be the low costs of compliance with EPR in relation to other business expenses, the fact that consumers are often willing to absorb these compliance costs within the products they buy and the fact that many of the fees were developed only to cover waste management costs, what may minimise recycling and treatment expenses, but will not change the behaviour of producers (Watkins et al., 2017, p. 24; Jänicke et al., 2003, p. 309).

Still, in the case of the here analysed directive and according to its article 8, EPR should not only cover waste collection and cleaning-up litter costs, but also the costs of awareness raising measures and data gathering related to specific SUP products, what may have a more positive effect in encouraging product innovations. Nevertheless, country specific effects will only be able to be analysed, when more data is available in some years.

5.4 Practicability, flexibility and acceptance

Having shortly assessed dynamic incentive effects concerning the EU 2019/904 Directive, this last subchapter will evaluate the administrability of the instrument mix, the Directive`s adapting capacity to new developments and the acceptance of these measures by the society and producers. First, a more general assessment of the different environmental instruments will be made and afterwards, more detailed information regarding Germany will be added.

Practicability should proof if the EU 2019/904 Directive is consistent with the existing regulatory framework, administratively manageable and enforceable, since a country may have very stringent environmental standards, but still not have environmental quality (Costanza et al., 2001, p. 240; Huppes, 2001, p. 11). Moreover, flexibility is

supposed to measure if the Directive is flexible enough to respond to changes in parameters, unpredictable effects or failure to meet its objectives (Costanza et al., 2001, p. 241). Finally, acceptance should verify if those who are impacted by the measures will accept them (Jänicke et al., 2003, p. 64,64).

Starting with a general evaluation of environmental policy instruments, regulatory instruments tend to have high practicability and limited acceptance, as, in theory, they may be easily controlled, but, in reality, lack of staff and equipment of the responsible authorities may lead to enforcement deficits due to insufficient control of the applied measures (Rogall, 2008, p. 242). Acceptance will depend on the depth of the intervention, the resulting costs and benefits, as well as on the public opinion about the subject (ibid., p 243).

Furthermore, according to Rogall (2008, pp. 248, 260), indirect-acting instruments tend to have high practicability, flexibility and acceptance, since they are easy to implement, as their depth of regulation is low and the measures not very complex. On the other hand, economic instruments, including EPR liability instruments, may have high practicability, but their acceptance can be reduced because of the price effects these instruments have. If the price changes become visible to consumers, acceptance of the instrument tends to decrease.

In relation to the practicability of the EU 2019/904 Directive in Germany, this topic may impact the effectiveness of this regulation in the country, if its practical application at national level does not correspond to the objectives specified in the EU legislation (Knill and Lenschow, 1998, p. 595). In this context, problems are more likely to occur if the implementation of the ordinance involves the change of deeply and/or broadly institutionalized regulatory patterns (ibid., p. 603), what does not seem to be the present case.

In the subchapter 5.1, issues regarding enforceability and administration of the here analysed Directive in Germany were already addressed, so that it is possible to expect that it may be practicable in the country, since Germany already has similar rules being applied to plastic products and a structure that will possibly allow timely and maybe less costly implementation of the required policies, including a central packaging register office (SZSV, 2019) dealing with issues related to many of the Directive`s regulated products.

As far as flexibility of the Directive is concerned, article 15 stablishes not only that an evaluation is to be carried out by July 2027, but also that a report on its main findings is to be submitted to the European Parliament, the Council and the European Economic and Social Committee, and also that, if necessary, this report should be accompanied by a legislative proposal. The report will include a review of the regulated SUP products, a feasibility study of the binding quantitative Union targets for the consumption reduction of specific SUP goods, different assessments regarding SUP products covered by the Directive, as well as a review of its measures, so that new binding measures may be included in the future (EP, 2019, p. L155/15). Insofar, the here analysed regulation seems to be flexible enough to respond to undesired effects and failure to meet its objectives.

Regarding the acceptance of the EU 2019/904 Directive, it is possible to affirm that in Germany and also in Europe it will be probably very high. According to the Eurobarometer, 84 percent of the Europeans are concerned about the environmental impacts of plastics and 74 percent of the EU population is also worried about plastics health impacts (Smet et al., 2019, p. 14). These public concerns have created a very positive political moment for addressing this issue by the implementation of such a Directive (ibid.).

Besides that, marine pollution has been identified by one third of the Europeans as the most important environmental issue (EC, 2018a, p. 16). Furthermore, 98,5 percent of the respondents of a public consultation made by the EC from December 2017 to February 2018 addressing the issues of marine litter, consider actions to reduce SUP marine litter necessary, and 95 percent consider those actions not only necessary, but also urgent (EC, 2018b, p. 32). Beyond that, support for the implementation of the here analysed directive comes even from manufactures and recyclers, since more than 70 percent of them consider such measures necessary and urgent (ibid.).

Additionally, 61 percent of the consultation respondents think consumers should pay an extra-charge for SUP goods (EC, 2018a, p. 17), what could be interpreted as a support for the implementation of the future consumption reduction measures of article 4. Anyway, when SUP alternatives are available for consumers, as it is the case for many of the regulated products, it turns easier for them accepting stringent measures (EC, 2018b, p. 58). Regarding plastic bags, for example, more than 27

percent of Europeans have already cut down their use, probably switching to reusable alternatives, although there is still no European ban on them (EC, 2018a, p. 16).

Lastly, regarding cigarette butts, considerable support of 91 percent of the respondents was given for the introduction of rules regarding the costs for cleaning up litter resulting from those products and among the 5 percent of respondents against these measures were plastic converters and manufactures, representing, however, only part of the sectors` responses (EC, 2018a, p. 18). A similar result was obtained for sanitary items, besides the fact that EPR and consumption reduction measures were also viewed favourably by respondents (ibid. pp. 18-19).

In Germany, environmental issues have been present in the programs of all its political parties, since the overall acceptance for environmental policy has been continuously growing (Jacob et al., 2016, p. 12). A representative survey of the German Federal Ministry for the Environment, Natural Conservation and Nuclear Safety (in the following “BMU”) in 2018 found out that environmental and climate protection are rated as very important social challenges and given almost the same importance as to the other two top issues of education and social justice, besides the fact that they have increased 11 percentage points in importance compared to the previous survey made in 2016 and have also been regarded as necessary “to master future challenges, secure prosperity and competitiveness and create jobs” (BMU, 2019, p. 9).

However, in the 2018 survey, respondents have rated environmental and climate protection notedly worse than in 2016, showing dissatisfaction with the engagement of the responsible authorities, possibly due to the increasing environmental problems and the non-fulfilment of the expectations for finding ecological solutions for them (ibid. p. 9, 12). The fact that more people recognise climate and environmental protection as a priority and as an important challenge to be faced, goes hand in hand with the purpose of the EU 2019/904 Directive, so that, as already stated above, its acceptance in Germany tends to be high.

5.5 Appraisal of the results

In the course of this thesis, the classification, analysis and assessment of the EU 2019/904 policy instrument mix, created to internalise part of the negative externalities caused by SUP waste, was made based on a literature approach, however, a personal interpretation of the law, assignment of the different instruments in categories, as well as interpretation of the possible results was also necessary, since there is still almost no data available about the analysed Directive and only one official assessment made until now, which was used by the EC as evidence and motivation for doing the draft policy and later passing it into law.

Furthermore, as already explained in the subchapter 5.1, there is still little academic literature assessing effectiveness of interventions for SUPs or plastics in general, although many countries have already passed different types of regulations addressing this subject, probably because of the difficulties in measuring and quantifying negative externalities of SUP waste and the costs and benefits of the different policy approaches to this issue. It is also important to remember that all these measures are very recent. Since the precision of the results depend on available information, it was not possible to calculate the exact economic impact of the Directive`s implementation on society and certain industries.

Consequently, the results here presented may be in part considered rather hypothetical or speculative and may be contested by future thesis. However, the here examined topic can not only be considered very relevant within the current political and ecological context of Germany and the EU but it will also affect the everyday life and habits of its population very soon. Thus, even if this thesis may be considered incomplete in some aspects and only being able to give an overview of the results to be expected from the Directive`s application, it is a first step in addressing and discussing this important topic in the academic environment.

Lastly, regarding Germany and taking into consideration the information presented in the previous chapters, it is possible to conclude that the country has many times adopted more stringent environmental policy measures than those enacted by the EU, being a kind of standard setter in environmental subjects. Insofar, the raising of the international regulatory level regarding those subjects, thought the implementation of the EU 2019/904 Directive, may be very beneficial for the country, making it possible for it to preserve its industry, minimizing the costs for adjustment to

European legislation and increasing its competitiveness in Europe. Thus, Germany should be interested in the success of this Directive in the EU.

6. Conclusion

In Europe, plastics growing use in short-lived applications, inadequate end-of-life treatment, low recyclability and reusability rates make its production and consumption patterns increasingly inefficient and linear. Additionally, improper plastic waste disposal leads to air, soil and marine pollution, which result in economic and environmental costs to society and may have an impact not only in the marine`s ecosystem but also on the fishing, tourism and agriculture industries and most likely on human health.

These costs which are not internalised in the pricing of plastic products are called negative externalities and need to be quantified, so that governments may apply the right measures for internalizing or compensating them. In the case of negative externalities caused by SUP`s pollution, such measures are called environmental policies and are very difficult to monetize, since besides the usual underestimation of environmental impacts, there are evaluation and data collection problems, as well as complex interrelations that make it hard to present consistent results. Nevertheless, the EU has adopted since January 2018 a new plastics strategy, in order to reduce the leakage of plastics into the environment and visioning a new circular plastics economy.

The EU 2019/904 Directive is part of this plan to reduce negative externalities of SUPs and a mix of available environmental policy instruments, which can be clustered into 4 groups, according to the type of instrument and the SUP products affected by its measures. The directive`s focus lies on plastic production prevention and prevention of plastic becoming waste, to be achieved through a ban on selected SUP products, consumption reduction measures for selected SUP products, EPR schemes and requirements and targets for design, manufacturing, collection and recycling of plastic bottles. Moreover, the Directive is supposed to be implemented into the German legal system and therefore to be applied in Germany.

The Directive`s assessment has focused on its environmental effectiveness, followed by economic efficiency, dynamic incentive effects, practicability, flexibility and its acceptance in the EU, as well as on its possible impacts on Germany. The analysed

regulation will probably meet its objective of reducing the environmental impact of SUPs, although empirical evaluations should be made in the future for more accurate results. Monitoring and enforcement mechanisms may be also necessary for achieving effectiveness. For Germany, it may be even easier implementing the Directive`s measures than for other Member States.

Economic efficiency was not assessed quantitatively, but an overview of the cost and benefits related to the application of the EU 2019/904 Directive makes it possible to expect that for both Germany and the EU the overall benefits will outweigh the overall costs, since Europe's and Germany`s plastic industry do not mainly produce low unit value SUP products, but high quality plastic items. Here, future quantitative assessments would be also needed for verifying the results.

Dynamic incentive effects were not able to be proved because of lack of data, although the prognosis for the EU and Germany can be considered to be positive. Practicability is expected to be high in Germany, since similar rules have been already applied to plastic products in the country and regarding flexibility, the analysed regulation seems to be flexible enough to respond to undesired effects and failures to meet its objectives. Finally, its acceptance in the EU and in Germany tends to be high, since there is a positive tendency of people recognising climate and environmental protection as a priority and also as an important challenge to be faced, what goes hand in hand with the aims of the EU 2019/904 Directive.

Therefore, based on the analysis and assessment of the EU 2019/904 Directive made in this bachelor thesis and taking into account the limitations regarding the results here examined, the implemented policy instrument mix seems to be an effective, efficient, practicable, flexible, acceptable and consequently suitable and upright option for reducing the environmental impact of SUPs and for promoting the transition to a more circular economy in Germany and in the EU.

IV Glossary

Biodegradation	The decomposition into natural substances like, for example, soil.
Coase theorem	A legal and economic theory developed by the economist Ronal Coase which affirms that, where there are complete competitive markets with no transaction's costs, an efficient set of inputs and outputs to and from production-optimal distribution will be selected, regardless of how property rights are divided.
Controlled-release fertiliser	A fertilisation technology where nutrient combinations are encapsulated within a nutrient pill, which is a coating made with a polymer. The coating allows the fertiliser to diffuse into the soil over a given time period, but does not degrade after the nutrients have been released.
Economic costs	The total cost of choosing one action over another. The economic cost includes the accounting cost and the opportunity cost.
Direct costs	The costs that can be easily attributed to a specified cost object which can be a product, service, project or a department. For example, raw material, manufacturing equipment, software and direct labour costs.
Indirect costs	The costs associated with all of the expenses that go beyond the production of a product. These are the costs of running a

	business after all direct costs have been attributed.
Microplastic	Small plastic particles of less than 5 mm in size.
Natural capital cost	The non-market value of the environmental resources that businesses depend on to grow revenue. Because these natural capital-related goods and services are not fully valued by markets and are not part of corporate finance accounting systems, they are typically not considered in most business decisions.
Plastic mulch	The use of plastic films on crops acting as insulation to protect seedlings and shoots. This technique is widely used due to the economic benefits its application offers, including increased crop yields, better crop quality, prevention of soil erosion and reduced pest pressure. Plastic mulches are generally made of polyethylene which does not degrade well in the soil and is therefore associated with discharges of plastic residues.
Polytunnel	An elongated semi-circular shaped tunnel made out of polyethylene and used to create a microclimate that provides higher temperatures and humidity, allowing to grow various fruit and vegetable plants even when they are out of season. The used plastic covers are rarely recycled or incinerated and are often left on the land, leaving high temperatures to disintegrate plastic debris in

	the soil or strong winds to transfer residues into the sea.
Public good	A product that one individual can consume without reducing its availability to others and from which no one is deprived. Examples of public goods include clean air, sewer systems, and public parks.
Sewage sludge	The residual, semi-solid material that is produced as a by-product during sewage treatment of industrial or municipal wastewater, which is composted and pasteurised to be used as agricultural fertiliser.
Silage bale	A type of fodder made from green foliage crops which have been preserved by acidification, achieved through fermentation. It can be fed to cattle, sheep and other ruminants and is made by wrapping large round bales tightly in plastic film.

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VI Declaration of originality

I hereby declare that the submitted thesis and the work reported herein was composed by and originated entirely by me without further assistance. Appropriate credit has been given where reference has been made to the work of others. The thesis was not examined before, nor has it been published. The submitted electronic version of the thesis matches the printed version.

Place, Date Hamburg, _____

Signature _____

VII Declaration of consent

I hereby declare that I,

- ○ agree
- ○ not agree

that a copy of my bachelor thesis will be included in the library of the department; rights of third parties will not be infringed.

[redacted] [redacted] _____

[redacted] _____