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ENVIRONMENTAL IMPACT CREATED BY PLASTIC BOTTLES. COMPARATIVE STRATEGY AIMED AT TACKLING PLASTIC BOTTLE WASTE

WPLYW PLASTIKOWYCH BUTELEK NA ŚRODOWISKO. PORÓWNAWCZA STRATEGIA UKIERUNKOWANA NA WALKĘ Z PLASTIKOWYMI ODPADAMI

Summary

Plastic bottles provide functionality, convenience and efficiency at a cost to the environment. These bottles end up in landfills or the ocean if not recycled. Legislation aims at tackling this problem by implementing Bottle Bills that provide economic incentive for returning bottles for either a deposit, tax or fee. Moreover, producers are expected to improve the design of bottles to ease recycling. However, requiring manufactures to market drinks in only reusable containers is deemed as going too far and interfering with the free market economy. Yet, the legislature does take interest in promoting resource conservation and resolving waste disposal issues. The solution could be by providing access to safe drinking water points throughout the city so that residents can refill their reusable bottle. An issue arises when the water network breaks and leaves a city to function solely on plastic bottles. Therefore, it is important to implement water purification technology into daily life to prevent such a crisis.

Keywords

plastic bottles, environment, environmental protection, the European Strategy for Plastics in a Circular Economy

Streszczenie

Plastikowe butelki są funkcjonalne, wygodne i wydajne, ale kosztem środowiska naturalnego. Jeśli butelki plastikowe nie zostaną poddane recyklingowi, wówczas trafią na wysypiska śmieci lub zostaną wrzucone do oceanu. Podejmowane są działania mające na celu rozwiązanie problemu plastikowych butelek poprzez ustanawianie przepisów dotyczących opakowań na napoje, które wprowadzają zachęty o ekonomicznym charakterze do dokonywania zwrotów butelek, np. kaucje, opłaty, podatki. Od producentów butelek oczekuje się podjęcia działań na rzecz projektowania takich opakowań, które będą ułatwiały ich szybki recykling. Jednak wymaganie od producentów wprowadzania do obrotu napojów tylko w pojemnikach wielokrotnego użytku uważa się za zbyt daleko idące żądania, zakłócające zasady funkcjonowania gospodarki wolnorynkowej. Ustawodawstwo zwraca jednak uwagę na promowanie oszczędzania zasobów i rozwiązywanie problemów związanych z usuwaniem odpadów. Wydaje się, że rozwiązaniem mogłoby być zapewnienie dostępu do bezpiecznych punktów wody

pitnej w miastach, aby ich mieszkańcy mogli wielokrotnie napełniać wodą butelki. Problem pojawia się wtedy, gdy następuje awaria sieci wodociągowej, a ludziom pozostaje korzystać z plastikowych butelek. Zapobiec temu może wdrażanie odpowiednich technologii oczyszczania wody.

Słowa kluczowe

plastikowe butelki, środowisko, ochrona środowiska, Europejska strategia w dziedzinie tworzyw sztucznych

INTRODUCTION

It is undeniable that plastics are common in daily life and vital for the economy. The global production of plastic has increased because it is convenient and efficient to use. Plastic bottles provide functionality but at a cost to the habitat because of marine litter, greenhouse gas emissions and our dependence on imported fossil fuels [American Chemistry Council, 2015]. The environmental impact of plastic beverage bottles is immense since most plastics are durable and degrade slowly due to the chemical structure that renders them resistant to the natural processes of degradation. The non-organic properties root the estimated time for a plastic bottle to break down up to 450 years [Vaughn, 2008, p. 23]. Therefore, it is necessary to take steps in order to limit the waste created by consumption of beverages from plastic bottles across the world. The United States have taken various measures to tackle the issue of plastic bottles waste.

1. EU Policy Instruments

The manner in which plastics are manufactured, used and discarded causes concern to the environment. Majority of plastic bottles are made from polyethylene terephthalate (PeT), a lightweight, shatter resistant, and recyclable material. However, in comparison to other materials such as paper, glass or metals, PeT reuse is low [Glennon, 2009]. Plastic water bottles are disposed by either recycling, returning the bottles for deposits, or throwing them in with general trash. The decision to recycle is affected by the opportunity cost of time and environmental benefit that the consumer derives for each bottle recycled. Stringent recycling laws increase the rate of recycling which will foster behavior to recycle. Both deposits and regulations in place increases recycling [Viscusi, et al., 2009]

The main catch is to actually have the general public collect, recycle and return the bottles so they are not disposed of in general trash and do not end up polluting the oceans or in landfills. Plastic in the ocean poses a risk of ingestion by sea birds, fish and marine animals. Scientist warn that this also harms humans, by eating seafood one can ingest those tiny pieces of plastic [Sands, 2003]. Intake of plastic can spur potential adverse health risk including direct toxicity, carcinogens and endocrine disruption.

The two principal policy instruments that promote water bottle recycling include bottle deposits and recycling laws. Legislation is implemented in efforts to decrease the environmental impact of disposing plastic products or packaging. Bottle deposits for plastic water bottles establish a financial incentive to foster recycling, while recycling laws generally encourage that behavior by reducing the time cost and increasing the convenience of recycling. In some instances, recycling laws may impose monetary penalties on failure to recycle properly [Viscusi, et al., 2009]. Recycling laws exhibit a range of policy stringency, from requiring local recycling to merely defining it as a goal.

A ban on bottled water in the United States concerning 23 national parks prevented up to 2m plastic bottles from being used and discarded every year [United States Department of the Interior, 2011]. However, the bottled water ban was reversed. This decision horrified conservationists while it satisfied the bottled water industry but the bill was flawed. One could not buy bottled water but was allowed to buy plastic bottled soft drinks. The reasoning being the bottled water is easily replaced with filtered or purified tap water in reusable bottles, while bottled soda or juice is not easily substituted in a similar manner. Therefore, reusable containers are the underlying goal in order to limit littering garbage into nature.

The European Strategy for Plastics in a circular Economy adopted in January 2018 aims to transform the method in which plastic products are designed, used, produced and recycled in the European Union (COM (2018) 28 final). The strategy, by improving the design of plastics will eventually raise the rate of recycling and thus boost the market for recycled plastics by enabling opportunity for innovation and competition. Therefore, this will contribute to the Sustainable Development Goals, the global climate commitments and the European Union's industrial policy objectives.

The EU Packaging and Packaging Waste Directive 94/62/EC aims at limiting production and promoting recycling, re-use and other forms of waste recovery. The scope covers all packaging in the European market and waste at all levels whether industrial or household. EU member states are to take necessary action in order to recover between 50% and 65% of packaging waste and to recycle between 25% and 45%, with a minimum of 15% for each type of packaging material. The Member States must take measures to prevent the formation of packaging waste and develop reuse systems reducing impact on the environment by introducing targets for member states to reach. Members differ considerably on the amount of packaging recovery, including plastics depending on length of integration with the program [Andrady, 2005]. Furthermore, manufactures need to indicate the nature of the materials used for the packaging to facilitate classification that will be compiled in databases for the recycling process.

Providing economic incentive to recycle has the potential to extend the capacity of landfills. Container deposit legislation entails the cost of a monetary deposit on beverage containers at the point of sale in order to ensure recycling [Andrady, 2005]. When the consumer returns the container to an authorized redemption center, the deposit is either partly or fully refunded. These bottles are then to be washed, refilled and resold. In the case in which the consumer does not claim the deposit, it could be either used to fund environmental programs or kept by the distributor to offset its costs.

A responsible policy in place to limit the waste of plastic bottles should encourage drinks companies to supply their product in multi-use, refillable plastic or glass bottles. These plastic containers can be refilled up to 25 times [Gleick, 2014]. Since fewer new bottles need to be manufactured, it can reduce the average CO₂ emissions per bottle in circulation. In terms of CO₂ output, it is more environmentally friendly to wash and sterilize existing bottles rather than producing new single use bottles. This system is a cycle in which the manufacturer fills for instance soda, beer or water into bottles that are sold to wholesalers or retailers. Either the wholesaler or retailer is responsible for paying a deposit to the producer. In the form of a surcharge, the deposit is put directly on the customer. The wholesalers have an extra step in the chain because the deposit put on to the individual retailers. End customers pay this deposit to the supermarket or whoever and returned to the consumer with the return of the bottles [Imhoff, 2005].

2. Comparative Strategy Aimed at Tackling Plastic Bottle Waste

In the United States, currently 10 states have so called “bottle bills”. The Oregon Bottle Bill was the first such legislation and is credited with reducing litter by increasing recycling [Gitlitz, et al., 2006]. Similarly, in California, the California Beverage Container Recycling and Litter Reduction Act imposes the deposit as applicable to plastic, aluminum, bimetal, and glass containers, including beer, malt, wine and distilled spirits, and all non-alcoholic beverages. The charge of \$0.05 refundable deposit on containers less than 24 fl. oz, and \$0.10 for containers 24 fl. oz. or greater. The redemption rate for PeT has totaled the return rate of 78% in the 1st half of 2017 [Morawski, 2009]. Whereas, In Hawaii, Deposit Beverage Container Program provided that the refundable deposit generated a total rate of 68%. Each State participating in such a program applies its own rate per container usually in a similar range [Vaughn, 2008 p. 50].

Delaware abolished its regulation and replaced it with the Universal Recycling law in favor of a non-refundable USD \$0.04 tax per beverage container sold. This only applies to non-aluminous containers that contain less than 2 quarts of a carbonated beverage and sales in which the beverage container are purchased by consumers for immedi-

ate consumption which are under control of the dealer. The exception applies to beverages sold at retail by non-profit organizations [Gitlitz, et al., 2006]. The Belgian system provides a voluntary deposit-refill and a mandatory tax on beverage containers that are not refilled. Those containers must meet the requirement of being usable at least 7 times and must then actually be refilled and show indication that it is refillable. The Ecotax 1994 aim to change the structure of relative prices in order to provide incentive to consume in an eco-friendly behavior [Andrady, 2005].

In Croatia in all beverages are covered in its Ordinance on Packaging and Packaging Waste to be subject to fees. The producer is responsible for paying a variety of fees when placing packaging on the market while the consumer receives compensation for return of empty containers. In addition, manufacturers are required to use all available technologies to produce reusable or recyclable packaging. In the Netherlands, PET bottles greater than 0.5L are subject to a €0.25 deposit for soft drinks and water. Excluded are all other beverage types, such as medical drinks, wine, spirits, etc. Whereas in Czechia, while glass bottles sold in returnable bottles carry a deposit there is not a deposit on other containers. In the other EU member states such as Poland a scheme for plastic bottles does not operate. Outside the EU, Switzerland actually abolished the idea because the recycling rate is high enough, even without deposit [ReLoop Platform & CM Consulting, 2016].

In Germany, according to the Ordinance on the Avoidance and Recovery of Packaging Wastes, the manufacturers are responsible for taking back the packaging of their products in addition to setting targets for refilling and recycling rates. Retailers were originally only required to accept the brands sold in the store. However, the law was amended to require acceptance of all containers made of the same material as containers sold [Morawski, 2009]. Now, stores with an area greater than 200 m² that sell drink cans, glass or plastic bottles are obliged to take back packaging of the material they sell from other drinks manufacturers. Single-use bottles such as cheap 6-pack of 1.5 liter mineral water bottles from the supermarket or products in 0.5 liter or 1.25 liter bottles which are single-use carry a higher deposit as a disincentive. Bottles purchased in specialist foreign foods market are exempt because import from wholesalers thus not subjected to German legislation on deposits [Fishbein, 1996].

In critical terms, the law may not be enough to give incentive to use of multi-use bottles. The price difference of 10 cents between single and multi-use bottles may not give motivation to the consumer to take the extra steps to deposit bottles rather than dumping it into the trash [Baumol, et al., 1971]. Yet, poor or homeless people supplement their incomes by collecting discarded bottles. Consumers may be more keen to return multi-use bottles when sold in crates which carry a higher crate deposit fee that will make it worth more while to return.

The Danish Bottles case [C-302/86, *Commission v. Denmark*] concerned a scheme that required manufactures to market drinks in only reusable containers approved by the national environmental agency which could be collected and refilled. The agency could potentially refuse the approval of new sorts of containers in the situation in where the container is not technically fit for the return system or the envisaged return system would not guarantee that a sufficient proportion of containers were actually reused [Sands, 2003]. Even after a modification to allow the use of a small quantity of non-approved containers, the European Commission brought proceedings against Denmark before the European Court of Justice (ECJ) to have both the compulsory deposit-and return system and approval system declared incompatible. It alleged the violation of Article 30 of the Treaty of the Functioning of the EU (TFEU) which prohibits quantitative restrictions on imports and all measures having equivalent effect' and was not within any of the exceptions listed in Article 36.

The European Court of Justice in its judgement recognized that rules for the protection of the environment could amount to a legitimate interference with free trade under the condition they were non-discriminatory between Member States and were proportionate to the objective. Nevertheless, the environmental objective of the Member State must be moderate [Jeppesen, 2002]. The Danish system which tried to achieve complete recovery of drink containers was excessive therefore could not be considered as a proportionate measure. If the system merely required deposit and return, it would have been permissible. Furthermore, the rules bore heavily on non-Danish drink producers who would also have to adapt. Therefore, the EU Member States were unable to set their own level of environmental protection. In addition, only minor interferences with the internal market would be accepted for the cause of environment protection [Wold, et.al., 2011]. Consequently, only in narrowly defined circumstances, can legal protection of the environment be allowed in the balance of interests.

The *Minnesota v. Clover Leaf Creamery Co.* (449 U.S. 456) case concerned a statute which prohibited the sale of milk and milk products in non-refillable and non-returnable plastic containers in order to promote conservation of resources, ease solid waste disposal and conserve energy. Which rose the question whether the Minnesota statute violated the Commerce clause of Article 1 or the Equal Protection clause of the 14th Amendment. The court maintained that the statute was not unconstitutional by acknowledging that the state legislature had an interest in promoting resource conservation and resolving solid waste disposal issues. Whereas, the disparity between non-reusable plastic containers and paper or reusable plastic containers was rationally related to the purpose of the legislature [Ducat, 2013]. Therefore, it proved not to be unconstitutional under the rational basis test set forth in *New Orleans v. Dukes*. There was no violation

of the commerce clause since the statute banned sale of all milk in the specified container and did not distinguish by seller.

As can be seen from the case law of the Court of Justice and the Supreme Court, important trade issues arise in the area of waste. The constitutional implication of a bottle recovery structure in order to recycle. The requirements that the arrangement set for essentially a prohibition for producers of beverage containers. This change could give rise to an increase in transportation costs, higher administration fees and challenge for logistics. The court must balance the environmental and trade interest against each other. Balancing provides a method for reconciling legitimate interest in the environment with free trade value. However, only economic analysis can show the benefits and the burden of such a policy.

Those in favor of such restrictions have also argued that such restrictions are necessary to give proper incentives to all states to develop adequate waste disposal facilities within their borders rather than to rely on facilities located in other states for waste disposal. Those opposed to such restrictions have generally view them as highly inefficient. It is dependent on the extent states should be authorized to impose restrictions on the exports of their own waste to other states. Although the states imposing such restrictions have sometimes claimed that they are necessary to protect the environment of other states, restrictions on the exports of waste are, however, generally motivated by economic considerations, such as ensuring the profitability of local waste-processing facilities.

The use of reusable bottles and the possible option to fill it up at stations, water fountains, or food establishments would be a simple environmentally friendly solution. By 2021 shops, cafes and businesses in the United Kingdom would offer free water refill points in every major city and town. Water UK claims that this scheme could potentially cut disposable plastic bottle use by tens of millions each year [BBC, 2018]. Most places in the US, either have water fountains, or you can ask any place for water and they will give it to you for free or use the sink if its work. Access to clean water enables one to not depend on plastic water bottles to satisfy thirst.

It is imperative to have access to safe drinking tap water in order to reduce the impact of plastic water bottles. In the United States, tap water and bottled water are regulated by different federal agencies. While the Food and Drug Administration (FDA) is responsible for regulating bottled water, the Environment Protection Agency (EPA) regulates tap water. The EPA's stricter policies require that incidents of tap water contamination shall be reported to citizens. Whereas, there is no such rule in response to bottled water by the FDA [Glennon, 2009, pp. 103–105]. Improper bottling procedures and storage procedures can cause bacteria in bottled water to multiply and yet is sold as a healthy water source.

Flint is an ongoing crisis with a continuing lack of access to water. Due to infrastructure damage, citizens face public health risk as they are reduced to relying on plastic water bottles for everything [Campbell, 2016]. When Flint changed its water source from Detroit Water and Sewerage Department sourced from Lake Huron to The Flint River the officials failed to apply corrosion inhibitors that led to lead contamination in the pipes. The elevated levels of heavy metal neurotoxin in drinking water caused health problems mentally and physically. The water was responsible for the outbreak of Legionnaires disease that left 10 dead.

Residents who claim the agency has mismanaged the crisis that exposed them to lead poisoning are suing the EPA in a class action lawsuit. The plaintiffs claim the EPA failed to warn of danger nor take steps to address the crisis at hand thus seek damages. All levels of government including local, state and federal failed causing residents to face a public health state of emergency [Clark, 2018]. Former emergency managers and water plant employees have been charged with felonies. The EPA enacted a Safe Drinking Water Emergency Order, which allowed it to more closely monitor and control the state and local response efforts. These efforts include rerouting the water supply, replacing corroded water pipes and distributing bottled water and filters.

To ensure the health and safety of the Flint residents while the pipes are being replaced the solution is to use water from plastic bottles rather than from the tap. These plastics quickly pile up since people are forced to use bottles for drinking, cooking and bathing. In order to carry on with life, 102,000 citizens use 200 bottles of water each that equals to 20.4 million 16oz. bottles of water per day, every day, until this problem is fixed in the next years. Millions of bottles of water donated in a goodwill gesture that led to unintended consequences. Bottled water is not only an expensive solution for such a wide spread problem, but also creating an environmental problem. Those discarded water bottles then need to be either recycled or end up in the landfill. Flint is drowning in empty bottles in an unsightly bottle buildup.

While the pipes are in the process of being replaced, residents are encouraged to use water purification filters. The governments are now realizing that bottled water is not the solution for water related disaster. Even the military is looking for alternative options. The HydroVolt portable filtration machines uses a process that involves carbon, ultraviolet light, and reverse osmosis to provide ideal drinking water or for any other needs. The units can filter as much as 7,000 gallons of water a day for a fraction of the cost of a case of bottled water without the plastic waste [Takepart, 2016]. Now officials claim lead in water is well within standard and have cut federal aid to supply bottles leaving citizens hesitant to use the water. The state supplied water purification filters and water filters at distribution points across Flint as part of a \$450 million state and federal aid package.

It is vital that one is prepared for any such water calamity needing plastic water bottles for survival with a water purification equipment.

CONCLUSION

In conclusion, water is vital for life, which can be obtained in convenient to use plastic bottles. Not only does this durable PeT supply water but any type of liquid beverage. These bottles however will then end up polluting earth in landfills or the ocean if one is not conscious what happens to the waste. Legislation aimed at recycling can tackle this problem by implementing Bottle Bills that provide economic incentive for returning bottles. In addition, producers are expected to improve the design of bottles to ease recycling. However, requiring manufactures to market drinks in only reusable containers is deemed as going too far and interfering with the free market economy. Yet, the legislature does take interest in promoting resource conservation and resolving waste disposal issues. The solution could be by providing access to safe drinking water points thought the city so that residents can refill their reusable bottle. An issue arises when the water network breaks and leaves a city to function solely on plastic bottles. Therefore, it is important to implement water purification technology into daily life to prevent such a crisis.

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