Catalyst to solve the global problem of plastic pollution

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Abstract. A method that incorporates an economic catalyst to solve the global problem of plastic pollution. The economic catalyst is a global deposit refund scheme (GDRS) applied to all plastic items sold. A GDRS makes all plastic items valuable after the point of purchase, and therefore is the catalyst for collection, recycling, and investment.

1. Introduction

Plastic as a material is one of humanity's greatest innovative achievements. It's the most commonly used man-made material only behind steel, concrete, and timber. Since its commercialisation in the 1950s, it's now used in nearly every aspect of our daily lives. As a material, it's strong, lightweight, and inexpensive. Due to these beneficial characteristics, its applications are near endless. Virgin plastic production since the 1950s has exponentially increased year-on-year. At just over 1 million tonnes produced globally in 1950, to 400 million tonnes produced in 2021 [1]. Over 9 billion tonnes of plastic has been produced since the 1950s, and less than 9% of this total has been recycled [2]. The majority landfilled, burnt, or leaked into the environment. Without a major systematic change, plastic production is forecast to triple to over 1200 million tonnes per year by 2060 [3]. This linear model of manufacture, usage, and disposal of plastics is unsustainable and cannot continue. Due to its synthetic characteristics, plastics will build up, break apart, and infiltrate every part of the global environment. This includes all food chains, water sources, and the human body.

The problem of plastic pollution is complex and there's many reasons why it has now become a global problem. Plastic is a victim of its own success: durable, sophisticated, and cheap. There are many parts to the plastic supply chain, from the petrochemical companies to manufacturing companies, consumers, waste management, and recycling companies. Systematic change is needed to correct the global problem of plastic pollution. Plastic pollution isn't just a problem that occurs or originates from developing countries. Plastic pollution is everywhere and a global problem that affects all countries. Recycling as the answer to plastic pollution hasn't been viable in the past, but now is if used intelligently. But recycling is only one piece of the puzzle. For the global problem of plastic pollution to be solved, all areas of the plastic supply chain must be economically satisfied.

This is purely an economic problem. The problem with plastic waste is, it has little to no economic value. Therefore, the economics of the whole system need to be changed to solve the global problem of plastic pollution.

2. The future of plastic.

The future of plastic is that it's produced in lower volume but has a higher value. Overall usage must be reduced by everyone, unnecessary plastic items eliminated, and plastic items must be designed with efficient recyclability in mind. Also, all plastic items sold must be part of a global deposit refund scheme (GDRS). This is the economic catalyst.

3. This is purely an economic problem.

The global problem of plastic pollution is purely an economic problem. There's no technical or practical reason why the global problem of plastic pollution can't be solved. The economics of the whole system need to be changed, and this can only happen with the introduction of a global deposit refund scheme (GDRS) for all plastic items sold. A GDRS automatically makes all plastic items sold valuable, and therefore is the catalyst for increased collection, recycling, and investment.

Currently and in the past, collection and recycling of plastic items has always been too expensive, therefore new virgin plastic is created to replace these items and the problem of plastic pollution gets exponentially worse. Plastic must be made into a valuable commodity. This can only be achieved by a GDRS which automatically makes all plastic items sold valuable after the point of purchase.

Any solution to the global problem of plastic pollution must economically satisfy all areas of the plastics supply chain. If it doesn't make economic sense to all areas of the plastics supply chain, scalable positive change will never be achieved. As previously mentioned, the future of plastic is that it's produced in lower volume but has a higher value. Therefore, by increasing plastic's economic value, production levels can be reduced while at the same time still being profitable to petrochemical/plastic manufacturing companies. This scenario is totally viable for plastics as a commodity.

4. A global deposit refund scheme (GDRS).

A global deposit refund scheme (GDRS) is the only way the global problem of plastic pollution can be solved. This is because it's the only way that works out economically. The needed funding to correct the problem can only be generated at the consumer level of the supply chain by way of a GDRS.

A GDRS would be similar to a generic deposit refund scheme, where a small deposit is applied to the price of a plastic item. This deposit can later be refunded to the consumer when the plastic item is returned to a collection point. A GDRS incentivises and covers the cost of collection, generates additional funding through unclaimed deposits, standardises the types of plastics collected, and builds the supply of recyclable plastics as a commodity. A GDRS would include all plastic items sold. Not just specific plastic packaging items such as plastic bottles, but all items sold which contain plastic. For example, all plastic packaging, synthetic

clothing, consumer goods which contain plastic (e.g., electronics, toys, sporting goods), plastic car parts, fishing equipment, etc. This is the only way the global problem of plastic pollution can be addressed. You can't only target specific plastic items for collection and recycling, because a large majority of plastic items won't be collected for recycling and the problem of plastic waste will be continuous.

The deposit value applied to each plastic item which is part of the GDRS has to be a decent monetary amount to incentivise the collection of the item after use by the consumer. For example, 10 cents for everyday packaging items and more of a monetary amount for larger items which contain plastic such as $5.00 for a television. Every plastic component will have a deposit applied to it as part of the GDRS. For example, a packaging item such as a yoghurt container which consists of multiple and separable plastic parts (lid and cup), each part will have a deposit applied (e.g., a 10 cent deposit for the lid, and another 10 cent deposit for the cup). For manufacturers of plastic products to continuously use the GDRS, the manufacturers must design their plastic products with efficient recyclability in mind. This is the only way the supply of recycled plastic as a commodity can be increased and circular plastic usage achieved. A transition period will be implemented for manufacturers of plastic products to align their plastic products to a set of standardised global recycling guidelines. If these guidelines aren't adhered to by the manufacturers, the manufacturers will not be able to use the GDRS. These global guidelines will ensure the plastic collected through the GDRS is of a certain quality and is easily recyclable.

The standardised global recycling guidelines will reduce the sheer variety of plastic currently in the market, eliminate or replace toxic additives in specific plastics, and eliminate unnecessary plastic items which aren't recyclable such as some single-use plastics. The GDRS can also be applied to some plastic items which are necessary or are always going to be used in the economy, but aren't and never will be recyclable. For example, medical items or cigarette butts. By applying a deposit to these unrecyclable plastic items ensures they're collected and properly disposed of.

As more plastic items become part of the GDRS and are designed according to the global recycling guidelines, the supply of recyclable plastic as a commodity increases and circular plastic usage can start being achieved.

5. Economics of a global deposit refund scheme (GDRS).

Deposit refund schemes have been implemented and proven financially viable in many countries for the last 50 years [4]. Not only do they substantially increase the collection rates of recyclable materials, they also generate additional funding through unclaimed deposits. Therefore, not only do such schemes make each individual recyclable item valuable, they also continuously generate funding. This funding is continuously generated with the sale of items and can be later allocated where needed. In well-designed deposit refund schemes, material recovery facilities claim 15-25% of total deposits on collected containers [5].

By initially giving a recyclable item value via a deposit scheme, results in the collection and recycling of that item being economically viable, but more importantly it's continuously economically viable as the more items are sold.

The global deposit refund scheme (GDRS) gives all plastic items value. This increases the collection and recycling of the plastic items but also continuously generates funding. This is the key to making plastics sustainable and circular. Due to the sheer size of the global problem of plastic pollution and the enormous quantity of plastic items produced each year, any economic catalyst implemented to correct the problem must be implemented at a per-item level. This is exactly what the proposed GDRS does. This is the only way the funding needed to correct the problem can be generated. The funding needed to correct the global problem of plastic pollution can only be generated at the consumer level of the supply chain by way of the proposed GDRS. All other methods don't generate enough funding.

6. Extended producer responsibility (EPR) schemes, plastic taxes, etc., aren't enough by themselves to address the global problem of plastic pollution.

Extended producer responsibility (EPR) schemes, plastic taxes, etc., aren't enough by themselves to address the global problem of plastic pollution because they don't add up economically. The funding needed to correct the problem can only be generated at the consumer level of the supply chain by way of a GDRS. Primary producers of plastics such as petrochemical companies or manufacturing companies can't be lumped with the full cost of fixing the global problem of plastic pollution by way of an EPR scheme or plastic tax. It's just not economically viable and also doesn't make sense.

The EPR rate/plastic tax rate per tonne would have to be so high (especially when calculated at a per-item per tonne rate) to account for all the costs associated with collection, recycling, etc. Current EPR rates/plastic taxes (EU EPR average= €500 per tonne, UK plastic tax = £200 per tonne) [6] are nowhere near enough especially to cover the cost of collection also. This can be explained more clearly with a mathematical example. Take an everyday plastic packaging item for example, such as a muesli bar wrapper. This muesli bar wrapper is made of flexible plastic and weighs less than 1 gram in total. (That equals approximately 1,000,000 muesli bar wrappers per tonne of plastic). To effectively collect and recycle this muesli bar wrapper by way of an EPR scheme or plastic tax (let's use the higher €500 EPR average per tonne rate for this example, for ease of understanding €500 equals approximately $577 USD).

a) $577.00 USD
X 100
= 57,700 cents

b) 57,700 cents
÷ 1,000,000
= 0.0577 cents

Therefore, all costs associated with the collection and recycling of this muesli bar wrapper must not exceed 0.0577 cents. This is clear evidence why EPR schemes, plastic taxes, etc., aren't enough by themselves to address the global problem of plastic pollution. They're just not economically viable to cover all the costs associated with the collection and recycling of plastics.

As previously mentioned, any EPR scheme or plastic tax which realistically covers the cost of collection and recycling in a real-world scenario, would have to be so high per tonne it would be unaffordable to any plastic producer or manufacturer. For example, even at a 3 cents per item combined collection and recycling cost, the above example would result in a EPR rate or plastic tax of $30,000 per tonne. This is clearly not economically viable for any plastic producer or manufacturer.

EPR schemes and plastic taxes also dismiss the largest and most important part of the plastic supply chain, the consumers. Consumers are the key to the effective collection of the majority of the plastic waste in this world. EPR schemes and plastic taxes also assume that just because established waste and recycling systems are in place, consumers are automatically going to do the right thing and pollution/litter isn't going to occur. This currently isn't the case and never will be because there's no incentive for all consumers to do the right thing. EPR schemes and plastic taxes can play a supportive role in addressing the global problem of plastic pollution, but by themselves aren't enough simply because they don't add up economically.

7. There can only be one privately-led global deposit refund scheme (GDRS).

There can only be one privately-led global deposit refund scheme (GDRS) for multiple reasons. First and foremost is from a technical perspective. There can't be multiple and different major deposit refund schemes (DRS) operating at the same time around the world. If multiple DRS are in operation at the same time with different rules/standards for what is collected, contamination will be unavoidable, and the quality of the recycled plastic as a commodity will not be able to be maintained. Plastics are an international product. Sometimes manufactured in one country, exported and sold in another country, and then exported and recycled in a third country. To ensure the quality of the recycled plastic as a commodity, all countries need to be collecting the same materials and following the same guidelines. This is most easily achieved by one privately-led global deposit refund scheme (GDRS). This is also how you build economies of scale.

Secondly is from an identification and knowledge perspective. Consumers need to know a plastic item is part of the GDRS and exactly how the GDRS operates. If there are multiple and different major deposit refund schemes (DRS) operating around the world, consumers may not identify a plastic product as being part of a particular scheme or the rules and guidelines of that particular scheme. This will only lead to a large percentage of plastic items not being collected and recycled, simply due to consumer confusion.

Thirdly, the GDRS must be a privately-led initiative. The GDRS cannot be a publicly-led initiative. The main reasoning behind this is economics. If the GDRS is privately led, it can be built as a company and value can be created. This value will need to be leveraged to fund all

initiatives related to fixing the global problem of plastic pollution. As previously mentioned, to solve the global problem of plastic pollution all areas of the supply chain must be economically satisfied. And this most importantly includes the petrochemical companies and manufacturing companies. Any global solution must economically satisfy these parts of the supply chain and show them a transitional path forward. This can only be achieved through a privately-led initiative such as a company, where economic value is created, where investments can be made, and strict operating procedures are followed and maintained. I'm not saying governments can't be involved, public-private joint ventures will be established, but this must be privately led for sheer technical and economic reasons.

8. The total cost of global plastic pollution. How much money is needed to correct the problem? And where is this money going to come from?

The total plastic pollution costs the global economy can't be exactly calculated, but approximations have been made and it's in the trillions of dollars per year [7]. This is mainly due to the sheer amount of plastic produced per year which is not collected, not recycled, and then leaked into the environment. Cost is also incurred due to virgin plastic production being a major source of C02 emissions. The most worrying cost which is currently unquantifiable, and which isn't currently included in the total cost estimates is the cost (economically and socially) plastic waste has on human health. Studies now show plastics (in micro and nano form) infiltrate all food chains, water sources, and therefore many regions of the human body. Evidence is accumulating that these plastics disrupt and change biological processes. The economic cost if these infiltrating plastics cause cancer, change DNA, etc. would be unfathomable but real. This could be one of humanity's greatest mistakes if not corrected.

How much money is needed to correct the problem? It's substantial but not unachievable. This money can only be generated by the proposed privately-led global deposit refund scheme (GDRS). This is mainly because it leverages the largest and most important part of the supply chain, the consumers. The initial and most important cost of collection is spread across the consumer level of the supply chain. This is the economic catalyst. After the plastic is collected, recycling can occur, and recycled plastic as a commodity can start becoming circular. As more plastic is collected and recycled, the value of the recycled plastic as a commodity will increase. This is where money can and will be made. Consumers and manufacturers are willing to pay more for plastic that's sustainable and ethically right. Current evidence of this is the price of rPET (recycled polyethylene terephthalate) versus virgin PET (polyethylene terephthalate). rPET is currently $700 per tonne more expensive than virgin PET [8]. This just shows the economics can be changed, and the past notion that recycled plastic as a commodity has to be cheaper than virgin plastic is wrong. Other funding can also be generated through the GDRS, due to it being a singular private global enterprise which can leverage the advantages of economies of scale. This funding would not be able to be leveraged by multiple and different deposit refund schemes (DRS) if they were in operation.

9. Time is of the essence.

Time is of the essence and we must implement the GDRS as soon as possible. As previously mentioned, there's no technical or practical reason why the global problem of plastic pollution can't be solved. The technology is available, and the economics can favour everyone. We can't wait 5, 10, or 20 years for everybody to get on the same page and implement action. On the current trajectory of plastic production and usage, plastic pollution could overwhelm the environment and everything in it including us as human beings within the space of the next ten years. This immediate need for action is why the solution must be privately led such as the proposed GDRS. The solution can't be publicly led. Because even with all the best intentions in the world, publicly-led initiatives take too long to implement simply because there's too many different parties involved.

10. Conclusion

The proposed global deposit refund scheme (GDRS) is the only way the global problem of plastic pollution can be solved because it's the only way that works out economically. All other methods don't work out economically and this is the key reason why they're not scalable. This is purely an economic problem and can only be solved when all areas of the supply chain are economically satisfied. The proposed global deposit refund scheme (GDRS) is the economic catalyst for the collection of plastics, recycling of these plastics, and investment in these recycled plastics as a commodity. Any costs associated with implementing the GDRS will be heavily outweighed by the global costs if no action is taken to address this problem we've all created. The proposed GDRS is the way we 'turn the plastic pollution tap off at the source'. At a minimum, the GDRS ensures the majority of plastic waste is collected and properly disposed of. This is exactly the main objective everyone is trying to achieve. So what do we do now? We build the GDRS. Because our health and the health of our planet depends on us.

* *Final word:* The GDRS is the main catalyst needed to reverse the global problem of plastic pollution. No other method will increase the collection and recycling rate of plastics better than the GDRS. Most plastic pollution in this world stems from plastics not being collected and recycled. The GDRS is a real-world solution and contains everything within its foundations for a sustainable plastics future. Even if factors and concepts are only briefly touched on in this white paper, the foundations are here within the GDRS for it to be the catalyst the world needs for a sustainable plastics future. If you have any questions about the solution, run the numbers through an advanced AI system, and you'll see why the GDRS is the best method to increase the collection and recycling of plastics and why it works economically. Current advanced AI systems can verify the solution economically and technically via data analytics. To conclude, the cost to implement the GDRS solution is far less than the total cost if plastic pollution is allowed to continue on its current trajectory.

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