SUBSTITUTE OF SINGLE USE PLASTICS IN PACKAGING OF FAST MOVING CONSUMER GOODS (BABY, FEMININE & FAMILY CARE PRODUCTS)

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER-I

INTRODUCTION

Prevalence of Plastics:

Just 300 million tonnes of manufacturing of plastics all over the world clearly states the demand for this less- eco-friendly, yet popular product used across various sectors and industries. This product has been used across a wide variety of industries (Plasticserope, 2018) like packaging, agriculture, construction, agriculture and electronics.

This also created 275 million tonnes of (Geyer, Jambeck, & Law, 2017) waste generated due to plastic in 2010 which has been increasing consistently since then. As its applications and usage are great companies and governments across the world still use it, which causes disastrous unimaginable consequences. In 2015 the wastage due to plastics accumulated was just 5000 million tonnes (Geyer et al., 2017) which could increase to 12,000 million tonnes by the mid of this century. Such is the impact and effects of plastics in this world.

Plastics and its prevalence had huge (Browne et al., 2011) environmental impact and disaster with oceans of the world. It was found that only 4.8 to 12.7 million tonnes of plastic (Thompson & Moore, 2009) waste was dumped in to oceans in 2010. Plastic fragments and pieces were found all over the marine world. It also affected health and economic performance (Xanthos & Walker, 2017) of nations.

(Europeancommision, 2018)Report plans for total market restriction on plastic items and its usage in EU by 2021 such as cotton bud sticks and its usage, cutlery, plates, straw & stick for balloons. Greenhouse gas emissions would get reduced to the extent of 2.63 million tonnes per year, due to this initiative. The change in the directive would impact on a shift from this product from 10- 90% for multi-use alternative (Petersen & Solberg, 2005) products for plastics packaging. It is also found that there is a lack of research studies which focus on the alternatives for single plastic usage packaging. It is found that wood is seen as a replacement for packaging in construction industry. It is also found that paper products are the alternative for packaging as carrier bags.

(Lord, 2016) has analysed the prevalence of plastics in the world economy. The study finds that global production (PlasticsEurope, 2015) of plastics has increased 20 times from 15 million metric tonnes in 1964 to 311 million metric tonnes in 2014. It is part of society (Andrady & Neal, 2009) as we find its application across different sectors and industries.

Although it provides a lot of benefits (Raynaud, 2014) it also increased environmental impact in a negative way. It has its effects on consumer goods industry with greenhouse gas emissions, air, and land and water pollution, depletion of water and has huge impact on marine economy as well.

The issues of single use plastics in packaging industry have been enormous and there has been a very limited study which has been conducted in EU region. This research study is an attempt to provide alterative and effective solutions for single use plastic packaging in EU region. This research would be conducted as an empirical and quantitative study. This study would be done based on secondary data analysis. This will be carried out with an analysis of published reports, periodicals, journals and publications since 2015 on these dimensions mentioned. The next section would deal with literature review on plastic packaging in EU region.

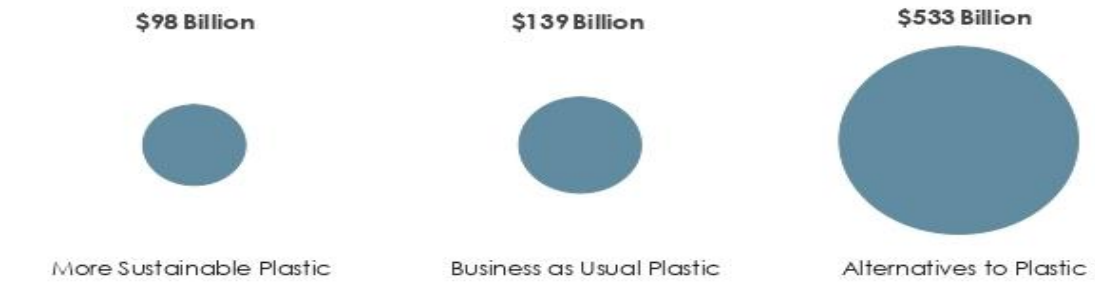
CHAPTER-II

LITERATURE REVIEW

Environmental cost of replacing plastics packaging - FMCG industry

Environmental cost of plastic packaging in consumer goods industry is 3.8 times lesser than alternative materials which could replace plastics. (Lord, 2016) clearly states that moving for other alternatives to plastics packaging could increase environmental costs from $139 billion to $533 billion. A typical soft drink bottle contains 30 gms of plastic and replacing with alternatives would add the alternative materials to 141 gms with tin, aluminium or glass. For the entire consumer goods industry there would be an additional requirement of 342 million tonnes of alternative material for packaging to replace the existing usage of 84 million tonnes of plastic in consumer goods and packaging industry in 2015.

Figure 1: Environmental cost analysis in packaging FMCG industry

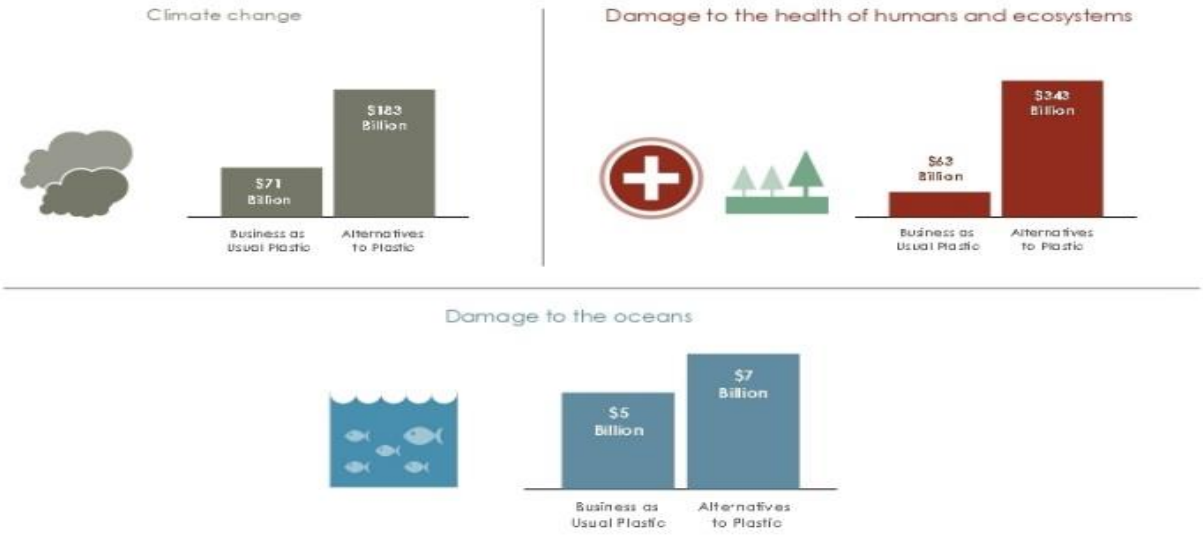


Source: (Lord, 2016)

We could see from the above figure that the alternative to plastics packaging tends to add up to the additional environmental costs by $635 billion in this FMCG industry.

So there is a need to evaluate and find out viable alternative to plastics packaging which would be environmental friendly. This study intends to provide such environmental friendly solution to plastics packaging for sustainable development and progress in EU economy.

Figure 2: Social and environmental costs of alternative to plastics packaging



Source: (Lord, 2016)

It is very clearly found that there is an immense need to find out alternatives to plastics packaging which is eco-friendly and which has social value. As there is a research gap in these dimensions, this research is conducted to provide environmental friendly solutions plastic packaging in EU region.

Production and transportation cost of plastics packaging: FMCG sector

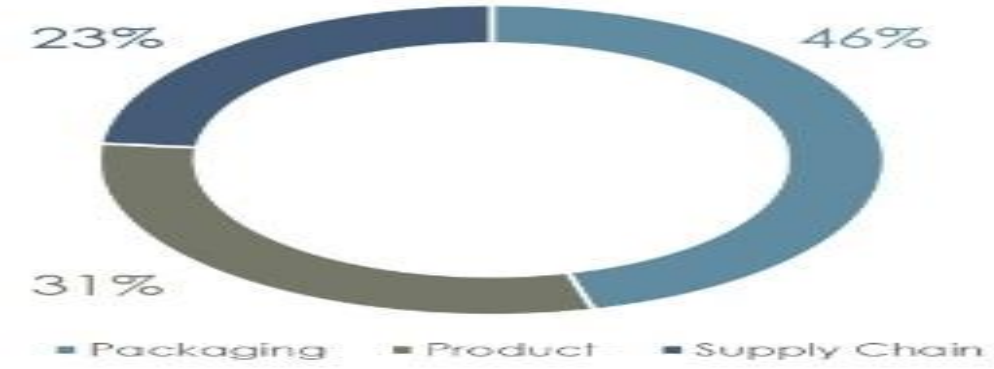
It was found that the production & transportation cost of plastics packaging was around 60 billion dollars in 2015 and the transportation costs further added another 53 billion dollars in the process. The total environmental cost and damages due to plastic packaging was around 113 billion dollars per annum.

If the recycling is effectively done in plastic packaging industry it would reduce the environmental damages by 55% which could be one alternative. Minimizing landfilling could reduce damages by another 10% which would reduce environmental damages in Europe to $7.9 billion dollars. Recycling by nature could reduce the damages by another 3.9%. So there is a need for alternative plastic packaging solutions which could provide sustainability to this economy. Investments in effective plastic packaging technology can reduce the environmental effects in this economy.

Plastic packaging demand for consumer goods:

A plastic has been used extensively in FMCG sector, 23% in packaging, 31% in product and 46% in supply chain.

Figure 3: Demand for plastic packaging



Source: (Lord, 2016)

It is found that a plastic has been very extensively used in packing and supply chain management of FMCG products. There is a need to find out alternative solutions, products and services which can be environment friendly and useful for the society in packaging for EU region. There is a need for R and D in this direction to provide viable solutions. Cost effective solutions have to be created and managed effectively which can provide intelligent plastic packaging alternatives.

Plastic demand Packaging alternatives and its implications:

Figure 4: Plastic vs. alternatives

CONSUMER GOODS SECTOR	BUSINESS AS USUAL (TONNES/$ MILLION)			PLASTIC ALTERNATIVES (TONNES/$ MILLION)		
	PLASTIC IN PRODUCT	PLASTIC IN PACKAGING	TOTAL PLASTIC*	ALTERNATIVES IN PRODUCT	ALTERNATIVES IN PACKAGING	TOTAL ALTERNATIVES
Automobiles	3.5	0.1	3.6	8	0.2	8.2
Soft drinks and ice	0	15.4	15.4	0	112	112
Clothing and accessories	3.2	0.3	3.5	4.6	0.9	5.4
Consumer electronics	3.4	0.8	4.2	10.4	1.9	12.3
Durable household goods	10.8	4.2	15	41.4	10.9	52.3
Food	0	3.1	3.1	0	14.4	14.4

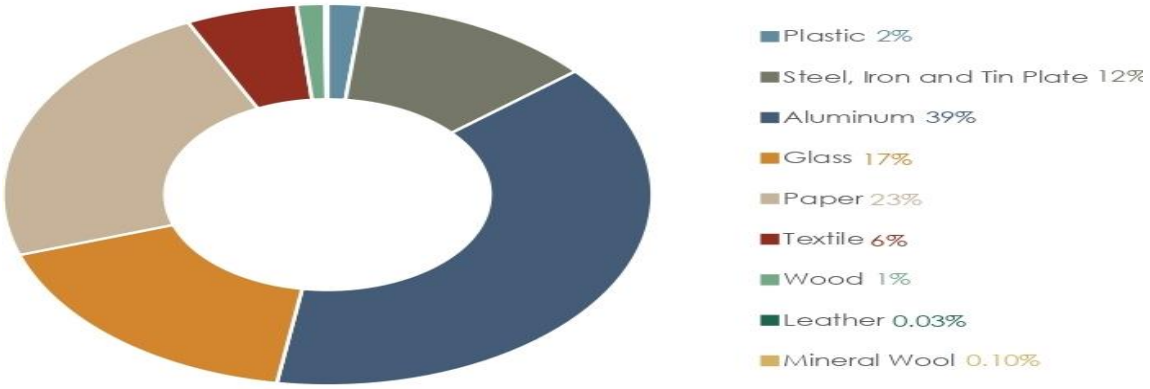
Source: (Lord, 2016)

It is found that across the FMCG sector, we could find that plastic packaging alternatives are having larger implications on environment and production of more products to satisfy the requirements.

Environmental cost for substitute plastic packaging material:

There are various substitutes which could be provided for plastic packaging which could be environmental friendly and it could add value for the same.

Figure 5: Replacement of replace plastics packaging



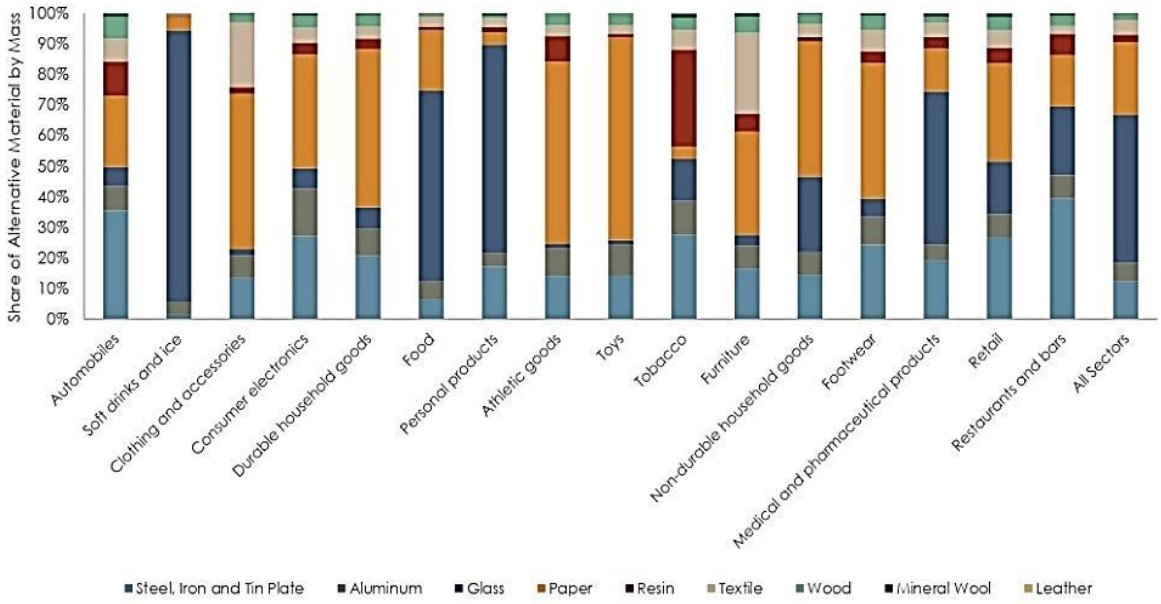
Source: (Lord, 2016)

As it is evident from the figure 5, alternatives like mineral wool, wood, leather and textile based solutions could replace plastics packaging. EU must work on these environmental friendly packaging products and use them more and reduce the global environmental damages and problems.

Alternatives to plastics used in FMCG sector:

It is found that already lot of alternatives do exist for plastics packaging and it has been widely used. Glass is the most commonly used alternative for plastics packaging which is viable and economical also. Steel, iron and tin plate is used widely across the sectors and industries & paper and textile alternatives are used in some sectors as alternatives for plastic packaging.

Figure 6: Alternatives of plastics in FMCG

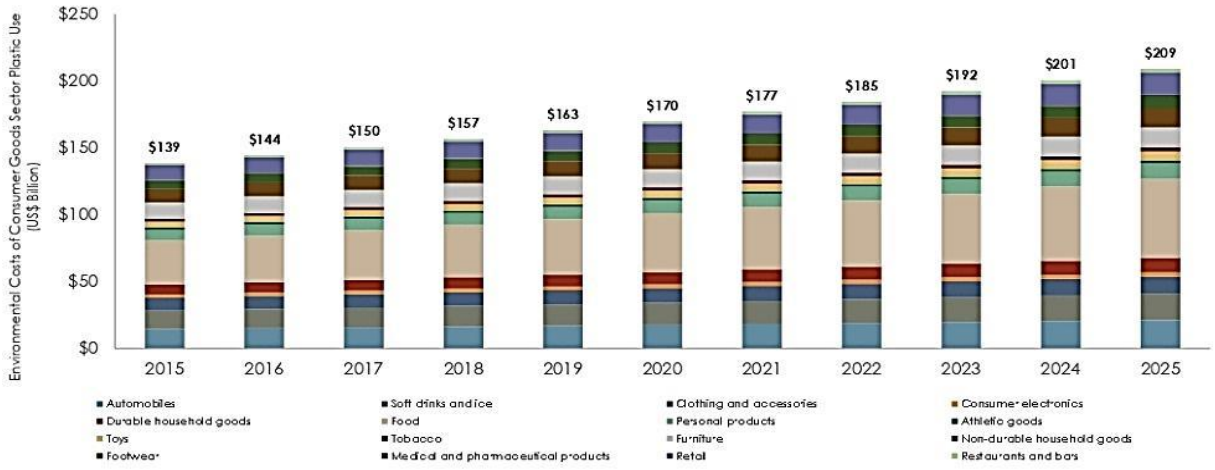


Source: (Lord, 2016)

It is evident from the figure 6 that Aluminium and paper based alternatives are widely used as alternative for single use plastics packaging in EU region. It is suggested that more empirical researches have to be conducted in EU region regarding the alternatives to plastic packaging and in providing environmental friendly products which can enhance value chain.

Sustainable plastic packaging usage and Implications – 2025

Figure 7: Usage of sustainable packaging& its implication since 2105 to 2025



Source: (Lord, 2016)

Although the current costs for using plastics packaging in consumer good industry is estimated to be around 139 billion dollars per annum & this could increase to 209 billion dollars by 2025.

EU circular economy strategy on Plastics packaging 2021

(Matthews, Moran, & Jaiswal, 2020) had done an evaluative study to assess the impact of plastic packaging on their circular economy strategy envisioned by 2018. EU has proceeded with sustainability as their grand strategy to manage the production and recycling of plastics which could make it economical. EU visionary strategy for 2030 towards plastic packaging to make it more reusable and recycled in a very effective way which can reduce the costs also. The challenge lies in plastic which is used in food packaging industry as the product cannot be recycled. It helps in minimising food wastage, economical and it helps in maintaining food quality and standards. It also helps in extension of shelf life of food products. The study concludes the need for research which could provide alternatives for multi-layer plastics, which can provide effective solutions for food packaging industry in EU region.

It is evident from the above researches in EU region conducted till date, that there is an intense search for recycling and having sustainable solutions for plastic packaging. Eco friendly products and solutions can be provided for packaging of consumer goods in EU region.

Research study: A prelude

The study is a search to find alternative solutions for global plastic package dependent economy. The study intends to provide eco-friendly, economical and value added solutions which can replace plastic packaging. This study would be empirical and quantitative in nature. This study would be done based on secondary data analysis. This will be carried out with an analysis of published reports, periodicals, journals and publications since 2015 on these dimensions mentioned.

The study intends to provide strategies and solutions for effective management of plastic packaging in EU region. The study would carefully evaluate the alternatives which are available to plastic packaging and the implications on sustainable development solutions for EU region.

Suggestions, recommendations and solutions would also be provided. Conclusions would also be provided. The next chapter would deal with the literature review aspects of plastic packaging and its prevalence in EU.

CHAPTER-III

RESEARCH METHODOLOGY

Aim of the study:

This study is an investigation in to the various packaging substitutes for single use plastics in baby, feminine and family care products. The study by nature is confined to Germany in EU region.

Focus of the study:

The study would focus on various packaging alternatives for single use plastics in FMCG industry of EU region. The study would in specific address the challenges and issues related to packaging of single use plastics. The study would focus on manager's perspectives working in these packaging industries across these countries in EU region and would also take in to consideration of consumer's views, opinions and perspectives on this.

Dimensions of the study:

In the exploratory investigation in to search for packaging substitute for single use plastics, shelf life, technology, investments, costing , production time, process, labour, raw materials and distribution challenges would be evaluated to provide specific insights for Baby, feminine and family care products industries to implement in EU region.

Is it a real investigation?

Yes, this is a real investigation.

This study by nature deals with the existing eco-friendly environmental challenges on packaging plastics. Plastics causes environmental damages as this waste cannot be managed effectively. It poses a very big challenge on sustainable development and progress. As this challenge has affected global sustainability as well, research organizations, companies and research scholars are trying to find out solutions to this. This study is an investigation on the various packaging alternatives for single use plastics in selected 4 countries in EU region -- Netherlands, Italy, France and Germany. The study intends to provide packaging solutions to this challenge across 3 different segments Baby, feminine and family care products in Fast moving consumer goods. As this research would provide strategies and solutions to the problem of packaging single use plastics, it is a real investigation in nature, purpose and in its pursuit.

Research Philosophy for the research

An effective determination of research philosophy would provide the perspective, orientations and dimensions of research pursuit. It would give clarity and direction for the research as intended to proceed for the desired output.

The research philosophy would effectively determine the assumptions and beliefs in development and management of knowledge. (Burrell & Morgan, 2017) have said in the research process, the scholar is bound to make assumptions, consciously or unconsciously. These assumptions have to be validated with scientific methodology of research.

The research philosophy provides the shape and clarifies on the (Crotty & Crotty, 1998) direction and intentions of research. The research philosophy (Johnson & Clark, 2006) by nature provides the appropriate fit in establishing the research design.

The research philosophy by nature would (Haynes, 2012) enabled the research scholar to reflect and reflex thinking on ideas and proceed in appropriate direction.

There is a need to establish and determine the specific research philosophy that the research scholar intends to pursue. This is very important in research and it has been emphasised by (Alvesson & Sköldberg, 2017) They have also clearly stated that there is a need to choose one best representative research philosophy for the research which is very significant.

Research Paradigms:

(Kelemen & Rumens, 2008) discusses and evaluates the criteria of research paradigms which would help research scholar to determine the purpose and orientation of research. Research paradigms provide the dimensions of research philosophy which has to be explored and investigated.

(Kelemen & Rumens, 2008) discusses regarding the paradigms which provide a set of assumptions for a particular sense of direction, approach and method. This would also help to determine on the explanations that we are going to provide and recommendations which are possible outcomes of the study.

(Kelemen & Rumens, 2008) evaluates on the interpretative paradigm which is the choice of pursuit for this research. This research philosophy by nature helps us to understand the humans and society which are associated and surrounded with us. It provides a sense of world for us.

(Kelemen & Rumens, 2008) said that it would help us to understand what is going on with regard to specific dimensions which help in evaluation and providing suitable suggestions & recommendations also.

(Saunders, Lewis, & Thornhill, 2007) has evaluated that there are five major philosophies which can be pursued by research scholars. These are positivism, post modernism, Interpretivist, critical realism and pragmatism.

(Crotty & Crotty, 1998) has said that interpretivist philosophy emphasises that human beings are different in creating and giving meaning to situations. The interpretivist by nature study the meaning and give their interpretations also.

This research would have interpretative philosophy for pursuing the objectives of the study. As this research philosophy enables the researcher to understand the realities which are prevailing for single use plastics and it would also make the scholar to interpret the realities to new concepts, ideas and solutions for alternative to single use plastic usage in EU region. So this research philosophy and its choice for this research study is justified.

This research intends to provide rich new understanding and meaning of the problems and dimensions associated with single use plastics. It also provides new ways and approaches of looking in to alternatives for single use plastics in fast moving consumer goods industry in EU region. This research philosophy provides the scope for multiple interpretations and in providing rich new meaning to the context and the problem which is investigated.

Rationale for the study:

(Walliman, 2005) has stated that research conducted has to be purposive, to find out a particular aspect, which is clearly stated and data collection and analysis is done systematically. This study would evaluate and investigate in to the packaging dimension of single use plastics and providing alternatives in EU region. It is also found that as research studies have not been done on these dimensions, there is a rationale to do this study which would provide new thinking, approaches, solutions and strategies for alternatives for single use plastics packaging in fast moving consumer goods industry in EU region.

Choosing a research strategy: Quantitative approach

In this research, the research strategy chosen for pursuit and proceeding is quantitative research design.

As quantitative research can provide answers to the problems and issues regarding single use plastics in EU region. It is the most appropriate way to find out answers using exploratory and conclusive methods of research. So the quantitative research design and choice as the most appropriate method as research strategy is justified.

Time horizon for the study

In this section, clearly stated that there is a need to clearly specify the time horizon for the study. The time horizon for this study would be decided based on the academic requirements of the university.

Interference of this research with other researchers conducted in the field already:

As this research deals with the issues regarding usage of single plastics and providing solutions and strategies in EU region, which has not been diagonise, evaluated or critically examined, this research by nature does not interfere with other researches which have been conducted already in this field.

Rationale of the topic and academic justification:

(Brady, 2015) has given the various methods which must be used for rational choice and selection of topic. Delphi technique was used extensively with professionals, academicians and research scholars of repute.

The past research works which have been done was analysed using the digital libraries of various universities all over the world. Brainstorming sessions were conducted with other research scholars and guide to gain more insights and perspectives.

Research Design: Quantitative

There is a need for establishment of quality in the entire research design process. In each and every stage care, attention and precaution has to be taken to ensure quality at the highest standards being ensured in this research.

There is a need to adopt scientific methodology and approach which would remove bias, confusions and contradictions. Reliability and validity are the cannons of scientific research which would be evaluated by interpretivist philosophers which has been reiterated by (Denzin & Lincoln, 2017) research scholars and philosophers and academicians.

As this research intends to provide quality in research, with removal of bias confusion and contradictions with reliability and validity, this study is intended to be pursued as a quantitative study.

This research would be empirical and quantitative in nature. The study would be empirical in its purpose and would use quantitative tools for analysis and interpretations.

In this study a combination of exploratory and conclusive research method would be used. This research would be exploratory as it would explore in to the various dimensions and issues regarding packaging single use plastics and its impact in EU region. The study would be conclusive as it would provide strategies and solutions for alternatives for single use plastics packaging.

This study would be done based on secondary data analysis. This will be carried out with an analysis of published reports, periodicals, journals and publications since 2015 on these dimensions mentioned.

Problem statement:

(Herberz, Barlow, & Finkbeiner, 2020) had conducted an investigation in to the implications on packaging ban of single use plastics in EU region. The study investigates the strategy of ban of single use plastics packaging is appropriate. In this study, product life cycle assessment was conducted for plastic products and other alternatives to plastics. The life cycle impact of these two alternatives were compared with EU consumption in 2016. In this study it was found that single use plastic ban has led to decrease of marine pollution by 5.5% in EU and also decreased global marine pollution by 0.06%. The study affirmatively and strongly concludes that single use plastics packaging in whatever way or form its being used is harmful.

Petersen, A.K.; Solberg 2004 & 2005 & Werner, F.; Richter 2007) studies have found that there is a lack of studies with regard to alternatives for single use plastics packaging. The comparative performance of other alternatives with plastics packaging – related studies are very less.

So there is a need to find alternative solutions and strategies for single use plastics packaging for industries in EU region. As the solutions and strategies would provide eco-friendly approach, this problem is investigated on these directions in 4 selected segments of Fast moving consumer goods industry in EU region.

Type of research:

This research would be quantitative in nature. The study intends to evaluate the alternatives for single use plastics packaging in fast moving consumer goods industry in EU region by using a quantitative analysis. Data collected from 100 managers and 100 consumers across 4 countries in EU region would be analysed with SPSS and suitable suggestions, recommendations and conclusions with strategies for implementation of packaging would be provided.

Research method:

In this research a combination of exploratory and conclusive research would be used. This research would be exploratory as it would explore in to the various, issues, challenges and problems regarding single use plastics packaging and alternatives for it in fast moving

consumer goods industry in EU region. The study would be conclusive as it would provide specific suggestions, recommendations and conclusions on alternatives to single use plastics packaging for fast moving consumer goods industry in EU region.

Research questions:

1. What is the extent of usage of single use plastics packaging in EU region?
2. Is the ban on single use plastics packaging in EU region correct?
3. What would be the implications of single use plastics packaging ban on fast moving consumer goods industry in EU region?
4. What are the alternatives to single use plastics packaging for baby, feminine and family care products in EU region?
5. What are the challenges and issues in implementation of alternatives to single use plastics packaging in EU region?

Objectives of the study:

1. To evaluate the extent of usage of single use plastics packaging in EU region
2. To find out the implications of single plastic packaging ban in EU region
3. To assess specific implication of single plastic usage packaging in fast moving consumer goods sector EU region
4. To suggest suitable alternatives for single plastic packaging usage in fast moving consumer goods sector in EU region
5. To investigate in to various challenges and issues regarding implementation of alternatives for single use plastics packaging for fast moving consumer goods sector in EU region

Hypothesis for the study:

H1: The extent of single use plastics packaging in EU region has been rising in the last five years

HO: The extent of single use plastics packaging in EU region has been reducing in the last five years

H1: Single use plastics packaging ban in EU region has positive impact on eco-friendly sustainable development.

HO: Single use plastics packaging ban in EU region has negative impact on eco-friendly sustainable development.

H1: Single use plastic packaging ban has provided benefits to fast moving consumer goods industry in EU region

HO: Single use plastic packaging ban has not any provided benefit to fast moving consumer goods industry in EU region

H1: Major challenge for implementation of alternative to single plastic packaging usage lies with CEOs of industries in EU region

HO: Major challenge for implementation of alternative to single plastic packaging usage does not lie with CEOs of industries in EU region

Secondary data collection:

This study would be done based on secondary data analysis. This will be carried out with an analysis of published reports, periodicals, journals and publications since 2015 on these dimensions mentioned. The next section would deal with literature review on plastic packaging in EU region.

Scope and limitations:

The study covers EU region.

The study covers dimensions of alternatives for single plastic usage packaging only.

The study does not cover other dimension other than specified above.

Outline of chapters

1. Introduction : Prevalence of Plastics
2. Review of Literature
3. Methodology
4. Analysis of data
5. Interpretations
6. Suggestion
7. Recommendation
8. Conclusion
9. References

Research contributions

This will provide effective and meaningful contribution to alternatives of single use plastic packaging.

Suitable strategies can be developed by them to provide alternatives for single use plastic packaging in EU region for fast moving consumer goods industry.

As this research satisfies effectively all the important characteristics of research, we do find that this research is;

- Socially relevant
- Impactful
- Provides practical knowledge
- Deals with a real problem

This research would provide a positive impact and changes with reduction of single use plastics packaging in EU region in specific with fast moving consumer goods industry.

Future perspectives and orientations

1. New usages of single use plastics packaging in EU region will be provided.
2. The study would provide new strategies for reducing single use plastics packaging in EU region.

Time line for Thesis

Introduction	Single use plastics packaging Single use plastics packaging in EU region Issues and implications	Timframe:1 Month
Literature reviews	50 comprehensive studies – empirical and conceptual Global and EU based studies Dimension based approach Scopus 2015 till date	
Research methodology	RM – major dimensions with comprehensive analysis	

Material collection	53 materials (Published reports, periodicals, journals and publications since 2015)	EU region Time period : 1 Week
Data analysis	Secondary data analysis	Analysis of published reports, periodicals, journals and publications since 2015 : 2 Weeks
Thesis writing	I draft Final draft Guide approval	Time period : 2 Weeks
Total time period		2 months

CHAPTER-IV

DATA ANALYSIS AND INTERPRETATIONS

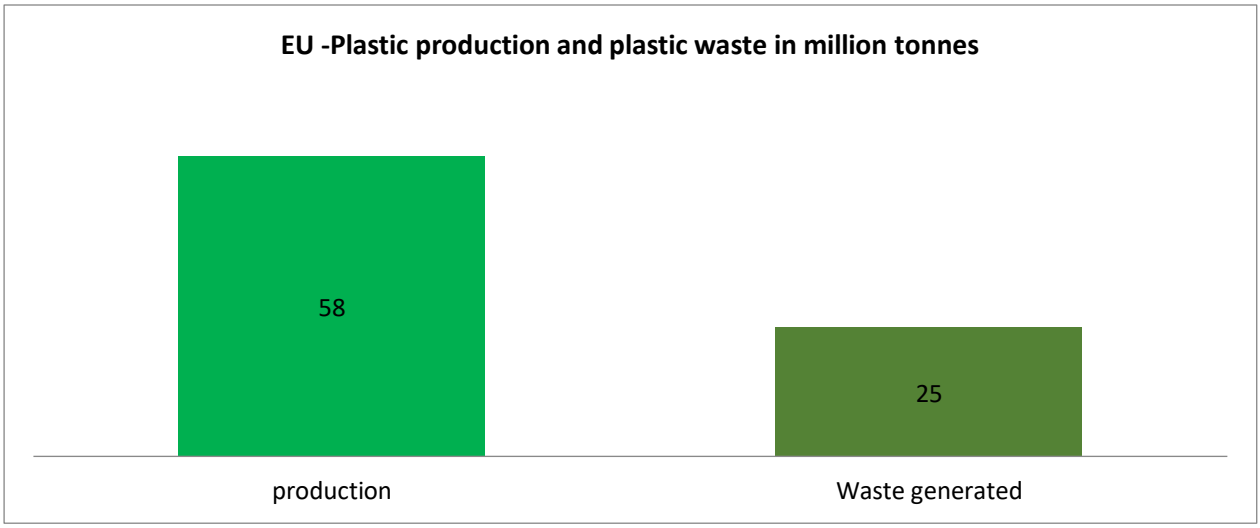
Demographic analysis

Table 1: Plastic production and plastic waste generation of EU region

production	**Waste generated**
58 million tonnes	25 million tonnes

Source:(EUCommission), 2018)

Figure 8: Plastic production and plastic waste generation of EU region



Inference:

From the table 1 and chart 1 it is found that 58 million tonnes of plastic was produced in EU region and nearly half of the produced plastic that is 25 million tonnes are generated as waste.

Table 2: EU region plastic converter demand per country

Country	**Demand percentage**
Germany	24.6%
Italy	14%
France	9.6%
Spain	7.7%
UK	7.3%
Poland	6.5%
Other countries	38%

Source:(PlasticsEurope, 2018; Tiseo, 2021)

Inference:

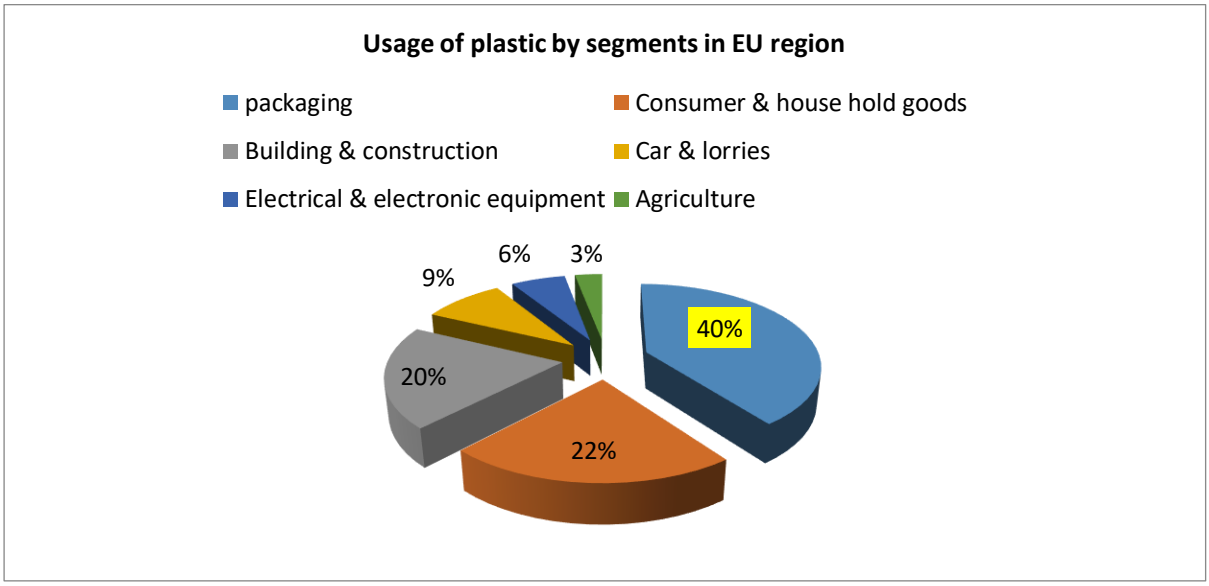
From table 2 it is found that Germany is in leading position regarding plastic converter demand.(CONVERTERS)highlighted that the plastic converters are the heart of the plastic industry in EU region. Huge employment generation is from this plastic converter companies that is above 1.6 million people are working in about 50000 plastic converter companies and creating turnover of 260 billion € annually. The major success factors of Germany plastic industry are Industrial structure and strong research base which is stated by the Dr. Josef chairman of Plastic Europe which is highlighted in the report(GTAI, 2017)

Table 3: Usage of plastic by segments in EU region

Segments	**percentage**
packaging	40%
Consumer & house hold goods	22.5%
Building & construction	20%
Car & lorries	9%
Electrical & electronic equipment	6%
Agriculture	3%

Source:(EUCommission), 2018)

Figure 9: Usage of plastic by segments in EU region



Finding:

From table 3 and chart 2 it is found that majority of the plastics are used for packaging segments and the next major segment is consumer & house hold goods in EU region.

Table 4: Waste management status of EU

	Percentage	**Alternative ways for waste as reusable**
Recycle	30%	
Incinerated	39%	Plastic waste to making colourful titles(Sil, 2020)
Landfills	31%	

Source:(EUCommission), 2018)

Inference:

From the table 4 it is found that recycling rate of plastic is very low in EU region it is only about 30% of the plastic wastes are recycled, 39% of the plastics waste are incinerated and 31% become landfills to avoid this Incinerated& landfills of waste plastics there are some alternate reusable techniques like making colourful titles.

Table 5: Packaging waste and recycle percentage status of EU

Total plastic waste	Packaging waste	Recycle of packaging plastic
25 million tonnes	60% of total plastic waste=15.88 million tonnes	40%

Source:(EUCommission), 2018)

Inference:

From table 5 it is revealed that the 60% (15.88 million tonnes) from the total plastic waste of 25 million tonnes is packaging waste and only 40% of those packaging waste are recyclable. So there is emergence need of creative alternative reusable techniques is needed to handle the huge unrecyclable packaging waste.

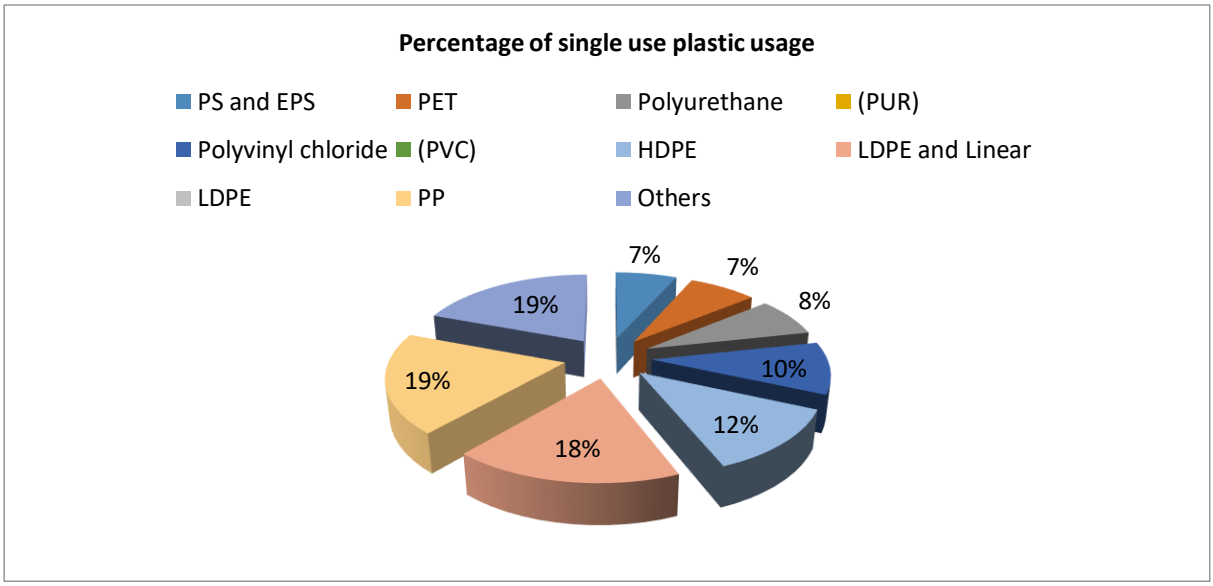
Table 6: Single use plastic usage in general as per EU

Type of plastic	**Usage in products**	**Percentage of use**
PS and EPS	PS products: Eyeglasses frames, plastic cups and egg trays PSE products : Packaging and building insulation	6.7%
PET	Products : Water bottles, soft drinks bottles , bottles for juices and cleaners	7.4%
Polyurethane (PUR)	Building insulation, pillows, mattresses and insulating foams for fridges	7.5%
Polyvinyl chloride (PVC)	Window frames, profiles, floor and wall covering, pipes, cable insulation, garden hoses and inflatable pools	10%
HDPE	Toys, milk bottles, shampoo bottles, pipes and housewares	12.3%
LDPE and Linear LDPE	LDPE products: Reusable bags, trays, containers and agricultural film	17.5%

	LLDPE products : Food packaging film	
PP	Food packaging, sweet and snack wrappers, hinged caps, microwave proof containers, pipes, automotive parts and bank notes	19.3%
Others	Hub caps, optical fiber, eyeglasses lenses, roofing sheets, touch screens, cable coating in telecommunications, medical implants and surgical devices	19.3%

Source:(cseindia, 2019)

Figure 10: Single use plastic usage



Inference:

From table 6 and chart 3 it is inferred that PP, LDPE and Linear LDPE and other type of plastics are used highly is single use plastic package.

Table 7: Single use plastic packaging usage specific to baby, family care, feminine products in EU region

Products	Rate of consumption (billion units)	Waste generation (tones)	Waste disposal scenario	Alternatives
Menstrual products	49	590,000	Land fill=87.4% Incineration=12.6%	Reusable menstrual products and reusable nappies
Baby nappies	33	6,731,000		
Individual wet wipes	68	511,000		

Source:(Cabrera, 2019)

Inference:

From table 7 it is found that very large amount of baby nappies and menstrual products wastes are generated and 87% of the wastes are become land filled ,13% are incinerated in EU region. There is an emergence need of making awareness to women regarding the issues of plastic waste and its harmful impact to environment and encourage them to prefer for alternatives to support the plastic free environment.

Table 8 : Single use plastic packaging products usage in germany

Product	Rate of consumption (per min)	Waste generation (billion per year)	**Alternatives**
Disposable cups(coffee ,tea and other hot drinks) Source:(Florasouthey, 2019)	5300	2.8	Use of reusable cups(50 uses in a year) Use of Own refillable cup or returnable cup
Product	Rate of consumption (in billion per year)	Collection rate (%)	Refilled and circulated around 15 times before

single-use plastic bottles source:(Schneider, 2019)	16.4	98.5	going into recycling. (Schneider, 2019) For reducing recycle cost some alternate reusable methods like Eco bricks will be an answer to waste plastic bottle handling after it crosses refill times (LeFevre, 2019; Lenkiewicz, 2017)

Inference:

From table 8 it is found that 5300 disposable cups are used per minute and 2.8 billion disposable waste cups are generated so the best alternatives to avoid this waste generation is use of reusable cups & use of own refillable cups or returnable cups.Single use plastic botteles rate of consumption in germany per year is 16.4 and the collection rate is good (98.5%) with DRS.The collected bottles are Refilled and circulated around 15 times before going into recycling .

A best solution for the reducing recycling cost is implementing some creative alternate reusable methods like Eco bricks it will be an answer to waste plastic bottle handling after it crosses refill times.

Analysis on alternatives for single use plastic packaging and its impact on Technical, economical, Sustainability and customer behaviour

Top 10 Single-use plastic products addressed by the EU Directive for more sustainable alternatives (Europeoncommision, 2019)

Table 9: Alternatives for single use plastic wet wipes and sanitary items

Product	Alternatives	Impacts
Wet wipes and sanitary items(Dando, 2019) Baby care products Pampers diapers- baby wipes	plastic-free and organic pads and tampons Reusable cloths, Use waste paper(zoe, 2015),	Organic pads and tampons are compostable, biodegradable and a 100% plastic free because of it is sustainable materials. There is a reduction of carbon foot print creation when using the organic pads and tampons compare to conventional single use plastic pads. 3.4 kg CO_2 produced per years

	biodegradable wipes(beauty) Bio degradable diapers(Choudhury, 2019)	with organic sanitary product usage, a roughly 35% carbon footprint reduction take places. 5%of women are using reusable menstrual products globally the reusable alternatives like cups or period-proof underwear could disrupt the sanitary-product industry.(Shreya, 2016)

Baby care products

In the first year baby use diapers in the range of 2500 to 3000 and the time for decompose Disposable diapers single use plastic diapers take hundreds of years.(Babycare, 2020)

- Biodegradable nappies

  Biodegradable nappies made from natural fibres and fabrics such as bamboo, woodpulp, cellulose, natural cotton or unbleached cotton and cornstrach paper.(Munden, 2020)

  Figure 11: Biodegradable nappies

- Cloth diapers

  Cloth diapers are a great alternative because of its reusable nature, it can be keep using again and again without sending anything to landfill. (Munden, 2020)

  Figure 12: Cloth diapers

Feminine care products

- ***Plastic-free and organic pads & tampons***

The organic pads and tampons are very hygienic it make the skin breathe and also reduce carbon footprint but the regular single use plastic sanitary can cause skin irritation and allergic reactions also it is very hard to dispose, and can take 100 of years to decompose.(Das, 2017)

- ***Reusable cloths***

(Rakheja, 2017)highlighted that the total purchase cost of single use plastic sanitary pads can go up to a lakh per annum for the family having three women so the reusable alternatives are the best options to achieve socio economic condition. And the rises in demands on several countries motivate the women entrepreneurship to do online sales of home based preparation of reusable sanitary napkins with cloth.

Figure 13: Home based preparation of reusable sanitary napkins with cloth

- ***Menstrual cups***

  A menstrual cup is a product made with silicone material it collects menstrual blood not absorbing it like tampons or sanitary napkins. The products are often reusable, leading to many advertising their potential benefits to the environment as a more sustainable alternative to disposable menstrual hygiene products. The study results of the 43 research with 3319 respondents from various income group countries proved that menstrual cups are a safe alternative product for menstruation management.(WATTS, 2019)

- ***Reusable liners***

  Cotton reusable panty liners are very easy to use and they are extremely lightweight and comfortable.(Rael, 2020)

Wet wipes

- ***Biodegradable wipes***

Bio degradable wipes are containing Aloe Vera, chamomile and calendula extracts help to keep skin healthy and comfortable and also they are better for the planet.(biggreensmile, Biodegradable wipes, better for the planet & better for you!)

- ***Use waste paper for cleaning***

(friendsoftheearth, 2017)listed the 34 fantastic ways for the use of wastepaper the following are highlighted for the cleaning purpose .cleaning windows, Barbecue cleaner, Oven cleaner.

Table 10: Alternatives for single use plastic Cotton bud sticks

Product	Alternatives	Impacts
Cotton bud sticks(sorcit)	Wood	The production cost of alternative product would increases, but its marginal impact is small when it is spread across a massive number of consumers and business people. The growth of Economic value is estimated to change from plastic product supply chain to those producing non-plastic alternatives, with a net increase in revenue but the loss of plastic products manufacturing industries are accounted for economic model. (RESEARCH, 2020)
	bamboo	
	paper	
	Fluid ear washes (WWF, 2020)	

Cotton bud sticks alternatives

- ***Wood stick***
- ***Bamboo stick***
- ***Paper stick***

Fluid ear washes

Table 11: Alternatives for single use plastic Cups for beverages

Product	Alternatives	Impacts
Cups for beverages	Switch to eco-friendly and compostable alternatives (WWF, 2020) paper cups, Ceramic, bio plastic cup	16 billion disposable cups are used for coffee every year globally, 0.24 pounds of carbon dioxide are emitted into atmosphere for every paper cup manufacturing. (Carneiro, 2019)

Table 12: Comparison of disposable coffee cups

Cup type	Cup Mass	Material Specific Energy	Embodied Energy
	g/cup	MJ/kg	MJ/cup
Ceramic	292	48	14
Plastic	59	107	6.3
Glass	199	28	5.5
Paper	8.3	66	0.55
Foam	1.9	104	0.20

Source:(UniversityofVictoria)

From the above table it is clearly known that the material specific energy saving is good with the reusable ceramic and glass cups compare to plastic ,paper and form cups.

Bio plastic cups

Biodegradable cups are made from bio plastics resultant from corn, sugarcane or potatoes. The waterproof linings are made from renewable resources, can break down into earth-friendly compost that can enrich soil.(McdonaldPaper, 2018)

Table 13: Alternatives for single use plastic cutlery, plates, straws and stirrers

Product	Alternatives	Impacts
Cutlery, plates, straws and stirrers(WWF , 2020)	Bamboo straws, Pasta straws Rice straws Paper straws and compostable	226 million units of cutlery , 199 million drinking straws, and 11 million drinks stirrers sold each year globally (RESEARCH, 2020) More than 50% of the consumers are not ready to go with alternatives because of it inconvenient nature but the responses from businesses are in need of strong

	plant-based straws	leadership support from Government to make changes in existing business arrangements and stated that the cost of alternatives, viability and availability of alternatives are barrier to phasing out single-use plastics.(TCCS, 2019)
	bamboo stirrers spoons, celery stick , carrot /cucumber	
	Banana leaf, Palm leaf or bamboo pulp plates.	

1. Straws: (eponline, 2019)

Compostable plant-based straws

PLA "biodegradable" straws are positioned as straws made from plants that can break down in the environment. They are made from naturally occurring, plant material some of them are

- Bamboo straws
- Pasta straws
- Rice straws

Single use plastic stirrer Paper straws are the best option for foodservice and venues because they are an environmentally safe, single-use option.

2. Stirrers

Bamboo stirrers

One of the best alternatives for the single use plastic stirrer is bamboo because it is biodegradable and the plant grows very fast.(hotcupfactory, 2019)

Herbal stirrers(shashwatbiopp, 2020)

- Stick of celery
- Carrot or cucumber stirrers

3. Plates: Banana leaf & palm leaf and bamboo pulp

Figure 14: Banana leaf plate

Banana leaf technology helps to replace 100% single use plastic plates and it also ensure the income generation for the poor farmer.(Mathur, 2020)

Figure 15: Palm leaf plate

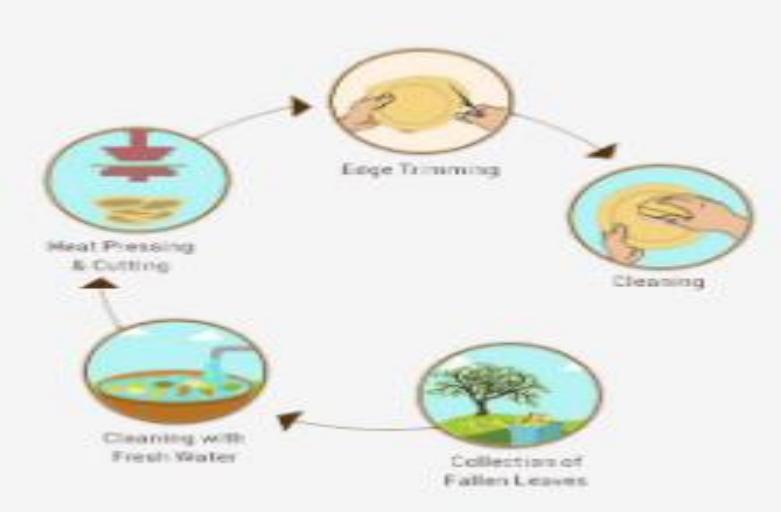


Figure 15 shows how the Palm leaf plates are made in step 1 fallen areca palm leafs are cleaned with water, step 2 it is dried and then stretched and flattened in step 3 and step4. In Final step various plates and bowl shapes are moulded using a heated press and edge trimming takes place. (buzzcateringsupplies, 2018)

Bamboo pulp plates

Bamboo plates are strong and durable and can easily contain large amounts of food. And it is better than the paper plates as thousands of trees are chopped off to make paper plates.(Swain, 2020)

Table 14: Alternatives for single use plastic Food containers

Product	Alternatives	Impacts
Food containers	Compostable Service ware (PLA/PHA-corn based, Bagasse-sugar cane/sorghum juice extraction, Paper)**(Ecocycle)** Cloth Food Sacks(Davis, 2015) aluminium, Glass (emmersonpackaging, 2021)	Glass is very sustainable material because of its fully recyclable nature but the issues with the glass food containers are heavy weight, require extra effort and energy for transportation, hard to recycle like plastic. Aluminium is also 100% recyclable and it can be recycled infinitely but the bauxite the mineral need for aluminium manufacturing mined usually from the remote areas which is harmful to the environment and leads to significant water contamination. The global production of aluminum require more than 3% of world's electricity supply and accounts double the greenhouse gases of plastic bottles (emmersonpackaging, 2021)

Corn based compostable service ware (PLA/PHA)

The trendy plastic made from a renewable resource such as corn based compostable service ware will break down under certain conditions into harmless natural compounds and this corn-based plastic are starting to look cheap.(Royte, 2006)

Bagasse-sugar cane/sorghum juice extraction

Bagasse is made out from the sugarcane stalk after the juice extraction it is the best hygienic alternatives for the single plastic container.(ecoproducts).

Figure 16: Bagasse

Aluminium container & Glass container

Table 15: Comparison of Recycling and reusable of Aluminium & glass with single use plastic container

	Glass bottle	Single use plastic	Carton	Aluminium can
Carbon Footprint reduction	26.5-40%*	30%	No data available	96%
How many times?	Infinite for brown color	About 1-2 times and then downcycled	Paper can be reused 4-5 times	Infinite
% recovered for recycling	80%	9.5%	No data available	45%

The glass and the aluminium container can be used for infinite time and recovery of glass bottle again is 80% where aluminium is 45% but the single use plastic is only 9.5%.(tappwater, 2019)

Table 16: Alternatives for single use plastic Balloons and sticks for balloons

Product	Alternatives	Impacts
Balloons and sticks for balloons	Decoration options like paper lanterns, skip the balloons , DIY bubble ,blowers and flowers(WWF, 2020) natural rubber balloon and new cardboard Balloon Grip(B-Loony, 2019)	1 million balloon sticks by volume sold each year globally (RESEARCH, 2020) Flat packed cardboard Balloon Grip saves the cost for packaging, storage and distribution. (productmediamagazine, 2019)

Natural rubber balloon

In 1931 the Tillotson Rubber Company created the first modern latex balloon made from the sap of a rubber tree. The sap removed from the tree is called latex and then the latex is added with curing agents, accelerators, oil, color, and water to make balloon.(scienceworld)

Cardboard Balloon Grip

It is plastic free product made from engineering cardboard it is completely recyclable and highly sustainable.(balloongrip)

Figure 17: Colourful Cardboard Balloon Grip

Table 17: Alternatives for single use plastic bags

Product	Alternatives	Impacts
Plastic bags(EBP)	Cotton Non-woven polypropylene (PP) Compostable Woven Polypropylene (PP) Bags Jute, paper bags	Manufacture of paper bags consumes 4 times more water, produce 3 times more green gases, consume 2.2 times more non-renewable energy and produce 2.7 times more acid gases than manufacturing of plastic bags. Paper bags carry a substantial environmental impact in their manufacture that is not seen with plastic bags. Paper bags contribute three times more to global warming than conventional plastic shopping bags. The paper bags are heavier than plastic bags so it leads to additional cost for waste management and recycling (allaboutbags)

Cotton

Cotton bags are made from renewable natural fibres which are strong in nature as compared to those plastic bags which are made from polyethylene which are derived from natural gas and petroleum .The Major strength of the cotton bags are thicker and can be used repeatedly as compared to the single-use plastic or paper bags.

Non-Woven

The Non-Woven bags are 100% green, recyclable and reusable which are made of fabric called Non-Woven.

Polypropylene (PP)

Polypropylene is a thermoplastic made from the combination of propylene monomers. This PP bags are used in following bulk packaging applications such as agricultural product packaging, food packaging, tourism and transport.

Compostable

Compostable food packaging made from plant-based, recycled materials and can return to earth quickly and safely as soil when disposed of in the right environmental conditions.

Jute

Jute is very strong and highly durable, 100% biodegradable, low-energy recyclable, and causes no threat to the environment. Carrying of products in a Jute bag no threat to hygiene. And it can be used multiple times.

Paper Bags

Paper bags are natural and biodegradable, reusable and recyclable the advantages of paper bags are,

- Protect the Environment
- Save Energy
- Durable and Fashionable

Woven Polypropylene (PP) Bags

Woven Polypropylene (PP) Bags are most widely used for bulk packaging

Table 18: Comparison of PP woven over paper and jute bags(chinawovenbag, 2012)

Functional Requirement for Bulk Packaging			
Parameter	**Jute**	**Paper**	**PP Woven Sacks**
Seepage	Relatively High	Low	Low
Moisture Prevention	Nil	Nil	Excellent
Contamination / Infestation	Very High	Nil	Low to Moderate
Organoleptic deterioration	Very High	Moderate	Minimum
Aesthetics	Poor	Good	Good
Availability	Seasonal	Limited	Abundant and Easy
Cost	High	High	Low
Seam Strength	Strong	Strong	Low
Operational Convenience	Good but Abrasive	Good	Good
Stack Stability	Good	Good	Good
Drop Test Performance	Fair	Poor	Very Good
Microbial attack	Very High	High	Nil
Air borne pollution	Very High	None	None
Biodegradability	Yes	Yes	No
Energy Recovery	Low	Low	High
Reusability	Good	Nil	Good

Table 19: Alternatives for single use plastic Beverage containers

Product	Alternatives	Impacts
Beverage containers	Paperboard, seaweed plastics, pouches,(Enterprises) and stone paper& plastic, cardboard and old newspaper (Greenway, 2020)	**Reasons for why plastic is hard to replace** • Very cost effective plastic packaging can cut production costs by almost 50% when compared to alternative packing materials • Transportation of alternatives like glass bottles increasing transport costs by up to 5 times per bottle and heavier containers requires 40% more energy • Reducing the Food waste by its key factor in lengthening the amount of time that food can stay fresh **The alternatives and its downside** • Paperboard-can't stand high heat temperatures not a great option for spillable materials • Molded Pulp-cost of production and its functionality (Design, 2020)

Paperboard

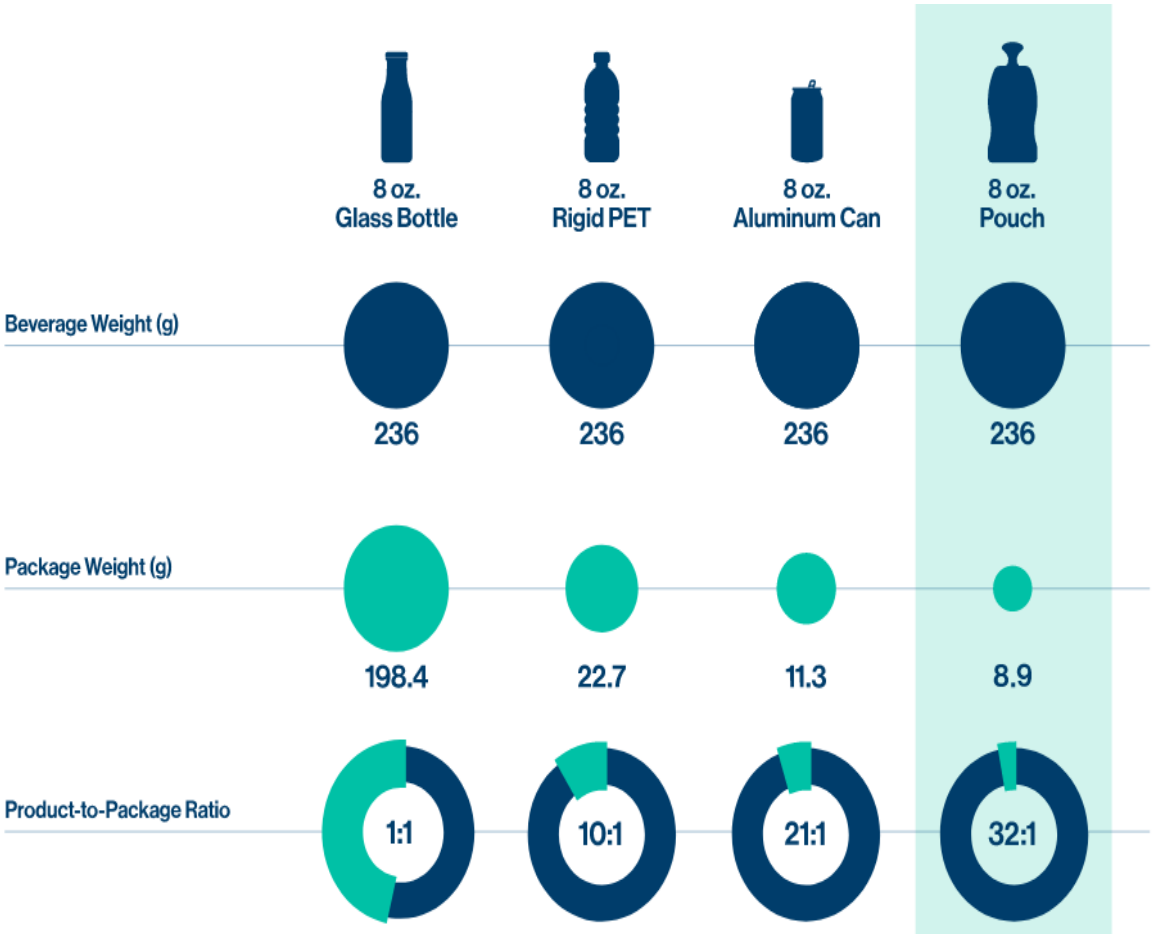
The paperboard beverage bottles will be non-transparent and non-breakable and its materials look somewhat similar to that of an egg box carton with a visible fiber structure .It can be recycled .(drupaadmin, 2015)

Seaweed plastics

Seaweed plastic bottles are made up from the agar a natural jelly derived from seaweed. When the bottle is full it solidifies in the shape of a bottle; and when emptied, it decomposes naturally.(veolia, 2016).

Pouches

Figure 18: Product-to-package ratio comparison



Source:(scholleipn, 2020)

Form the above figure 11 it is found that the product to package ratio of pouch packaging is very low because of its lightweight flexible structure. Flexible Packaging is good for the Circular Economy.

Stone paper

Figure 19: Advantage of stone paper

Source:(stonepaper)

This stone paper is made from the waste marble, rich mineral paper and rock paper.(IMARC)

Advantages

- Acid-free with a neutral pH
- Resistant to water, grease, and insect
- Collects no static charge

Uses

- Stationery
- Packaging
- Adhesives
- Wrappers
- Bags

Global market for stone paper

Transparency Market Research (TMR) says the global stone paper market is foreseen to develop at a growth rate of 6% CAGR over the forecast timeframe, from 2020 to 2030 one of the major reason for this rise in demand for environment friendly items in the packaging industry.(packagingstrategies, 2021)

Cardboard

Figure 20: Cardboard beverage can

Germany based company designed multi-layered cardboard beverage can which can be used for beverages such as soft drinks, fruit juices, and coffee drinks.(Mark, 2011)

Table 20: Alternatives for single use plastic Cigarette butts

Product	Alternatives	Impacts
Cigarette butts	Green butts(grrenbutts; Joy, 2017)	4.5 trillion Cigarette butts are improperly discarded globally every year.(MichaelBloach, 2010) The average time for degradation of a Green butts filter is 3 days but it can take up to 15 years for common acetate filters to degrade. (grrenbutts)

Green butts

Green butts cigarette filters are manufactured from the natural compostable materials such as organic cotton and de-gummed hemp with the help of wheat flour and pure water the filter elements are binded.(Salton, 2010)

Table 21: Alternatives for single use plastic Packets and wrappers

Product	Alternatives	Impacts
Packets and wrappers(Hefer, 2020)	Parchment Paper Bees Wrap Cardboard	The food wrapping paper market size has the potential to grow by USD 830.20 million during 2021-2025, and the market's growth momentum will accelerate at a CAGR of 3.79%.And the key drivers and trends for this growth is because of increased demand for reusable packaging such as reusable food wrapping paper. (technavio, 2021)

Parchment

Vegetable parchment paper is used for wrapping butter and it is broadly used as layer between slices of pastry or meat because its grease resistance and wet strength properties make it easily removable from food contact surface.(Deshwal, Panjagari, & Alam, 2019)

Paper

Paper containers are made from renewable resources it can be used as wrapping paper, fibre-board, and paper sacks and it will provide us with a sustainable, healthy, and safe environment.(sonocoasia).The different types of wrapping paper are available butcher paper, freezer paper, wax paper or sandwich paper.(uniwraps, 2019)

Bees Wrap

It is made of cotton fabric Cardboard coated with a layer of food-grade beeswax, rosin and coconut or jojoba oils. Used to wrap cheese, fruit and vegetables and other dry-prepared foods or snacks and easy to dispose

Analysis on recycling and reusable of single use plastic packaging and its impact on Technical, economical, Sustainability and customer behaviour

There is a huge material loss about 95% (USD 80-120 billion) in single use plastic package products globally only 14% of the plastic packaging collected for recycling.so the recycling of single use plastic packaging and usage of reusable products are best options for strengthening New Plastics Economy(NPEC, 2017)

Table 22: Recycling and reusable of single use plastic packaging and its impact

Products	recycling and reusable	Impacts
Cotton bud sticks(sorcit)	Reusable	ear spoons instead of cotton buds as reusable or recyclable(Rodrigo, 2017) One pound of plastic requires 22 gallons of water(waterreport, 2017) and cotton require requires 20,000 liters of water per one kilogram of cotton so the consumer behaviour have to take an initiator as eco-warrior by switching to a reusable cotton swab is very cost effective and environment (Burr, 2020)
Cutlery, plates, straws and stirrers(WWF, 2020)	Reusable silicone straw ,Stainless steel straws	Almost 80% of the consumers opined that they are using reusable alternatives and more than 35% of the business respondents stated that they are also in favour of reusable cutlery, cups & plate as alternative (TCCS, 2019)
	Reusable glass stirrers	
	Reusable bamboo utensils, travel cutlery, Chopsticks	
	Glass or porcelain plates	
Balloons and sticks for balloons	Crochet water balloons(leftinknots, 2020)	Eco-friendly, Latex-free, Mess-free and Reusable Water Balloon They are washable, reusable, dryer safe, and eco-friendly! No more spending time filling

		balloons(leftinknots, 2020)
Food containers(WWF, 2020)	own reusable container glass containers, stainless steel lunch boxes and mason jars	ECOBOX established in Luxembourg which come under the DRS for food container with close to 100 participating restaurants sizes of 500 and 1 litre. India (Mumbai)- Stainless steel tiffin boxes for 200,000 meals Belgium- With more than 1,000 members for tiffin Tiffin system started in EU region UK.(Murphy, 2019)
Cups for beverages	own reusable cup or a mason jar(WWF, 2020)	Using Deposit Return System (DRS) EU reaches the highest rates(90%) of separate collection In Germany DRS is doing very well for re-cup consumer pay of EUR1 (Murphy, 2019) Charging for single-use, disposable to-go cup and providing discount for discount for customers who bring their own cup saved 55000 cups and very cost effective, reducing waste for environment friendly and making. (Carneiro, 2019) It is necessary for changes in next generation consumer behaviour to accept the reuse is best for the environment(Wozniacka, 2020)
Beverage containers	Metal and glass (Enterprises) reusable	DRS deposit return schemes would collected the beverage

	Recyclable for single-use bottles	containers bottles for further recycling(Rodrigo, 2017)
Cigarette butts	Recycle(SINGH, 2016) and reusable	DRS deposit return schemes and use of reusable filters(Rodrigo, 2017)
Plastic bags(EBP)	Paper (Recycled) Reusable Plastic	Paper bags are not reusable because it will tear easily and they are not waterproof but the Conventional plastic bags are highly reusable and outperform than paper. Reuse rate is 40.3% they are reused as carry bags and as kitchen catchers for garbage and organics, among their many uses. (allaboutbags)
Packets and wrappers	Glass Containers and Mason Jars reusable(Hefer, 2020) Plate On Top Of Bowl Cloth Bowl Covers Beeswax Wrappers Glass Container Or Jar Sandwich Wrappers(Klemperer, 2019)	DRS would collected the bottles for further recycling(Rodrigo, 2017)
Wet wipes and sanitary items	Reusable pads, Period pants, menstrual cups(Dando, 2019) Reusable baby wipes cloths (beauty)	Feminine sanitary item: In Europe the right incentives will provide to progress reusable nappy schemes. Laundry services scheme Separate collection scheme menstrual cups

		Wet wipes alternatives: Flannels Towels Sponges (Rodrigo, 2017)

P&G-global commitment to reduce plastic and achievement of sustainability goals by 2030

- 2030 goal of P&G is producing 100% recyclable or reusable packaging by 2030
- Reduce global use of virgin petroleum plastic in our packaging by 50% by 2030

The continuous use of recycled plastic (PCR) to reduce our environmental footprint will help to reach the goal

Table 23: Recycled plastic (PCR) usage in Europe

Product	Percentage of PCR
Ariel Bottles	25%
Lenor Bottles	50%
Unstopables Bottles	50%
Fairy Dishwashing Liquid-Clear Bottles	25%
Hair Care Brands-Head & Shoulders, Pantene, Aussie	25%
Home Care Brands-Mr. Proper& Viakal	
Before 2020	20%
2020	70%

Source:(P&G, 2019)

CHAPTER –V

SUGGESTIONS & RECOMMENDATIONS

Economical impact of alternative usage on single use plastics

- 70% of the business respondents are opined that usage of single plastics definetely increased their operating cost and 30% of the respendents positively stated that usage

and implementation of other alternatives would increase their operating costs. (TCCS, 2019)

- More than 45% of the business respondents stated that they would pass these costs onto customers. (TCCS, 2019)

The Alternatives of single use plastic will increase the operting cost of the business and its effect will pass onto customers,so the alternative usage of palstic will have a greatly affect the economic condition of millions of people all over the globe.

Consumer behaviour impact of alternative usage on single use plastics

- 68% of the consumers are ready to shift for alternatives of single-use plastics if they knew more about alternatives and they are expecting very cost effective solutions which would not imply on additional costs. (TCCS, 2019)

As per the above point it is clearly known that consumers ready to change for alternative products of single use plastic but the challenge lies in providing such a viable cost effective alterantive within the same price range of plastic .

Technological impact of alternative for single use plastic

- Fro the effective and efficient technological changes from replacing alternative for single use plastics require transition time period to platic Industry and business.
- More than 30% of the business respondents opined that they are infavour of complete change of particular single-use plastic products that could change their technical aspects.And more than 40% of the business respondents opined that complete transition requires 3 to 5 years of extened time period. (TCCS, 2019)

  There is a need of transition time period fot technological changes to implement alternatives instead of single use plastic packaging .It may take atleast five years for complete transition.

Environmental impact of alternative for single use plastic

Table 24:Positive and Negative impact of alternatives

Alternative products	Positive impact	Negative impact
Bags with 100% recycled content	Durable, strong	More expensive
Woven product Non-woven product	Durable, strong	fossil-fuel based plastic required for manufacture
Cotton	Durable light weight Easy to wash	More resources required for manufacture
Paper	Light eight Easy accessible Easy to carry	Producing high carbon footprint during manufacturing Requires lot of resources

Source:(MFE)

The alternative products are having long durability which are very strong are also easy to wash, like paper products. These are light weight, very accessible and easy to carry but the manufacturing of such alternatives needs a lot of resources which increases manufacturing cost and the paper products produces high carbon footprint also.

Impact of Alternatives of single use plastics in packaging of fast moving consumer goods

Economic impact

Feminine

The two main sustainable alternatives for the feminine product are cloth pads and the menstrual cup .These products are much cheaper and very good alternative to disposables because of their low lifecycle cost.(Solanki, 2020)

As per the global feminine hygiene products report(globalfemininehygiene, 2020) the market size for feminine eco-friendly biodegradable products would reach 27.7USD billion by 2025 because of increasing female population & rapid urbanization, rising female literacy and awareness of menstrual health & hygiene, rising disposable income of females, and women empowerment.

Baby care product

(Schley, 2018) highlighted in his report that if the baby spends 3 years in diapers we can save $120 $270 by using cloth diapers.

Consumer behaviour impact

Baby care & family care product

There is an increase in new generation consumers opting natural products as a result of environmental awareness. There is a high growth of Alternatives of single use plastics in packaging of fast moving consumer goods such as baby care, personal care, household products, and cosmetics.(DELVENTHAL, 2020)

Feminine care product

Ethical consumerism in the field of feminine hygiene is currently in the development stage so the good awareness on information is essential for the development of ethical consumerism and changing of the consumer behaviour(Rihtaršič & Rihtaršič, 2017).

Environmental impact

Feminine

The environmental impact of Menstrual cups are estimated to have less than 1.5% but the impact of single use plastic pads are at 10% of the cost. Cloth pads can use for 12 to 24 months and most of the cloth pads are biodegradable.so the environment impact is very low with these alternative single uses plastic free feminine products. (Solanki, 2020)

Baby care

Cloth diapers will be more environmentally friendly; if the proper careful is taken on acquire and wash of cloth. (Schley, 2018)

Technological impact

Baby products

The diaper industry has struggled to move to greener products due to its new technological adoption in manufacturing process.(Kavilanz, 2017)

Figure 21: Bio renewable polymer making process

A corn starch-based mixture is put through an extruder, a machine that changes material as its compressed noodle-like material comes out the other end and is eventually turned into a powder.

Figure 22: Bio diaper’s renewable polymer

Feminine product

Usage of bio-derived products will open the opportunity to use renewable materials and also will reduce the overall material quantity for about 5% with reference to the current product values. An optimized design of the innovative multilayer absorbent core of the bio feminine products will deliver 10–15 % reduction of volume and mass than disposable single use plastic pads.(Carlucci, 2012)

CONCLUSION

Nothing is impossible. Human behaviour changes over time, complete elimination of plastic usage would take some time because the growth rate of plastic is very high, in 1950 it started as 1.5 million tonnes and in 2019 it has reached 368 million tonnes. Though some alternatives of single use plastic packages are having positive effects as it tends to provide other challenges like high cost, high carbon footprint, and requirement of more resources.

"Where there is a will there is a way", some single use plastic packaging products in the segments -- feminine, baby and house hold, single use plastic could be completely eliminated with the help of consumer awareness towards the alternatives. Recycling and reusable of single use plastic packaging with creative & innovative ideas are the best viable option for handling current scenario without affecting economic and technological aspects. Eco bricks, colourful plastic tiles are some examples for creative reusable techniques successfully implemented as a first step to address the current plastic waste management.

It is concluded that in these segments feminine, baby and house hold, single use plastic packaging could be completely eliminated and alternative solutions are to be provided for an eco-friendly society in EU region.

References:

1. cseindia (Producer). (2019). SINGLE-USE PLASTIC. *cdn*. Retrieved from https://cdn.cseindia.org/attachments/0.28582200_1570445163_factsheet-2.pdf
2. EUCommission), D.-G. f. E. E. (2018). chaning the way we use plastics. *op.europa*. https://op.europa.eu/en/publication-detail/-/publication/e6f102e3-0bb9-11e8-966a-01aa75ed71a1/language-en
3. Florasouthey (Producer). (2019). Single-use round-up:EU,England,and Germany address disposable plastics. *foodnavigator*. Retrieved from https://www.foodnavigator.com/Article/2019/05/22/Single-use-round-up-EU-England-and-Germany-address-disposable-plastics
4. LeFevre, C. (Producer). (2019). Ecobricks: An Answer to Plastic Waste? . *buildwithrise*. Retrieved from https://www.buildwithrise.com/stories/ecobricks-an-answer-to-plastic-waste
5. Lenkiewicz, Z. (Producer). (2017). How to turn mixed plastic waste and bottles. *wasteaid*. Retrieved from https://wasteaid.org/wp-content/uploads/2017/10/9-How-to-turn-mixed-plastic-waste-and-bottles-into-ecobricks-v1-mobile.pdf
6. PlasticsEurope (Producer). (2018). Plastics – the Facts 2018. *plasticseurope*. Retrieved from https://www.plasticseurope.org/application/files/6315/4510/9658/Plastics_the_facts_2018_AF_web.pdf
7. Schneider, H. (Producer). (2019). Deposit systems for single-use. *reloopplatform*. Retrieved from https://www.reloopplatform.org/wp-content/uploads/2019/11/HENRIETTE-SCHNEIDER_en.pdf
8. Sil, D. (Producer). (2020). This Delhi Startup Has Used 340 Tonnes Of Plastic Waste To Make 11 Lakh Colorful Tiles. *thelogicalindian*. Retrieved from https://thelogicalindian.com/exclusive/paras-saluja-colorful-tiles-plastics/#:~:text=Exclusive-,This%20Delhi%20Startup%20Has%20Used%20340%20Tonnes%20Of%20Plastic,Make%2011%20Lakh%20Colorful%20Tiles&text=A%20Delhi%20based%20startup%20has,to%20make%20colour
9. allaboutbags (Producer). Paper vs. Plastic Bags. allaboutbags. Retrieved from http://www.allaboutbags.ca/papervplastic.html

10. Alvesson, M., & Sköldberg, K. (2017). Reflexive methodology: New vistas for qualitative research: sage.

11. Andrady, A. L., & Neal, M. A. (2009). Applications and societal benefits of plastics. Philosophical Transactions of the Royal Society B: Biological Sciences, 364(1526), 1977-1984.

12. B-Loony (Producer). (2019). How will the ban on single use plastics impact your business? B-Loony. Retrieved from https://www.b-loony.co.uk/blog/2019/07/08/how-will-the-ban-on-single-use-plastics-impact-your-business/

13. Babycare (Producer). (2020, feb 15). How to Choose the Right Cloth Diaper. puracy. Retrieved from https://puracy.com/blogs/baby-care/choosing-right-cloth-diaper

14. balloongrip (Producer). balloongrip. balloongrip. Retrieved from https://www.balloongrip.co.uk/

15. beauty, H. (Producer). What's the green alternative to baby wipes & wet wipes? beashadegreener. Retrieved from https://www.beashadegreener.com/eco-friendly-alternative-baby-wipes/

16. biggreensmile (Producer). (Biodegradable wipes, better for the planet & better for you!). biggreensmile. Retrieved from https://www.biggreensmile.com/article/biodegradable-wipes-better-for-the-planet-better-for-you.aspx#:~:text=Not%20only%20are%20they%20better,wipes%20is%20particularly%20great%20value.

17. Brady, S. R. (2015). Utilizing and adapting the Delphi method for use in qualitative research. International Journal of Qualitative Methods, 14(5), 1609406915621381.

18. Browne, M. A., Crump, P., Niven, S. J., Teuten, E., Tonkin, A., Galloway, T., & Thompson, R. (2011). Accumulation of microplastic on shorelines woldwide: sources and sinks. Environmental science & technology, 45(21), 9175-9179.

19. Burr, A. (Producer). (2020, jan 30). 5 Ways Cotton Swabs Impact the Planet. lastobject. Retrieved from https://lastobject.com/blogs/blog/5-ways-cotton-swabs-impact-the-planet

20. Burrell, G., & Morgan, G. (2017). Sociological paradigms and organisational analysis: Elements of the sociology of corporate life: Routledge.

21. buzzcateringsupplies (Producer). (2018). Palm Leaf Tableware. buzzcateringsupplies. Retrieved from https://www.buzzcateringsupplies.com/catering-blog/article/palm-leaf-tableware%20eco-friendly-packaging?__cf_chl_jschl_tk__=8bb138e640b0440b2e62b11a30400189dfb4b5f5-1617095049-0-AZMJJoKK0IrmntFy6Vr-qMDKh7eq4mqSL8bOlehI3i_W1fgVVxPc7GPKeNpwPbpG56I4saz0g8EDA

22. Cabrera, A. (2019). SINGLE-USEMENSTRUALPRODUCTSBABY NAPPIES& WET WIPES. zerowasteeurope. https://zerowasteeurope.eu/wp-content/uploads/2019/12/bffp_single_use_menstrual_products_baby_nappies_and_wet_wipes.pdf

23. Carlucci, G. (2012). New technologies for feminine hygiene products with reduced environmental impact. WIT Transactions on Ecology and the Environment, 155, 597-606.

24. Carneiro, A. C. D. (2019). sustainablity&transparency report. static1.squarespace. https://static1.squarespace.com/static/5419e3c7e4b090c9db3d42ca/t/5d0bc51aa2343f00014258ab/1561052454593/Sustainability-Report-2018-19_Nossa-Familia-Coffee.pdf

25. chinawovenbag (Producer). (2012). PP Woven Bags & Packaging Products. chinawovenbag.com. Retrieved from https://chinawovenbag.com/blog/pp-woven-sacks-for-bulk-packaging/

26. Choudhury, D. R. (Producer). (2019). How to reduce use of plastic products around your child. indianexpress. Retrieved from https://indianexpress.com/article/parenting/family/happy-earth-day-how-to-reduce-use-of-plastic-products-around-child-5688354/

27. CONVERTERS, E. P. (Producer). EUROPEAN PLASTICS CONVERTERS. plasticsconverters. Retrieved from https://www.plasticsconverters.eu/

28. cseindia (Producer). (2019). SINGLE-USE PLASTIC. cdn. Retrieved from https://cdn.cseindia.org/attachments/0.28582200_1570445163_factsheet-2.pdf

29. Dando, T. (Producer). (2019). WHAT ARE THE SUSTAINABLE ALTERNATIVES TO DISPOSABLE PERIOD PRODUCTS? resource. Retrieved from https://resource.co/article/what-are-sustainable-alternatives-disposable-period-products

30. Das, S. (Producer). (2017). Organic pads and tampons: An expensive fad or a healthier, greener option. Hindustan Times. Retrieved from https://www.hindustantimes.com/fitness/organic-pads-and-tampons-an-expensive-fad-or-a-healthier-greener-option/story-a6SKPpHnpcIy2zNrFhfXlI.html

31. Davis, C. (Producer). (2015). 5 Food Containers Alternatives to Plastic. sustainability. Retrieved from https://sustainability.ncsu.edu/blog/changeyourstate/5-food-containers-alternatives-plastic/

32. DELVENTHAL, S. (Producer). (2020, feb 29). New Generation of Consumers Increase Demand for Natural Products. investopedia. Retrieved from https://www.investopedia.com/articles/investing/022217/study-shows-surge-demand-natural-products.asp

33. Denzin, N. K., & Lincoln, Y. S. (2017). The Sage handbook of qualitative research: Sage publications.

34. Deshwal, G. K., Panjagari, N. R., & Alam, T. (2019). An overview of paper and paper based food packaging materials: health safety and environmental concerns. Journal of food science and technology, 56(10), 4391-4403.

35. Design, D. (Producer). (2020, oct 5). THE STRUGGLE FOR ALTERNATIVES TO PLASTIC PACKAGING. dealdesign. Retrieved from https://dealdesign.com/2020/10/05/alternatives-to-plastic-packaging/

36. drupaadmin (Producer). (2015). Beer in a cardboard bottle. drupa. Retrieved from https://blog.drupa.com/de/cardboard-bottle/

37. EBP (Producer). The Best Alternatives To Single-Use Plastic Bags For Your Business. ebpsupply. Retrieved from https://www.ebpsupply.com/blog/alternatives-single-use-plastic-bags

38. ecoproducts (Producer). Sugarcane. ecoproducts. Retrieved from https://www.ecoproducts.com/sugarcane.html

39. emmersonpackaging (Producer). (2021, March 1). Alternatives to Single-Use Plastic: What's More Sustainable? emmersonpackaging. Retrieved from https://www.emmersonpackaging.com/2021/03/01/alternatives-to-single-use-plastic-whats-more-sustainable/

40. Enterprises, H. (Producer). The Future Of Plastic Bottles. hughesent. Retrieved from https://www.hughesent.com/blog/the-future-of-plastic-bottles/

41. eponline (Producer). (2019). The 4 Truths of PLA Straws. eponline. Retrieved from https://eponline.com/Articles/2019/09/25/The-4-Truths-of-PLA-Straws.aspx?Page=4

42. EUCommission), D.-G. f. E. E. (2018). chaning the way we use plastics. op.europa. https://op.europa.eu/en/publication-detail/-/publication/e6f102e3-0bb9-11e8-966a-01aa75ed71a1/language-en

43. Europeancommision (Producer). (2018). Reducing marine litter: action on single use plastics and fishing gear. europa.eu. Retrieved from https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1502-Reducing-marine-litter-action-on-single-use-plastics-and-fishing-gear

44. Europeoncommision (Producer). (2019, jul 2). Single-use plastics. ec.europa.eu. Retrieved from https://ec.europa.eu/environment/topics/plastics/single-use-plastics_en

45. Florasouthey (Producer). (2019). Single-use round-up:EU,England,and Germany address disposable plastics. foodnavigator. Retrieved from

https://www.foodnavigator.com/Article/2019/05/22/Single-use-round-up-EU-England-and-Germany-address-disposable-plastics

46. friendsoftheearth (Producer). (2017). 34 uses for old newspapers. friendsoftheearth. Retrieved from https://friendsoftheearth.uk/sustainable-living/34-uses-old-newspapers

47. Geyer, R., Jambeck, J., & Law, K. (2017). Producción, uso y destino de todos los plásticos jamás fabricados. Science Advances, 3(7), 1207-1221.

48. globalfemininehygiene (Producer). (2020, Nov). Feminine Hygiene Products Market by Nature (Disposable, Reusable), Type (Sanitary Napkins, Panty Liners, Tampons, Menstrual Cups), Region (Asia Pacific, North America, Europe, Middle East and Africa, South America) - Global Forecast to 2025. marketsandmarkets. Retrieved from https://www.marketsandmarkets.com/Market-Reports/feminine-hygiene-product-market-69114569.html

49. Greenway, S. (Producer). (2020). 13 Plastic Packaging Alternatives. thestrategydistillery. Retrieved from https://www.thestrategydistillery.com/news/13-plastic-alternatives/

50. grrenbutts (Producer). greenbutts. green-butts. Retrieved from https://www.green-butts.com/

51. GTAI. (2017). THE PLASTICS INDUSTRY IN GERMANY. chemicalparks. https://chemicalparks.com/fileadmin/user_upload/Downloads/industry-overview-plastics-industry-in-germany-en.pdf

52. Haynes, K. (2012). Reflexivity in qualitative research. Qualitative organizational research: Core methods and current challenges, 72-89.

53. Hefer, A. (Producer). (2020). Alternatives for Plastic Wrapping and Packaging. bioenergyconsult. Retrieved from https://www.bioenergyconsult.com/alternatives-for-plastic-wrapping-and-packaging/

54. Herberz, T., Barlow, C. Y., & Finkbeiner, M. (2020). Sustainability Assessment of a Single-Use Plastics Ban. Sustainability, 12(9), 3746.

55. hotcupfactory (Producer). (2019). Clever Alternatives to Plastic Stir Sticks. hotcupfactory. Retrieved from https://hotcupfactory.com/blogs/news/clever-alternatives-to-plastic-stir-sticks

56. IMARC (Producer). Stone Paper Market Catalysed by Demand for Eco-Friendly Packaging. imarcgroup. Retrieved from https://www.imarcgroup.com/global-stone-paper-market

57. Johnson, P., & Clark, M. (2006). Business and management research methodologies: Sage.

58. Joy, W. (Producer). (2017). Students Create 'Greener' Alternative to Cigarette Butts. kgns. Retrieved from https://www.kgns.tv/content/news/Students-Create-Greener-Alternative-to-Cigarette-Butts--414710803.html

59. Kavilanz, P. (Producer). (2017). The disposable diaper game changer: corn starch. money. Retrieved from https://money.cnn.com/2017/02/01/technology/diapers-ecofriendly-tethis/index.html

60. Kelemen, M. L., & Rumens, N. (2008). An introduction to critical management research: Sage.

61. Klemperer, J. (Producer). (2019). 5 Reusable Plastic Wrap Alternatives. foodprint. Retrieved from https://foodprint.org/blog/reusable-plastic-wrap-alternatives/

62. LeFevre, C. (Producer). (2019). Ecobricks: An Answer to Plastic Waste? . buildwithrise. Retrieved from https://www.buildwithrise.com/stories/ecobricks-an-answer-to-plastic-waste

63. leftinknots (Producer). (2020). crochet-water-balloons. leftinknots. Retrieved from https://www.leftinknots.com/home/crochet-water-balloons

64. Lenkiewicz, Z. (Producer). (2017). How to turn mixed plastic waste and bottles. wasteaid. Retrieved from https://wasteaid.org/wp-content/uploads/2017/10/9-How-to-turn-mixed-plastic-waste-and-bottles-into-ecobricks-v1-mobile.pdf

65. Lord, R. (2016). Plastics and sustainability: A valuation of environmental benefits, costs and opportunities for continuous improvement. Trucost is an affiliate of S&P

Global Market Intelligence (2020 S&P Trucost Limited, an affiliate of S&P Global Market Intelligence).

66. Mark (Producer). (2011). Cardboard beverage can designed to meet sustainability demands. beveragedaily. Retrieved from HTTPS://WWW.BEVERAGEDAILY.COM/ARTICLE/2011/11/28/CARDBOARD-BEVERAGE-CAN-DESIGNED-TO-MEET-SUSTAINABILITY-DEMANDS

67. Mathur, B. (Producer). (2020). Replacing Single-Use Plastic, One Leaf At A Time: This 20-Year-Old's Invention Can Help Tackle The Rising Plastic Waste Crisis. swachhindia. Retrieved from https://swachhindia.ndtv.com/replacing-single-use-plastic-one-leaf-at-a-time-this-20-year-old-invention-can-help-tackle-the-rising-plastic-waste-crisis-41810/

68. Matthews, C., Moran, F., & Jaiswal, A. K. (2020). A Review on European Union's Strategy for Plastics in a Circular Economy and its Impact on Food Safety. Journal of Cleaner Production, 125263.

69. McdonaldPaper (Producer). (2018). War Of Waste: Several Alternatives To Take Out Paper Cups. McdonaldPaper. Retrieved from https://mcdonaldpaper.com/blog/war-of-waste-paper-cup-alternatives

70. MFE (Producer). Environmental pros and cons of alternatives to single-use plastic shopping bags mfe. Retrieved from https://www.mfe.govt.nz/waste/single-use-plastic-shopping-bag-ban/pros-cons-of-alternatives

71. MichaelBloach (Producer). (2010). Green cigarette buts? greenlivingtips. Retrieved from https://www.greenlivingtips.com/eco-news/green-cigarette-butts.html#:~:text=The%20chemicals%20can%20leach%20from,to%20small%20crustaceans%20and%20bacteria.&text=A%20company%20called%20Green%20Butts,cigarette%20filter%20with%20a%20twist.

72. Munden, E. (Producer). (2020). Biodegradable Nappies: Are They Any Good? kidadl. Retrieved from https://kidadl.com/articles/biodegradable-nappies-are-they-any-good

73. Murphy, E. R. G. (2019). MOVINGAWAY FROMSINGLE-USEGUIDE FOR NATIONAL DECISION MAKERS TOIMPLEMENT THE SINGLE-USE PLASTICSDIRECTIVE. rethinkplasticalliance. https://rethinkplasticalliance.eu/wp-content/uploads/2019/10/2019_10_10_rpa_bffp_sup_guide.pdf

74. NPEC (Producer). (2017). THE NEW PLASTICS ECONOMY:RETHINKING THE FUTURE OFPLASTICS & CATALYSING ACTION. ellenmacarthurfoundation. Retrieved from https://www.ellenmacarthurfoundation.org/assets/downloads/publications/NPEC-Hybrid_English_22-11-17_Digital.pdf

75. P&G (Producer). (2019). AMBITION 2030:A New Global Commitment to Reduce Plastic. assets. Retrieved from https://assets.ctfassets.net/oggad6svuzkv/2HiwiX1CEMLg6vnUU5UbPC/ccde21de0eca8481aa7bdd612e9210cc/Plastic50by2030_infograph.pdf

76. packagingstrategies (Producer). (2021, mar 9). Rising Demand for Environmentally Friendly Packaging Solutions Spells Growth in Stone Paper Market. packagingstrategies. Retrieved from https://www.packagingstrategies.com/articles/96048-rising-demand-for-environmentally-friendly-packaging-solutions-spells-growth-in-stone-paper-market

77. Petersen, A. K., & Solberg, B. (2005). Environmental and economic impacts of substitution between wood products and alternative materials: a review of micro-level analyses from Norway and Sweden. Forest Policy and Economics, 7(3), 249-259.

78. Plasticserope (Producer). (2018). Plastic-The Facts(2018). plasticseurope. Retrieved from https://www.plasticseurope.org/application/files/6315/4510/9658/Plastics_the_facts_2018_AF_web.pdf

79. PlasticsEurope (Producer). (2015). Plastics - the facts 2014/2015 by PlasticsEurope. plasticseurope. Retrieved from

https://www.plasticseurope.org/application/files/5515/1689/9220/2014plastics_the_facts_PubFeb2015.pdf

80. PlasticsEurope (Producer). (2018). Plastics – the Facts 2018. plasticseurope. Retrieved from https://www.plasticseurope.org/application/files/6315/4510/9658/Plastics_the_facts_2018_AF_web.pdf

81. productmediamagazine (Producer). (2019). B-LOONY CUTS PLASTIC USE. productmediamagazine. Retrieved from https://www.productmediamagazine.co.uk/b-loony-cuts-plastic-use/

82. Rael (Producer). (2020, dec). REUSABLE PANTY LINERS: A MORE COMFORTABLE AND ECO FRIENDLY ALTERNATIVE. getrael. Retrieved from https://www.getrael.com/blogs/r-blog/reusable-panty-liners-an-alternative

83. Rakheja, H. (Producer). (2017). Menstrual Hygiene Day: Switch to reusable menstrual products to save the environment. hindustantimes. Retrieved from https://www.hindustantimes.com/more-lifestyle/menstrual-hygiene-day-switch-to-reusable-menstrual-products-to-save-the-environment/story-LD8gqEkhppvYPeSA1759xK.html

84. Raynaud, J. (2014). Valuing plastics: The business case for measuring, managing and disclosing plastic use in the consumer goods industry: UNEP.

85. RESEARCH, S. (2020). Preliminary Research to Assess the Impacts of. gov. https://gov.wales/sites/default/files/statistics-and-research/2020-05/impacts-of-a-ban-or-restrictions-in-sale-of-items-in-the-eus-single-use-plastics-directive-summary.pdf

86. Rihtaršič, T., & Rihtaršič, M. (2017). Model of Consumer Behaviour-Feminine Hygiene. Economics, 5(1), 127-138.

87. Rodrigo, A. (2017). Seizing the opportunity:Using plastic only where it makes sense. zerowasteeurope. https://www.zerowasteeurope.eu/wp-content/uploads/2017/09/ZWE-Plastics-Reduction-Paper-FINAL.pdf

88. Royte, E. (Producer). (2006). Corn Plastic to the Rescue. smithsonianmag. Retrieved from https://www.smithsonianmag.com/science-nature/corn-plastic-to-the-rescue-126404720/

89. Salton, J. (Producer). (2010). Greenbutts cigarette filters sprout flowers when planted. newatlas. Retrieved from https://newatlas.com/green-cigarette-butts-sprout-flowers/14735/

90. Saunders, M., Lewis, P., & Thornhill, A. (2007). Research methods. Business Students 4th edition Pearson Education Limited, England.

91. Schley, C. (Producer). (2018). Cloth vs. Disposable Diapers: Which Kind Should I Use? nytimes. Retrieved from https://www.nytimes.com/wirecutter/blog/cloth-vs-disposable-diapers/

92. Schneider, H. (Producer). (2019). Deposit systems for single-use. reloopplatform. Retrieved from https://www.reloopplatform.org/wp-content/uploads/2019/11/HENRIETTE-SCHNEIDER_en.pdf

93. scholleipn (Producer). (2020). Beverage Packaging. scholleipn. Retrieved from https://www.scholleipn.com/beverage/

94. scienceworld (Producer). BALLOONS. scienceworld. Retrieved from https://www.scienceworld.ca/resource/balloons/

95. shashwatbiopp (Producer). (2020). 10 worst single-use plastics and eco-friendly alternatives. shashwatbiopp. Retrieved from http://shashwatbiopp.com/10-worst-single-use-plastics-and-eco-friendly-alternatives/

96. Shreya (Producer). (2016). The Ecological Impact of Feminine Hygiene Products. digital.hbs. Retrieved from https://digital.hbs.edu/platform-rctom/submission/the-ecological-impact-of-feminine-hygiene-products/

97. Sil, D. (Producer). (2020). This Delhi Startup Has Used 340 Tonnes Of Plastic Waste To Make 11 Lakh Colorful Tiles. thelogicalindian. Retrieved from https://thelogicalindian.com/exclusive/paras-saluja-colorful-tiles-plastics/#:~:text=Exclusive-,This%20Delhi%20Startup%20Has%20Used%20340%20Tonnes%20Of%20Plast

ic,Make%2011%20Lakh%20Colorful%20Tiles&text=A%20Delhi%20based%20startup%20has,to%20make%20colour

98. SINGH, T. (Producer). (2016). No More Butts: This Duo Is Recycling Every Part of the Cigarette Butt and Paying Collectors Too! thebetterindia. Retrieved from https://www.thebetterindia.com/77701/cigarette-butt-recycling-noida/

99. Solanki, D. (Producer). (2020, june 25). The future of periods can now be sustainable and cheap. theconversation. Retrieved from https://theconversation.com/the-future-of-periods-can-now-be-sustainable-and-cheap-133025

100. sonocoasia (Producer). PAPER PACKAGING AND ITS BENEFITS. sonocoasia. Retrieved from https://sonocoasia.com/paper-packaging-and-its-benefits

101. sorcit (Producer). Cotton Buds Ban: What Are My Alternatives? sorcit. Retrieved from https://sorcit.co.uk/cotton-buds-ban-what-are-my-alternatives/

102. stonepaper (Producer). stonepaper. stonepaper. Retrieved from https://www.stonepapertech.com/

103. Swain, S. (Producer). (2020). Various Types Of Disposable Plates You Can Switch To, Leaving Plastic Plates Behind karmicseed. Retrieved from https://karmicseed.com/blogs/posts/various-types-of-disposable-plates-you-can-switch-to-leaving-plastic-plates-behind

104. tappwater (Producer). (2019). Glass vs plastic vs aluminium – what is the most sustainable choice? tappwater. Retrieved from https://tappwater.co/us/footprint-of-glass-vs-plastic-vs-aluminium-best-choice/

105. TCCS. (2019). PHASING OUT SINGLE-USE PLASTICS. ENGAGEMENT REPORT. https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.act-yoursay.files/2415/7199/4497/Engagement_Report.pdf

106. technavio (Producer). (2021, feb). Food Wrapping Paper Market by Type and Geography - Forecast and Analysis 2021-2025. technavio. Retrieved from https://www.technavio.com/report/food-wrapping-paper-market-industry-analysis

107. Thompson, R. C., & Moore, C. J. (2009). FS vomSaal and SH Swan. Philos. Trans. R. Soc. London, Ser. B, 364, 2153-2166.

108. Tiseo, I. (Producer). (2021, jan 27). Distribution of plastics demand in Europe in 2019, by country. statista. Retrieved from https://www.statista.com/statistics/830187/plastics-demand-europe/

109. UniversityofVictoria. Comparativelifecyclecosts. sustainability. https://sustainability.tufts.edu/wp-content/uploads/Comparativelifecyclecosts.pdf

110. uniwraps (Producer). (2019). TYPES OF FOOD WRAPPING PAPER AND ITS ADVANTAGES. uniwraps. Retrieved from https://www.uniwraps.com/types-of-food-wrapping-paper-and-its-advantages/#:~:text=Wrapping%20your%20food%20in%20food,store%20your%20food%20germ%2Dfree.

111. veolia (Producer). (2016). Icelandic design: a biodegradable bottle made from seaweed. livingcircular. Retrieved from https://www.livingcircular.veolia.com/en/eco-citizen/icelandic-design-biodegradable-bottle-made-seaweed

112. Walliman, N. (2005). Your research project: a step-by-step guide for the first-time researcher: Sage.

113. waterreport (Producer). (2017). The Hidden Water in Everyday Products. watercalculator. Retrieved from https://www.watercalculator.org/footprint/the-hidden-water-in-everyday-products/

114. WATTS, K. (Producer). (2019). Menstrual cups: A viable alternative? healthissuesindia. Retrieved from https://www.healthissuesindia.com/2019/07/17/menstrual-cups-a-viable-alternative/

115. Wozniacka, G. (Producer). (2020, Feb 5). Plastic to-go containers are bad, but the alternatives might not be much better. greenbiz. Retrieved from https://www.greenbiz.com/article/plastic-go-containers-are-bad-alternatives-might-not-be-much-better

116. WWF (Producer). (2020). 10 worst single-use plastics and eco-friendly alternatives. wwf. Retrieved from https://www.wwf.org.au/news/blogs/10-worst-single-use-plastics-and-eco-friendly-alternatives#gs.wn8fvo

117. Xanthos, D., & Walker, T. R. (2017). International policies to reduce plastic marine pollution from single-use plastics (plastic bags and microbeads): a review. Marine pollution bulletin, 118(1-2), 17-26.

118. zoe (Producer). (2015). Eco-friendly wet wipe alternatives. ecothriftyliving. Retrieved from https://ecothriftyliving.com/2015/03/eco-wet-wipe-alternatives.html