Circular Economic Models

Assessing the Proposed Circular Economy Bill 2021 and the Validity of the Implication of Circular Economies

Project Overview & Line Of Enquiry

I was initially inspired to prepare this project when I learned about and discovered the Irish government's proposed Circular Economy Bill 2021. Upon further reading about this new legislation, I additionally researched information about circular economic systems, their proposed introduction into modern societies, and the implications of turning to a sustainable approach.

My previous knowledge of environmental issues and unsustainable production in the industrial sector subsequently motivated me to choose this topic, as circular economies can provide an adequate and clear solution to this pressing dilemma.

In writing this work, I aim to introduce the concept of circular economies, and the implications of introducing these systems. Addressing this aspect holds much significance, since the general concept behind circular economies has much value, and yet there are certain flaws, such as the extensive costs behind transitioning to more sustainable methods.

This project also intends to resolve the question of whether or not we really do require circular economies, and how such systems differ from other commonly utilised methods; whether free market techniques of allowing businesses and enterprises to hold the majority of control in an economy, or having the government control each individual sector in a centrally planned economy suffice to prevent the growing amount of waste we produce.

I also seek to highlight the effects of implicating circular economies worldwide and the impacts of this with regard to achieving the UN Sustainable Development Goals, and the EU Effort Sharing targets. I will focus particularly on Ireland, and the effects that the Circular Economy Bill 2021, and introduction of a circular economy, will have on Ireland's achievement of our targets for the reduction of greenhouse gas emissions, and contributions to the accomplishment of the UN SDGs.

Finally, I aim to provide an overview and analysis of the legislation put forward in the Circular Economy Bill 2021, and assess the benefits and negative aspects of the propositions, while adding several suggestions and amendments which could improve on the clauses set out.

About the Author

Name: David Oskwarek
Age: 15
Class: 3rd Year
Time of Writing: 23 June 2021 - 29 December 2021*

* Data and information outlined and utilised in the making of this project may be subject to change or be out of date following this project's creation.

Table of Contents

Laying the Foundations: What Are Circular Economies?

"There is a major problem of unsustainability of our environment, and we're seeing it in our natural resources, peak oil is probably upon us, and it can't be sustained. We're on an unsustainable path, and at this point in history we are responsible for that. We're going to have to change our ways. We're going to have to think through this problem." - Edgar Mitchell[1]

Our usage of natural resources, and our wastefulness with regard to these resources is now causing pressing environmental issues around the globe. Newspaper articles, radio and TV broadcasts, and all other media platforms are brimming with stories about climate change, global warming and plastic pollution. Many of us already know the details regarding these problems, but the key topic is how nations are going to work to eradicate, or reduce the consequences of our leniency with regard to caring for the natural world.

Circular economies are an example of one of these solutions. Previous economic and business models have implemented a linear "take-make-waste" system, which involves producing a good, selling this product to a consumer, who uses it and then later disposes of it. Although such methods can be more profitable for individual businesses and consumers, these actions are extremely damaging and harmful to the majority in the long run.

"A circular economy would turn goods that are at the end of their service life into resources for others, closing loops in industrial ecosystems and minimizing waste." - Walter Stahel[2]

Circular economic models aim to eliminate or decrease this waste, by designing and producing goods that can be recycled or replaced, and can go through multiple life cycles. This can apply to all manner of goods and industries, such as clothes, electronics or white goods, to name but a few. Circularity can also apply to techniques used during primary economic activities, such as sustainable approaches to farming and fishing, for example replacement of fishing with aquaculture.

Circular economies also require the participation and willingness of each individual consumer, such as taking the time to segregate waste, and reducing energy consumption and waste food material, or composting any waste food material.

Although many would associate circularity and sustainability with the "Three R's": Reduce, Reuse, and Recycle, however, the model extends much farther beyond this, encompassing concepts such as repurposing products once they have served a certain function, and renting and repairing products, instead of purchasing and then disposing of or replacing goods. An example of circularity and repurposing can be once again seen in the food sector, where waste food material can be used to produce biofuels, or used as fertiliser for growing other plants and crops.

This technique has already been put into practice at projects such as *The Plant*; a community where food producers have develop a system where organic byproducts of food production are repurposed into producing biogas, and as a base for growing mushrooms and other products.[3]

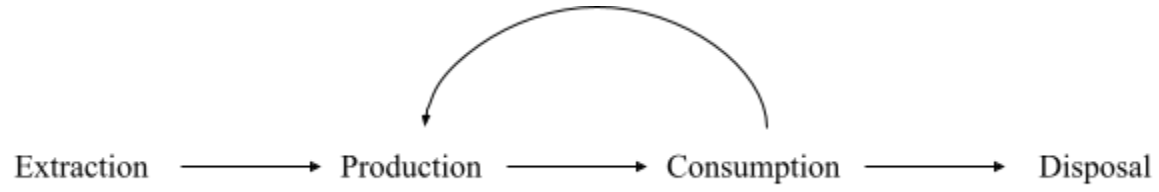
Why Do We Need Circular Economies?

Recent years have seen an increased rise in the popularity of the "take-make-waste" cycle, linear product lifespans, and inferior product quality and planned obsolescence.

The "take-make-waste" system involves raw materials and natural resources being extracted and processed into manufactured products, which are then used by the ordinary consumer and disposed of. This is an example of a linear product cycle, where products travel along a single line, i.e:

Extraction → Production → Consumption → Disposal[4]

Circular economies seek to reform this model by removing, or minimising the "Disposal" stage, and instead looping around the cycle so that products are recycled, reused, remanufactured once again in the "Production" stage before being once again consumed and used by consumers, i.e:



Or:

Extraction → Production → Consumption → Production → Consumption → Etc.

The first diagram above displays a model where waste is reduced, while the second shows an alternative where waste is removed. However, a system with zero waste production is difficult, even impossible, to achieve, and a more viable approach involves the method shown in the former diagram.

Even a minimal reduction in the waste material we produce would prove effective and have widespread positive economic, social and environmental effects. For example, Ireland produces approximately 63,000 tonnes of textile waste annually[5], and 92 million tonnes of textiles are discarded each year on a global scale[6]. Another drastic example involves food waste, where Ireland produces approximately 1 million tonnes of waste food material per annum[7], and about 14% of food worldwide is wasted, amounting to about $400 billion annually[8].

Inferior product quality has also been an issue in recent times, as producers prefer to minimise their expenditure and production costs by purchasing cheap raw materials, and outsourcing production to countries, particularly in Asia and South America, with low wages and cheap labour.

This has led to a steady decline in product quality, and this encourages consumers to dispose of goods quicker, and purchase more, further increasing waste output. Another key factor which further motivates buying is that the low costs of production for manufacturers allow them to sell their goods at low prices.

A key example of this is, once again, in the textile industry. Fast fashion refers to new clothes being designed, marketed, and then sold to consumers on a constant, regular and frequent basis, with new products often appearing in outlets and retail centres on weekly bases. This leads to consumers buying new clothes routinely, and disposing of clothes at the same rate as they purchase new products.

The manufacturing processes involved with producing textiles also use up large amounts of resources and produce significant amounts of waste. The fast fashion industry consumes about 79 trillion litres of water annually[9]. That amounts to approximately 2,700 litres of water required to produce one shirt[10]. Over 92 million tonnes of textile waste are produced per year[6], and the majority of this waste is then disposed of in landfills, for example, two thirds of textile waste produced in the US, amounting to almost 10.3 million tonnes, is disposed of in landfills annually[11].

Such unsustainable practices cannot be kept up and major reform is required to prevent furthering the already substantial effects of our current methods.

Circular Economic Models: Benefits and Negatives

Circular economies may seem to be a perfect solution to the problems we face now, but there are also many disadvantages, and they are far from an ideal answer. Of course, they are a stepping stone towards achieving sustainability, and provide a far better alternative to outdated ideologies that are providing a damaging effect on our environment. It is important to take matters one step at a time in order to achieve our goals as a society.

Advantages of circular economies:

- Circular economies provide a sustainable approach, which allows us to maintain economic balance while also preventing a negative impact on the environment. Sustainability is also more profitable in the long run to enterprises, for example, a change to organic production of food in Egypt led to a 30% increase in total yields, and a further 14% annual increase in income[12].
- Circular thinking and processes decrease our waste output, for example, in the repairing, recycling and remanufacturing of goods, or in the digitalisation of media, such as the transfer of written goods, such as books and newspapers to a computerised medium, thus eliminating the need to physically produce such products.
- New jobs and areas are additionally created through circular economies, such as the development and designing of sustainable energy methods, or eco-friendly recycling and waste reduction and waste removal mechanisms. The development of sustainable energy further benefits others, such as those who produce the materials and components required to assemble wind turbines or hydro-electric power plants, for example, and then even further benefits those employed in building and installing such projects.
  This allows for the boosting and benefitting of the circular flow of income (CFI), and the increasing of income for all.

Disadvantages of circular economies:

- The initial transition to a more sustainable and circular approach can prove to be expensive and costly at the beginning, with many wind farms costing upwards of €1.4 million to install[13]. This provides many potential private investors with a disinclination towards sustainable conversion and discourages the purchasing of cleaner energy options. Nonetheless, the role of governments and officiating bodies comes into play in situations such as these, as the subsidisation of the building of clean energy and the provision of grants to prospectors can encourage many to consider such methods.
  This can be seen in Ireland's steps to encourage such activity in the provision of solar panel grants to homeowners, which significantly reduce the cost of purchasing[14].
- As mentioned in the advantages to circular economies, a transition would create new industries and employment opportunities to many. Meanwhile, other industries and sectors would decline with a shift to greener means of production. A key example would potentially be the oil production and automobile industry. The burning of fossil fuels, such as oil, is one of the main benefactors to climate change and the reasons behind incentivising sustainability, and tied with this is the automobile or car-manufacturing industry, at least with regard to non-electric vehicles.
  The risks associated with sustainability have been identified by oil companies and car manufacturers for some time, as can be seen by their taking action and distribution of propaganda and false information with regard to the climate crisis throughout past decades[15].

There are many positive and negative sides to circularity, with the above being only examples of a vast number of arguments for each side, but even so, I believe that the benefits outweigh the negatives and would provide a significant and beneficial contribution to moving to a more ecological future.

Circularity in Action: Current Examples of the Implementation of Circularity

Many of the projects and undertaking involved with a transition to a circular economic model may seem long-term and unattainable in the near future, there are some who have been working to build more sustainable lifestyles now, whether this be large and wider impacting, or work put forward by individuals or smaller groups, any effort to be more eco-friendly is appreciated and acknowledged.

On a worldwide scale, clothing and textiles saw major positive developments, such as Nike's provision of 100% recycled clothing to Tokyo Olympic teams, such as the USA, France and Brazil[16]. Nike further stepped up with the development of recycled footwear and a clothing collection manufactured from consumer and factory waste[16].

Other clothing brands further invested into green options, such as Adidas, Puma, Patagonia and H&M. H&M's involvement is additionally notable, as it included products made from natural fibres sourced from alternatives to current commonly used materials such as cotton. These included wood pulp and waste food material[16].
The move from cotton to other alternatives would prove extremely beneficial, as cotton in particular, which is one of the primary raw materials inputted into the textile industry, requires a significant amount of natural resources. This can be seen in the fashion industry consuming approximately 79 trillion litres of water per annum[9].

Nearer to home, Irish enterprises are also participating in, and engaging with, sustainability and circularity. For example, a new green energy facility has been announced by Cork-based company EI-H2. The projected green hydrogen and ammonia power plant has been designed and projected in cooperation with US firm Zenith Energy[17].

Additionally, Ireland's first zero-waste enterprise was recently founded in County Cavan. The EcoShack, situated in Cavan town, provides consumers with goods and services, while eliminating any plastic waste product[18].

The endeavours and initiative accomplished by these individuals and firms shows us that circularity and sustainability aren't unattainable or unachieveable, but can simply be established through care and attention. This is but the beginning of a revolution and change in enterprise, and these are just a few examples of all the work being put in around the globe.

Comparisons & Alternatives

Circular economic models naturally include plenty of differences and variations to current practices and models implemented nowadays. These differences can range from large, significant changes to others, that are less noticeable but equally important, and both positive, better changes, but other negative aspects as well.

Take-Make-Waste:

- The main purpose of circular economies is, as previously mentioned, to substitute and improve upon the current "take-make-waste" model implemented by both consumers and businesses alike. Therefore the greatest variations will be seen in this comparison.
- While the "take-make-waste" model focuses on the present, and maximising both profits for businesses and savings for consumers, circular economies directly centre on planning ahead for the future, and taking into consideration the long-term effects of our actions today.

- Whereas current low cost manufacturing in mass quantities can aid businesses earn more profits now, and the integration of sustainable means can be initially costly, it increases the long-term earning potential for businesses and enterprises.
- Unfortunately, a negative aspect of circularity compared to the "take-make-waste" model is that it increases prices for consumers, and would require the willingness of consumers in order to be effectively incorporated.

Free Market Economies:

- The role of government is necessary and crucial for the efficient development of circularity, and would need to be increased, with governments needing to exert more pressure or encouragement where required in order to influence what goods and services are produced, how they're produced, and for whom they are produced.
- This is very contrasting with the ideas behind free market economies, firms decide on the production of goods, their methods of production and their target markets. These decisions by businesses in free market economies often tie in with the "take-make-waste" rationale, with businesses often polluting the environment through dumping of waste material and chemicals as this decreases their expenses in the short term.
- Thus, circular economies would bring about a slight decrease in the independence of businesses and enterprises, and enforcement of sustainable practices would increase expenses in the short-term, but decrease them, as well as the negative environmental impacts, in the long-term.

Centrally Planned Economies:

- As I mentioned in the above section, the role of government would play a crucial part in the development and incorporation of circular economic systems.
- For example, the introduction of increased taxes and tariffs on environmentally detrimental goods and practices, and the subsidisation of the development, designing and building of environmentally beneficial products and services would both prove productive in promoting sustainability and circularity.
- Additionally, if private firms were also permitted to set up and produce their own eco-friendly and sustainable products and services, this would allow for greater competition between businesses, leading to the development of higher quality products, and advantageous prices for consumers, which would counteract the issue of the extensive costs associated with a transition to circular economic practices.

Mixed Economies:

- As the above sections have laid out, it is clear that mixed economies are the most suitable for the integration of circular economies. Both governments, private firms and consumers need to cooperate and work together in order to prevent any negative environmental impacts.

Effects of Circularity: Social Effects

There are many effects associated with, and related to, circular economies. These can be split into three main categories; social, economic and environmental effects. Each of these separate categories needs to be considered when governments and businesses decide on and delegate the development of circularity.

The Individual Consumer:

- In many cases, introduction of circularity would provide employment and job opportunities for many people and consumers. For example, over 5,000 people are currently employed in the wind energy industry in Ireland[19], with this number expected to increase to a further 7,000[19].

Businesses and Enterprises:

- Circularity requires the development and design of sustainable and circular systems and product innovations. This creates new markets and new industries for enterprises to grow and develop. Once again, the wind energy industry can be viewed as an example, with it currently being worth €400 million in Ireland annually[19], with this figure expected to increase by €150 million annually by 2030[19].

Communities:

- Communities and groups of people and consumers, such as towns and cities are also impacted by the development of circularity. The new, cleaner, more eco-friendly innovations would allow for increased quality of life, not only with the availability of these new goods and services to consumers, but also in terms of the employment the production and provision services offer.

The Island of Ireland:

- If circularity was fully implemented in Ireland, with steps in this direction already being made, there would be many opportunities and benefits, for example, increased employment created by the introduction of new markets and industries would generate increased income and corporation tax for the government, which can in turn be spent further subsidising and providing support for development of such innovations and entrepreneurial projects.

Effects of Circularity: Economic Effects

The economic effects of circular economic models do tie in in many respects with the social effects, but they are very much their own class and category.
The economic effects are often one of the aspects that are mainly highlighted in terms of sustainability and eco-friendliness, usually in a negative perspective due to their extensive set-up costs.

The Individual Consumer:

- Consumers would both be impacted positively and negatively in the event of the implementation and integration of a circular economy. While circular economies provide new employment opportunities for consumers, there is the possibility of inflation in terms of prices, for example, energy costs, as these may rise in order to cover the costs of the production and construction of renewable energy production.

Businesses and Enterprises:

- As mentioned in the previous section in terms of social effects, the circular economy creates new sectors and industries, and this allows for entrepreneurs to start and develop their own businesses and enterprises, ensuring employment opportunities and income. Sustainability and circularity has also been proven to be more profitable in the long-term, for example, development of goods that consume lower amounts of energy will incidentally decrease energy bills for enterprises[20]. Another key way for businesses to adapt to the circular economy is to implement a "triple bottom line", where they aim to make a profit, ensure fairness to consumers and protect the environment.

Communities:

- The implementation of sustainability allows for the economic growth of towns and communities. For example, populations located on rivers where hydroelectric power plants have the potential to be constructed would benefit in terms of employment opportunities which would lead to the building and establishment of housing, and other essential services. Thus, as a byproduct of the establishment of such renewable energy plants, there are new investment opportunities for all sorts of communities.

The Island of Ireland:

- The development of sustainable energy would be very beneficial to the Irish government, mainly in the long-term. While the initial set up costs would be extensive, and government investment would be required if subsidisation of renewable energy was applied, significantly increasing government expenditure. However, the development of circular systems would greatly benefit and boost the circular flow of income, as new industries would be developed, leading to new employment opportunities, resulting in a decrease in unemployment rates, and ending in more people earning higher incomes. This

would increase government income in the form of greater income and corporation tax, and decrease government expenditure in the form of lower pressure on the import of non-renewable fuels from abroad.

Effects of Circularity: Environmental Effects

The main reason for the increase in the identification of unsustainable and environmentally harmful business practices is, naturally, that they are exerting overwhelming pressure on the environment. The primary purpose of circular economies is to solve these issues, and therefore, the environmental effects are primarily beneficial.

The Individual Consumer:

- In a circular economy, there is an increased focus on the production of sustainable and eco-friendly goods and services. Therefore, this would lead to a greater supply of such goods and services, and provide more incentive to consumers to opt to purchase such goods and services. This reduced consumers' carbon footprints and their negative effects on the environment personally, but with a large impact through the collective reduction of carbon emissions as a whole in terms of consumers worldwide.

Businesses and Enterprises:

- Unfortunately, current economic models and business practices often involve the dumping and pollution of the environment with adverse and often dangerous chemicals and waste, frequently on an illegal scale. The increased role of governments in circular economies, whether this be in the provision of financial support for enterprises producing sustainably, or the increased management and inspection of businesses in order to prevent illegal and environmentally detrimental activities, would considerably decrease, or possibly eliminate such negative activities and their damaging impacts.

Communities:

- Similarly to consumers, circular economies would provide related effects for communities. Pollution, whether in the form of waste material such as plastics, or air pollution from vehicular exhaust fumes, has become a frontrunner in terms of issues associated with towns and cities. This often causes detriment to the natural beauty of areas, but this can be acted upon, for example with the promotion of organisations such as the Tidy Towns.

The Island of Ireland:

- Circular economies would be highly constructive for the country, particularly in terms of achieving our carbon dioxide emission reduction targets by promoting and developing

renewable means of producing energy, and in contributing to the achievement of the United Nations Sustainable Development Goals.

The Circular Economy & Fifteen-Minute Cities

Fifteen minute cities are another concept that has seen a rise in popularity in recent times. They follow a similar, more sustainable and manageable framework, just as circular economies, while also having a greater focus on city planning and catering to societal and communal needs.

Fifteen minute cities, first conceived by Carlos Moreno[21], essentially refer to cities and communities where all the resources that consumers require to satisfy their daily needs are located within fifteen minutes walking distance from their homes. These envision cities that are separated into multiple communities and neighbourhoods which each contain housing, grocery stores, healthcare services, recreational areas, and more, instead of cities being segregated into large districts, each with a single purpose, such as large residential estates, industrial estates, and commercial zones.

Many of the concepts and ideas outlined in circular economies can be used and applied to the achievement and establishment of fifteen minute cities. The key requirements and necessities for the formation of fifteen minute cities are proximity, diversity, density and ubiquity or prevalence[21].

The topic of proximity and closeness of resources and services perfectly goes in line with circular economic focuses on energy usage reduction. The affordable distribution of electric vehicles can reduce greenhouse gas emissions from petrol vehicles, and the low commute distances and emphasis on walking and cycling as a means of transport further decrease the requirement for extensive transport and vehicles. This would not only decrease the costs of importing fuel, but also lessen the damaging environmental effects of burning of fossil fuels.

Circular economies also share many similarities with fifteen minute cities in that they emphasise the redesigning and rebuilding of current systems, rather than on the absolute building or replacement of existing structures. Fifteen minute cities focus on the planning of existing city space, for example, the repurposing and repairing of existing buildings and how to delegate and plan with existing outdoor space instead of building entire new neighbourhoods, and circular economies seek to improve upon and expand upon recycling and remanufacturing of products instead of producing new products, whether sustainable or not, with disregard to existing goods requiring recycling.

This shows how circular economies and fifteen minute cities can coexist with one another, and even help each other develop, or circular economies can provide stepping stones to the integration of fifteen minute frameworks in cities and neighbourhoods.

Circular Economies Around The World

Unfortunately, only 8.6% of our global society is circular[22], and a major deployment of circular techniques and practices is required around the world. Collaborations and co-operation among nations is crucial for the integration of circularity.

Luckily, there are many frameworks and initiatives already in place, or being developed, for example:

- The Platform for Accelerating the Circular Economy, or PACE, is an organisation that provides and analyses resources required for governments and leaders to boost and implement the circular economy. Projects such as the Circular Economy Indicators Coalition, which improves *"knowledge, alignment, and implementation of CE indicators"* , and helps identify and analyse rates of circularity and indicators of circular economies which thus aids businesses and governments embrace circular and sustainable practices[23], are all ways in which PACE is playing a part in global integration of the circular economy.

- Scale360° is another framework, developed in 2020[24], this time centred around supporting, developing and encouraging innovation and encouraging the further integration of the fourth industrial revolution. The fourth industrial revolution centres around digitalisation and the information and communication technology (ICT), while also linking this into the circular economy by working with governments, enterprises and other organisations to identify markets and intervene in such a way as to promote sustainable and circular development.

- The Global Plastic Action Partnership is an example of an organisation and collaborative that seeks to decrease the amount of plastic waste produced, currently approximately 8 million tonnes per annum[25], and develop strategies involving the recycling of plastic waste in line with circular theories. GPAP was created and launched by the World Economic Forum in 2018, during the Sustainable Development Impact Summit[25], and has since helped countries and organisations decrease their plastic pollution by laying out plans and frameworks, for example by developing systemic changes and interventions to decrease Indonesia's plastic pollution by 70% by the year 2025, and a full circular economy by the year 2040[25].

The UN Sustainable Development Goals: Overview

"Our burning of fossil fuels, our destruction of nature, our approach to industry, construction and learning, are releasing carbon into the atmosphere at an unprecedented pace and scale."
- David Attenborough[26].

Sir David Attenborough's recent speech at the COP26 summit in Glasgow outlined the issues faced by modern society in reference to climate change, and the problems caused by consumers, businesses and governments alike which contribute to this process, for example our approaches to industry such as the "take-make-waste" model, and unnecessary polluting with chemicals and waste.

"Is this how our story is due to end? A tale of the smartest species doomed by that all too human characteristic of failing to see the bigger picture in pursuit of short-term goals."
- David Attenborough[26]

He continued by showing how we all add to climate change by failing to develop and realise long-term targets and goals, instead focusing on the short-term and disregarding the long-term impacts of our actions.

"A new industrial revolution, powered by millions of sustainable innovations is essential. It is indeed already beginning. We will all share in the benefits; affordable clean energy, healthy air, and enough food to sustain us all."
- David Attenborough[26]

However, Attenborough further stated that we have the power and knowledge to avert this, how an industrial revolution is necessary and imminent for the benefit of our environment. He showed how current methods need to be revolutionised, with many of his statements being in line with elements of the circular economy, such as the development of renewable and sustainable energy, the environmental effects of introducing renewable energy through the decrease of air pollution from burning of fossil fuels, and the formulation of sustainable farming methods and an increased focus on the reduction of food waste.

The key focus of his speech and presentation was that change, and new sustainable and circular innovations are required immediately. As I mentioned previously, we have the knowledge to introduce sustainability and circularity, and part of this comes down to the United Nations Sustainable Development Goals.

The UN has hosted many climate change conferences over the past several decades, notably the Kyoto conference, or COP3 in 1997, the Paris Climate Conference, or COP21 in 2015, and recently the COP26 Glasgow conference from October to November of 2021. However, the

Sustainable Development Goals were only prepared in 2015, as part of the 2030 Agenda for Sustainable Development[27].

The SDGs are a set of goals, and the targets and policies prepared in order to achieve these goals, which have been agreed upon by world leaders, and other organisations in order to tackle and combat world crises and problems, such as poverty, inequalities, sustainability, and the climate crisis.

Circular Economies & The UN SDGs

Circular economies tie in with most of, if not all of the United Nations Sustainable Development Goals, especially as they often encapsulate many of the aspects of sustainability and sustainable practices. I believe that the main goals that circularity relates to are Goal No.9; Industry, Innovation and Infrastructure, Goal No.11; Sustainable Cities and Communities, and Goal No.12; Responsible Consumption and Production, however, as circular economies tie in with the majority of the SDGs, I intend to examine their relation to each individual goal.

Goal No.1: No Poverty:

- Extreme saw a rise in 2020 due to the pandemic; over 119 million people were forced into poverty as a direct result of it[28], whether this was from job losses or other causes. The introduction of a circular economy would aid in reducing these figures, as the development of new industries would lead to employment opportunities, and provide a source of income for many people. Even if people in extreme poverty would be unable to secure employment, the increased taxes gained by governments could allow for the increasing of social protection payments and other support to people in extreme poverty.

Goal No.2: Zero Hunger:

- 2.37 billion people were unable to access food, and maintain a balanced diet regularly in 2020[29]. This is mainly due to food waste. Global farming output is enough to feed approximately 10 billion people, or about 1 and a half times the world population[30]. Unfortunately, we waste approximately 30 - 40% of total food produced[30], and food distribution systems are also extremely inefficient. The circular economy would decrease this food waste, as it promotes the recycling and reusing of food, for example as compost or fertilisers, and circularity also promotes farming methods and techniques which require small amounts of natural resources, and don't consume artificial chemicals. This would lead to both increased output for farmers using the same amount of resources, and for similar outputs for producers while using lower amounts of resources and chemicals.

Goal No.3: Good Health & Well-Being:

- Both physical and mental health have come up as frontrunners behind many issues nowadays. Unsustainability and wasteful consumption are not excluded from causing negative effects to health. For example, air pollution and poor quality of air, from burning of fossil fuels and the harmful gases this expels, causes about 1 million annual deaths in China[31]. The introduction of circularity and a move to renewable energy would significantly decrease the amount of gases and chemicals expelled into the air by fossil fuels, thus increasing health as a bonus benefit.

Goal No.4: Quality Education:

- Educational organisations and circular economies need to cooperate with each other in order to boost and aid in the development of circular and sustainable innovations. Circular education is a form of education where there is a greater focus on innovation and entrepreneurship involving sustainable and responsible development.

Goal No.5: Gender Equality:

- Gender equality and women's rights have also become an issue in modern times. Although the majority of societies are forward-thinking in terms of this issue, it isn't reflected in the numbers. Only 28% of women are in managerial positions, and only 26% are involved in national parliaments[32]. However, circular economies can be an opportunity for society to promote equality and fairness. This is already reflected in multiple projects and enterprises throughout the world, and women have shown to be thoroughly engaged and innovative in developing and preparing sustainable solutions and alternatives[33].

Goal No.6: Clean Water & Sanitation:

- Similarly to the air pollution caused by burning of fossil fuels, water sources, such as rivers, lakes and seas have also been negatively affected by pollution. Water is also a resource that is being used in large, unsustainable quantities in current manufacturing processes. The circular economy provides sustainable methods of production and consumption of goods that require water as an input, and the increased governmental investment in the circular economy allows for increased monitoring and inspection of businesses and enterprises in order to prevent pollution.

Goal No.7: Affordable & Clean Energy:

- One of the key aspects of the circular economy, renewable or clean energy as an alternative to fossil fuels, is a key concern regarding the climate crisis and the urgency for climate action. Renewable energy accounted for 43% of electricity consumption in Ireland in 2020, a 7% improvement over the previous year's 36% in 2019[34]. Introduction

of a circular economy would further boost this and increase the usage of renewable energy over non-renewables.

Goal No.8: Decent Work & Economic Growth:

- As I mentioned several times before, the circular economy would provide new industries and sectors, and with this new employment opportunities for people. These new sectors and industries would be in high demand, even more so if governments promoted consumer support by providing subsidies and grants, which would lead to increased economic growth and development.

Goal No.9: Industry, Innovation & Infrastructure:

- In a nutshell, circular economies create and benefit new industries and sectors, they promote sustainable development, entrepreneurship and innovation, and they seek to improve upon and reimagine infrastructures into to extract, manufacture and consume goods and services in a more sustainable and environmentally friendly way. Such benefits can already be seen worldwide and in Ireland, such as the development and construction of a new green energy facility in Cork.

Goal No.10: Reduced Inequalities:

- Income inequalities and income gaps have seen an increased rise in current markets, with the rich getting richer and the poor getting poorer. An example of this can be seen in Germany, where, despite the thriving economy, an exxtreme income gap exists. The top 1% of income earners receive as much money as the bottom 50%[35]. There are many ways of preventing such instances from occurring in a circular economy, for example, by increasing circular education in order to allow for more workers to have equal chances of securing employment and sufficient income, and for increased government involvement by developing governmental organisations and by regulating and deregulating where necessary in order to prevent the occurrence of monopolies and oligopolies and ensuring competitive markets.

Goal No.11: Sustainable Cities & Communities:

- Of course, the main goal of circularity is to create sustainable and environmentally friendly towns, cities and communities, whether this be through the introduction of renewable energy, reusing, recycling and remanufacturing waste goods and materials, or through the planning and implementation of sustainable food production methods. Another distinct link between the circular economy and sustainability are fifteen minute cities, which strive to link all of the aspects mentioned above, while also including increased accessibility for consumers to their needs.

Goal No.12: Responsible Consumption & Production:

- The production of goods and services, and the role of consumers and their influence on production is also highlighted and addressed in the circular economy. Circularity refers to a circular system, where resources travel through a loop with minimal waste output, instead of a linear "take-make-waste" model. Examples of this include the using of waste food material for compost, as a growth medium for other foods or as an energy source for the production of renewable biomass energy, and in the breaking down of textiles back into basic fibres in order to produce new materials and clothes. Circularity also seeks to solve the issue of planned obsolescence among businesses, where products are specifically designed to be of inferior quality in order to maximise current profits at the expense of increased waste material.

Goal No.13: Climate Action:

- The climate crisis has become one of the main issues of our time, with it being constantly featured in newspapers, TV programmes and other media platforms. One of the main driving causes behind it is the extensive emission of greenhouse gases, such as through the burning of fossil fuels or through the release of methane from the agricultural sector. One of many ways in which the circular economy strives to contribute to the prevention of climate change is through the introduction of renewable energies, such as wind energy, hydroelectric power or solar energy, and the replacing of non-renewable, polluting fuels with these renewable, eco-friendly options.

Goal No.14: Life Below Water:

- Unsustainability and linear production models which result in extensive amounts of plastic and other waste are exacting a significant impact on our environment. 23-37 million tonnes of plastic waste are estimated to be added to oceans annually[36]. If such wasteful and unsustainable practices are to be continued, this will lead to a total of 207-333 million tonnes of plastic being added to the already significant amount present in oceans by 2030. In circular economies, the increased emphasis and incentive to recycle would lead to a considerable reduction in the production of plastic waste, and in the case of the further implementation of beach and ocean cleaning, potentially reduce the amount of plastic in our oceans.

Goal No.15: Life On Land:

- Unsustainable practices and over-industrialisation, such as in the mass clearing of land to make space for farms has led to the endangering, and in some cases extinction of many plant and animal species. Another key impact has also been caused by the creation of large amounts of farms. Deforestation has led to 100 million hectares of woodland being removed over the past two decades, from 2000 to 2020[37]. One of the ways in which this could be combated is in the introduction of sustainable farming methods, such as use of

natural fertilisers, and reducing or eliminating use of artificial fertilisers and pesticides. This would lead to similar or increased food outputs from smaller areas of land, which would allow for space for reforestation or the replanting of forests.

Goal No.16: Peace, Justice & Strong Institutions:

- Sustainable Development Goal Number 16 is not one that initially appears to be associated with circularity and the environment. However, there are ways in which the two are linked. Tensions have recently risen, and a main issue has been the export of waste material from developed countries such as the USA and Canada, to less developed countries such as China, Malaysia and Indonesia, causing many governments in these countries to ban the import of waste[38]. However, if waste production was reduced through the implementation of a circular economy, then there would be no requirement for the transportation of waste, this would allow for the cooperation between nations in order to solve issues peacefully and collectively.

Goal No.17: Partnerships for the Goals:

- Cooperation among nations and governments is crucial for the achievement of the SDGs and the development of a worldwide circular economy. For example, governments can work together to incentivise and boost the development of renewable energy and the implementation of efficient recycling systems by developing subsidies and grants for producers and exporters of such goods and services. If nations collaborate with each other, then circular economies can be a viable and adequate solution to many of the issues faced by our modern society.

The Circular Economy Bill 2021: Background & Overview

The Circular Economy Bill of 2021 is a new legislation that has been drafted by the Irish government in an effort to begin the implementation of a circular economy in Ireland. Our economy is no exception from the linear "take-make-waste" methods that have seen such a troubling rise in recent years;

"Ireland is the highest producer of plastic waste per person in the EU and the fourth worst in recycling rate." - Dr Liam Morrison[39]

The above information shows that change, reform and new economic policies are required in order to increase and improve economic growth while also preventing damage to the environment. This has led to multiple endeavours by the Irish government in order to implement and prepare sustainable practices, such as in the form of the Waste Action Plan, the Climate Action Plan, and the Circular Economy Bill.

The main goals and aims of the bill are to provide a background and foundation for the complete integration of a circular economy in the form of the Circular Economy Strategy. Increased focuses on waste management and plastic categorisation, preparation of a Circular Economy Fund in order to provide for the support and subsidisation of circular and sustainable projects, and preparation of recycling and remanufacturing of goods, as well as an emphasis on reusing of materials and products, are all examples of the aims set out in the Circular Economy Bill.

The bill also provides a footing and foundation for the Circular Economy Strategy, which is set up to be published and prepared by the government, and will aim to provide a dependable and effective framework for the transition of Ireland to a circular economy.

The Circular Economy Bill & The Waste Action Plan

The government's Waste Action Plan was a framework drafted last year which provides templates for sustainable and responsible waste management and monitoring. The plan focused mainly on the recycling and waste reduction aspect of the circular economy, and the recycling of waste material.

The Circular Economy Bill further builds upon the aims set out in the Waste Action Plan, by adding further measures for the prevention of extensive waste production, such as introducing the use of drones in order to identify areas experiencing illegal dumping, while also setting out additional measures for the introduction of a circular economy, such as the development of funding for sustainable projects and endeavours, as can be seen in the Circular Economy Innovation Grant Scheme[40].

The Waste Action Plan also focuses on food waste production, as Ireland generates around 1 million tonnes of food waste annually[41]. Methods such as the introduction of a food waste "hierarchy" are detailed in order to decrease this figure[41]. The plan also takes into account plastic and packaging waste, and solutions to this include the introduction of a deposit and return scheme for bottles and cans, in order to increase recycling of such materials.

The Circular Economy Bill further supplements the aims for decreased plastic and packaging waste production set out in the Waste Action Plan by providing a legal footing for the preparation and introduction of legislations regarding the elimination and reduction of single-use products, such as single-use cups, food packaging and plastic bags[42].

The Circular Economy Bill & The Climate Action Plan

The Climate Action Plan, which was earlier this year in November of 2021, provides a more direct focus on the decrease of greenhouse gas emissions in Ireland. And the achievement of carbon neutrality in Ireland.

We have already seen that one of the dilemmas that the circular economy seeks to solve is greenhouse gas emissions, whether this be carbon dioxide from burning of fossil fuels, methane production from the agricultural sector, or from other sources.

The Climate Action Plan sets targets regarding the reduction of emissions, and details the policies to achieve these targets. For example, the plan aims to reduce emissions by 51% by the year 2030, and prepare for carbon neutrality in Ireland by the year 2050[43].

The Circular Economy Bill takes into account reduction of greenhouse gas emissions, as well as many other aspects of the circular economy, such as plastic and material pollution as was seen with the Waste Action Plan. For example, the bill establishes the Circular Economy Fund, which aims to provide funding for multiple causes, such as projects relating to improving the environmental condition of communities. Air pollution from burning of fossil fuels is one of many contributors to damage caused to local environments, and the Circular Economy Bill, coupled with the Climate Action Plan, could work to combat this issue.

The Circular Economy Bill 2021: Benefits & Negatives

Integration of a circular economy into Ireland would prove extremely beneficial, especially in terms of reforming damaging economic practices and eliminating linear production and consumption models. However, as with the circular economy as a whole, there are also certain negatives and disadvantages to the Circular Economy Bill as well;

Advantages of the Circular Economy Bill 2021:

- Funding and encouragement for communities and enterprises engaging in sustainable and circular practices is provided in the formation of the Circular Economy Fund. This would ensure that businesses engaging in environmentally friendly approaches are motivated to continue such activities, and other enterprises are incentivised into transitioning to circularity.
- Development of programmes for the reuse and recycling of waste material is also promoted by the Circular Economy Fund. Linear “take-make-waste” models produce extensive amounts of waste material, and there is often a lack of sufficient recycling plants to address this waste material, which often ends up in unhygienic and polluting landfills. The creation of adequate methods for enterprises and consumers to recycle

waste would decrease the requirement for such landfills, providing benefits in the form of land being available for other urgent issues, such as solving the current housing crisis here in Ireland, and other positive impacts such as reduced land pollution.

- Plastic pollution and dumping of other single-use materials are also addressed by the Circular Economy Bill. It provides a legal footing for the development and implementation of restrictions regarding the production of single-use plastics and packaging products, further reducing land and sea pollution from such waste materials.

Disadvantages of the Circular Economy Bill 2021:

- Funding for the Circular Economy Fund set to be established by the bill may provide a concerning issue. Although the bill states that funding will be provided in accordance with regulations unders Heads 6, 15 and 73 of the Waste Management Act 1996[42], and that additional funding may be provided by the Oireachtas committee, this will provide additional expenditure for the Irish government. With the budget for 2022 showing a government deficit, this additional expenditure will put a further strain on government finances. Financing for the policies set out in the bill will need to be generated, whether this be by increasing foreign borrowing, or increasing taxes for citizens.
- The Circular Economy Bill 2021 also relies heavily on consumer and business compliance with the aims and goals laid out. For example, protest and reluctance may be shown by businesses and firms, who produce disposable products and packaging, such as single-use coffee cups, and those who benefit from the production of such products, such as companies involved with catering services. Further reluctance from citizens may also be experienced if increased taxes are opted for in order to generate additional income for the Circular Economy Fund.

The Circular Economy Bill 2021: Additions & Amendments

Having analysed and assessed the Circular Economy Bill 2021, and having found the advantages and disadvantages of the bill, I applied my own knowledge of circular economic models and assembled my own additions and amendments to the bill which I believe would prove beneficial to the integration of a circular economy into Ireland;

- Allocation of space for communal vegetable gardens in housing estates could prove beneficial in partially dealing with food waste problems. Firstly, growing of vegetables would prove financially sustainable for consumers, as this would decrease their expenditure on food products. Secondly, this would educate consumers about food waste and management of food and resources. This could additionally be boosted with the purchasing and provision of composters in order to productively reuse any food waste. Thirdly, this would boost the implementation of fifteen minute cities, as consumers would have easy access to part of their needs, and not require as much time for travelling elsewhere to acquire these needs.

- Management of local environments is another area that could be improved upon. For example, the Tidy Towns organisation allows for the cleaning and management of communities. However, these organisations are voluntary, and therefore there is not as much incentive for people to become members. This could be changed if the Circular Economy Fund focused on providing funding and wages or salaries to people engaging in such activities, whether this be by making the Tidy Towns a governmental organisation which would pay people to engage in cleaning of communities, or by setting up a new separate institution which would serve this purpose.
- Another shortcoming of the Circular Economy Bill was that it relied heavily on consumer and business compliance with the aims set out, for example, placing of restrictions on the production and consumption of single use products. Procuration of a plan setting out directly and clearly sources of alternative, environmentally friendly products for these enterprises could improve their approach towards the bill. This plan would provide suitable alternatives, such as recyclable, or multiple use packaging products and coffee cups, and at similar prices, for example by providing temporary financial support for businesses purchasing such products.

The Circular Economy Bill & Ireland's Emission Reduction Targets

Reduction of greenhouse gas emissions has become a significant goal for many nations, including Ireland. As I previously mentioned, objectives such as the Climate Action Plan set targets aiming to reduce emissions by 51% by the year 2030, and prepare for carbon neutrality in Ireland by the year 2050[43].

I was interested in seeing how the Circular Economy Bill would help to achieve these targets and whether the goals and aims set out would prove beneficial to the reduction of our carbon footprints and emissions.

One way in which the bill helps improve air quality and decrease emissions is in the establishment of the Circular Economy Fund, which sets out to provide funding for many causes, such as *"to facilitate or assist projects, commonly known as partnership projects, that involve local authorities and the purpose of which is to improve the quality of the environment in so far as it affects a particular local community or communities"*[42]. As the scope of the fund is rather broad, it would presumably include projects which provide alternatives to practices that produce greenhouse gases, such as projects promoting the use of alternative transport methods instead of travelling by car, or projects that seek to decrease the amount of methane produced by farms and the agricultural sector.

Another way in which the bill combats the unnecessary production of greenhouse gases, and waste production as a whole, is through the enabling of local authorities to set up CCTV and

monitoring systems in order to detect and investigate any practices that cause environmental pollution.

Survey: Analysis & Conclusions

Having completed my desk research involving circular economies and the role of sustainability in the future of entrepreneurship and enterprise, I was interested in finding out whether consumers apply environmentally friendly techniques in their lifestyles as well.

I gathered my information in the form of an online survey, where my business studies class, of ages fourteen to sixteen[44], replied to questions regarding sustainability.

To begin with, I asked whether my classmates segregate waste at home, and in what forms. This question showed a positive trend, as 87% replied that they sort waste in their households[44]. Coupled with the measures set out in the Waste Action Plan, this would greatly decrease the amount of waste produced in Ireland, having both environmental and economic benefits.

When asked to go into further detail regarding waste at home, 50% stated that they compost food waste, 43% stated that they sort glass products by various colours, 14% stated that they sort plastics by different types, 14% stated that they separate paper and cardboard from other waste, and 21% stated that they separate metal waste products[44]. This shows that a significant majority engaged in various forms of waste management, but the answers also proved that there is still room for improvement.

For example, the introduction of a governmental presence in the waste collection sector, or subsidisation of waste collection services, would decrease prices and thus motivate larger numbers of consumers to participate in waste segregation and management. Furthermore, the introduction of communal gardens as a potential addition to the Circular Economy Bill 2021 would increase management of food waste.

I next surveyed my class about their preferred means of transport, in this case, their methods of getting to school. 33% stated that they travel by car, 33% stated that they walk to school, 27% stated that they travel by bus, and 7% stated that they cycle to school[44]. These numbers show that there is still a long way to go in order to eliminate the use of motorised vehicles, and thus reduce greenhouse gas emissions. The introduction of fifteen minute cities and towns would greatly benefit the environment and reduce the amount of people travelling by car or bus; 60%, or 3 in every 5 people.

Following this, I asked about the implementation of renewable energy in homes. 47% replied that they had a form of renewable energy in their household, with all of these respondents having

solar panels, while 53% did not have any form of renewable energy[44]. A way to increase the amount of people using renewable energy over non-renewable, would be to further promote and market government subsidisation of solar panels, or, rather than relying on consumers themselves to purchase and integrate renewable energy, the government could invest more money in state-owned renewable energy plants.
Finally, I asked if any of my classmates engage in additional environmentally friendly practices, and I received the following responses[44]:

- *"Recycling"*
- *"An electric car"*

The first answer emphasises and shows the importance of recycling and waste management for the circular economy and sustainability, while the second response shows that, although a general reduction in the use of motorised vehicles would prove extremely beneficial to the environment, the use of electric vehicles is a step in the right direction.

Conclusion, Final Verdict & Recommendations

As I stated in my line of enquiry, when I was beginning this project, I wanted to find the implications of turning to a more sustainable approach, figure out whether circular economies are the answer to our pressing climate issues, and overall resolve the question of whether or not we really do require circular economies.

Change is necessary in order for us to restore the environment, and maintain its health while also ensuring profitability and economic growth, whether this be here in my local community, on the island of Ireland, or worldwide.

The problems facing us today, such as the unnecessary production of millions of tonnes of waste, or the over-exploitation of natural resources, have solutions which simply need to be implemented. I believe that the circular economy is one of these solutions. The environmental, and economic benefits, such as the significantly decreased negative impact on the environment and the increase in business profitability in the long-term, by far outweigh the negatives, such as the initial set up costs.

Where to next? There are many other solutions and practices which can be used to benefit and help the world around us. For example, an increased focus on fifteen minute cities, or how to integrate the circular economy into all forms of governmental and economic systems would prove integral for the widespread implementation of sustainability. A further in-depth analysis of

the Circular Economy Strategy would help highlight the benefits and negatives, allowing for possible amendments which would improve and increase its positive effects on our environment.

Altogether, I believe that enterprise and governments alike need to cooperate and work together in order to implement circular strategies and adapt to our changing economic and environmental needs.

References

1. *There is a major problem of unsustainability in our environment and were* [Online]. Available at: https://www.idlehearts.com/1737486/there-is-a-major-problem-of-unsustainability-of-our-environment-and-were (Accessed: 14 September 2021)
2. *The circular economy: historical grounds* [Online]. Available at: https://www.ics.ulisboa.pt/books/book3/ch04.pdf (Accessed: 15 September 2021)
3. *Cities and the Circular Economy* [Online]. Available at: https://archive.ellenmacarthurfoundation.org/explore/cities-and-the-circular-economy (Accessed: 19 September 2021)
4. *How Bad Design Is Driving The "Take-Make-Waste" Economy* [Online]. Available at: https://www.whatdesigncando.com/stories/how-bad-design-is-driving-the-take-make-waste-economy/ (Accessed: 28 October 2021)
5. *Cheap clothes are cheap clothes, but fast fashion is the real environmental problem* [Online]. Available at: https://www.thejournal.ie/readme/cheap-clothes-and-fast-fashion-5198063-Sep2020/ (Accessed: 28 October 2021)
6. *Fast fashion is leading to a mountain of clothing being thrown away each year and has a huge impact on the environment, so can we turn our unwanted garments into something useful?* [Online]. Available at: https://www.bbc.com/future/article/20200710-why-clothes-are-so-hard-to-recycle (accessed: 28 October 2021)
7. *How much food do we waste in Ireland?* [Online]. Available at: https://www.epa.ie/publications/circular-economy/resources/NWPP-Food-Waste-Report.pdf (Accessed: 28 October 2021)
8. *Food loss and waste must be reduced for greater food security and environmental sustainability* [Online]. Available at:

https://www.fao.org/news/story/en/item/1310271/icode/
(Accessed: 28 October 2021)
9. *The environmental price of fast fashion* [Online]. Available at: https://www.nature.com/articles/s43017-020-0039-9 (Accessed: 30 October 2021)
10. *Clothes in Conservation: Fashion and Water* [Online]. Available at: https://sustainablecampus.fsu.edu/blog/clothed-conservation-fashion-water (Accessed: 30 October 2021)
11. *Clothes mountains build up as recycling breaks down* [Online]. Available at: https://www.rte.ie/news/business/2020/0930/1168467-clothes-mountains/ (Accessed: 30 October 2021)
12. *Making Sustainability Profitable* [Online]. Available at: https://hbr.org/2013/03/making-sustainability-profitable (Accessed: 4 November 2021)
13. *Wind Energy* [Online]. Available at: https://www.teagasc.ie/media/website/publications/2018/Teagasc-A4-Energy-Fact-Sheet-No.-17-Wind-Energy_2pp.pdf (Accessed: 4 November 2021)
14. *Solar Electricity Grant* [Online]. Available at: https://www.seai.ie/grants/home-energy-grants/solar-electricity-grant/ (Accessed: 4 November 2021)
15. *Tracing Big Oil's PR war to delay action on climate change* [Online]. Available at: https://news.harvard.edu/gazette/story/2021/09/oil-companies-discourage-climate-action-study-says/ (Accessed: 4 November 2021)
16. *10 Brands That Embraced the Circular Economy in 2020* [Online]. Available at: https://www.triplepundit.com/story/2020/brands-circular-economy-2020/709596 (Accessed: 7 November 2021)
17. *West Cork green energy facility to be biggest of its kind in world* [Online]. Available at: https://www.irishexaminer.com/news/munster/arid-40330754.html (Accessed: 7 November 2021)
18. *Sisters realise zero waste dream with Co Cavan shop* [Online]. Available at: https://www.rte.ie/news/2021/0708/1233916-two-sisters-open-cavans-first-zero-waste-shop/ (Accessed: 7 November 2021)
19. *Economic impact of onshore wind in Ireland* [Online]. Available at: https://windenergyireland.com/images/files/economic-impact-of-onshore-wind-in-ireland.pdf (Accessed: 16 November 2021)
20. *Environmental Sustainability in Business* [Online]. Available at:

https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/2_Develop_Your_Business/1_StartGrow_Your_Business/Environmental-Sustainability-in-Business-BT-ESB-C9-0913-4.pdf
(Accessed: 22 November 2021)

21. *Introducing the 15-Minute City Project* [Online]. Available at: https://www.15minutecity.com/blog/hello (Accessed: 24 November 2021)
22. *Circular Economy and Material Value Chains* [Online]. Available at: https://www.weforum.org/projects/circular-economy (Accessed: 25 November 2021)
23. *Circular Economy Indicators Coalition* [Online]. Available at: https://pacecircular.org/circular-economy-indicators-coalition (Accessed: 25 November 2021)
24. *Circular Economy Innovation - Scale360°* [Online]. Available at: https://pacecircular.org/scale-360 (Accessed: 25 November 2021)
25. *About Us - Global Plastic Action Partnership* [Online]. Available at: https://globalplasticaction.org/about/ (Accessed: 25 November 2021)
26. *Sir David Attenborough's Address to World Leaders at COP26 – Speech in Full* [Online Video]. Available at: https://www.youtube.com/watch?v=qjq4VWdZhq8&t=84s (Accessed: 27 November 2021)
27. *The 17 Goals* [Online]. Available at: https://sdgs.un.org/goals (Accessed: 27 November 2021)
28. *Goal 1* [Online]. Available at: https://sdgs.un.org/goals/goal1 (Accessed: 27 November 2021)
29. *Goal 2* [Online]. Available at: https://sdgs.un.org/goals/goal2 (Accessed: 28 November 2021)
30. *We produce enough food to feed 10 billion people. So why does hunger still exist?* [Online]. Available at: https://medium.com/@jeremyerdman/we-produce-enough-food-to-feed-10-billion-people-so-why-does-hunger-still-exist-8086d2657539 (Accessed: 28 November 2021)
31. *How China is tackling air pollution with big data* [Online]. Available at: https://www.weforum.org/agenda/2021/02/china-tackling-air-pollution-big-data/ (Accessed: 28 November 2021)

32. *Goal 5* [Online]. Available at: https://sdgs.un.org/goals/goal5 (Accessed: 28 November 2021)
33. *Take Five: "Women can be the engines and souls of the circular economy"* [Online]. Available at: https://eca.unwomen.org/en/news/stories/2019/03/take-five-women-can-be-the-engines-and-souls-of-the-circular-economy (Accessed: 28 November 2021)
34. *Renewable Generation Accounts for 43% of Electricity Consumption in 2020 as EirGrid Further Increases Amount of Renewable Energy on the Grid* [Online]. Available at: https://www.eirgridgroup.com/newsroom/electricity-consumption-f/ (Accessed: 28 November 2021)
35. *Inequalities in Germany* [Online]. Available at: https://www.sdgwatcheurope.org/wp-content/uploads/2019/06/3.3.a-report-DE.pdf (Accessed: 28 November 2021)
36. *Plastic pollution on course to double by 2030* [Online]. Available at: https://news.un.org/en/story/2021/10/1103692 (Accessed: 4 December 2021)
37. *Goal 15* [Online]. Available at: https://sdgs.un.org/goals/goal15 (Accessed: 4 December 2021)
38. *A Brief Look at the SDGs and the Circular Economy (in India): Goal 16* [Online]. Available at: https://www.linkedin.com/pulse/brief-look-sdgs-circular-economy-india-goal-16-tim-de-ridder (Accessed: 4 December 2021)
39. *Microplastics found in 90% of protected Irish marine environments - study* [Online]. Available at: https://www.irishtimes.com/news/environment/microplastics-found-in-90-of-protected-irish-marine-environments-study-1.4649484 (Accessed: 7 December 2021)
40. *€490,000 awarded to projects to promote the Circular Economy across Ireland* [Online]. Available at: https://www.gov.ie/en/press-release/3a8d0-490k-awarded-to-projects-to-promote-the-circular-economy-across-ireland/ (Accessed: 8 December 2021)
41. *A Waste Action Plan for a Circular Economy* [Online]. Available at: https://www.gov.ie/en/publication/4221c-waste-action-plan-for-a-circular-economy/ (Accessed: 8 December 2021)
42. *General Scheme of the Circular Economy Bill 2021* [Online]. Available at: https://www.gov.ie/en/publication/89838-circular-economy-bill-2021/

(Accessed: 8 December 2021)
43. *Climate Action Plan 2021* [Online]. Available at: https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/ (Accessed: 9 December 2021)
44. *Circular Economic Models: Survey* [Online]. Available at: https://www.surveymonkey.com/stories/SM-7PNHGVBQ/ (Accessed: 29 December 2021)