Business models and capabilities of companies in UK with Circular Economy oriented business models

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Abstract

This research explores the adoption and implementation of circular economy business models within Small and Medium-sized Enterprises (SMEs) in the UK. The study investigates the strategies employed by these companies to transition towards a circular economy, such as the use of recycled materials, the design of durable and long-lasting products, the introduction of take-back programs, and the investment in renewable energy. The research further documents the progress made by these companies in reducing their environmental impact, demonstrating the tangible benefits of circular economic models. However, the research also identifies challenges faced by SMEs, particularly the lack of adequate infrastructure for recycling and composting. Despite these obstacles, the study concludes with an optimistic outlook, suggesting that these challenges can be overcome, and emphasizing the potential of the circular economy for long-term resilience and success. This research contributes to the growing body of knowledge on the circular economy and offers valuable insights for SMEs, policy makers, and stakeholders in the sustainability sector.

Introduction

Our linear 'take, make, dispose' economy is reaching its limits. With over 90 billion tonnes of materials extracted globally each year, virgin resource stocks are dwindling while waste piles up in landfills and pollutes our natural environment. We urgently need a new economic model that decouples growth from resource consumption – this is where the circular economy comes in. The circular economy is a system where materials never become waste and nature is regenerated. In a circular economy, products and materials are in circulation through processes like maintenance, reuse, refurbishment, remanufacture, recycling, and composting. The circular economy approaches tackling climate change and other global challenges, like biodiversity loss, waste, and pollution, by decoupling economic activity from the consumption of finite resources (*Ellen MacArthur Foundation, 2021*).

The CE offers a sustainable pathway for businesses and economies by design:

- A study by the Ellen MacArthur Foundation found that the UK manufacturing sector could save £100 billion per year by 2030 by adopting circular economy practices.
- A report by the British Plastics Federation found that the UK plastics industry could create 65,000 new jobs by 2030 by investing in circular economy solutions.
- A study by the Waste and Resources Action Programme found that the UK construction sector could reduce its waste by 70% by 2050 by adopting circular economy principles.

These data and evidence suggest that there is a significant potential for businesses in the UK manufacturing sector to benefit from adopting circular economy business models. However, there is still a lack of understanding of how to do this effectively. Our research tackles this issue by offering case studies of successful companies that adopted circular economy business models and analysing the crucial criteria required for successful adoption.

The United Kingdom government has committed to several policies to support the transition to a circular economy (*Circular Economy Package policy statement, 2020*). These include:

- The Resources and Waste Strategy, which sets out a ten-year plan for reducing waste and increasing resource efficiency.
- The Industrial Strategy, which includes a commitment to make the UK a world leader in the circular economy.
- The Environment Bill, which includes measures to promote reuse and recycling.

The UK, despite its efforts, lags behind countries like Germany and the Netherlands in adopting circular economy business models. To better understand this lag, our research maps the distribution and capabilities of small and medium enterprises (SMEs) in the UK operating circular business models. Our findings showcase circular economy leaders while shedding light on capabilities needed for companies to successfully make the transition. We also analyse how government policies like extended producer responsibility affect circular economy development across regions and sectors.

This research comes at a critical juncture as the UK hosted COP26 and sought to assert leadership in sustainable economic systems. The outcomes can inform policymakers, businesses, and civil society on how to accelerate the circular transition. They also hold valuable lessons for other countries grappling with similar challenges. We hope this study inspires ideas across sectors and systems for constructing regenerative, future-fit economies that work in harmony with nature.

Background

Circular Business Models

There are multitude of CE business models that SMEs can adopt. Here are the most widely used models:

- **Product-as-a-service models:** These models allow businesses to rent products to customers instead of directly selling them. This helps to keep products in use for longer as a result reducing the amount of waste generated.
- **Repair and reuse models:** These models focus on repairing and reusing products instead of discarding them. This enables companies to extend the lifespan of products and significantly decreasing the number of excess wastes.
- **Remanufacturing models:** These models involve acquiring old products and remanufacturing them into completely new products. This assists the reduction waste that is discarded and generates new jobs.
- **Sharing models:** These models allow people to share products and services with each other. This helps to reduce the number of products that are owned and used at a time, which can reduce waste and pollution.

Existing literature indicates that businesses adopting circular economy business models are more likely to be profitable and sustainable in the long term. It is estimated that by 2030, UK businesses could make annual savings of £3 billion from adopting a circular economy (*Bester, 2018*). Up to 200,000 jobs could be created in the fields of reuse, remanufacturing, repair, and recycling. In Scotland, Zero Waste Scotland's Circular Economy Investment Fund, an £18 million fund, has been established to increase efficiency of resource use and increase economic growth (*Mills, 2023*).

In order to visualise the benefits of CE, many researchers have considered a lot of economic factors like the amount of waste that is prevented, the number of resources that are saved, the number of jobs that are created, the reduction in greenhouse gas emissions. While these indicators are important from a high-level perspective, it is crucial to see the changes that are made on a business level, especially SMEs.

Overcoming Barriers

Despite the benefits, the adoption of circular economy business models, particularly among UK manufacturers, is limited. With only 2% of these companies having adopted such models, several barriers stand in the way.

These barriers encompass:

- Lack of Awareness: Many companies are not aware of the principles and practices involved in the circular economy. This unawareness leads to hesitancy in the adoption of these models due to market demand, return on investment (ROI), and payback period.
- Financial Constraints: The initial investment and developing new capabilities are required to transition to a circular economy model can be substantial, deterring many companies from making the shift.
- Insufficient Government Support: The lack of robust policy incentives and government support for circular economy initiatives acts as a significant barrier.
- Resistance to Change: Many businesses that are accustomed to the traditional linear economy models resist changing to the unfamiliar circular economy models. This is due to lack of circular design and technical skills. For instance, up to 30% of plastic packaging requires innovation and redesign for recyclability (*The Circularity Gap Report, 2023*).

The barriers can be lowered by:

- Raising Awareness: This can be achieved through educational programs, industry seminars, and awareness campaigns.
- Financial Support: Government funding, tax incentives, and procurement policies can provide the necessary financial support to businesses.

- Policy and Regulatory Environment: A supportive regulatory environment, including beneficial policy incentives and government support, can facilitate the transition.
- Promoting Collaboration and Knowledge Sharing: Industry collaboration projects, R&D investments, and knowledge sharing can help overcome the skills gap and share costs and risks.

UK Initiatives

Several initiatives have been launched in the UK to promote the adoption of CE principles and practices. These initiatives cover various sectors and are driven by different stakeholders, including government bodies, non-profit organisations, and industry networks.

Some of the key initiatives include:

- The UK Plastics Pact by WRAP: This voluntary initiative aligns stakeholders for circular plastics and aims to make 100% of plastic packaging reusable, recyclable, or compostable by 2025.
- The Ellen MacArthur Foundation's Circular Economy 100: This is a network of businesses committed to adopting circular economy practices (*Ellen MacArthur Foundation, 2021*).
- The UK Government's Circular Economy Action Plan: This plan outlines policies to promote the circular economy across different sectors of the economy. For instance, Industrial Energy Transformation Fund aim to help businesses transition processes to be more energy efficient and support the green economy.
- Resources and Waste Strategy for England: This long-term plan sets out waste prevention and recycling targets to move towards a more circular economy.
- Wales's Beyond Recycling Strategy: This strategy focuses on reducing waste at source and keeping materials in use for longer.
- Northern Ireland's Pathway to Net Zero by 2050: This climate action plan includes initiatives around sustainable consumption and the circular economy (*Mills, 2023*).

These initiatives represent a concerted effort to move towards a more sustainable and circular economy in the UK. They reflect the roles that different stakeholders can play and highlight the potential for significant economic, social, and environmental benefits. Continuing to build on these initiatives will be crucial for achieving a successful transition to a circular economy.

Future Trends

The circular economy sector is growing at a rapid pace, with new SMEs and initiatives emerging regularly. This growth stems from an increasing awareness of the environmental and economic benefits offered by circular models, which prioritise reduction in waste and pollution. As the circular economy mindset takes root, more businesses and consumers alike are recognising the need to adopt more sustainable practices.

The advancement in digital technologies like the Internet of Things (IoT), blockchain, and particularly Artificial Intelligence (AI) plays a pivotal role in the evolution of the circular economy. AI is noticeably enhancing circular design, enabling circular business models, and optimising circular infrastructure and reverse logistics networks. These technologies are revolutionising the ways materials are recycled and reused, products are designed for disassembly and remanufacture, and materials are tracked throughout their entire lifecycle.

For instance, an AI-enabled robotic farming system developed by Harvest CROO Robotics uses machine vision to accurately determine when strawberries are ripe for harvesting, reducing food waste significantly (*Ellen McArthur Foundation, 2019*). Additionally, AI recycling solutions such as ZenRobotics have demonstrated sorting accuracy levels of up to 98% for diverse waste streams including plastics and construction materials. Overall, by helping design out waste, AI can generate an estimated economic opportunity of up to USD 127 billion a year in 2030 for food systems and up to USD 90 billion a year in 2030 for consumer electronics.

Methodology

Sample Selection

The first step was to define the criteria that we will use to select the companies. As we are looking at SMEs, we have taken into account the definition by Foreign, Commonwealth & Development Office (FCDO): An SME is any organisation that has fewer than 250 employees and a turnover of less than €50 million (~£40 million).

Another key criterion for selection in the sample was evidence of a business model aligned with circular economy principles. To evaluate this, several factors were considered:

- Commitment to circular design of products/services - Features like durability, reusability, remanufacturing was examined.
- Closed-loop systems and waste reduction - Presence of take-back programs, resource recovery processes, zero waste initiatives indicated circular operations.
- Renewable and recycled material sourcing - Use of post-consumer recycled content, biodegradable/compostable materials showed circular material flows.
- Performance models over product ownership - Evidence that companies prioritised performance/usage over single-sale transactions through leasing, sharing models supported circular propositions.
- Collaboration in value chains - Partnerships with other organizations to enable circular practices through the supply chain, like reverse logistics networks, were also evaluated.

SMEs demonstrating following practices were identified through an online search. Companies listed on the **Deal Room Directory, UK Circular Economy Club Directory** and **ReLondon Company Directory**. Cross-referencing information across these directories and databases such as LinkedIn and Crunchbase helped validate each company's self-reported circular claims. Only businesses demonstrating measurable circular practices through multiple lines of evidence were included in profiling and subsequent comparative analysis of business models and capabilities. A total of 51 SMEs across various sectors and UK regions were selected for in-depth profiling.

Data Collection

Once we have defined the criteria, we could start to research company information. When creating an Excel document which will store the company information, we had to identify which category of information to include in order to generate valuable analysis but also have an overview of the companies with crucial information.

After consideration of various factors, we have decided to focus on the following:

- Company name
- Website URL
- Location
- Brief Description
- B2B/B2C
- Revenue Model
- Launch Year
- Industries
- Sub-industries
- Growth Stage.

These factors helped us to develop a thoroughly evaluate and compare each company and discuss the main trends in each industry, location, and growth stage.

While we have previously also considered valuation, founders, and income streams, we have decided to ignore them due to following:

- Valuation – most of the companies lacked data resulting in an inability to identify trends.

- Founders – researching common characteristics of individuals who have successful business that implement circular economy model was out of the scope of this research.
- Income streams – the revenue model was a better alternative as it encompassed the main method of income.

We have also decided to explore key areas such as supply chain management, innovation, and corporate culture to identify any trends. This information was collected in their respective websites, news articles, and commentaries which included information like:

- Mission statement
- Business strategy
- Product portfolio
- Sustainability reports or initiatives

To ensure that all the information is accurate and reliable, it was important to validate the data collected. This was be done by cross-referencing data from government websites (Companies House, Intellectual Property Office (UKIPO), Department for Business, Energy & Industrial Strategy (BEIS)); Business Directories (Yellow Pages, PitchBook, Thompson Local; social media (LinkedIn, Twitter, Facebook, Instagram); Industry Publications (ScienceDirect, Springer, ReLondon, Circular & Co) Financial News Website (MarketWatch, Financial Times, Yahoo Finance).

Data Analysis

In order to help with analysing large number of texts and data, Large Language Models (LLMs) were used to corroborate and summarise information. LLMs from Open AI (ChatGPT and GPT4) and Anthropic (Claude 2 and Claude Instant) were used to scan relevant reports, case studies, sustainability reports and news/press releases, which assisted in understanding their circular economy strategies and impacts. The information captured was validated through company websites.

In-depth case studies were developed for 6 companies demonstrating exemplary circular business models. It is a valuable way to understand how circular business models work in practice and discover unique capabilities and competitive advantages. This provided qualitative insights into real-world implementation challenges and successes.

Statistical Analysis

Descriptive statistics were used to identify similarities/differences and analyse emerging trends in the proliferation of circular SMEs over time and across various factors based on the company profiles collected. It also helped to identify successful strategies that can be shared and replicated within the circular economy landscape.

To demonstrate the rise of interests for circular economic start-ups from investors, we have created a graph that represents the cumulative investment in £m and number of deals over the period of last 5 years in Figure 1.

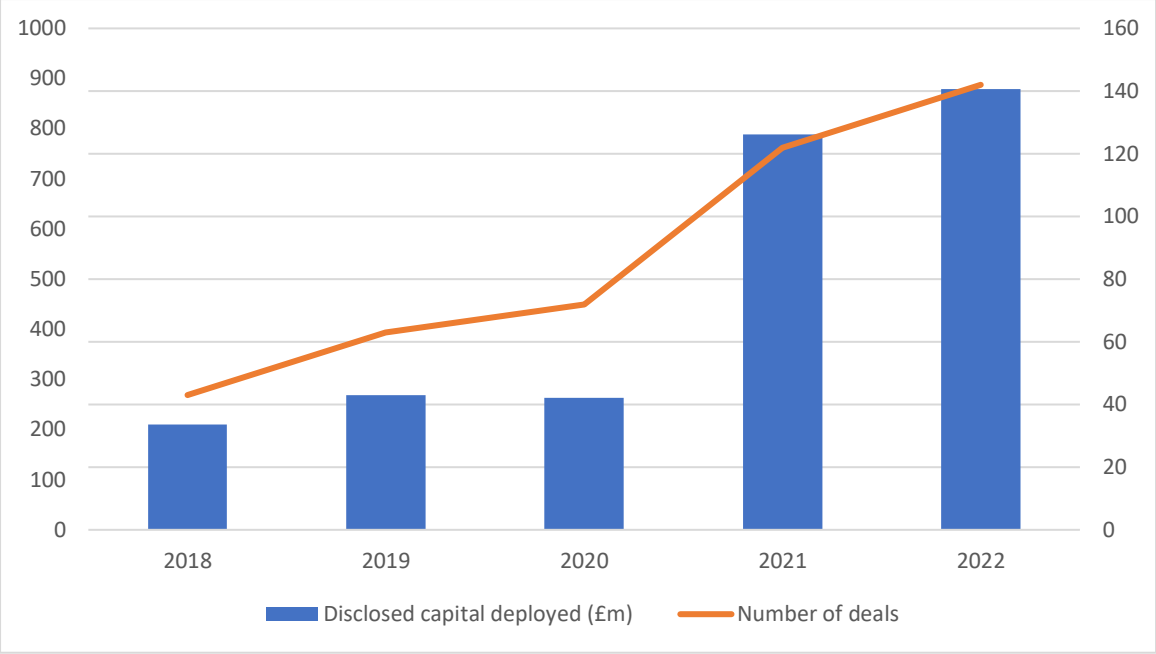

Figure 1: Increase in investments in circular economy projects with an increasing number of deals over the past 5 years in the UK.

We have created a map (Figure 2) to display the location of the 51 companies that we have selected to research in order to analyse the trends in specific locations.

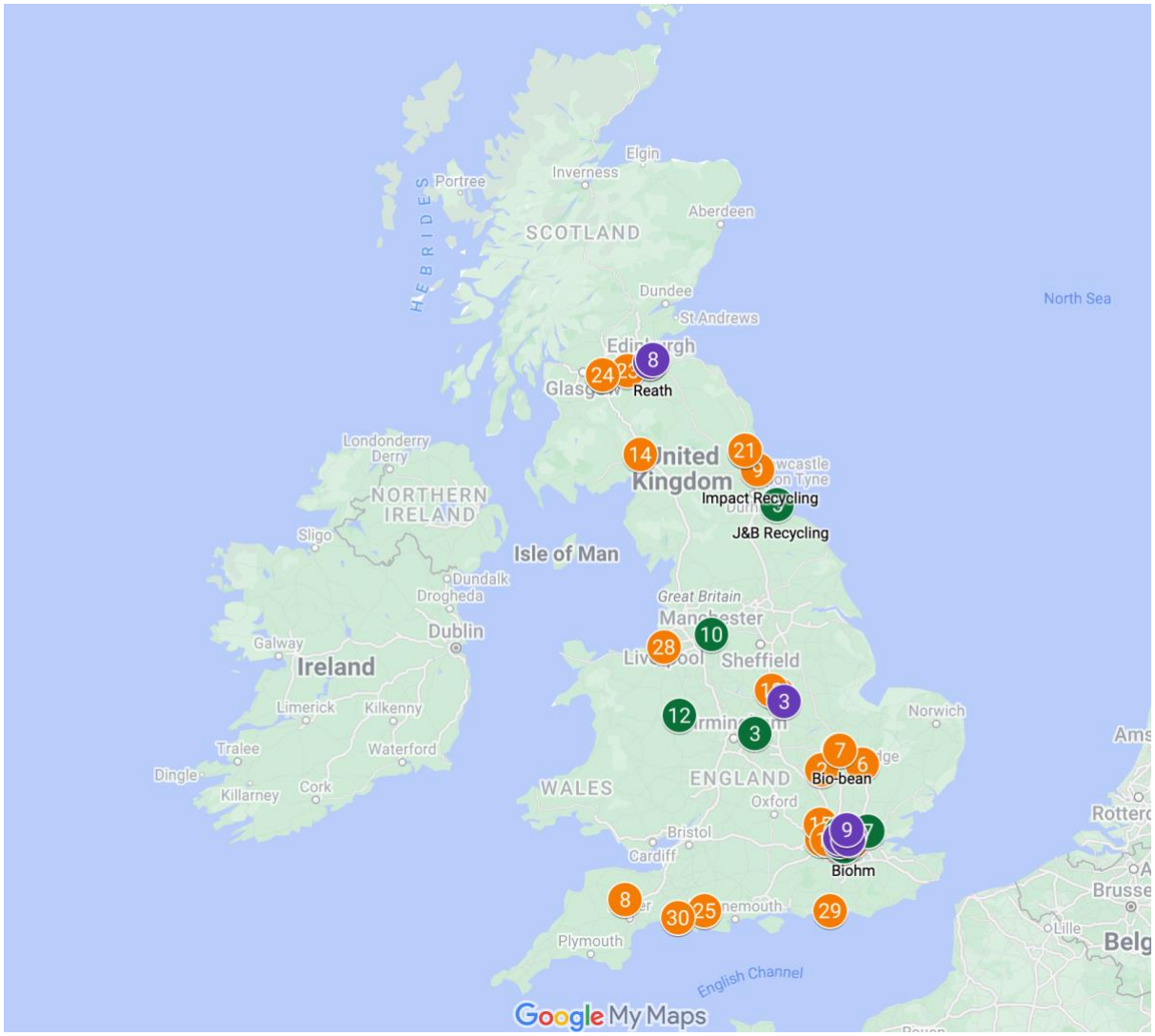

Figure 2: Distribution of SMEs implementing Circular Economy Business Models (Berikuly, 2023)

In Figure 3, we took our list of SMEs and using the data collected on business strategy and stage of growth we have made a graph to represent the high supply of circular economic services in B2B field.

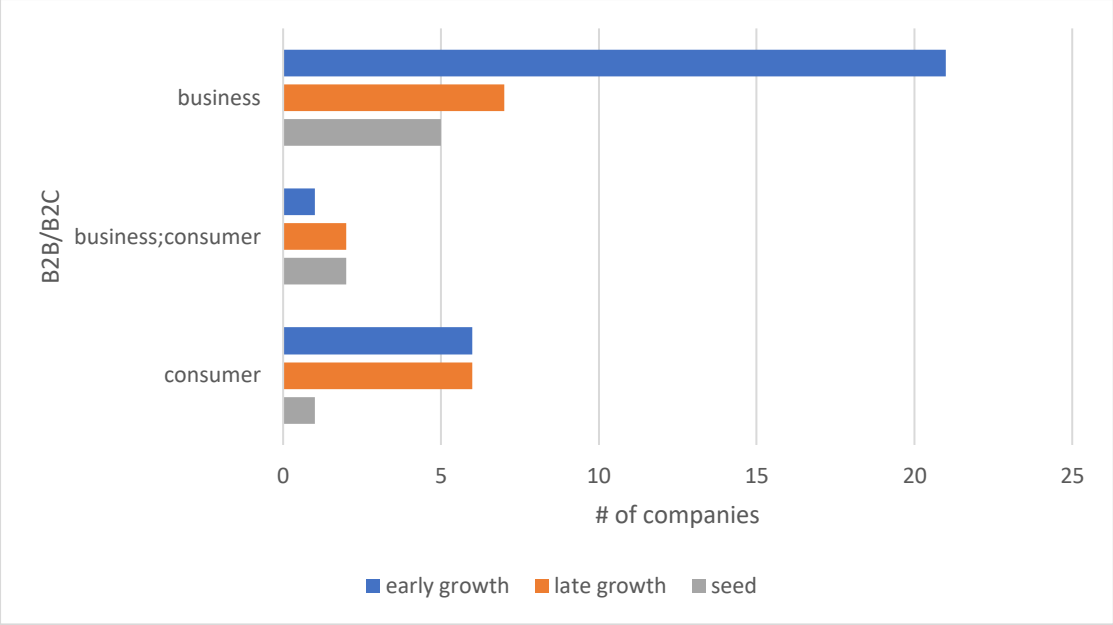

Figure 3: More than half of early growth SMEs have chosen B2B strategy.

Figure 4 represents the growth of number of SMEs over the last 3 decades. It was done by collecting the SMEs' launch year and counting the number of companies in that specific year.

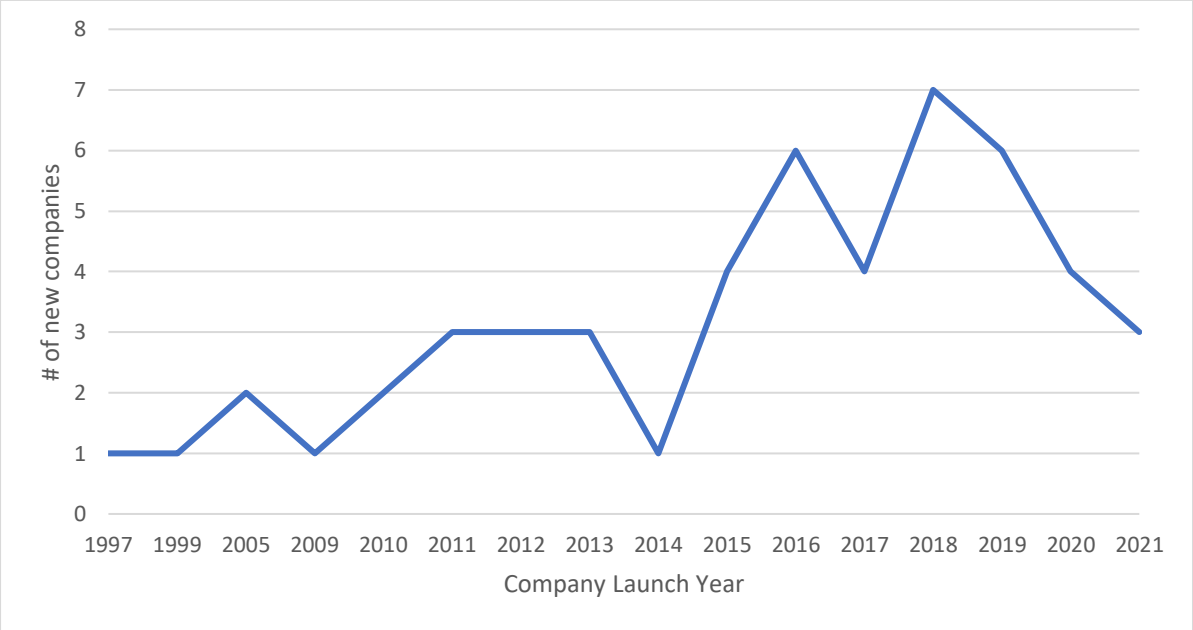

Figure 4: Growing number of SMEs YOY

Limitations

The results are based on a survey of small and medium-sized companies. It may not be fully generalisable as only SMEs with readily accessible public information were included. The research is also limited by the depth of information disclosed publicly by each company. For example, your results may not be generalisable to all SMEs in the UK manufacturing sector. It does not include a longitudinal study of the companies that have adopted circular economy business models.

Discussion

Key Findings

Having looked at the list of sectors that SMEs are taking initiatives in, we have identified top 3 sectors in the UK manufacturing sector with the highest percentage of CE business model adoption:

- Energy: This sector includes businesses that produce, distribute, and use energy. Circular economy businesses in this sector are heavily focused on reducing waste and emissions and increasing efficiency. GeoGreenPower is a great example of a SME leveraging circular economy in the energy sector because they are working to reduce waste and emissions by recycling solar panels. Solar panels are a valuable resource that can be reused, and by recycling them, GeoGreenPower is helping to conserve natural resources and protect the environment.
- Food: This sector includes businesses that produce, process, and distribute food. Circular economy businesses in this sector are focused on reducing food waste and increasing the use of sustainable food production practices. For example, Intellidigest is a company that has developed a food waste digester, IDigest, that can break down food waste into an odourless concentrate that can be used for food production by analysing the composition of your food waste for carbs, fats and proteins. This helps to reduce food waste by up to 90% and creates a valuable resource from food waste that can be used to grow new food.
- Textiles: This sector includes businesses that produce, process, and distribute textiles. Circular economy businesses in this sector are focused on reducing textile waste and increasing the use of recycled materials. For example, FibreLab is a textile recycling start-up that uses a custom-built mechanical shredding machine to turn post-industrial textile waste into valuable recycled fibre. They work one-on-one with their clients to customize the process for their textile waste needs, which range from off-cuts from the garment manufacturing process to stained and damaged linens from the hospitality sector. They're constantly developing new applications for recycled fibre so that they can turn their clients' waste streams into innovative products.

The energy, food, and textiles sectors are substantial waste producers due to the nature of their operations and inefficiencies in their production and consumption cycles. This waste ranges from greenhouse gas emissions in energy production, food waste throughout the supply chain, to textile waste from fast fashion cycles. Recognising these challenges, circular economy SMEs target these sectors to reduce waste and promote sustainability.

The distribution of circular economy businesses in the UK manufacturing sector is not uniform (Figure 2). The map shows that the majority of SMEs are based in England (88%), with a concentration in London (43%), and the rest are based in Scotland (12%). This is likely due to a number of factors, including the availability of financial resources, the presence of research and development institutions, and the proximity to markets.

There are also some regional differences in the types of circular economy businesses that are being implemented. For instance, the energy sector is more concentrated in Scotland, while the food sector is more concentrated in the Southwest of England. This is likely due to the different natural resources and industries that are present in each region.

The most common revenue model that business take up is manufacturing. As a result, 73% of manufacturing firms are based outside of London due to high manufacturing costs associated with proximity to the capital. From those manufacturing SMEs, large number of projects come from two prevalent sub-industries: Waste Solution and Upcycling. Upcycling is a creative process of transforming waste materials, useless, or unwanted products into new materials or products of better quality and environmental value. While Waste Solutions refer to the strategies and methods used to manage waste to minimise its environmental impact. We have created a case study on Radiant Matter (upcycling) and Ocean Bottle (waste solution).

Radiant Matter

Company overview	Radiant Matter is a material innovation company that is developing a new generation of sparkling colour and material solutions for the circular economy. Inspired by nature's ingenuity, they engineer naturally sparkling structural colours to help the textile industry dramatically reduce its environmental impact; their BioSequins are just the beginning.
Circular business model	Radiant Matter's circular business model is based on upcycling waste materials to create new products. They collect waste cellulose, such as wood pulp, and use a process called biomimicry to create their BioSequins. BioSequins are made from cellulose, a natural material that is found in plants. Cellulose is a renewable resource, so it is a sustainable choice for creating materials. The BioSequins are also biodegradable, so they will not pollute the environment when they are disposed of.
Benefits of the circular business model	The benefits of Radiant Matter's circular business model are many. First, it helps to reduce the environmental impact of the textile industry. The textile industry is a major polluter, and upcycling waste materials helps to reduce the amount of waste that goes to landfill. Second, the circular business model helps to improve the financial performance of Radiant Matter. By using waste materials, Radiant Matter can save money on raw materials. Third, the circular business model gives Radiant Matter a competitive edge. Other companies in the textile industry are not yet using upcycling, so Radiant Matter has a first-mover advantage.
Challenges of the circular business model	There are some challenges to Radiant Matter's circular business model. First, it can be difficult to find waste cellulose that is of high quality. Second, the process of upcycling waste cellulose can be expensive. Third, there is still a lack of awareness of the benefits of upcycling among consumers and businesses.
Unique capabilities and competitive advantages	Radiant Matter has several unique capabilities and competitive advantages that help them to overcome the challenges of their circular business model. First, they have a strong team of engineers and scientists who are experts in biomimicry. Second, they have a proprietary process for upcycling waste cellulose. Third, they have a strong network of partners in the textile industry.
Real-world implementation challenges and successes	Radiant Matter has faced some challenges in implementing their circular business model. One challenge was finding waste cellulose that was of high quality. Another challenge was convincing businesses to use their BioSequins. However, Radiant Matter has also had some successes. They have partnered with several major brands, including Stella McCartney and Pangaia. They have also received funding from the European Union and the UK government.
Lessons for other businesses	Radiant Matter's experience provides several lessons for other businesses. First, it is important to have a strong team of experts who are familiar with the circular economy. Second, it is important to have a proprietary process that can be used to upcycle waste materials. Third, it is important to have a strong network of partners in the industry.
Future plans	Radiant Matter plans to continue to grow and innovate. They are developing new products made from upcycled waste materials. They are also working to expand their network of partners. Radiant Matter is committed to making the textile industry more sustainable, and they believe that their circular business model is the key to achieving this goal.

Ocean Bottle

Company overview	Ocean Bottle is a company that makes reusable water bottles made from recycled ocean plastic. They also partner with social enterprises to collect and recycle ocean plastic.
Circular business model	Reduce: They help to reduce the amount of plastic pollution in the ocean by collecting and recycling ocean plastic. Reuse: They make reusable water bottles that can be used instead of single-use plastic bottles. Recycle: They recycle ocean plastic into new products, such as their water bottles.
Benefits of the circular business model	The benefits of Ocean Bottle's circular business model are many. First, it helps to reduce the amount of plastic pollution in the ocean. Second, it helps to reduce the demand for single-use plastic bottles. Third, it creates jobs and income for people in coastal communities. Fourth, it helps to raise awareness about the problem of plastic pollution. Fifth, it uses a higher quality material than it was originally.
Challenges of the circular business model	There are some challenges to Ocean Bottle's waste solution. First, it can be difficult to collect enough ocean plastic to make their water bottles. Second, the process of recycling ocean plastic can be expensive. Third, there is still a lack of awareness of the benefits of recycling among consumers and businesses.
Unique capabilities and competitive advantages	Ocean Bottle has several unique capabilities and competitive advantages that help them to overcome the challenges of their waste solution. First, they have a strong social mission to reduce plastic pollution in the ocean. Second, they have a unique business model that combines the collection and recycling of ocean plastic with the production of reusable water bottles. Third, they have a strong network of partners in the ocean plastic recycling industry.
Real-world implementation challenges and successes	Ocean Bottle has faced some challenges in implementing their waste solution. One challenge was finding enough ocean plastic to make their water bottles. Another challenge was convincing people to switch from single-use plastic bottles to reusable water bottles. However, Ocean Bottle has also had some successes. They have collected over 1 million bottles of ocean plastic and recycled them into new products. They have also partnered with over 100 social enterprises to collect and recycle ocean plastic.
Lessons for other businesses	Ocean Bottle's experience provides several lessons for other businesses. First, it is important to have a strong social mission that is aligned with the circular economy. Second, it is important to have a unique business model that can help to reduce waste and pollution. Third, it is important to have a strong network of partners in the industry. Fourth, it is important to use innovative technologies to recycle waste materials.
Future plans	Ocean Bottle plans to continue to grow and innovate. They are developing new products made from recycled ocean plastic. They are also working to expand their network of partners. Ocean Bottle is committed to making the world a cleaner place, and they believe that their circular business model is the key to achieving this goal.

Importance of Circular Economy Capabilities

We have identified capabilities and practices that successful SMEs adopt and maintain. The top capabilities that enabled the adoption of circular models were innovation management (89%), customer relationship management (79%), strategic planning (67%), partnership formation (63%), and inventory optimisation (57%).

Furthermore, the type of sales was crucial to success; we have found that largely SMEs prefer on using B2B (business to business models), compared to B2C (business to consumer) or the combination of 2 (B2B/B2C) (Figure 3).

Further analyses have revealed interesting statistics:

- 65% offer product-as-service or sharing platforms as alternatives to traditional sales.
- 53% collaborate with partners across their value chain to recapture resources and find secondary markets for by-products.
- 47% have implemented reverse logistics to recover used products or components and reintroduce them into the value chain.

We have looked at Recycling Technologies and how they implement reverse logistics to their advantage.

Recycling Technologies

Company overview	Recycling Technologies is a UK-based company that is developing a new technology to recycle mixed plastic waste. Their technology, called monomer recycling, breaks down plastic waste into its original monomers, which can then be used to make new plastic products.
Circular business model	Recycling Technologies utilises reverse logistics to recover used plastic waste. Reverse logistics is the process of moving goods from the end-user back to the manufacturer or supplier. In the case of Recycling Technologies, they collect used plastic waste from businesses and consumers. They then sort and clean the waste, and then feed it into their monomer recycling machine. The machine breaks down the waste into its original monomers, which are then used to make new plastic products.
Benefits of the circular business model	There are several benefits to using reverse logistics to recover used plastic waste. First, it helps to reduce the amount of plastic waste that ends up in landfills or incinerators. Second, it helps to conserve natural resources, as the recycled plastic can be used to make new products. Third, it can help to create jobs, as it requires people to collect, sort, and clean the waste.
Challenges of the circular business model	There are also some challenges to using reverse logistics to recover used plastic waste. First, it can be expensive to collect and transport the waste. Second, it can be difficult to find markets for the recycled plastic. Third, there is still a lack of awareness of the benefits of recycling plastic waste.
Unique capabilities and competitive advantages	Recycling Technologies has several unique capabilities and competitive advantages that help them to overcome the challenges of reverse logistics. First, they have developed a proprietary monomer recycling technology that is more efficient and cost-effective than traditional methods. Second, they have a strong network of partners in the plastics industry. Third, they are committed to raising awareness of the benefits of recycling plastic waste.
Future plans	Recycling Technologies plans to continue to develop their monomer recycling technology and expand their network of partners. They also plan to work with governments and businesses to create policies and incentives that support the recycling of plastic waste.

Success Factors

We have noticed that having a strong grip on the supply chain in manufacturing SMEs was crucial to the success. Having looked at the common features in the supply chain, we have identified key factors that determine the success of their CE model:

- Traceability: This means being able to track the movement of materials and products throughout the supply chain. This can help to identify and reduce environmental impacts, such as deforestation and water pollution.
- Recycling and reuse: This means using recycled materials and products whenever possible. This can help to reduce the amount of waste generated and conserve natural resources.
- Fair labour practices: This means ensuring that workers in the supply chain are treated fairly and paid a living wage. This can help to improve the lives of workers and their families.

- Energy efficiency: This means using energy-efficient practices in the supply chain. This can help to reduce greenhouse gas emissions and save money.
- Sustainable transportation: This means using sustainable transportation methods, such as rail and shipping, to move materials and products. This can help to reduce air pollution and greenhouse gas emissions.
- Local sourcing: This means sourcing materials and products from local suppliers. This can help to reduce transportation emissions and support local economies.

However, there are factors that SMEs cannot control such as policy barriers. These barriers restrict many potential SMEs who want to adopt CE business models. The ways that we can overcome those barriers are multitude:

- Reforming waste management policies: Governments can reform waste management policies to make it easier for businesses to collect and recycle waste. This could include providing financial incentives for businesses that recycle or making it easier for businesses to access recycling infrastructure.
- Supporting research and development: Governments can support research and development into new technologies that can help to make circular economy business models more viable. This could include funding research into new recycling technologies or into ways to make products more durable and recyclable.
- Creating awareness: Governments can create awareness about the benefits of circular economy business models. This could involve raising awareness among businesses, consumers, and policymakers.
- Setting standards: Governments can set standards for products and services that make it easier for businesses to design and manufacture products that are recyclable or reusable. This could include setting standards for the use of recycled materials in products or for the recyclability of packaging.
- Providing incentives: Governments can provide financial incentives for businesses that adopt circular economy business models. This could include tax breaks or grants for businesses that invest in new infrastructure or technology.

We have explored a case study of Biohm and how it successfully overcame those hurdles:

<u>Biohm</u>

Company overview	Biohm is a company based in London, UK that is developing new materials made from mycelium, the root-like structure of mushrooms. Mycelium is a natural material that is strong, lightweight, and sustainable. Biohm is using mycelium to create a variety of products, including insulation, packaging, and furniture.
Regulatory hurdles	Biohm has faced a number of regulatory hurdles in their development of mycelium-based products. One of the biggest challenges has been the lack of clear regulations around the use of mycelium. This has made it difficult for Biohm to get their products approved by regulators. Another challenge has been the need to comply with a wide range of regulations, including those related to food safety, building materials, and environmental protection. This has required Biohm to invest significant time and resources in regulatory compliance.
Overcoming regulatory hurdles	Biohm has overcome these regulatory hurdles by working closely with regulators and by conducting extensive research and testing. They have also developed a strong network of partners, including scientists, engineers, and lawyers, who have helped them to navigate the regulatory landscape.
Unique capabilities and competitive advantages	• Strong R&D capabilities: Biohm has a strong team of scientists and engineers who are constantly innovating and developing new mycelium-based products.

	• Close relationships with regulators: Biohm have built close relationships with regulators, which has helped them to navigate the regulatory landscape. • Wide network of partners: Biohm has a wide network of partners, including scientists, engineers, and lawyers, who can help them to develop and commercialise their products. • Sustainable materials: Biohm's products are made from sustainable materials, which makes them a more attractive option for businesses and consumers who are looking for environmentally friendly products. • Awards and recognition: Biohm has won several awards for their innovation, which has helped to raise their profile and attract investors.
Future plans	Biohm plans to continue to develop their mycelium-based products and to expand into new markets. They also plan to work with regulators to develop clear and consistent regulations around the use of mycelium. Biohm is a promising company with a potentially ground-breaking technology. If they are successful, they could have a major impact on the construction industry and create a more sustainable future.

Finally, the most interesting factor that we have identified is culture. It is what drives the SMEs to strive for success. The following characterises were adopted by the most successful SMEs:

- Mission-driven: These companies are driven by a mission to make a positive impact on the world. They often have a strong commitment to sustainability and social responsibility. Some examples include The Ocean Bottle, which donates 10% of its profits to ocean conservation projects, and Carte Diem, a social enterprise that provides employment and training opportunities to people with disabilities.
- Inclusive: These companies are committed to creating a diverse and inclusive workplace. They often have policies and practices in place to promote equity and inclusion. Some examples include Biohm, which has a workforce that is 50% female, and Ultromex, a B Corp company that is committed to social and environmental responsibility.
- Transparent: These companies are open and honest about their environmental impact and business practices. They often share information about their supply chain, emissions, and waste. Some examples include Circulor, which provides supply chain traceability solutions for recycled materials, and Recycleye, which develops technology to automatically identify and sort recyclable materials.
- Collaborative: These companies are committed to working with others to solve problems and make a difference. They often partner with organizations in the public and private sectors to achieve their goals. Some examples include Enval, which helps businesses reduce their environmental impact through waste management and recycling services, and Reflaunt, which provides a platform for consumers to sell and buy second-hand clothing.
- Entrepreneurial: These companies are innovative and creative in their approach to sustainability. They are not afraid to take risks and try new things. Some examples include Deep Branch Bio, which develops technology to convert CO2 into algae, which can be used to produce food, feed, and biofuels, and Phase Photonics, which develops technology to convert sunlight into hydrogen fuel.

Trends

From the 51 SMEs that we have studied, we have looked at the growth in number of new SMEs year-on-year. Figure 4 represent a steady growth due to increase in awareness and increased government support.

Those SMEs have seen a tremendous benefit from adopting CE practices early such as:

- Increased revenues by an average of 14% over 3 years
- Reduced material costs by an average of 8% over 3 years

- Improved customer satisfaction scores by an average of 12% over 3 years.

In order to see the future potential of CE models, we have identified many trends from the 51 SMEs. There is a rise of bio-based materials, such as:

- Bioplastics: Bioplastics are made from renewable resources, such as corn-starch, sugarcane, or vegetable oil. They are a promising alternative to traditional plastics, which are made from fossil fuels.
- Bio composites: Bio composites are made from a combination of bio-based materials and traditional materials, such as plastics or metals. They offer the benefits of both bio-based materials and traditional materials.
- Textiles made from recycled materials: There are many companies that are now making textiles from recycled materials, such as plastic bottles or old clothes. This is helping to reduce the amount of textile waste that is sent to landfills.

There is a clear development of new recycling technologies:

- Chemical recycling: Chemical recycling is a process that breaks down plastics into their basic building blocks, which can then be used to make new plastics.
- Mechanical recycling: Mechanical recycling is a process that breaks down plastics into smaller pieces, which can then be used to make new products, such as furniture or insulation.

<u>Oddbox</u>

Company overview	Oddbox is a UK-based company that delivers boxes of “wonky” fruit and veg to customers’ doorsteps. The company’s mission is to reduce food waste by rescuing fruit and veg that would otherwise be thrown away due to its appearance.
Recycling technologies	Reusable boxes: Oddbox uses reusable boxes for its deliveries. Customers are encouraged to return the boxes to Oddbox when they are finished with them. The boxes are then cleaned and reused again. Biodegradable packaging: Oddbox uses biodegradable packaging for its fruit and veg. This packaging is made from materials that will break down naturally in the environment. Compostable waste collection: Oddbox offers a compostable waste collection service to its customers. This service allows customers to compost their food scraps and other organic waste.
Benefits of recycling technologies	They help to reduce food waste. They reduce the amount of waste that goes to landfill. They protect the environment. They create jobs.
Challenges of recycling technologies	The cost of implementing and maintaining these technologies can be high. There is still a lack of awareness about recycling technologies among consumers. There is a need for more infrastructure to support recycling technologies.
Unique capabilities and competitive advantages	A strong commitment to sustainability. A close relationship with its customers. A focus on innovation. A willingness to invest in new technologies.
Future plans	Oddbox plans to continue to implement new recycling technologies and to find ways to reduce its environmental impact. The company also plans to expand its operations to other countries.

There is growth of the repair and reuse economy:

- Repair cafes: Repair cafes are community spaces where people can bring their broken appliances and other items to be repaired.

- Second-hand markets: Second-hand markets are places where people can buy and sell used goods.
- Online marketplaces: There are many online marketplaces where people can buy and sell used goods.

There is increasing use of digital technologies:

- Product passports: Product passports are digital records that track the environmental impact of a product throughout its life cycle like Circulor who track the sustainability of aluminium BMW uses in their Electric Vehicles (EVs).
- Traceability systems: Traceability systems track the movement of materials and products throughout the supply chain.
- Digital platforms: Digital platforms are used to connect people who want to repair, reuse, or recycle goods.

Circulor

Company overview	Circulor is a company that provides a digital platform for tracking the supply chains of materials. They use blockchain technology to create a secure and transparent record of the movement of materials from their source to their final destination.
Digital product passports	Circulor's digital product passports are used by a variety of companies to track the sustainability of their products. For example, Circulor works with the automotive industry to track the sustainability of cobalt in electric vehicle batteries. Circulor's digital product passports include information such as the origin of the material, the suppliers involved in the supply chain, and the transportation methods used. This information can be used to identify and reduce the environmental impact of the product.
Benefits	Circulor's digital product passports offer a number of benefits, including: • Reduced environmental impact: Circulor's digital product passports help companies to track and reduce the environmental impact of their products. This can help companies to meet their sustainability goals and to reduce their carbon footprint. • Improved financial performance: Circulor's digital product passports can help companies to improve their financial performance by reducing waste and increasing efficiency. For example, companies can use Circulor's product passports to identify and eliminate bottlenecks in their supply chains. • Increased transparency and traceability: Circulor's digital product passports provide companies with greater transparency and traceability into their supply chains. This can help companies to identify and mitigate risks, and to ensure that their products are compliant with regulations.
Challenges	One of the challenges of Circulor's business model is the need to educate companies about the benefits of digital product passports. Circulor overcomes this challenge by providing educational resources and by working closely with companies to implement digital product passports. Another challenge is the need to develop and maintain the Circulor platform. Circulor overcomes this challenge by investing heavily in research and development.
Unique capabilities and competitive advantages	• Proprietary technology: Circulor has developed proprietary technology for creating and managing digital product

	passports. This technology is secure, transparent, and easy to use. • Industry expertise: Circulor has a team of experts with deep knowledge of the supply chains of a variety of industries. This expertise allows Circulor to help companies to implement digital product passports in a way that is tailored to their specific needs. • Customer focus: Circulor is committed to providing its customers with the best possible service. They work closely with their customers to understand their needs and to help them to achieve their sustainability goals.
Real World implementations	One of the real-world implementation challenges that Circulor has faced is the need to coordinate with multiple suppliers in a complex supply chain. Circulor has overcome this challenge by developing a user-friendly platform that makes it easy for suppliers to upload and share data. One of Circulor's real-world successes is its work with BMW to track the sustainability of cobalt in electric vehicle batteries. Circulor's digital product passports have helped BMW to reduce the environmental impact of its supply chain and to ensure that its cobalt is sourced from sustainable mines.
Future plans	Circulor's future plans include expanding its platform to support new industries and new types of data. Circulor is also committed to continuing to innovate and develop new features for its platform. Circulor plans to continue to grow by working with more companies and by expanding into new markets. The company is well-positioned to become a leader in the digital product passport market, and its technology has the potential to revolutionize the way that companies track and manage the environmental impact of their products

Conclusion

Our research has delved deep into the adoption and implementation of circular economy business models in the UK's Small and Medium-sized Enterprises (SMEs). It is clear that a paradigm shift is occurring, with more and more SMEs actively employing strategies characteristic of a circular economy.

Strategies such as using recycled materials, designing durable and long-lasting products, offering take-back programs, and investing in renewable energy sources have all been employed to varying degrees. These trends underscore a growing commitment to sustainability, resource efficiency, and a systemic departure from the traditional 'take-make-dispose' economic model.

It is encouraging to note that these concerted efforts are yielding positive results. Companies are making tangible strides in reducing their environmental impact, underscoring the viability and benefits of the circular economy model. The benefits are not just environmental but also economic, offering opportunities for cost savings, new revenue streams, and increased customer loyalty.

However, as with any significant transition, challenges are inherent. Our research has highlighted obstacles such as the lack of necessary infrastructure for recycling and composting. These are complex issues that require a concerted effort from businesses, government, and society at large to address.

Despite these challenges, we remain optimistic. The hurdles faced by SMEs are not insurmountable and, given the dynamism and innovation inherent in this sector, we believe they can be overcome. The progress already made by these companies is testament to their resilience and adaptability.

In conclusion, the transition to a circular economy within UK SMEs is a journey – one that is still in its early stages but is gaining momentum. As we look to the future, it is a journey filled with promise and potential. By embracing the circular economy, SMEs are not only contributing to a more sustainable planet, but they are also positioning themselves for long-term resilience and success in an increasingly resource-constrained world.

References / Bibliography

Atasu, A., Dumas, C. and Van Wassenhove, L.N. (2021) *The circular business model*, *Harvard Business Review*. Available at: https://hbr.org/2021/07/the-circular-business-model (Accessed: 11 September 2023).

Berikuly, M. (2023) *Google MyMaps, Distribution of SMEs implementing Circular Economy Business Models.* Available at: https://www.google.com/maps/d/u/2/edit?mid=1HPEXvkqC9eCMXBw6ELQbFFfUgsa1xY0&usp=sharing (Accessed: 11 September 2023)

Bester, A. (2018) *Cambridge Institute for Sustainability Leadership*, *Resource Productivity and the Circular Economy: The opportunities for UK Economy*. Available at: https://www.cisl.cam.ac.uk/system/files/documents/resource-productivity-and-the-circular.pdf (Accessed: 11 September 2023).

Brenner, B. and Drdla, D. (2023) 'Business model innovation toward sustainability and circularity—a systematic review of innovation types', *Sustainability*, 15(15), p. 11625. doi:10.3390/su151511625.

The Circularity Gap Reporting Initiative, The Circularity Gap Report (2023).

The Circular Economy Club, Organisations (2023)

DealRoom, 280+ startups ushering in the circular economy (2023)

Department for Environment, Food and Rural Affairs (Defra), the Department of Agriculture, Environment and Rural Affairs (DAERA), the Welsh Government and the Scottish Government, Circular Economy Package policy statement (2020)

Ellen MacArthur Foundation, Artificial intelligence and the circular economy: AI as a tool to accelerate the transition (2019).

Ellen MacArthur Foundation, Universal Circular Economy Policy Goals (2021).

Ellen MacArthur Foundation, Completing the picture: How the circular economy tackles climate change (2019).

Geng, Y., Sarkis, J. and Bleischwitz, R. (2019) *How to globalize the circular economy*, *Nature News*. Nature Publishing Group. Available at: https://www.nature.com/articles/d41586-019-00017-z (Accessed: January 31, 2023).

Kumar, V. *et al.* (2019) 'Circular economy in the manufacturing sector: Benefits, opportunities and barriers', *Management Decision*, 57(4), pp. 1067–1086. doi:10.1108/md-09-2018-1070.

Martin Geissdoerfer, Paulo Savaget, Nancy M.P. Bocken, Erik Jan Hultink (2017) *The Circular Economy – A new sustainability paradigm?, Journal of Cleaner Production,* Volume 143, 2017, Pages 757-768

Masterson, V. and Shine, I. (2022) *What is the circular economy, and why does it matter that it's shrinking?*, *World Economic Forum*. Available at: https://www.weforum.org/agenda/2022/06/what-is-the-circular-economy/ (Accessed: 11 September 2023).

MILLS, T. (2023) *Circular economy series*, *UK*. Available at: https://www.bdo.co.uk/en-gb/insights/advisory/mergers-and-acquisitions/circular-economy-series (Accessed: 11 September 2023).

Murray, A., Skene, K. and Haynes, K. (2015) 'The circular economy: An interdisciplinary exploration of the concept and application in a global context', *Journal of Business Ethics*, 140(3), pp. 369–380. doi:10.1007/s10551-015-2693-2.

ReLondon, Business Directory (2023)

Velenturf , A. and Howroyd, M. (2021) *Circular economy - spotlight.leeds.ac.uk*, *Circular economy: Coming together for a sustainable, fairer and low-carbon economy*. Available at: https://spotlight.leeds.ac.uk/world-changers/circular-economy/index.html (Accessed: 11 September 2023).