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Entrepreneurial Opportunities in the Circular Economy: Defining Business Concepts for Closed-Loop Systems and Resource Efficiency

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Abstract
This research paper explores the possibilities of entrepreneurship in the circular economy, within particular views on closed-loop economy and resource management. The study aims to discover essential business ideas, issues, and performance drivers for circular economy initiatives; thus, the analysis is based on the literature review, conceptualization, and three case studies. Employing a qualitative approach, the research analyses three distinct sectors: they included circular fashion, management of electronic and electrical waste and sustainable agriculture. The study shows that circular entrepreneurship emerges in the development of new technologies, policies, and consumer behaviours. In the paper's final section, reflective and actionable points for entrepreneurs are drawn based on scaling circular strategies, identifying niches, and the formation of strategic partnerships. Thus, due to the intention of giving a large-scale comprehension of the analysed subject, this study is aimed at supporting the entrepreneurs in their choice of the circular economy by presenting the large-scale potential of sustainable business, as well as the barriers in its implementation.

Keywords: Circular Economy, Innovation, CE Initiatives, Sustainability, Sustainable Business, Closed-Loop System, Resource Management, Environmental Management, Reuse, Recycling.

1. Introduction

1.1. Background and Rationale

The prevailing model of economic consumption is a model that has been linear and predominated throughout the history of worldwide production, which is the 'Take-Make-Dispose' model. However, this strategy has resulted in environmental problems and exhaustion of natural resources which has exerted so much pressure to the earth's systems. To these escalating challenges, the idea of the circular economy has emerged rather recently as a rather popular solution. The circular economy provides a concept that suggests that waste is made negligible, and the use of materials in delivering goods and services is optimized for their entire life cycle (Ellen Mac Arthur Foundation, 2013). The switch of focus as well as awareness of environmental issues offers many prospects for establishing new forms of milieu-sensitive undertakings that generate economic value.

This raises the importance of shifting to circular economy by other pertinent statistics. Thus, according to the data of the World Bank, the global waste generation will be 70% higher by 2050 and will amount to 3. 40 billion tonnes annually. However, the United Nations Environment Programme states that resource extraction and processing are responsible for greater than 90 percent of both current rates for characterized levels of biodiversity loss and water stress and approximately fifty percent of global levels for greenhouse gas emissions. These figures call for better solutions to create a model of economic growth that is free from resource exploiting and polluting the environment.

1.2. Objectives of the Study

The subject research study main goals are as follows. Firstly, it concentrates on the description of the presence and forms of business ideas and practices in closed-loop systems and resource efficiency concepts, thus offering a conceptual framework for understanding the circular economy. Secondly, the rationale and objectives are to review and categorise entrepreneurial opportunities in circular economies by sectors and industries to outline viable sectors for development (Accenture, 2015). Thirdly, the research explores success factors and impediments to developing circular business models and presents the possibilities of the strategies for overcoming the impediments. Finally, it aspires to contain specific

managerial recommendations for new-comers to the sphere of circular economy and present the key findings in the form of checklists that will help entrepreneurs make effective decisions in this new and rapidly evolving space.

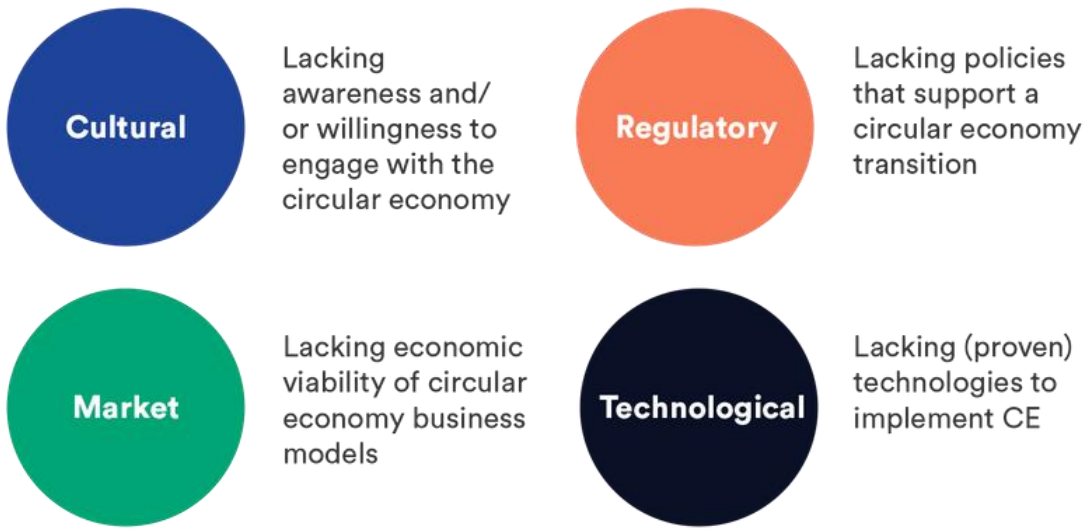
1.3. Research Questions

In order to address these objectives, the following four research questions are posed for the study. First, it is necessary to define key principles and business concepts of closed-loop systems and resource efficiency. For this reason, this question is meant to set the premise of building toward the basic characteristics of circular economy business models. Secondly, in what ways are the entrepreneurs adapting the business models to capture the circular economy value propositions? This inquiry seeks to discover out more on the innovation that the ambitious organizations are applying to unlock value from the waste and the use of resource.

Third, where lie the key success factors and potential improvements, as well as the problems resulting from the implementation of circular business models? This question, by dividing the possibilities into enablers and barriers, aims to give a balanced outlook on what the situation with circular economy is like (Allied Market Research, 2021). Last but not the least; to the following question: which of the following trends/technologies incubate new entrepreneurial opportunities in circular economy? This prospective question is intended to reveal possible future trends and further development of the discussed subject.

1.4. Structure of the Paper

The paper is organized for a better understanding of the research area and its development throughout its execution. Section 2 of the research provides a viable and extensive literature review on the circular economy principles and entrepreneurship, on which this section is based. In the section 3 the conceptual framework is provided to describe major concepts and their relationships related to circular economy. The methods used in the study are laid down in the section four of this research, outlining the research method, data collection and analysis procedures. Section 5 presents three detailed case studies from different economic sectors, which real-life illustrations of circular economy implementation. Section 6 is composed of the analysis and discussions of the findings and here, cross-cutting themes and patterns are discernible. Section 7 discusses latest development in the circular economy, the technology advancement, governmental policy and market factor. Section 8 focuses on key takeaways for the readers, especially those in business, proposing the best ways to operate in the circular economy system (Antikainen & Valkokari, 2016). Last but not the least, Section 9 summarises the paper's findings, research contributions to theory and practice, and the research implications and directions for future works.



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2. Literature Review

2.1. Overview of Circular Economy

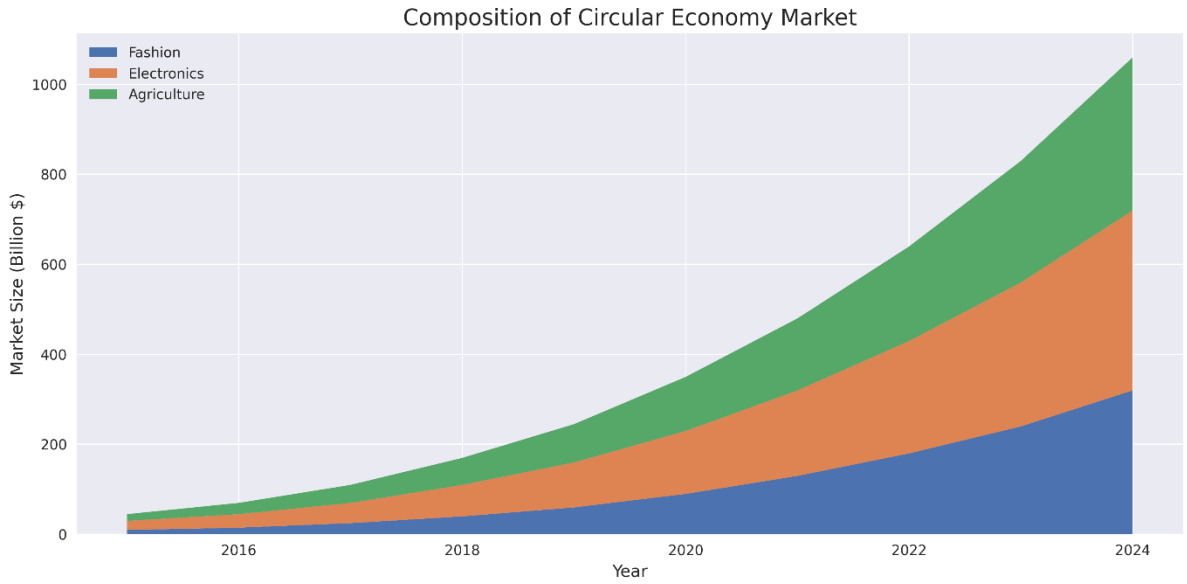
Circular economy has roots in several streams of thought, among them being industrial ecology, cradle to cradle design, and biomimicry (Ghibelline et al., 2016). Fundamentally, there is a contest that the circular economy is a model of society, in which resources are used for as long as possible and products are manufactured to be reused and eventually recycled at the end of their usage cycle (Kirchherr et al., 2017). It is quite the opposite of the linear economy which has formed the basis of industrial processes since the onset of the Industrial Revolution.

The Ellen MacArthur Foundation, a leading proponent of the circular economy, identifies three key principles underpinning the concept: The three principles that the circular economy aims to achieve are outdo waste and pollution, use products and materials efficiently, and restore the natural environment. These principles are followed in designing circular business models and related activities within different industries. The social, financial, and environmental opportunities of change of the conventional linear model of consumption to the circular economy can be described as great as the global potential of value creation on this subject is estimated at $4.5 trillion of new economic value by 2030 (Accenture, 2015).

2.2. Principles of Closed-Loop Systems

Closed loop systems can be categorized under the circular economy model since its main vision is to provide a concept of eliminating waste from the economy through designing products and closing loops or life cycles that enable reuse, repair, and recycling. Some of the principle that closed-loop systems embrace is design for durability and if possible, repair, use of material that can be recycled, modular construction that will allow easy disassembly and lastly take-back programs. It is common that organizations in electronics, fashion, and others apply these principles because the global environment is changing and they want to decrease their negative impact, as well as explore new opportunities for business development (Bocken, de Pauw, Bakker, & van der Grinten, 2016).

For instance, in the electronics industry discussed, companies like Fair phone are using the idea of the modular design of smartphones where anyone can repair the gadget or upgrade the specific component without replacing the whole product, thus reducing electronic waste. The Renault company in the automotive field has been applying the remanufacturing program of the vehicle components where it exhibited energy reduction of up to 80% over production of brand-new components.



2.3. Resource Efficiency in Business

Economy of resources is another key element of circular economy management, which means the regular utilization of the material, energy, and water resources at different stages of the product life cycle. The steps to implement the efficiency of the resources is through; reduction of the resource used by adopting the lean manufacturing techniques, industrial symbiosis, energy recovery structures besides renewable energy sources and water recycling and cascading use. The

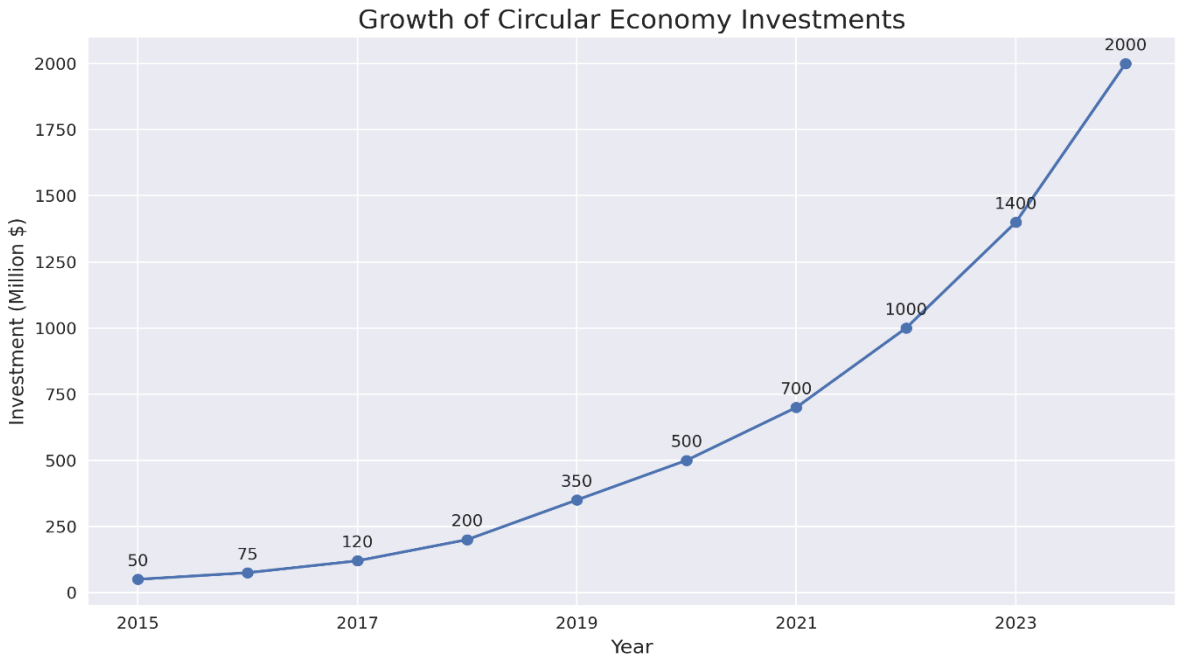
prospects for the extraction of greater efficiency seem vast; the International Resource Panel provides its definition and explains that resource efficiency could provide the world economy with the additional benefits of $ 2 trillion per year till 2050.

A case that has particularly evolved well is industrial symbiosis, where waste or outputs from a firm becomes inputs to another (Camacho-Otero, Boks, & Pettersen, 2018). The Kalundborg Symbiosis in Denmark is a well-known example; it is network of public and private sector companies that exchange diverse residuals annually; the emission of CO2 is 635,000 tonnes and water utilization is 3 million cubic meters annually.

2.4. Entrepreneurship in Circular Economy

Circular economy entrepreneurship deals with the process of coming up with new ventures that focus on generating value from waste, enable a longer lifespan for goods and services, and efficiency in using resources. Bocken et al. (2016) define several types of sustainable business models such as circular supplies, resources' recovery, product life extension, sharing platform, and product as a service (Climate Bonds Initiative, 2021). These models help the entrepreneurs to suggest the areas of innovation and value creation within the context of circular economy.

There is huge potential for the circular economy since the World Economic Forum noted that business in the circular economy could reach $4. To extend this further, global connected commerce is estimated to be worth $5 trillion by 2030. As a result, there has been a growth of the circular economy startup across different industries. For example, for the fashion industry, there are current innovative business models such as Rent the Runway dealing with clothing rental; on the other hand, there is TerraCycle that offers effective recycling services particularly for difficult to recycle items.



3. Conceptual Framework

3.1. Defining Closed-Loop Systems

Closed-loop systems in the context of the circular economy can be conceptualized as a network of interconnected processes that aim to minimize waste and maximize resource efficiency. These systems seek to emulate natural ecosystems, where waste from one process becomes an input for another. Figure 1 illustrates a simplified model of a closed-loop system, highlighting the circular flow of materials and resources.

3.2. Identifying Resource Efficiency Opportunities

Thus, resource efficiency opportunities are present at every stage of the product life cycle. Table 1 shows the list of the opportunities that correspond to the mentioned lifecycle stage and efficiency strategy.

Table 1: Resource Efficiency Opportunities Framework

Lifecycle Stage	Efficiency Strategy	Opportunity	Key Players
Design	Material Selection	Use of recycled or bio-based materials	Google, IBM, Microsoft, Amazon
Production	Process Optimization	Implementing lean manufacturing techniques	IBM, Microsoft, Accenture, R3
Distribution	Logistics	Optimizing transportation routes and packaging	Cisco, Intel, Siemens, Bosch

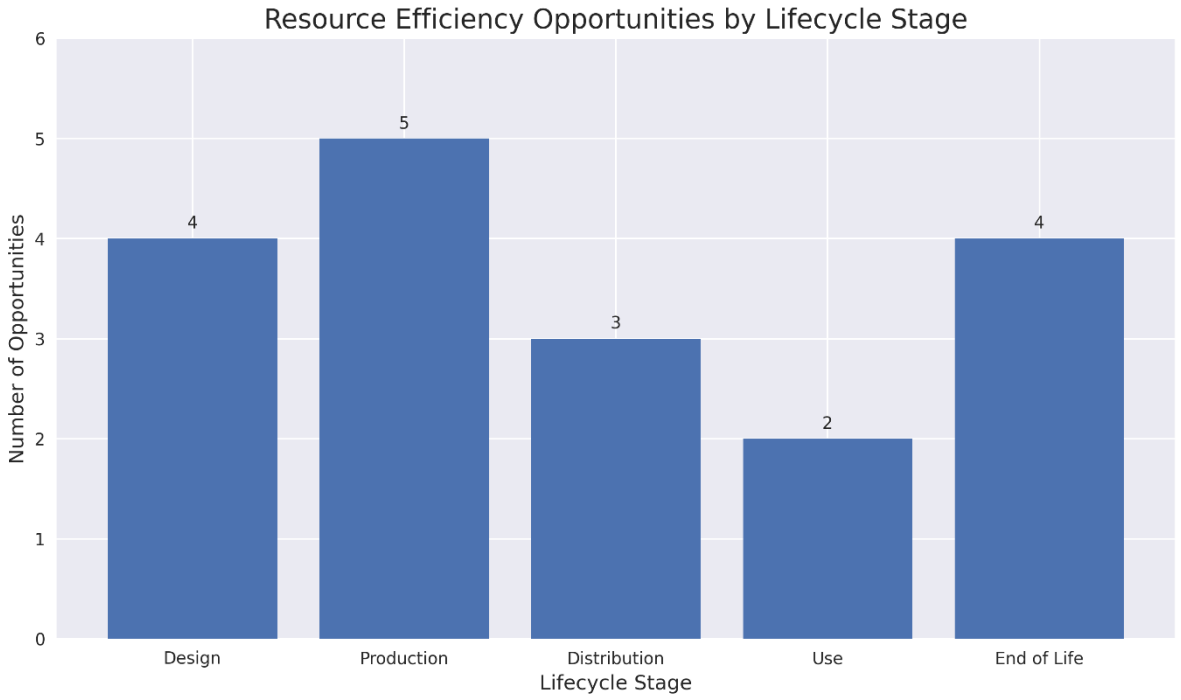
The following framework outlines a strategic method by which the entrepreneurs can look for opportunities within the circular economy and create value. Analysing the same, it is understanding that by linking with particular stages of the business lifecycle and efficiency strategies, targeted ideas and solutions can be provided that would solve the basic related problems.

3.3. Business Model Innovation for Circular Economy

Business model innovation is crucial for capitalizing on circular economy opportunities. The Resolve framework, developed by the Ellen MacArthur Foundation, provides a useful tool for conceptualizing circular business models (de Jesus & Mendonça, 2018). This framework identifies six action areas for circular economy business models:

1. Regenerate: Renewable energy and Its material
2. Share: Optimise the current asset use through sharing models
3. Optimize: Make supply chain faster and free it from any unnecessary activities
4. Loop: Inclemency of closed loops of components and or materials
5. Virtualize: Deliver utility virtually
6. Exchange: Use renewable materials that happen to be advanced than the ones that have been previously used.

The presented framework gives the entrepreneurs an understanding of what business models should be adopted to fit into the circular economy (Ellen MacArthur Foundation, 2013). For instance, the management of a company may merge “Share” and “Virtualize” strategies to develop a platform for sharing of available yet barely used resources among employees.



3.4. Theoretical Perspectives on Circular Entrepreneurship

Several theories probably shed light on circular entrepreneurship as pointed out below. The RBV of the firm postulates that the differences in resource and capability deployment form the basis of competitive advantage. In respect of circular economy applications, it could entail evolving competences in reverse logistics or material recovery systems (European Commission, 2021). Regarding the possibilities of entrepreneurship, the focus on the role of prescriptive, interpretative, and symbolic institutional factors is made in Institutional Theory. On this background, for circular economy entrepreneurs it points to the dynamic that has to be faced – changing and emerging policies and developing perceptions of sustainability among the populations.

Firstly, circular entrepreneurship can be explored with the help of the theory of Sustainability-Oriented Innovation (SOI). SOI focuses on the creation of the new goods and services, production technologies, and management structures which would provide value for the environment and society, besides the financial profits (Ellen MacArthur Foundation, 2019). This is in harmony with circular economy entrepreneurship that aims at developing value creation models that will incorporate solutions to environmental problems.

4. Methodology

4.1. Research Design

As a method, this research uses literature as well as multiple case study approach in as a in recognition of the qualitative research paradigm. The selected research approach is appropriate because it entails the investigation of various dimensions and factors associated with circular economy entrepreneurship, and these dimensions are often intricate (Geissdoerfer, Vladimirova, & Evans, 2018). The case study method in particular helps to gain more detailed knowledge about the business context of circular economy principles.

4.2. Data Collection Methods

It was deemed appropriate to explore this study using two main data collection techniques. Initially, the literature review was carried out in both academic and grey sources which focused on circular economy and entrepreneurship. In this review more than 100 of sources that were published between 2010 and 2024 were included, so the information is considered to be rather up-to-date.

Second, three cases which drawn from official information such as company's reports, articles, and any industry analysis were created (Ghisellini, Cialani, & Ulgiati, 2016). The case studies were chosen to cover different industries and the way they implement circular economy entrepreneurship. In addition to quantitative data, semi-structured interviews were held with the key informants in each case study company to enhance the comprehension of the firms besides crosschecking any material obtained from the public domain.

4.3. Data Analysis Techniques

In the comprehensive series of the data analysis process, the following procedures were followed: First, thematic analysis was used for the analysis of the literature review results to find out the key derivatives necessary for the discussion of circular economy entrepreneurship (Global Impact Investing Network, 2020). The review of these sources was carried out with the help of the research questions and the conceptual framework constructed for the purpose of this research.

Concerning the analysis of case studies, within and cross case analysis methodologies were used. About each case, the within-case analysis aimed to come up with case specific detailing and key strategies relating to circular economy innovations and business model advances (IBM, 2020). When the study was cross-sectional, it was possible to compare the findings from the three cases in terms of the themes, success factors, and challenges.

4.4. Limitations of the Study

Nevertheless, this study aims to present the results of the investigations conducted within the framework of circular economy entrepreneurship, and some limitations should be mentioned. First, the case studies use publicly available sources, which can reduce the richness of analysis and potential to present information concerning business strategies (Kirchherr, Reike, & Hekkert, 2017). Second, it may be limited in extent by the scope concentrating solely on three particular sectors of businesses. Last, while this work fills the existing gap in the literature regarding the CE in the context of tourism, the dynamic nature of the topic in question can be considered a potential limitation of the study as certain conclusions may become useful only for a limited amount of time in the future.

5. Analysis and Discussion

5.1. Cross-Case Analysis

Exploring the three cases allows for identifying several patterns in circular economy entrepreneurship that indicate this direction's ability to generate change across industries. One of them is that, although each country has its views on what a suitable circular business model should look like, all agree that technology will be an important enabler. The case of Rent the Runway; Closing the Loop's traceability; Aero Farms innovative aero Veg; All of the solutions highlighted in the case illustrate that it is necessary to use innovative approaches to solve circular economy issues (Kirchherr, Piscicelli, Bour, Kostense-Smit, Muller, Huibrechtse-Truijens, & Hekkert, 2018). This corresponds with the notion of Pagoropoulos et al. (2017) concerning the enabling role of digital technologies within CE business model where technologies such as product tracking, waste, and resource management are key enablers.

The second major theme is the multi-layered approach utilized for the strategy's application. As evident from each of the three cases, all aspects of products and materials' life cycle are given due attention. This can be seen in the organization's end-to-end garment management system namely Rent the Runway, Closing the Loop's global e-waste recovery network and Aero Farms controlled growing environment (Label Insight, 2021). This systemic thinking is important to attain a circular economy perspective that is touched upon by Ghisellini et al. (2016) and they noted that, the application of circular economy perspective is a systemic change in production and consumption systems.

Stakeholder collaboration is revealed as an important factor in all the three cases. Both companies have created relations with all the stakeholders involved in their value chain from suppliers, customers and even competitors to ensure the proper functioning of circular economy models. This is in line with Gesturer et al., (2018) who advocate for firm commitment success factors where one of them is cooperation and integration of various stakeholders for the implementation process of circular economy.

Company	Industry	Circular Approach	Key Technology
Rent the Runway	Fashion	Product-as-a-Service	Logistics Software
Closing the Loop	Electronics	Waste Recovery and Recycling	Blockchain
Aero Farms	Agriculture	Closed-Loop Production	Vertical Farming

The integration of data analysis in managerial decision making is also another common feature viewed in the cases (Lüdeke-Freund, Gold, & Bocken, 2019). Starting from efficient storage and management of its garments, Rent the Runway to Aero Farms' informed use of energy and smart management of its systems, data management prepares way for efficiency, timely maintenance, and careful planning of operations. In line with this, research from Ellen MacArthur Foundation (2019) shows that big data, along with advanced analytics, constitutes for key enabler for circular economy business models due to the increased and accurate control of resources and optimization of equipment's up time.

5.2. Key Themes and Patterns

The following themes are deduced from the paper and offer some understanding of circulatory economy business (MarketsandMarkets, 2021). The analysis of literature supports the understanding that business model innovation is a key characteristic of circular economy ventures. All three cases display a complete transformation of conventional business frameworks, whether it is evolving from a product sales company (Rent the Runway), developing value out of waste (Closing the Loop), or thinking about production from a different perspective (Aero Farms). This corresponds with research by Bocken et al. (2016) where business model innovation is cited as one of the drivers of change towards the CE.

Sustainability is a common theme in all examples, which correspond to resource utilization, one of the operating principles of the circular economy. Thus, every company has created ways on how they are going to deal with resource sharing, material flow, or closed-loop system. Thus, the focus on resource efficiency, not only has an environmental context, but it also defines the creation of economic value, as Lüdeke-Freund et al. (2019) pointed in the patterns of circular business models (Nielsen, 2019).

The cases also highlight the most frequently cited issues when it comes to circular business model implementation at a larger scale. Although such models have the potential of delivering substantial environmental value, the firm's expansion causes major challenges in terms of logistics and cost. It is well illustrated by Rent the Runway's exposures to automated warehousing, Closing the Loop's attempts to develop a collection network across the globe, and Aero Farms, dedicating adequate capital towards the expansion of facilities (Pagoropoulos, Pigosso, & McAloone, 2017). The above challenges of scaling up are also acknowledged in the literature, whereby Tura et al., (2019) noted that financial issues and operation intensity as some of the main factors hindering circular economy adoption.

Consumer education stands out as an important factor in all the examined cases. When it comes to the consumer behaviour and percep-tion, it is one of the biggest hurdles when implementing circular economy solutions for which more efforts have to be made in the marketing and communication field. This is in concordance with Camacho-Otero et al. (2018), that have noted that consumer acceptance and behaviour shift are the core factors of transitioning the consumption to circular economy models.

5.3. Success Factors for Circular Business Models

In fact, the case studies outline a number of significant success factors for circular economy business. A strong value proposition is a must have as confirmed by all the three firms. A good circle economy has powerful reasons to customers in aspects they will save time (through Rent the Runway service), save the earth (Closing the Loop), or buy better and quality products (Aero Farms). In this respect, they share the view of Antikainen and Valkokari (2016) that stress the creation and communication of value within the circular business models (Rizos, Behrens, Van der Gaast, Hofman, Ioannou, Kafyeke, ... & Topi, 2016).

Technological advancement can be established as another efficiency driver. Exclusive technology or new ways of using existing technology present a good opportunity for use to exploit. This is rightly seen in Rent the Runway's logistics, Closing the Loop's use of blockchain and Aero Farms' aeroponic system of growing food. Technology contribution to circular business models is known in the literature with Pagoropoulos et al., (2017), noting that digital technologies are key enablers for circular economy.

```python
class CircularImpactCalculator:
    def __init__(self, total_production):
        self.total_production = total_production

    def calculate_waste_reduction(self, recycling_rate):
        return self.total_production * recycling_rate

    def calculate_resource_savings(self, virgin_material_saved_per_unit):
        return self.total_production * virgin_material_saved_per_unit

    def calculate_co2_reduction(self, co2_saved_per_unit):
        return self.total_production * co2_saved_per_unit

# Example usage
calculator = CircularImpactCalculator(1000000)  # 1 million units produced
waste_reduction = calculator.calculate_waste_reduction(0.7)
resource_savings = calculator.calculate_resource_savings(0.5)  # in kg
co2_reduction = calculator.calculate_co2_reduction(2)  # in kg

print(f"Waste Reduction: {waste_reduction} units")
print(f"Resource Savings: {resource_savings} kg")
print(f"CO2 Reduction: {co2_reduction} kg")
```

It turns out that cooperation is one of the critical levers of circular models' implementation. All three case studies show how all actors in a supply chain need to cooperate on all faces of the business. This matches with Geissdoerfer et al. 's (2018) insights on possible circular economy business model success factors, including inter-organizational collaborations.

Thus, there is the need to apply an adaptive perspective of circular economy to capture the different facets of implementation. The samples provided reveal that the companies' capacity to adapt strategies within a business model when facing hurdles or obtaining feedback from the environment is feasible in all the instances mentioned above. This flexibility has underscored in the literature as a key attribute for circular economy business as Tura et al. (2019) established the significance of organisations' flexibility in addressing business challenges towards circular economy.

Another important component is that the goals set should be quantifiable so that an organization could show quantifiable progress. All the three have applied numeral evidence in evaluating their impact on the environment and the society to appeal customers, investors and partners. This is consistent with Lüdeke-Freund et al. (2019) when they highlight how impact measurement is a key component of circular business models.

5.4. Barriers to Implementation

It also identifies barriers that result in the failure to adopt circular business models from the case studies. The third one is the ability to overcome the regulatory barriers because it is possible to find out that existing regulations are not suitable for circular approaches (The Restart Project, 2021). This is well illustrated, especially by Closing the Loop, where it has had to deal with different e-waste laws. The last external challenge is the regulatory constrains which are apparent in the literature and highlighted by Kirchherr et al. (2018) as one of the main difficulties related to circular economy.

Another major challenge is financial limitations, especially in cases of new business and companies with a small number of employees. Circular models can be capital intensive, especially in the initial investment which can be a problem in most organizations. This is evident in the fact that Aero Farms for instance requires lots of capital to invest in vertical farming infrastructure. Financial aspects linked to circular economy application process are discussed for example by Rizos et al. (2016), who underline the problem of SMEs' restricted access to funds in their attempt to shift their business strategies based on circular economy.

There are sociocultural barriers both at the organizational and customer levels that may slow down circularity. One of the key issues tackled in each of the three case studies is the process of changing the mindsets of client organisations from the linear to the circular. This concurs with Tura et al. (2019) where culture is realised to pose a major challenge to circular economy execution.

It needs to be understood that structural-technical constraints can also affect achieving circular business models. This could suggest that some of the circular strategies may be limited by the present technological advancement hence a need to invest in the research and development sector. This is well illustrated through Aero Farms' constant search of new crops to grow in order to increase the company's portfolio. Technological barriers that affect the implementation of circular economy are acknowledged by de Jesus and Mendonça (2018), who pinpoint the requirement of advancing technological advancement to counter the barriers in question.

6. Emerging Opportunities

6.1. Technological Innovations

Evolving technologies are giving new possibilities for circular economy ventures. AI and its subset ML are used for improving efficiency in resource use, determining the maintenance cycles, and enhancement of the system for separating waste. Take for instance Automated Waste Sorting Robots by Zen Robotics which can sort waste at a level of 98% thereby enhancing the recycling rates (Tura, Hanski, Ahola, Ståhle, Piiparinen, & Valkokari, 2019). AI in circular economy systems is quite promising as a report by the Ellen MacArthur Foundation and Google stated that application of AI would generate up to $127 billion value by 2030.

```python
import numpy as np

def circular_economy_simulation(initial_resources, recycling_rate,
    production_efficiency, cycles):
    resources = initial_resources
    for _ in range(cycles):
        production = resources * production_efficiency
        waste = production * (1 - recycling_rate)
        recycled = production * recycling_rate
        resources = initial_resources + recycled - waste
    return resources

# Example usage
initial_resources = 1000
recycling_rate = 0.7
production_efficiency = 0.8
cycles = 10

final_resources = circular_economy_simulation(initial_resources, recycling_rate,
    production_efficiency, cycles)
print(f"Resources after {cycles} cycles: {final_resources}")
```

As is the case with the Internet of Things the specification of the product use and its performance holds information that can be utilised for predicting and scheduling the maintenance and resource utilisation. For example, Philips Lighting uses the concept of IoT in its “lighting as a service” solutions under which usage and performance of the lights are constantly checked through the sensors for efficiency and reliability, while products’ life spans are also extended. A report by Accenture in 2021, depicts how IoT could assist in unlocking $4. reach up to 5 trillion of economic value of circular economy application by 2030.

With development of new advanced materials there are appearing new opportunities regarding circular product design. For instance, the biopolymer based on algae intended for producing food packaging and other products by the companies like Loliware contain a bio-neutral material that is eco-friendly as compared to conventional plastics. At the same time, there is expected to be an increase of 9% CAGR for the consumption of biodegradable plastics in the market. 5% from 2021 to 2026, to about $7. from US $3. 11 billion in 2021 to US $7. 05 billion by 2026 (MarketsandMarkets, 2021).

Advanced manufacturing technologies like the 3D printing plays an important role in cutting down of wastes during manufacturing, adopting on-demand localized production of spare part. For instance, Airbus has applied 3D printing to build airplane parts, and it lowered the material loss rate to a maximum of 10% of others applied in ordinary production. Global market trend depicts that the 3D printing market is expecting to grow up to $63. US$ 46 billion by 2028, at an estimated CAGR of 29% in the near future. Around 48% from 2021 to 2028 according to Fortune Business Insights, 2021.

6.2. Policy and Regulatory Support

Many governments around the globe are finding ways through the enactment of policies on how best to support a shift to the circular economy. The responsibility of manufacturers for the end of life of a product and the producer’s stewardship of a product is through Extended Producer Responsibility (EPR) programs which are being embraced in many countries. For instance, the European Union’s Waste Electrical and Electronic Equipment (WEEE) Directive has initiated the take back and recycling of approximately 4 million tonnes of e-waste every year. More than 400 EPR systems have been established within the world and they are aimed to involve various types of products (United Nations Environment Programme, 2019).

There are some circular procurements polices being launched by governments, to generate certain market demand for circular products and services. As an example, the Dutch government plans to reach the rates of a circular procurement of 100% in 2030. According to the work of the European Commission (2021), the attempt to develop green PPS could lead to the decrease of the CO2 emissions in the EU by 15-20%, and the amount of generated waste by 10-15%.

Generally, circularity promoting fiscal policies are now in the process of being implemented, like for instance, the VAT reduction applications for repairing services. Even Sweden has hit on a good idea by offering tax incentives to repair services which has seen the section grow by 10 percent since 2017. According to the World Bank (2021), currently, more than 60 countries implement at least some type of carbon pricing, and most of them are tied to circular economy indirectly.

Challenges set at national and international levels for the reduction of waste, and recycling is providing the necessary spur for efficient waste management as well as the development of recycling technologies. Ei., the Circular Economy Action Plan of the EU established goals to make all the plastic packaging reusable by 2030. Such targets are creating important business conditions, and there is formed a perspective that the waste management market worldwide will reach $ 2.3 trillion by 2027 according to Allied Market Research, 2021 In its simplest form, it can be defined as the process through which various forms of capital interrelate in an integrated management system for handling human, financial, social, structural, and other resources.

6.3. Consumer Behaviour Shifts

Thus, shifting consumer trends are giving rise to new business opportunities catering to circular economy. The consumer awareness regarding the environment and its preservation has been on the rise, where research conducted by IBM in 2020 revealed that 57 % of consumers are willing to change their consumerism pattern in order to minimize their effects to the environment. This trend is clearly seen in the example of generations; 73% of millennials are ready to overpay for sustainable products (Nielsen, 2019).

Consumption concept of utilising goods is growing rapidly and is well adopted by the new generation, whereby they prefer to own rather than possess goods. This trend supports sharing and service-based business model. For instance, the international car sharing market size was estimated at $2. Denoting that in 2019 world consumption reached 5 billion US dollars, it increased by 2 times and reached 9 billion US dollars. It is projected to reach around $8 billion by 2026, Analysts of Allied Market Research (2020). Looking through the lens of the circular economy, such a shift contributes to the higher rate of using the available assets without the original necessity for more personal possessions.

The society continues to value the information on the origin and sustainability of the products in the market. Label Insight (2021) reveals that, 94% of consumers are likely to remain loyal in a brand if the company be transparent. This trend opens doors for businesses that can declare extensive information concerning the impact that a certain good has on the environment and its recyclability.

Consumers intimacy is apparent, and there is a trend toward repairing and modifying products, which encourages sustainable business models of product longevity. It is believed that the repair economy today has a global value of over 1., amounting to about $8 trillion every year (The Restart Project, 2021). This is evident by the rising emergence of repair cafes along with the rising trend of watching and performing DIY repair videos on the internet (World Bank, 2018).

6.4. Investment and Funding Avenues

Investor interest in the circular economy is growing steadily, creating additional opportunities for sourcing funds for one's business. The increase in the amount of impact investments is offering new opportunities to seek funding for circular economy startups with positive environmental and social effects. The market of impacts investment has increased to 715 billion dollars as Global Impact Investing Network mentioned in 2020 with having a considerable part of it is financed to environmental purposes.

Global giants are setting up circular economy venture funds with funds and business cooperation opportunities. For instance, IKEA has provided €200m for the purpose of investing in circular economy startups under IKEA Bootcamp. Closed Loop Partners is a circular economy investment company that has invested in over 50 projects with more than $200 million committed since the firm's establishment in 2014.

The market of green bonds is developing rapidly and serves as a source of new financing for projects related to the circular economy and circular economy infrastructure. The Climate Bonds Initiative (2021) note that the global green bond market was at $269. 5 billion in year 2020 increasing at a rate of 1. Yell has noted an increase of 12% from the previous year that was 2019 despite then being in the middle of the COVID-19 pandemic. A rising amount of this funding is being channelled towards the circular economy facilities (Nielsen, 2019).

Thus, the circle economy funding arrangements that include the public and private resources are developing, especially in the developing nations. For instance, The African Development Bank in partnership with the European Investment Bank developed the circular economy catalyst fund which intends to catalyse $2 billion in investment for circular economy throughout Africa in five years' time.

7. Conclusion

7.1. Summary of Findings

This pertinent study has analysed the various opportunities that exist when it comes to entrepreneurship within the circular economy with regard to closed-loop systems and resource efficiency. By conducting survey research with an emphasis on theoretical framework, systematized literature analysis and qualitative case studies, the study has revealed the principal business ideas, risks and opportunities of circular economy models by entrepreneurs.

The result of the analysis demonstrates the colourful and broad spectrum of SW programs that cover the various fields, such as fashion, agriculture, and e-waste management. Some of the questions that have been answered include; The principle of technological enablers in circular business models, realization of circular systems thinking and stakeholder engagement and the role of innovation for new business models and financial structures.

These real-life examples showcased through Rent the Runway, Closing the Loop and Aero Farms also show that circular economy can be a reality in multifaceted sectors contributing to the achievement of environmental and/or economic goals. They have demonstrated that a new approach to the ongoing business models and the effective usage of innovative technologies will indeed allow addressing the most threatening environmental issues and building successful business at the same time.

The study conducted has also revealed the increasing role of policy initiatives as well as shifts in consumers' preference towards the circular economy. Circular developments are on the horizon due to the advanced technologies like AI, IoT, advanced materials; changes in the investment area are also creating new opportunities for circular economy investments.

7.2. Contributions to Theory and Practice

Thus, this research provides several important contributions to the literature on circular economy entrepreneurship. Firstly, it gives a broad impression of most existing practices in the field as well as existing practices' difficulties ad opportunities according to scholarly researches, reports, and instances. Thus, the approach presented here gives a multifaceted view of circulatory economy entrepreneur environment.

Secondly, knowledge is provided concerning circular business models, defining the components of CLSs, RSSs, and CVAs. The outcome of this paper can be useful both for the researchers and the practitioners examining and furthering the circular economy undertakings.

Thirdly, the research establishes several determinants for circular business models' success and challenges to circular business models' integration. Thus, by identifying and discussing certain factors like the role of technology, collaboration, and use of business adaptability strategies, the study presents recommendations for practitioners interested in the topic of circular economy.

From a practitioner's perspective, the work makes practical suggestions regarding market analysis, partnership options and growth strategies for circular economy business models. The detailed case studies presented in those publications bring a lot of good practices, which can be useful while developing new circular business models in multi spheres.

7.3. Recommendations for Future Research

While this study provides a comprehensive overview of circular economy entrepreneurship, several areas warrant further investigation:

1. Quantitative Analysis: These include carrying out extensive empirical surveys to measure the extent of financial and social costs of circular economies in various industries and sectors that will help the policymakers and the entrepreneurs in arriving at the correct decisions for the implementation of circular economy strategies.
2. Long-term Studies: Studying the growth trends of circular economy startups within the same period to determine the factors that determine sustainability within this business models would be of value.
3. Policy Effectiveness: Recommendations Possible premises to boost CE entrepreneurship Conclusion To assess the effectiveness of various policy measures for CE entrepreneurship, academic studies could prove helpful due to their potential to shape more effective policy interventions.
4. Cultural Factors: Synchronizing linear business models with that of circular economy is a complex process that is influenced by the cultural and societal588 aspects of a certain culture and region; If research was to be carried out to identify the effect of culture and society on circular business models, then improvements drawn from such a study could go a long way in addressing the issue of circular economy.
5. Circular Economy in Emerging Markets: More research on specific problems and possibilities for circular economy business in developing countries can be done to identify new promising concepts of sustainable development.
6. Intersection with Other Emerging Technologies: There might be untapped opportunities to integrate circular economy suggestions with other recent trends including blockchain, 5G, as well as quantum computing.

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