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An Exploratory Study on Circular Economy in Pakistan Textile Sector: Antecedents, Barriers and Implementation

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The textile sector is the backbone of Pakistan's economy and significantly contributes to GDP and employment rates. Circular economy practices need to be implemented in this sector to increase output. In this regard, this study is conducted to identify the drivers that can implement circular economy practices in this sector and the barriers that prevent the implementation of circular economy practices in the Pakistani textile industry. Population growth will double the demand for primary raw materials in the next forty years. Recycling and other measures were implemented several years ago to alleviate the climate emergency. The linear economy must be replaced with a circular economy. The qualitative research design is employed to gather information through interviews using grounded analysis. This study explores different drivers who can bring circular economy practices to the textile sector and identifies barriers. The study will have implications for policymakers, Government officials, and economists.

1. Introduction

In the next forty years, the demand for primary raw materials will double due to population growth (EC, 2018). A direct relationship exists between the population increase and energy consumption, so the energy demand will also increase in future (Khan et al., 2021). Rising sea levels, more carbon dioxide emissions, and more plastic trash in the ocean are all problems, and there is a need to deal with all these problems (Kibria et al., 2023). Because of these problems, people who will have to move because of climate change are now called "climate refugees." (Ahmed, 2018).

Several years ago, recycling and other measures were implemented to alleviate the climate emergency (Gills & Morgan, 2022). In 2000, the recycling rate for municipal waste in the European Union stood at 27.3%, but in 2019, it increased to 47.7% (EC, 2021), which shows that the European countries are very serious about recycling. However, these steps still need to be improved, as most waste is non-recyclable (Tsekeris & Anastassakis). Furthermore, the ecological footprint has been expanding yearly due to the exponential rise in consumption (Rehman et al., 2021). Therefore, adopting a sustainable lifestyle and replacing the linear economy with a circular economy is needed (Rashid & Malik, 2023).

The notion of the CE emerged due to the climate emergency, which has led to an increasing global awareness of environmental issues (Spratt, 2022). In light of the discussed circumstances, the United Nations formulated 17 Sustainable Development Goals in 2015 to achieve them by 2030. While each approach may emphasize different features, they all have a shared objective: establishing the Circular Economy (CE) as a viable and sustainable alternative to the traditional linear production and resource management model. This linear paradigm has negatively impacted the economy, environment, and society.

The series of initiatives was suggested in response to the possibilities arising from the shift towards a sustainable Circular Economy (CE). Collaboration on climatic objectives, preserving environmental resources, generating substantial wealth, and attaining a competitive edge would be attainable by Circular Economy practices (Velenturf & Purnell, 2021). However, even if material recovery were to be adopted as a global goal, several institutional and financial obstacles would need to be overcome (Sharma et al., 2021). Businesses must align their business models with the concepts of a functional Circular Economy (CE) (Centobelli et al., 2020).

The textile sector is the backbone of Pakistan’s economy, contributing significantly to its GDP and employment rates (Ali et al., 2020). Using circular economy techniques to enhance textile sector performance is necessary (Saha et al., 2022). The transition of the textile industry towards circularity is not merely a temporary trend but a necessity prompted by environmental concerns, finite resources, and evolving customer expectations (Reike et al., 2023). Therefore, it is crucial to comprehend the factors driving this transformation. Many factors, including governmental policies, business initiatives, and customer demand, influence the implementation of circular economy techniques in Pakistan's textile industry.

Nevertheless, there are notable obstacles to the pursuit of sustainability. The paper thoroughly analyses the obstacles that impede the smooth incorporation of circular economy ideas. The barriers encompass a wide range of obstacles, including limitations in infrastructure and technology, resistance to change within institutions, and the need to make economic trade-offs. By clearly identifying and defining these challenges, individuals or groups with a vested interest can develop specific plans to overcome them and provide a path towards a more environmentally friendly and lasting future. This study also gives a clear picture to readers of which drivers can bring circular economy practices in the textile sector of Pakistan, as by implementing these drivers, the textile sector can be boosted very quickly, which is also better for the economy.

Furthermore, the article offers valuable perspectives on how circular economy ideas can be effectively applied in Pakistan's textile industry. This study provides practical suggestions for industry participants, policymakers, and other interested parties eager to adopt circularity in the textile sector. The aim is to stimulate discussion, encourage cooperation, and motivate coordinated actions towards a more sustainable and resilient textile sector. This will be achieved by examining the causes, obstacles, and strategies for implementing circular economy ideas.

2. Literature Review

2.1 Textile Sector of Pakistan

The Pakistani fabric industry started with three factories and seventeen thousand brooches (Khan, 2011). However, the number of factories has now increased to six thousand, and the combined revenue of these factories ranges from seventeen thousand to eight hundred five million USD (Bari, 2003). The production of various fibers, including cotton, rayon, synthetic fibers, filament yarn, art silk, wool, and jute, contributes to Pakistan's diverse textile industry (Ahmad & Akhtar, 2017). Cotton spinning, with 521 operational units, stands out as the most crucial segment in the textile sector (Ahmed, 2008).

Nylon, polyester, acrylic, and polyolefin dominate the production of synthetic fibers. Pakistan has five significant producers with a combined annual capacity of 636,000 tons. Six manufacturing facilities in the country create several types of filament yarn, including acetate rayon yarn, polyester filament yarn, and nylon. Pakistan produces artificial silk, a cost-effective alternative to natural silk, using approximately 90,000 looms (TAHIR). Most of these looms are located in Jalalpur Jattan, Karachi, Faisalabad, Gujranwala, and Faisalabad, with a few being found in FATA.

Pakistan is the fourth-largest global raw cotton exporter (Malik & Ahsan, 2016). The history illustrates the escalating and swift surge in the popularity of Pakistani clothing since its establishment (Trenin & Malashenko, 2010). Pakistan is positioned as the eighth most significant exporter and the fourth most significant manufacturer of fabrics and garments, in alignment with global demand (Frederick et al., 2019). It accounts for a substantial portion of the country's total production, and precisely forty percent of the workforce is employed in the glamour industry (Government of Pakistan [GOP], 2019). Cotton had a significant impact during the production

period of 201b8-2019. This is supported by its 8% contribution to the gross domestic product and the export revenues of cotton and related products, which amounted to 11.11 billion dollars (State Bank of Pakistan, 2019). It is essential to mention that Pakistan has a very favourable geographical position in terms of agricultural products and international trade as it has China and India (which have a considerable population in the world) in the neighbouring countries, and likewise, the flow of the Arabian Ocean on our southern border.

2.2 Literature on the Circular Economy

The Circular Economy is a conceptual framework for the sustainable and restorative use of resources, underpinned by a transition to renewable energy sources, which can only be decoupled from economic growth (CGE, 2012; EMF, 2012). This approach enjoys growing support from various studies and organizations, e.g. (Blomsma & Brennan, 2017; Homrich et al., 2018; Potting et al., 2017). Numerous countries around the globe embrace Circular Economy practices. Macro-scale CE is monitored using Material Flow Analysis (MFA), energy analysis and input-output analysis (Kalmykova et al., 2018). China was already the first nation to establish specific legislation about the circular economy in 2008 (Arpin, 2015). There are also various academic contributions to the circular economy, such as those of China, which are mentioned in the literature, e.g., Ghisellini et al. (2016) and Homrich et al. (2018).

Geng et al. (2013) Contend that Germany and Japan were the first to develop specific policies to stimulate the adoption of the Circular Economy. The European Union (EU) has presented scheduled legislation to implement Circular Economy (CE) across the EU and its Member States by the end of 2015. Infringements and problems like the Circular Economy (CE) concept have already been present in EU initiatives, e.g. the 1970s waste-related regulations and resource efficiency. The European Commission (EC) has recently introduced a framework for monitoring CEs (Bengtsson & Rhinard, 2020). There still needs to be an internationally accepted definition of the CE. The relationship between corporate entrepreneurship and sustainability is still an open question (Ashfaq et al., 2022; Kirchherr et al., 2017).

A development towards a more environmentally sustainable and durable future is underway (Geissdoerfer et al., 2018). The adoption of the circular economy (CE) concept has been underpinned by more and more endorsements and publications as an emergent framework of development and economics (Kirchherr et al., 2017), setting off a debate over whether further scrutiny is beneficial to assess its appropriateness speeding up the process of sustainable development (Hobson & Lynch, 2016; Lazarevic & Valve, 2017; Pomponi & Moncaster, 2017).

2.3 Literature on Circular Economy and Textile Sector

The textile industry has become unsustainable due to the fast fashion business model that emerged four decades ago and the practice of outsourcing textile production to developing nations (Niinimäki). Specifically, it is now apparent that the waste issue in the sector is projected to worsen. Despite the European Union (EU) having a well-developed system for collecting used textiles, less than half of these products are being reused or recycled. Less than one percent of

textiles are transformed into "new" ones. Clothes sourced from the European Union, Australia, and the United States are being sent to nations like Ghana. Out of the 13-15 million clothes received each week, around 40% are promptly rejected due to their substandard quality (ABC, 2021; BBC, 2021). Moreover, it is essential to mention that the COVID-19 epidemic has caused a temporary pause in the global trade (Ashfaq et al., 2024; Contreras & Abid, 2022) and second-hand textiles (Caprotti & Capitanio, 2021). This episode has demonstrated the vulnerability and delicacy of the entire industry, as seen by the increasing sustainability difficulties it faces, which make it very susceptible to disruption.

The worldwide textile industry is acknowledged for its urgent requirement for a disruptive change brought about by the shift towards a circular economy, henceforth referred to as the "circular transition" (Guarnieri & Sarafinovska, 2021; Neuman, 2021; Reike et al., 2023). By adopting this approach, the industry can efficiently tackle its complex sustainability issues. To create a circular textile business, it is crucial to repeatedly cycle materials (Lewandowski, 2016) and ensure that the origin of material inputs can be traced throughout their entire lifespan (Jurgilevich et al., 2016). This will facilitate a fundamental change in design, production, and consumption patterns, resulting in significantly diminished negative environmental and social impacts.

3. Methodology

This study relates to exploratory study, which helps to understand and seeks new perspectives into what is going on and how much the findings seem to be valuable and also sheds new light on assessing requirements and challenges for achieving the research objective by conducting questioning (Schell, 1992). The researcher conducted a qualitative study investigating the exploratory study on Circular Economy in Pakistan Textile Sector: Antecedents, Barriers and Implementation. In-depth investigations can be carried out quickly and effectively with open-ended investigative methods, including interviews. The data is gathered via a semi-structured interview with experienced workers who were giving their services in the Textile industry.

The qualitative research approach aims to provide an in-depth, socio-contextual, and thorough explanation and analysis of the research topic. Qualitative research provides an in-depth and narrow perspective of relevant studies to become more focused on an area of study. The qualitative study looked into the drivers that can implement the circular economy in the textile sector of Pakistan, the barriers that stopped the circular economy.

3.1 Sample Description and Participants Introduction

Researchers conducted 17 in-depth semi-structured interviews with top management of the textile sector in Lahore who have significant experience between 6 and 25 years in this field and are familiar with the concept of circular economy. Age, experience, gender, Education, and job rules were all well-represented in the sample.

Table No 1: Participants Details

Sr. No.	Names	Age	Experience	Gender	Education	Job Rule
1	Respondent 1	55	23	Male	Master	Manager
2	Respondent 2	54	21	Male	PHD	Manager
3	Respondent 3	52	20	Male	Master	Manager
4	Respondent 4	50	24	Female	Master	Manager
5	Respondent 5	48	20	Male	PHD	Manager
6	Respondent 6	47	18	Male	Master	Manager
7	Respondent 7	53	22	Male	PHD	Manager
8	Respondent 8	51	20	Female	Master	Manager
9	Respondent 9	45	17	Male	Master	Operation Manager
10	Respondent 10	46	18	Male	PHD	Operation Manager
11	Respondent 11	47	16	Male	Graduation	Operation Manager
12	Respondent 12	48	17	Male	Master	Operation Manager
13	Respondent 13	39	14	Male	Master	Operation Manager
14	Respondent 14	33	10	Female	Graduation	Operation Manager
15	Respondent 15	35	12	Female	Master	Operation Manager
16	Respondent 16	39	13	Male	Master	Operation Manager
17	Respondent 17	38	12	Male	Graduation	Operation Manager

3.2 Procedure

Experienced person's perspectives on their interactions with the Study on Circular Economy in Pakistan Textile Sector: Antecedents, Barriers, and Implementation were gathered through semi-structured interviews. All interviews were transcribed and typed up in Microsoft Word, and factors were identified using manual coding via selective coding based on the respondents' arguments. The average duration of each interview was almost fifteen minutes.

4. Results and Analysis

4.1 Drivers

The demand for greener products is soaring, and stakeholders are embracing circular economy principles (Salvioni & Almici, 2020). Other equally powerful motivators are the potential for cost savings, resource efficiency, and new business opportunities. Adopting circular economy principles in the textile sector is not just about environmentalism. It outlines a business course that best positions these businesses for success in the evolving economic landscape (Laszlo, 2008). The past, present, and future of the textile sector's journey toward a circular economy can be done by implementing drivers that can help the textile industry adopt a circular economy. The respondent gives their response regarding the drivers that can bring circular economy practices in the textile sector. Many factors are driving the development of circular activity in the textile sector, including the following:

4.2 Resource Scarcity and Raw Material Pressures

The respondent asked if raw materials and resources will be scarce as the textile industry depends on finite resources such as water, energy, and raw materials. As concerns about resource scarcity grow and competition for these inputs increases, adopting circular practices becomes a strategic imperative for long-term viability.

4.3 Environmental Sustainability

Pakistan has too much environmental pollution as the textile industry carries a significant environmental footprint, contributing to water pollution, greenhouse gas emissions, and waste generation. Circular economy principles, such as recycling, upcycling, and reducing waste, align with global sustainability goals and regulations, making them necessary for environmental stewardship.

4.4 Consumer Awareness and Demand

Awareness and demand are essential weapons for the implementation of the Circular Economy. Rising consumer awareness and demand for sustainable and ethically produced textiles have also driven companies to adopt circular practices. With consumers increasingly demanding products that are good for both the environment and the workers who make them, the textile industry has no choice but to integrate circularity into its operations.

4.5 Regulatory Compliance and Standards

In the future, legislation will force our hand. Companies in developed and developing nations alike will have to become more conscious about the materials they use. Strict regulations and standards related to environmental impact, waste management, and resource conservation should be enacted by governments and international bodies -- seriously, they must. As textile companies try to stay out of trouble and save some money, they will follow suit and take on circular economy practices.

4.6 Cost Savings and Efficiency

Every business person wants to reduce costs and maximize the profit from their products. Cost savings often result from practices that enable the circular economy through greater resource efficiency and waste reduction. Closed-loop production systems, recycling, and remanufacturing technologies have the potential to optimize the use of resources, reduce production costs, and enhance overall operational efficiency.

4.7 Technology Advancements

Nowadays, technology has become the backbone for the success of any organization. Technology plays a pivotal role in enabling circular practices within the textile sector. Advances in recycling technologies, sustainable materials, and digitalization are making implementing circular economy strategies more accessible and economically viable.

4.8 Brand Reputation and Corporate Social Responsibility

Corporate Social Responsibility has a significant positive impact on societies. The commitment to circularity enhances a company's brand and supports its CSR initiatives. Brands and their moral pressure on individuals have become increasingly important to consumers, making circular economy practices essential for a company's brand and corporate reputation.

4.9 Supply Chain Resilience

With a circular economy approach, the supply chain becomes more resilient since this ensures reduced dependency on external inputs, minimizes supply chain risks, and promotes local sourcing — a benefit felt more acutely than ever given today's disruptions and growing uncertainties around the globe.

4.10 Circular Business Models

There is a need to enforce Circular Business models in every business. New revenue streams and economic incentives for companies arise from the emergence of circular business models (e.g., product-as-a-service and leasing) within the textile sector. These business models, which shift from a traditional ownership model to a service-oriented mindset, incentivize product durability, reparability and recyclability.

4.11 Barriers

Implementing a circular economy in Pakistan's textile sector is a complex and considerable challenge. The shift towards sustainability and circular business models faces multiple barriers. The industry stakeholders often need to be made aware of what circular economy is and what it entails. This leads to resistance to change. The lack of recycling and waste management infrastructure, transparent regulations, and incentives for promoting circular practices hinder the transition process (Chioatto & Sospiro, 2023; Salmenperä et al., 2021). A collaborative approach is needed to raise awareness, establish standard policies, shape the market, develop infrastructure, and nurture an alternative ecosystem to promote CE in Pakistan's textile sector. According to the respondents, several barriers impede the widespread implementation of circular practices in Pakistan's Textile sector, which are as follows:

4.12 Lack of Circularity Expertise

There is a need for experts to run anything correctly. With experts, it is easier to get possible results. Designing products for circularity requires particular expertise, and many textile companies may need the skills or knowledge to integrate these principles into product design. Creating products that are easy to disassemble, reuse, or recycle is an essential piece of the circularity puzzle.

4.13 High Initial Investment Costs

Financial resources are needed to implement strategies in any organization. Transitioning to circularity commonly involves significant upfront costs for new technology, machinery, and

infrastructure. Smaller textile companies may need a more straightforward, immediate financial return to make this outlay.

4.14 Supply Chain Fragmentation

The textile industry often involves complex and fragmented supply chains that span multiple stakeholders across different geographical locations. Coordinating across such chains for circularity can be difficult, mainly if there is a need for more alignment and collaboration across a diverse supplier or partner base.

4.15 Limited Collection and Recycling Infrastructure

The infrastructure in our organization could be better. Inadequate infrastructure for collecting and recycling textile waste is a significant barrier. Limited recycling facilities, especially for specific types of textiles, make it difficult to close the loop and reintegrate recycled materials into new products.

4.16 Challenges in Textile Recycling Technologies

There is a drawback to innovative technology in our country. Some textile materials are challenging to recycle due to their composition, blending of fibres, or the presence of coatings and finishes. Developing effective and scalable recycling technologies for diverse textile types remains a significant hurdle.

4.17 Consumer Behavior and Awareness

People need to be made aware of the circular economy concept in Pakistan, and consumer behaviour could be improved. Consumer habits and lack of awareness pose challenges to circularity. Fast fashion and a throwaway culture contribute to the high turnover of textiles, making it difficult to establish and promote circular consumption patterns.

4.18 Regulatory and Policy Gaps

In Pakistan, the organization needed to follow the rules and regulations properly. Consistent regulations and policies related to circular economy practices in the textile sector can help progress. Clear guidelines and incentives are often necessary to encourage companies to adopt circular practices.

4.19 Limited Market Demand for Recycled Products

Most people in Pakistan need to be made aware of recycled products and think they have no durability and value. Companies may be discouraged from investing in circular practices when there is no marketplace for recycled textiles. Businesses may see no reason to invest in circular initiatives when consumers are not proactively seeking sustainable and recycled products or are unwilling to pay a premium.

5. Conclusion

This qualitative study provides rich insights into the complex landscape of circular economy adoption within the Pakistan textile sector through the lens of antecedents and barriers. Transitioning to a circular economy in textiles is a win-win-win scenario: It represents an opportunity to bolster the industry's approach to environmental sustainability while leading to significant economic gains in a developing country — gains in job creation and increased customer value creation through product innovation, and finally, it will lead to increased economic resilience to natural and market challenges. Different Drivers for implementing a Circular Economy in the Textile Sector are identified in this study.

Barriers, which are significant hurdles for implementing a circular economy in this sector, are also highlighted. As the Pakistan textile sector embarks on this transformational journey, only a focused, well-coordinated policy drive among stakeholders within the ecosystem makes this shift—unlocking its full potential and ensuring the sustainability and resilience of the textile sector and national economy. The study concluded that by adopting circular economy practices in Pakistan's textile sector, the textile sector and the economy were boosted by different advantages.

5.1 Contribution of Research

"An Exploratory Study on Circular Economy in Pakistan Textile Sector: Antecedents, Barriers, and Implementation" would help us understand sustainable practices in a vital industry for Pakistan. The analysis can guide targeted policy interventions and strategic initiatives to help the sector transition to sustainability by identifying circular economy antecedents. Determining the unique hurdles to this transformation allows the research to provide concrete solutions. The study can also highlight successful case studies and best practices from comparable situations to help stakeholders execute effectively. This research can lead to better decision-making and promote resource-efficient sustainable practices.

5.2 Limitations of the Study

The sample used in this study comprises the city of Lahore and Lahore's textile sector.

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