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Drivers for and barriers to circular economy transition in the textile industry: A developing economy perspective

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Abstract

Increasingly, pressing sustainability issues including the rise in greenhouse gas (GHG) emission rates, climate change-related vulnerabilities, and natural resource depletion have propelled companies to transition from a linear economy to a circular economy (CE). While circular business models are gaining currency in the manufacturing sector, empirical research on CE transition in the continuous process industry in developing economies is scarce. Accordingly, the purpose of this study is to investigate the drivers and barriers of CE adoption in the textile industry of Pakistan. To this end, we utilized a qualitative methodology, and a total of 22 semi-structured interviews were conducted with consultants and senior corporate managers working in the textile sector. Building on the natural resource-based view (NRBV) and institutional theory, the findings revealed various internal drivers (resource efficiency-related, organization-related, and research and innovation-related factors) and external drivers (market, regulatory, and societal factors) for CE transition. Additionally, the findings demonstrated internal barriers including behavioral, technical, and economic issues, and external issues such as customer and brand-related barriers, regulatory and policy-related barriers, as well as supply chain-related barriers hindering the adoption of CE. We argue that it is one of the early studies to utilize the NRBV and institutional theory to examine the drivers and barriers and provide novel insights into the CE transition in the textile process industry in a developing economy. The findings can assist academics, consultants, practitioners, and policymakers to understand and promote CE as a sustainable strategy in the textile process industry.

KEYWORDS
barriers, circular economy, drivers, process industry, sustainable production, textile

1 | INTRODUCTION

The circular economy (CE) is increasingly being incorporated in the manufacturing sector to address pressing environmental issues through closed-loop production systems that foster reusing and recycling products, reducing raw material and natural resource consumption, minimizing waste, creating value, and achieving environmental stewardship (Awan et al., 2022; Goyal et al., 2018; Ul-Durar et al., 2023). In particular, the textile industry is widely criticized for environmental problems such as excessive waste generation, intensive use of hazardous chemicals, water, and energy, the release of air pollutants, greenhouse gas (GHG) emissions, and inadequate disposal of used textile products into the municipal solid waste (Sardar et al., 2022). The industry produces both operational and environmental waste during the life cycle of various products including fiber, yarn, and fabric production, dyeing and finishing processes, and distribution and transportation operations (Niinimäki et al., 2020; Patti et al., 2020; Schmutz & Som, 2022). According to the Ellen MacArthur Foundation (2017), the GHG emissions from the textile and apparel industry exceed the combined emissions from maritime transport and international aviation. Further, it is expected that this industry will account for a quarter of the world's carbon emissions by 2050 if air pollution and GHG emissions continue along this path (Ellen MacArthur Foundation, 2017; Jia et al., 2020). The manufacturing processes of textile products such as garments, footwear, and technical and household textiles consume massive amounts of water and primary raw materials. According to an estimate, this industry consumes 93 billion cubic meters of water annually, discharges 20% of the global industrial wastewater, and 200,000 tons of untreated dyes; hence it is recognized as the second largest water-polluting industry in the world (Khan et al., 2023; Saha et al., 2021; UNCTAD, 2019). The untreated wastewater discharge from textile companies has adversely affected groundwater purity which causes a serious threat to human health and animal species (Saha et al., 2021). In addition, microplastics and chemicals are released into the wastewater from household washing of garments (Camilleri, 2020; Monea et al., 2020). Further, due to the low recycling rate, post-consumer textile waste is often incinerated, landfilled, or exported to developing economies (Camilleri, 2020).

Thus, owing to the increasing sustainability issues in the textile industry, environmental regulations are becoming stringent and require manufacturers to implement circular design principles and practices to ensure their engagement in sustainable and closed-loop business models (Camilleri, 2020). By adopting such business models, manufacturers can reuse and recycle their resources, effectively handle the chemicals in an environmentally friendly manner, and drive consumers towards sustainable consumption practices (Camilleri, 2020; Monea et al., 2020). Among these models and business strategies, the circular economy (CE) is recognized as an emerging paradigm that has changed the definition of waste from materials, products, or substances that cannot be used anymore to a more valuable resource (Schmutz & Som, 2022; Tedesco & Montacchini, 2020). CE enables firms to reduce waste, conserve the natural environment, and reduce reliance on non-renewable resources during the production and consumption of products (Kazancoglu, Kazancoglu, Yarimoglu, & Kahraman, 2020; Schmutz & Som, 2022), as well as enhancing social performance by improving working conditions and employees' health and safety (Kazancoglu, Sagnak, Kumar Mangla, & Kazancoglu, 2020).

As CE scholarship continues to evolve, there remains significant potential for theory-building and empirical research. For instance, the CE approach has been widely investigated in developed economies including the United Kingdom, Poland, Sweden, France, Switzerland, and Italy. However, it has been an under-researched phenomenon in the emerging economies context (Saha et al., 2021; Shaikh et al., 2022). Despite the increasing interest in CE scholarship, there is a dearth of research on the factors triggering CE adoption at the firm level (Ul-Durar et al., 2023). In a similar vein, there is a paucity of research that could help practitioners and manufacturers integrate CE practices into a firm's operations (Awan et al., 2021). In addition, due to the involvement of various stakeholders, firms have difficulties in formulating CE strategies and executing practices as they need to consider stakeholders' expectations at different supply chain levels (Awan et al., 2021). Accordingly, it is vital to understand the internal and external motivations for and barriers to executing CE adoption in manufacturing firms to address the pressing requirements of the stakeholders.

While CE adoption has received attention in the manufacturing sector (Ul-Durar et al., 2023), CE practices have mostly been adopted in discrete manufacturing industries such as electronics, automotive, steel, and construction (Awan, 2021; Farrukh et al., 2023b; Lim et al., 2022; Wuni & Shen, 2022). However, there is a paucity of research on the application of a CE approach in the process industries such as pharmaceutical, leather, and packaging (e.g., Farrukh et al., 2022; 2023a; Ma et al., 2015) which suggests a need for exploration of CE concepts in this sector. Similarly, the extant scholarship lacks in-depth insights concerning the drivers and barriers to the CE transition in the textile and clothing industry (Coppola et al., 2023; Schmutz & Som, 2022). Exploring the CE transition in a continuous process industry such as textile and garment manufacturing is imperative as this sector is highly energy intensive, consumes vast amounts of natural resources, uses hazardous chemicals, and releases toxic waste, volatile organic compounds, and gaseous emissions (Farrukh et al., 2023b; Saha et al., 2021). Accordingly, we argue that developing an in-depth understanding of the drivers and barriers to CE adoption in the process industry is required as they primarily determine the overall direction of a firm's CE-related initiatives and outcomes.

Additionally, scholars posited that theoretical perspectives play a critical role in understanding the research phenomenon, advancing knowledge, and developing rich insights (Handfield & Melnyk, 1998); however, CE-focused studies mostly lack theoretical integration to fully understand empirical findings. To this end, we draw on the natural resource-based view (NRBV) (Hart, 1995) and institutional theory (Meyer & Rowan, 1977; Sarkis & Zhu, 2011) to develop rich insights into the drivers and barriers to CE transition in the textile industry. Accordingly, to bridge the aforementioned knowledge gaps, this study aims to investigate the drivers and barriers to the CE transition in the textile process industry of an emerging economy – Pakistan. Hence, the following research questions are addressed in this study.

> **RQ1.** *What are the drivers for and barriers to circular economy adoption in the textile process industry?*

> **RQ2.** *How do these drivers and barriers influence the circular economy transition in an emerging economy context?*

The present study aims to answer the above research questions to fill the knowledge gaps in the existing literature. Accordingly, we adopted an exploratory qualitative methodology and conducted 22 semi-structured interviews with consultants and practitioners working in the textile industry of Pakistan. We selected Pakistan's textile industry as it is one of the country's largest manufacturing sectors with a contribution of 8.5% to the country's gross domestic product (GDP) and employs 45% of the workforce (38% of the manufacturing workers) (Kusi-Sarpong et al., 2021). Pakistan is the 8th largest exporter of textile products and the textile sector is one of the primary contributors to the economic growth of the country (Kusi-Sarpong et al., 2021) including home textiles, technical textiles, footwear, and clothing (Sardar et al., 2022) and the 4th largest producer of cotton in Asia (Kusi-Sarpong et al., 2021). In addition, Pakistan's textile industry has 5% of the global spinning capacity and is recognized as the 3rd largest spinning capacity in Asia (Kusi-Sarpong et al., 2021). Despite the importance and contribution of the textile sector, it is one of the environmentally polluting industries in Pakistan facing various challenges such as water shortages, recycling issues related to post-industrial and post-consumer textile waste generation, and energy crises (Jianguo et al., 2023; Sardar et al., 2022). Thus, to address critical environmental sustainability issues, textile companies are struggling to transit toward a CE approach (Irfan et al., 2022; Kusi-Sarpong et al., 2021). Since textile companies in Pakistan manufacture a variety of textile products for international brands and retailers (e.g., Levi's, H&M, Gap, Nike, Adidas, and ZARA) in the European Union (EU) and the United States of America (USA) (Irfan et al., 2022), the understanding of CE transition in this sector can facilitate manufacturers in achieving competitive advantage and sustainable business performance through a closed-loop business model.

This study contributes to the existing body of knowledge in several ways. First, the study investigates the CE approach using a qualitative research methodology that provides in-depth insights into salient drivers and barriers to CE transition in a continuous process industry (i.e., the textile sector) which are lacking in the extant literature. In this regard, the present findings reveal different drivers such as research collaboration between industry and academia, international brands and corporate customers' pressure, post-consumer textile waste from developed countries, the trickle-down effect of CE adoption, and the role of the development sector, as well as advocacy organizations and stakeholder governance groups, in transitioning to CE. Similarly, the findings highlight different barriers to CE adoption such as inadequate price offers from brands, unrealistic CE goals, misinterpretation of CE, supply chain disruptions, and giving high priority to economic sustainability as the salient issues emerging from the present study. Second, the findings contribute to a rapidly emerging, albeit scarce CE literature in the developing economies context (Sardar et al., 2022). Third, the existing research on waste management and CE-related aspects lacks a strong theoretical foundation (Kumar et al., 2022); thus, the application of the NRBV and institutional theory to analyze the current findings enriches the CE literature. Fourth, the study offers practical and policy implications for consultants, practitioners, and policymakers in understanding and encouraging CE transition in textile companies and shifting their focus from the prevailing linear production models to sustainable and regenerative models such as CE.

2 | LITERATURE REVIEW

2.1 | Circular economy

CE has emerged as an ambitious, albeit more realistic, regenerative business model to address climate change, natural resource depletion, and other pressing sustainability issues. According to the Ellen MacArthur Foundation (2023), the circular economy is one of the best ways to effectively tackle wicked environmental problems such as climate change, biodiversity loss, waste elimination, and pollution prevention by decoupling economic activity from the consumption of finite natural resources. It emphasizes the need for an integrated business strategy for efficient production and consumption of resources, waste reduction, and environmental protection (Farrukh et al., 2023b; Kazancoglu et al., 2018). CE contributes to achieving sustainable development through economic prosperity, environmental improvement, and social sustainability (Saha et al., 2021). Building on restorative thinking and the waste equals food principle, a CE approach provides a holistic framework to "maximize resource efficiency and minimize waste" (Abu-Ghunmi et al., 2016, p. 228). The CE concept has its roots in environmental and industrial economics, where the relationship between the environment and economic systems has been investigated. As such, the CE concept seeks to replace the traditional linear models with circular or closed-loop models that emphasize resource efficiency and environmental conservation (Brydges, 2021; De los Rios & Charnley, 2017). By embracing sustainable production and consumption patterns, CE can be perceived as a progressive model for decoupling economic growth and environmental loss (Brydges, 2021; Elia et al., 2017).

2.2 | The need for circular economy in the textile process industry

The textile process industry is facing an environmental burden due to post-industrial and post-consumer textile waste. The post-industrial textile waste includes various types of waste generated during manufacturing operations such as leftover fibers and yarns, fabric scraps, and fiber edge trimmings (Niinimäki et al., 2020; Patti et al., 2020). Moreover, the synthetic fiber – polyester – used in textile products is manufactured using non-renewable resources (oil) and requires extensive energy during the extrusion process (Schmutz et al., 2021; Schmutz & Som, 2022). According to an estimate, polyester is the most used synthetic fiber, accounting for 52% of the total fiber production and its consumption has reached the level of 57 million megatons, followed by a natural fiber – conventional cotton – with a level of 25.7 million megatons (Schmutz & Som, 2022; Textile Exchange, 2020). Further, producing natural fibers requires a considerable quantity of fertilizers, pesticides, and artificial irrigation

(Schmutz & Som, 2022), leading to high carbon and water footprints (Schmutz et al., 2021). Along with fiber production, other manufacturing processes such as yarn production, dyeing, and finishing have energy, environmental, and social footprints (Schmutz et al., 2021; Schmutz & Som, 2022).

On the other hand, post-consumer textile waste includes the used household textiles and clothing no longer required by the consumers (Sandvik & Stubbs, 2019; Schmutz & Som, 2022). Due to unsustainable consumption patterns and low-cost fast fashion trends, textile waste is increasing to alarming levels (Koszewska, 2018; Schmutz & Som, 2022). It is estimated that the total amount of post-consumer textile waste could even reach 148 million tons worldwide by 2030, representing a 62% increase compared to 2015 (Schmutz & Som, 2022). Further, the lack of collection programs and segregation facilities in developing economies compared to developed countries is one of the key challenges faced by the textile industry (Dissanayake & Weerasinghe, 2021). In addition, due to the lack of recycling, the post-consumer textile waste is mostly incinerated or landfilled, thus contributing to negative environmental impacts including natural resource depletion, the release of GHG emissions (such as methane and CO_2), and soil pollution (Niinimäki et al., 2020; Patti et al., 2020). Considering the present global environmental crisis, it is imperative for the textile industry to transit to a CE paradigm (Koszewska, 2018; Schmutz & Som, 2022) by replacing the cradle-to-grave approach and focusing on maintenance, reuse, refurbishment, remanufacture, and recovery aspects in the production and consumption of textile products (Saha et al., 2021).

2.3 | Drivers of the circular economy transition

The analysis of the literature revealed different internal and external motivators for the CE transition in the textile industry. Waste reduction, natural resource depletion, and environmental pollution are identified as the key internal drivers for CE adoption in textile and apparel companies (Kazancoglu, Kazancoglu, Yarimoglu, & Kahraman, 2020; Saha et al., 2021). In addition, textile companies are trying to adopt CE to increase resource efficiency by reusing, recycling, and repairing post-industrial and post-consumer textile waste (Salo et al., 2020). Textile companies are collecting, sorting, and recycling waste to extract valuable materials such as fibers which can be reused in manufacturing textile products. In doing so, the manufacturers are trying to reduce their reliance on virgin materials, thus contributing to a circular textile industry (Schmutz & Som, 2022). Further, the textile industry is adopting CE practices from the research and innovation perspective to develop circular products and incorporate eco-design principles since the traditional linear models focus on developing textile products with a short lifespan leading to rapid disposal (Brydges, 2021).

Additionally, textile companies are transitioning to the CE due to organizational factors such as increasing environmental awareness which has prompted manufacturers to execute sustainable practices (Quartinello et al., 2017). As a result, the companies are reducing the environmental footprints associated with the production of textile products including wastewater generation, excessive energy and water consumption, and usage of hazardous chemicals (Piribauer et al., 2020; Quartinello et al., 2017). In this context, a study by Degenstein et al. (2023) utilized a qualitative approach and semi-structured interviews with key stakeholders including manufacturers, designers, and retailers in the New Zealand textile industry. The results revealed that environmental concerns as part of the organization's mission and vision were one of the key internal motivations for implementing CE (Degenstein et al., 2023).

From an external perspective, the literature highlighted that companies embrace CE practices to differentiate themselves by offering sustainable and eco-friendly products to gain a competitive advantage (Adamkiewicz et al., 2022; Jia et al., 2020). A review study highlighted that textile companies are embracing CE principles to enhance their image and reputation and attract customers (de Aguiar Hugo et al., 2021; Saha et al., 2021). On the other hand, increasing customer environmental awareness and demand for sustainable products are driving the textile industry to implement CE practices (Degenstein et al., 2023; Michna, 2022; Salmi & Kaipia, 2022; Wójcik-Karpacz et al., 2023). Further, multinational corporations in the global textile industry such as Burberry, Gap, H&M, and Levi's have recently adopted CE business models in their supply chains which propel the suppliers and other manufacturers to transition from a linear economy to CE (Saha et al., 2021). In a similar vein, government support and regulatory frameworks are essential to execute sustainable practices in the textile industry (Jia et al., 2020). Local and international regulatory authorities are also propelling textile companies to adopt the CE paradigm and adhere to environmental laws (Bukhari et al., 2018). Governments are introducing new regulations and policies for reusing, recycling, and remanufacturing garments and ensuring the effective enforcement of laws and frameworks to reduce the environmental burden of the textile industry (Jia et al., 2020). For example, a qualitative case study conducted in the second-hand clothing industry in Poland revealed international regulations such as the European legislation regarding textile waste management as one of the significant drivers of CE adoption (Wójcik-Karpacz et al., 2023). In this regard, extended producer responsibility programs, waste management regulations, and eco-design requirements are introduced to address negative environmental impacts (Bukhari et al., 2018).

2.4 | Barriers to the circular economy transition

The transition from a linear economy to CE presents several challenges preventing the adoption of sustainable practices (Jianguo et al., 2023; Majumdar & Sinha, 2019). The review of the literature revealed different internal and external barriers to CE in the textile industry. Among the internal barriers, the lack of willingness and readiness of manufacturers to adopt CE practices and design challenges including a lack of recycling, disassembly, and separation due to the complex structures and interconnected parts are identified as the important barriers (Kazancoglu, Kazancoglu, Yarimoglu, & Kahraman, 2020). In this regard, a study conducted in the textile and clothing industry in Slovakia highlighted the companies' lack of interest and willingness to adopt circular business models due to the lack of awareness and information regarding the CE principles and sustainable outcomes of CE-related practices (Daňo et al., 2020). Further, the high cost of sustainable, recycled, and environmentally friendly materials is another challenge for textile manufacturers (Kazancoglu, Kazancoglu, Yarimoglu, & Kahraman, 2020). A qualitative study conducted in the fast fashion industry in Australia emphasized that quality issues, scarcity, and operational complexities of sustainable and circular materials are major challenges in promoting the CE approach (Piller, 2022). Small and medium-sized enterprises (SMEs) are largely unaware of the potential benefits of a CE approach due to a lack of knowledge and information. Similarly, the employees in textile firms lack the technical expertise to implement CE practices (Kazancoglu, Kazancoglu, Yarimoglu, & Kahraman, 2020). A recent study in the Netherlands' textile context highlighted that manufacturers were hesitant to adopt CE in their organizations due to resistance to change (Hartley et al., 2021). Further, the high initial investment cost of CE initiatives is another firm-level obstacle prohibiting manufacturers from transitioning to the CE business model (Hartley et al., 2021; Kazancoglu, Kazancoglu, Yarimoglu, & Kahraman, 2020). In this regard, a study used the multiple-case study methodology and conducted semi-structured interviews in the Scandinavian fashion industry to investigate the drivers and barriers to CE. The findings revealed high research and development costs as one of the significant internal barriers (Abbate et al., 2024).

From the external perspective, the textile industry is facing issues related to the lack of collection, handling, and segregation facilities for post-industrial and post-consumer textile waste (Kazancoglu, Kazancoglu, Yarimoglu, & Kahraman, 2020; Koszewska, 2018; Subramanian et al., 2021). Due to the mixed fibers with varying characteristics and structures, recyclers are facing challenges in recycling clothes (Subramanian et al., 2021). A recent study in the Swiss textile context revealed that companies face varied challenges such as a lack of markets for recycled materials and a lack of recycling technologies for mixed materials, different colors, and multi-layer textile products (Schmutz & Som, 2022). Similarly, due to the use of mixed materials and different colors in textile products, sorting waste becomes difficult and requires intensive efforts (Schmutz & Som, 2022).

Further, a lack of stakeholder collaboration for CE implementation is yet another challenge in the textile industry. Since the textile supply chain includes diverse stakeholders such as suppliers, manufacturers, designers, retailers, and consumers, it is not surprising that differing interests, values, and beliefs of multiple stakeholders lead to coordination issues (Abbate et al., 2024; Gomes et al., 2023). In this regard, a qualitative multiple-case study conducted in the textile and fashion industry in Finland highlighted that ease of consumption, low prices of fast fashion apparel, and negative perceptions related to the price and quality of circular alternatives are significant behavioral barriers (Salmi & Kaipia, 2022). Moreover, transforming consumer behavior towards sustainable consumption of textile products is a key challenge in the CE transition (Salmi & Kaipia, 2022) owing to the inadequate knowledge of the environmental impacts of the clothing and apparel industry (Hartley et al., 2021; Salmi & Kaipia, 2022) and lack of education regarding the use and disposal of textile products (Luoma et al., 2022). Another study conducted in the textile industry of Taiwan emphasized the infrastructural issues, lack of information sharing among the stakeholders, and lack of consumer awareness as fundamental barriers to the CE transition (Huang et al., 2021). Inadequate government policies, support, and infrastructure for recycling textile products, using sustainable materials, and promoting circular design can be considered key barriers to CE transition (Jia et al., 2020; Kazancoglu, Kazancoglu, Yarimoglu, & Kahraman, 2020). In this regard, a qualitative study conducted in the Brazilian apparel industry highlighted the lack of government support and policies including incentives and national programs, and the lack of regulations related to end-of-life textile products as the major barriers to CE adoption (Gomes et al., 2023).

While the CE business model in the textile and clothing industry has been investigated in prior studies (Sections 2.3 and 2.4), the proposed drivers and barriers are still largely fragmented and examined in isolation, with a lack of integration of relevant theoretical lenses to understand the research phenomenon. In addition, the review of the literature revealed that most studies were conducted in developed countries while limited research was carried out in developing countries such as Brazil, India, and Pakistan (e.g., Jianguo et al., 2023; Ponnambalam et al., 2023). Further, from the methodological perspective, extant research predominantly employed a literature review methodology (e.g., systematic literature review) to identify the drivers and barriers to CE adoption in the textile and clothing industry (e.g., Abbate et al., 2024; de Aguiar Hugo et al., 2021). Prior studies also used the quantitative research methodology to examine challenges and motivations to adopt CE in different countries such as India, Bangladesh, and Vietnam (Ponnambalam et al., 2023; Saha et al., 2021); however, most of the qualitative research was conducted in developed economies such as Sweden, Norway, Finland, Poland, New Zealand, and Slovakia (e.g., Daňo et al., 2020; Degenstein et al., 2023; Hartley et al., 2021). Moreover, among these qualitative studies, semi-structured interviews were generally conducted with the fashion brands, designers, and retailers, ignoring the manufacturers' perspective on CE adoption (Brydges, 2021; Degenstein et al., 2023). Accordingly, an in-depth investigation of the CE drivers and barriers in the textile industry in developing nations is required as these countries (such as India, Bangladesh, Pakistan, Sri Lanka, and Vietnam) export a huge amount of textile products to the developed nations such the USA and those in the EU (Khan et al., 2022; Uddin et al., 2022). Despite the importance of industrial production in their national economies, the textile industry in developing countries is facing serious sustainability challenges including wastewater discharge, gaseous emissions, inadequate waste management, and employees' health and safety issues (Sardar et al., 2022; Uddin et al., 2022).

2.5 | Theoretical lens

Organizational theories help in exploring "why and how acts, events, and thoughts occur" to provide a coherent and holistic description of a phenomenon (Chang et al., 2017, p. 48). Prior studies have utilized several theoretical perspectives to understand and explain complex sustainability-related aspects in an organizational context (Chang et al., 2017; Sarkis & Zhu, 2011). However, for the purpose of this research, we have adopted the NRBV and institutional theory, which are particularly useful for examining the drivers and barriers to the CE transition in the textile industry of Pakistan. It is argued that utilizing multiple theories in an integrated fashion fosters knowledge-building and could help in unpacking complex interrelated issues such as the transition from a linear economy to CE. Further, using a single theory is insufficient to examine waste management-related practices, and fully understand sustainable and circular supply chains, and stakeholder collaboration in environmental initiatives (Farrukh et al., 2023b; Kumar et al., 2022). Therefore, we have used two organizational theories (NRBV and institutional theory) to rationalize the identified drivers and barriers in CE adoption and provide fresh insights to explain the research phenomenon.

The NRBV emphasizes a firm's competitive advantage through positive impacts on the natural environment (Hart, 1995) and has been used in prior studies to explore the internal motivations of an organization to adopt sustainability practices (Caldera et al., 2018; Farrukh et al., 2023a). It refers to an organization's pollution prevention, product stewardship, and sustainable development strategic capabilities which have different environmental driving forces (Barney, 1991). Among the three strategic capabilities, pollution prevention seeks to reduce waste and emissions rather than cleaning them up "at the end of the pipe" and focuses on cost reduction. Product stewardship extends the scope of pollution prevention by focusing on the entire value chain of an organization's product system and integrating the "voice of the environment" into product design and development (Hart et al., 2010, p. 1466). Sustainable development not only focuses on environmental improvements but also requires organizations to maintain natural resources for the indefinite future (Baumgartner & Rauter, 2017; Farrukh et al., 2021; Hart et al., 2010). Additionally, sustainable development incorporates economic and social concerns since these aspects are interconnected with the issues of poverty and environmental degradation in developing economies (Hart et al., 2010). We apply the NRBV as theoretical anchoring to develop an in-depth understanding of internal drivers and barriers specific to the resources and associated capabilities of textile companies.

Institutional theory emphasizes how external influences affect organizational actions. It is used to examine how an organization addresses environmental sustainability issues resulting from external pressure (Sarkis & Zhu, 2011). In particular, the institutional theory clarifies three types of isomorphic forces – coercive, normative, and mimetic. Coercive isomorphisms refer to the external forces in power that drive organizations to execute environmentally benign practices through environmental fines and penalties from government agencies (Rivera, 2004). Normative isomorphic drivers focus on social requirements resulting from the increasing consumer environmental awareness, ecological thinking, ethical values, and expectations that force organizations to follow sustainable practices (Ball & Craig, 2010). Mimetic isomorphic drivers emphasize an organization's initiatives as a result of imitation of competitors' strategies, best practices, and leadership styles to address sustainability issues (Aerts et al., 2006; Sarkis & Zhu, 2011). Accordingly, to address the research questions and develop insights into factors driving and inhibiting CE transition in the textile industry we draw on the institutional theory for unpacking the catalytic role played by formal (such as government, NGOs, and industry organizations) and informal institutions (such as societal norms and values) (Mzembe et al., 2019).

3 | RESEARCH DESIGN

This study adopts a qualitative research design due to the exploratory nature of this study and to provide empirically enriched insights into the complex phenomenon of CE transition in the continuous process industry (Denzin, 2008; Valentine, 2013). The data were collected through semi-structured interviews with consultants and senior managers working in textile manufacturing organizations in Pakistan (Table 1). A total of 22 semi-structured interviews were conducted between May 2023 and August 2023 with an average duration of 1 hour. The interviews were carried out via video conferencing and recorded with the participants' permission. A purposive sampling approach has been used (Yin, 2014) to select the participants with the inclusion criteria: (i) experience in the textile industry of Pakistan and (ii) more than 2 years' experience in CE and sustainability implementation. Further, the snowball sampling method was used to select the study participants, in which interviewees were requested to refer other potential participants in their networks (Kirchherr & Charles, 2018). A careful selection of participants with adequate experience and knowledge in CE and sustainability ensures research rigor and enhances the validity and generalizability of the findings in qualitative research (Yin, 2014). Accordingly, we conducted eight interviews with the consultants and 14 interviews with senior corporate managers working in textile manufacturing companies. We found limited consultants with experience in CE and sustainability practices in the process industry of Pakistan. While we invited 15 consultants via LinkedIn, eight responded and agreed to participate in the study. The rationale behind selecting consultants is that they have diverse knowledge and profound expertise in executing CE and sustainability projects in different process industries facing similar environmental issues. Similarly, we contacted 30 corporate managers in the textile companies in Pakistan out of which 18 agreed to participate in this research. We selected senior managers with different organizational roles (e.g., production manager, sustainability manager, safety and compliance manager, procurement manager, research and development, and logistics manager) since they have extensive knowledge of the CE practices and sustainability aspects in the textile supply chain operations that can foster in-depth insights into the research phenomenon. Table 1 below provides the details of the research participants.

An information sheet was sent to the participants and their consent was obtained prior to interviews. To ensure the anonymity of the participants and their organizations, pseudonyms are used to protect

TABLE 1 Details of the participants.

Participants' codes	Participants' role	Position	Type of expertise	Years of experience
TE-1	Consultant	Executive director	Circular economy and environmental sustainability	25
TE-2	Consultant	Consultant	Sustainability, circular economy, and corporate responsibility	9
TE-3	Senior manager	Procurement manager	Sourcing and procurement	8
TE-4	Corporate manager	Logistics manager	Supply chain and logistics	15
TE-5	Corporate manager	Marketing manager	Marketing	5
TE-6	Senior manager	Head of materials management and production planning	Sustainable sourcing and production planning	4
TE-7	Consultant	Technical advisor	Sustainability, resource efficiency, and climate change	6
TE-8	Consultant	Senior environment and climate advisor	Sustainability and circular economy	28
TE-9	Senior manager	Sustainability manager	Sustainability and circular economy	3
TE-10	Senior manager	Head of sustainability	Sustainability and circular economy	18
TE-11	Senior manager	Deputy manager research and development	Sustainable apparel design	6
TE-12	Consultant	Executive director	Circular economy, energy management, chemicals management, and resource efficiency	10
TE-13	Consultant	Chief advisor	Circular economy	25
TE-14	Consultant	Executive director	Circular economy and sustainable development	9
TE-15	Senior manager	Sustainability manager	Sustainability and circular economy	3.5
TE-16	Senior manager	Manager safety and compliance	Environmental safety and compliance	12
TE-17	Senior manager	Senior production manager	Sustainable operations and resource efficiency	15
TE-18	Senior manager	Senior sustainability manager	Sustainability and circular economy	13
TE-19	Senior Manager	Production manager	Sustainability and production operations	3
TE-20	Senior manager	Sustainability manager	Sustainability and circular economy	5.5
TE-21	Consultant	Chief executive officer	Environmental sustainability	16
TE-22	Senior manager	Head of sustainability and ESG	Sustainability, circular economy, and corporate governance	3

their identities. An interview guide was developed using an extensive literature review. The participants were asked different questions about drivers and barriers to CE adoption in the textile industry. A case study database including the participants' details, interview recordings, transcripts, and field notes taken during the interviews was maintained to address the reliability and validity criteria of the qualitative research (Yin, 2014).

For analyzing the data, we followed a step-by-step thematic analysis process recommended by Braun and Clarke (2006). First, the interviews were transcribed using the Otter.ai software (Paulus, 2023) and transcripts were read several times, conceptualized, segmented, and analyzed (Farahani et al., 2021). We also shared interview transcripts with the participants to identify and validate any missing data to address the validity and reliability criteria (Yin, 2014). Then, a systematic manual coding process was followed to extract the information from interview transcripts and convert it into a logical data structure for a profound and in-depth analysis (Gioia et al., 2013). The data structure also provides a graphical presentation of the textual information by arranging the raw data into concepts and themes which aids in performing the thematic analysis (Gioia et al., 2013; Tracy, 2010). Further, the use of theoretical lenses of the NRBV and institutional theory enabled the investigation of internal and external drivers and barriers inhibiting CE adoption in the textile industry. The emergent themes were reviewed multiple times to confirm consistency (Yin, 2014) and address the internal validity aspects. Accordingly, various 1st-order concepts were combined under the 2nd-order themes which were further synthesized into the dimensions of drivers (internal and external) and barriers (internal and external) to the CE transition.

We used Microsoft Excel spreadsheets to organize and structure the information which further facilitated in recognition of the priori and emergent codes generated from the thematic analysis (Castleberry & Nolen, 2018). Sorting features and different color schemes of Microsoft Excel were utilized to organize the similar and contrasting patterns (Bree & Gallagher, 2016). The pattern-matching technique was used to compare the resulting patterns with the predicted ones. Along with the pattern-matching technique (for similar patterns), we searched for divergent data to identify conflicts in participants' narratives to refine themes for a better presentation of the broad theoretical ideas emanating from the study (Antin et al., 2014). In this regard, field notes taken during the interviews and memo tags assigned to the divergent data during the coding and data analysis process helped us consider the divergent cases as the salient themes (e.g., supply chain disruptions, inadequate price offers from brands, and unrealistic CE goals). Further, we had given the code title "contrasting themes" to the conflicting data and included it in the codebook to ensure the credibility of the study (Antin et al., 2014). Figure 1 presents the data structure as a pivotal step in a qualitative research approach building on the 1st-order concepts, 2nd-order themes, and aggregate dimensions (Gioia et al., 2013).

4 | FINDINGS

4.1 | Drivers of the CE transition in the textile process industry of Pakistan

4.1.1 | Internal drivers

The participants emphasized that textile companies are recognizing the value of resources used in the manufacturing of textile products. TE-2 highlighted that optimizing resource efficiency is a key pillar for transitioning towards CE as "we need to make sure that the resources are well utilized or maximum utilized." TE-2 further explained that Pakistan is facing a water shortage problem and the textile industry consumes a considerable quantity of water, "compared to other processes in the home textile industry, denim (jeans) is consuming large quantities of water." Therefore, to improve water consumption, organizations are adopting CE practices. TE-1 noted textile companies in Karachi have installed wastewater treatment plants and they are recycling water and reusing it in their processes, "because of the importance of clean water, they [manufacturer] reuse the treated water." Similarly, in Faisalabad, there are more than 250 industries that are recycling trimming waste to remanufacture the thread through a spinning process and place a tag on the fabric and garments, "it is manufactured using 30% recycled materials which are sold at good rates in the international market," TE-1 remarked. Similarly, TE-5 illustrated that their company has recently developed a textile product "zero cotton" (without cotton) for their German and Polish customers using wood fiber and elastane. This product consumes 40% less water compared to the conventional textile products (such as jeans). Similarly, textile companies are transitioning towards CE practices from material and resource recovery perspectives. TE-1 noted that the manufacturers are conducting experiments for caustic recovery (residues of dyes) from effluents (wastewater) to be reused in the moisturizing process of textile manufacturing.

In addition, the financial feasibility is another driver of CE transition in the textile industry as in the past, the manufacturers ignored the material and process waste since they were earning high profits. Nevertheless, the decreasing profit margins are prompting the companies towards sustainability and CE adoption. Hence, the textile manufacturers are thinking, "the chemicals we were discarding or draining, we should restrain, collect, and reuse them to reduce our cost," TE-9 cited. TE-21 commented that the driver behind the CE adoption is the environmental awareness of manufacturers, "the waste we were previously producing was not actually waste, it was the material that we were wasting or discarding in the environment." Since the chemicals have a direct impact on the health and safety of employees, the textile companies are following chemical management guidelines such as zero discharge of hazardous chemicals to ensure employees' safety and achieve environmental compliance, TE-2 and TE-12 emphasized. Additionally, the organization is introducing traceability measures for chemical usage and these chemicals are properly scanned and traced into the production processes, TE-2 noted.

The participants also emphasized that textile companies are taking CE initiatives due to the rising concerns of innovation and technological advancements. TE-11 suggested, "apart from all these drivers, our research and development department are working on the dimensions of a sustainable and circular economy for process and product improvement." TE-11 further indicated that every 2 months their company participates in an exhibition called Kingpins where they introduce some innovative products and materials. It is the only exhibition of denim or jeans in which manufacturers from all over the world showcase their innovative products, environmentally friendly technologies, and sustainable materials: "we introduce various sustainable raw materials. For example, we are using hemp and modal. Since we are [a] manufacturer, we can play with the raw materials". Similarly, TE-5 pointed out that their company has introduced some technologies such as "up technology, zero water, and drop of water" which consume less water in the washing process of denim. Before using these technologies, the water consumption was 1200–1500 gallons of water for a pair of jeans which has now been reduced to less than 15 gallons.

In addition, academia and industry collaboration also plays a significant role in the CE transition. For example, TE-11 and TE-9 argued that their companies are involved in CE practices with the help of universities and research institutes. In this regard, TE-11 cited, "we collaborate with universities and ask them to tell us what solutions they have for our industry. I remember a team of professors from National Textile University approached us when they developed some sustainable washing stones that could give four times better results." In a similar vein, TE-9 reported that their company has recently signed an agreement with a research institute for handling ash produced from the rice husk boiler. The institute collects the sludge of the stones produced during the washing process of garments and composts it. Moreover, another project handling the "fluff (tiny fiber trims) produced during the manufacturing of fiber is about to start with the same institute," TE-9 mentioned.

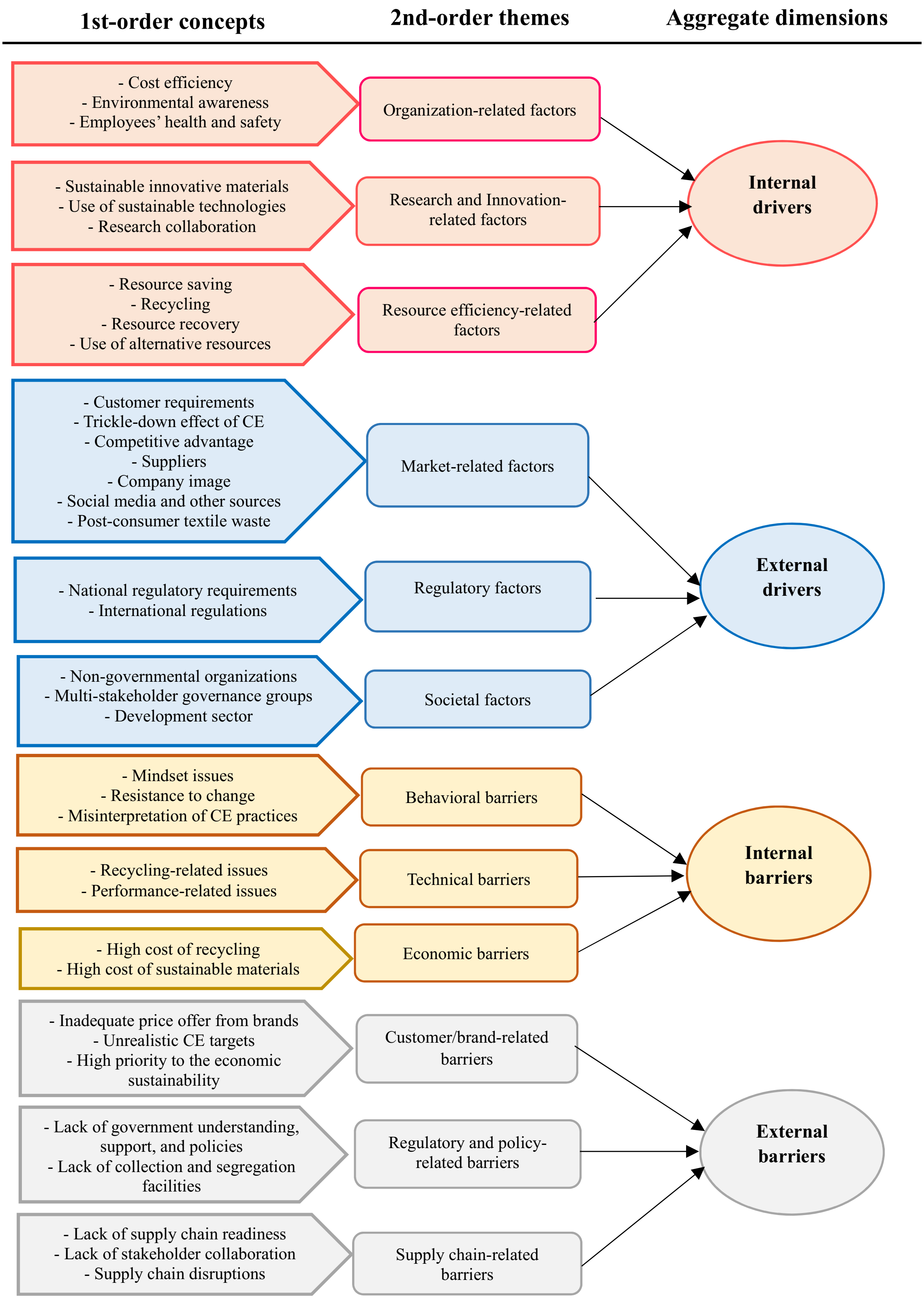

FIGURE 1 Data structure.

4.1.2 | External drivers

The participants also mentioned increasing customer awareness and requirements as a motivation behind the adoption of CE in the textile industry. For example, TE-1 demonstrated that corporate customers such as Nike and Levi's pay 10 to 20% higher prices for the products that are tagged with 30% recycled material due to the awareness of CE benefits: "it is nice, you are promoting circular economy and reducing environmental footprints." *They [customers] have their targets and standards for energy conservation and use of recycled materials*. TE-1 further explained that if a textile company follows their standards, it earns bronze, silver, and gold certifications. Moreover, if an organization has obtained a gold certification, they offer a premium price for the garments. TE-5 indicated that the international customers require transparency and traceability in the textile supply chain; therefore, the company shares the data of the Higg index comprising different parameters such as water consumption, energy consumption, and chemical usage. Further, international customers and buyers ask the manufacturers to keep the hazardous chemical quantity at zero during the testing process. TE-1 argued, "the international buyer is demanding some sustainability initiatives, you need to reduce the consumption of water, electricity, and chemicals and adopt renewable energy practices." Another driver of CE is that the large textile companies such as Interloop sublet their orders from international buyers to SMEs which has a "trickle-down effect of CE and sustainability" on these companies, TE-13 argued. Consequently, SMEs adopt CE practices, and large companies also offer good prices to these small firms. In addition, TE-7 posited, "[the] consumer is also conscious and especially the international consumers demand sustainability initiatives and ask about recycling and disposal."

The participants also emphasized achieving a competitive advantage by implementing CE practices. TE-11 noted, "*when we go to our Kingpins show, we introduce new process technology, new products, and sustainable raw materials to engage our customers and achieve competitive advantage*". In addition, suppliers are also a source of CE transition in the textile industry. For instance, chemical suppliers follow a charter – "*responsible production care*" – to develop new sustainable chemicals and they drive textile companies to use them to make sustainable products, TE 12 emphasized. TE-11 explained, "suppliers also provide new options of washing stones that will last longer and reduce our wastewater sludge." Further, "we get information on energy efficient technologies and innovation for sustainability and CE through social media, international or local conferences, and exhibitions," TE-11 noted. TE-6 demonstrated that the companies invest a huge amount of money in maintaining their green image, "for example, companies can face penalties in case of noncompliance which tarnish their brand name and reputation. Hence, they are working on sustainability and circular economy."

TE-1 emphasized that the government of Pakistan has taken a few sustainability and CE-related initiatives such as supporting renewable energy development and forcing textile companies to move toward renewable energy. Further, the government is encouraging private sector involvement in carbon emissions reduction projects. Moreover, the Net Zero Pakistan initiative is Pakistan's largest net zero coalition in which the textile companies commit to initiate science-based net zero targets, measure and disclose GHG emissions, and improve environmental performance. In addition to national regulations, the textile experts and practitioners emphasized that new compliance requirements are coming from the European Union (EU) and one of these is the "EU Green Deal." Under this deal, the EU has introduced several guidelines for sustainability and CE for textile products. TE-7 underlined that currently, the EU has asked only export-oriented companies with a workforce of 8000 or more workers to implement these guidelines. However, from 2024, companies with a workforce between 1000 and 2500 workers will also need to adhere to EU guidelines. Further, from 2026, companies with 500 employees will also need to comply with these requirements. TE-7 further asserted, "the trend we are seeing in the next three years is that even these small brands will also be bound to execute CE practices under the EU Green Deal. So, these small textile companies in Pakistan who say that our customers do not ask us for sustainability and resource conservation, then from 2025 to 2026, all of these will have to implement CE practices." Similarly, TE-2 emphasized that buyers are under pressure from the EU governments and society to take social initiatives: "the EU has developed their policies around social development which will be immediately applied to the brands."

TE-7 and TE-13 suggested that the post-consumer textile waste from international consumers is another factor driving the textile industry in Pakistan to adopt CE practices. According to TE-7, "you know that whatever used clothes come from Europe are either dumped in Africa or goes to Pakistan." TE-7 further noted that the domestic level of post-consumer textile waste is not significant compared to the international post-consumer textile waste because consumers in Pakistan use clothes and garments for a long time, "I use jeans for four years and some of my t-shirts last up to eight years. So, in Pakistan, the consumer knows about the repairing and sharing economy concepts." In a similar vein, TE-13 noted that in the EU countries such as Germany, there are "huge mountains of waste" as the consumers purchase large volumes of garments, "they do not have this attitude that 'we have to repair it.' If a button is missing, they throw the whole shirt away." TE-13 further demonstrated that although the EU has recycling facilities, "the biggest direction of their recycling activities is developing nations. They bring the textile waste to this area."

Moreover, non-governmental organizations (NGOs) and advocacy organizations are also driving the textile and apparel industry to adopt CE practices. TE-11 noted that their company is following the guidelines provided by the Ellen MacArthur Foundation called "The Jeans Redesign" comprising CE practices such as extending the life of garments, avoiding hazardous chemicals, using recycled materials, and upcycling to make the same product. Similarly, TE-3 remarked that the Better Cotton Initiative (BCI) – a non-profit multistakeholder governance group promoting better standards in cotton farming and social sustainability – drives their company to CE adoption. As a result, their company uses 70–80% BCI-based cotton in their garments and fabric that ensures "the farmers have been paid a fair rate of their cotton cultivation and no child labor has been used."

Table 2 presents illustrative quotes from consultants and senior managers on the internal and external drivers of the CE transition aligning with the NRBV and institutional theory.

TABLE 2 Illustrative quotes on the drivers to the CE transition.

Drivers	Categories	Sub-categories	Illustrative quotes	Organizational theories (NRBV and institutional theory)
Internal drivers	Resource efficiency-related factors	Resource-saving	*"In terms of water saving, Pakistan's textile industry has excellent and global best practices." (TE-2)*	*Pollution prevention, product stewardship, sustainable development*
		Recycling	*"We are installing a shredder to shred our post-industrial textile waste to remanufacture the fiber." (TE-5)*	
		Resource recovery	*"Textile industries have implemented a heat recovery system around the large generators for producing electricity." (TE-1)*	
	Organization-related factors	Cost efficiency	*"Since the raw materials are expensive; therefore, manufacturers are adopting CE practices from a cost efficiency perspective." (TE-2)*	
		Environmental awareness	*"Because there are limited resources in the world, they [textile manufacturers] are realizing that they will have to do this [circular economy]." (TE-7)*	
		Social sustainability	*"To ensure the employees' health and safety, the garment manufacturing firms are improving working conditions and insulating their machines" (TE-15)*	
	Research and innovation–related factors	Sustainable and innovative materials	*"This exhibition (Kingpins) is held four times a year and our main focus is to launch sustainable materials and products in the market." (TE-11)*	
		Use of technologies	*"We are using systems, applications & products in data processing (SAP)-B1 for controlling our inventory which resulted in waste reduction." (TE-5)*	
External drivers	Market-related factors	Customer requirements	*"Our German, Polish, and Spanish customers are currently focusing on CE and sustainability." (TE-5)* *"We had this driving force from the brands and they audit our production floors and materials every 2 months." (TE-11)*	*Coercive isomorphisms*
		Company image	*"The other name of brand image is now sustainability." TE-14*	
		Unsustainable consumption patterns	*"The consumer buys it and then throws it away." (TE-13)*	
		Post-consumer textile waste	*"Ultimately, in Pakistan, most of the waste comes from developed countries." (TE-2)*	
	Regulatory factors	International regulations	*"The Dutch Embassy in Pakistan is driving and facilitating the textile industry to execute CE practices such as using recycled textile waste in garments due to rising concerns of the Netherlands' government toward CE adoption." (TE-2)* *"According to the EU guidelines, there are 11 points that need to be followed by any company to export its products after 2025. If anything is imported to Europe, either it is jeans or a machine or a table, it should last for at least 2 years (a shelf-life of 2 years) and even if it expires, it should be recyclable." (TE-11)*	
	Societal factors	Non-governmental organizations	*"More than 80 textile industries from Pakistan are associated with the Ellen Macarthur foundation." (TE-11)*	*Normative isomorphisms*
		Development sector	*"Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is working on improving labor and environmental performance in Pakistan's Textile Industry." (TE-14)*	

4.2 | Barriers to the CE transition in the textile process industry of Pakistan

4.2.1 | Internal barriers

The participants revealed different issues related to the beliefs and mindset of the textile manufacturers such as being more concerned with economic sustainability compared to environmental sustainability and therefore, they are reluctant to adopt CE practices. TE-9 stated, "the mindset of manufacturers is like that, 'let's make hospital bed sheets in white color, then we can save the printing cost,' they are not seeing how their company can grow? how textile industry can grow? He [owner] thinks, 'if I make one million pieces of bedsheets then I will progress and my children can live in a 10-acre house.' In addition, TE-7 noted that the owners of SMEs are facing productivity issues due to their behavior, "they started with 10 to 12 machines and reached to 200 to 250 machines; however, their mindset is same as working with 10 machines. They still want to maintain the culture of keeping everything in their hands". Similarly, TE-12 emphasized that the mindsets of manufacturers are profit-oriented and they do not consider the fact that they are wasting water, energy, chemicals, and raw materials. TE-1 explained, "when we go to the textile industries, they resist change and do not want to adopt sustainability practices due to the lack of adequate education … they do not just accept the change."

TE-7 emphasized that the SMEs are the backbone of Pakistan's textile industry; nevertheless, they are wasting raw materials and human resources, "for example, if they can achieve 90% of line efficiency, they are operating with 70% which indicates that they are wasting resources." TE-7 further argued that another challenge in the textile industry is the misinterpretation of CE practices as the manufacturers are mainly concerned about the post-consumer waste, "make the fibers and then make the thread again. The circular economy includes 9R practices (refuse, rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle, and recover); however, they only talk about recycling." Nonetheless, resource efficiency is a critical factor in upstream and midstream supply chain operations in the textile industry to achieve CE. TE-10 stressed, "if you are purchasing cotton, then you need to make cotton growing process resource efficient, you need to make farming process resource efficient, you need to make ginning process resource efficient, and then you need to make manufacturing processes resource efficient."

Additionally, the textile industry is facing recycling issues for the garments manufactured using mixed fibers "such as cotton and polyester as these cannot be recycled, and therefore, eco-design practices are needed," TE-7 noted. On the other hand, TE-1 emphasized that recycling is a water-intensive process and 90% of the textile recycling industries are in Faisalabad due to the freshwater availability in Punjab. These companies supply recycled thread to the fabric and garment manufacturers in Karachi, "our big industries in Karachi cannot recycle the textile waste due to the water scarcity issues, for example, the big brands like Soorty and Artistic cannot recycle textile waste since it is not viable for them," TE-1 noted. Another issue while using the recycled material is the lack of performance and quality. For example, the product esthetics can be affected by using more than 40% recycled cotton in the garments as suggested by TE-11, "when you go above 30-40% of recycled cotton, then the problem starts. We develop the prototypes and show these to the brands; however, the end consumer does not want those esthetics." While the textile manufacturers conduct pilot runs with different sustainable materials, they do not get the desired results every time. For example, TE-11 explained that although sustainable bleach is available in the market, their company is not able to use it because it is expensive and the results are not satisfactory, "it is a new start-up and taking time."

Another issue highlighted by TE-1 is the lack of economic feasibility of recycling in some regions of Pakistan, "for example, fresh and usable water is abundant in Punjab which costs only Rs. 8-9 per meter cube while on the other hand, the cost of treated water is around Rs. 130 per meter cube." Due to the capital expenditure (CAPEX) and operational expenditure (OPEX) of a wastewater treatment system, manufacturers are reluctant to recycle the wastewater. Similarly, the participants emphasized that sustainable materials are expensive and customers are not ready to pay more. TE-11 demonstrated, "well, we make a [pair of] jean[s] for $20 and if we introduce sustainable materials, the cost raises to $23 and then the customer does not accept it."

4.2.2 | External barriers

The findings revealed that while the corporate customers and brands are forcing the producers and upstream suppliers to initiate CE practices, they do not offer manufacturers reasonable financial incentives. TE-2 noted that "circularity comes at a cost, it is not free" because sustainability means more investment in energy, production processes, and human resource development. If the brands do not pay an adequate price, then it affects the lower-level employees and ultimately the businesses. TE-2 further argued, "ultimately it impacts in a way that industry is closing or maybe the industry is not having the orders or the business. So, it is much more complex but more specifically brands need to understand the ground rules, they need to increase prices." On the other hand, TE-19 highlighted, "international brands also want to see the economic growth of their businesses as they are more concerned with profitability. They are practicing sustainability only due to the government and regulatory requirements as well as the pressure from NGOs."

Similarly, TE-9 revealed that the big brands have given some sustainability targets to their company, "we were told that by 2050 we need to produce 50% renewable electricity. For an industry that operates 24 hours a day and 365 days a year, it is almost impossible to reach 50% electrification because there are few hours in a day in which we can produce electricity through solar. So, I was just writing a letter to my brand, you need to talk to us about renewable energy, not renewable electricity as we also use biomass in our units and if we include it in our total renewable sources then we are currently producing more than 50% renewable energy, not electricity." On the other hand, TE-11 underlined that circular and sustainable solutions are available in the market. The manufacturer focuses on process improvement to improve their cost; however, they rely on the brand from the product improvement perspective. Similarly, the participants highlighted that sometimes corporate customers prioritize economic sustainability over environmental sustainability. For example, "if a customer requires a certain product urgently, then we need to export it through air shipping which also increases cost and GHG emissions", TE-9 noted.

The participants further emphasized there is a lack of government understanding, support, and policies in promoting CE adoption in the textile industry of Pakistan. For example, TE-2 argued that the government needs to assist the textile manufacturers from the renewable energy perspective and provide sustainable funding opportunities. TE-2 further noted that "the government needs to take a pause, think once more either they would like to work for a generalized scheme of preferences plus or circular economy or another concept which could be their concept." Moreover, TE-9 emphasized that one of the major challenges in CE adoption in the textile industry of Pakistan is the attitude of bureaucrats, "for example if any deal is being signed anywhere in the world, they make commitments and then the countries make us accountable for our commitments. The government needs to make wise decisions, they first need to understand the CE challenges in the textile supply chains, get the technology, and then sign the agreements." In addition, TE-12 advocated that adequate execution of CE requires coordination between federal and provincial level, "a lot of improvisation is needed at the governmental level and less inspection, and more facilitation approach is required." Further, industry and government in developing economies such as Pakistan "need to sit with brands to identify, develop, and execute CE plans from the process perspective, technical perspective, and people perspective," TE-12 cited. On the other hand, TE-22 emphasized that a lack of guided policies and structured directions for achieving circularity in the textile supply chain is one of the key barriers hindering CE adoption.

TE-7 emphasized that the lack of segregation and collection facilities for textile waste is another challenge in CE adoption, "if we look at the downstream supply chain including segregation and collection activities, it has many problems. There are only one or two textile mills in Pakistan that segregate the clothes." The participants also stressed the lack of stakeholder collaboration in the CE transition in the textile supply chains. TE-7 asserted, "there is a new concept in textile – cradle-to-cradle; however, it is not achievable in the textile industry. The circularity cannot be implemented in-house by a company; it requires stakeholder collaboration. We have a habit of building silos, keeping things on our own, and hiding things. We need to change the behavior. We need to be open and talk with others." TE-21 emphasized that as far as the textile supply chain is concerned, "*it is not ready yet*". The understanding and awareness of the supply chain and its readiness are important in executing CE practices. The participants also revealed that one of the key external barriers to CE adoption in the textile industry is the supply chain disruptions caused by the ongoing economic crisis in Pakistan which is hindering the implementation of various CE practices. For example, TE-9 highlighted that due to a continuous rise in the dollar value, their company's sustainability projects are delayed, "two years ago we had to start our prime project of installation of wastewater recycling plant with a cost of Rs. 7 million which is now on hold because its cost has now reached to Rs. 23 million due to the inflation and economic crisis."

Table 3 presents illustrative quotes from consultants and senior managers on the internal and external barriers to the CE transition aligning with the NRBV and institutional theory.

5 | DISCUSSION

This study investigated the drivers and barriers of the CE transition in the textile industry of Pakistan. Building on the NRBV, the findings revealed various internal drivers such as resource efficiency, organizational factors, and innovation and technological advancements. Textile manufacturers are recognizing the value of resources, thereby executing CE practices such as resource recovery, recycling waste, and use of sustainable and renewable materials. These findings are also aligned with prior studies (e.g., Abbate et al., 2024; Coppola et al., 2023; Salo et al., 2020). In doing so, the manufacturers are conserving resources, reducing waste, and minimizing negative environmental impacts, hence strengthening their pollution prevention and product stewardship strategic capabilities. The reason can be associated with resource scarcity issues in developing countries such as energy, water, and raw materials (Farrukh et al., 2021). Further, due to increasing sustainability awareness, textile companies are demonstrating their commitment to environmental and social responsibility by adopting CE practices (Adamkiewicz et al., 2022). The findings also revealed that the textile industry is adopting CE practices from a cost-efficiency perspective (Saccani et al., 2023; Saha et al., 2021) which can be attributed to increasing operational costs of manufacturing, rising prices of raw materials, and diseconomies of scale resulting in reduced profitability (Bennur et al., 2020; Shaikh et al., 2022).

Technological advancement, research, and innovation are also driving manufacturers to adopt CE as technology and digitization can help achieve waste reduction, resource conservation, emission reduction, and employee health and safety which strengthen pollution prevention, product stewardship, and sustainable development strategic capabilities of an organization (Kazancoglu, Kazancoglu, Yarimoglu, & Kahraman, 2020; Sarasi et al., 2023). Further, research collaboration between industry and academia also drives the textile industry to the CE transition since researchers and academics facilitate the industry in developing innovative and alternative solutions using their intellectual capabilities and knowledge. However, these findings are lacking in the extant literature. The empirical evidence on internal drivers of the CE transition leads to the following proposition:

> **Proposition 1.** *The textile process industry in a developing economy is transitioning to CE adoption due to the internal motivations of resource efficiency, organizational concerns, and innovation and technological advancements linked with pollution prevention, product stewardship, and sustainable development strategic capabilities.*

In terms of external drivers, the findings revealed that the textile manufacturers are implementing CE practices due to various reasons associated with the institutional theory including market-related factors that are linked with the coercive isomorphisms such as customer and buyer requirements for environmentally friendly products developed with less use of chemicals and natural resources (Michna, 2022; Salmi & Kaipia, 2022). Nevertheless, the findings revealed that only international brands and corporate customers are aware of the CE paradigm forcing the textile firms to adopt sustainable business practices, unlike local customers. This can be attributed to the regulatory pressure on international customers, MNEs, and retailers to select manufacturing organizations in developing countries based on strict environmental criteria (Sardar et al., 2022). The findings also revealed

TABLE 3 Illustrative quotes on barriers to the CE transition.

Barriers	Categories	Sub-categories	Illustrative quotes	Organizational theories (NRBV and institutional theory)
Internal barriers	Behavioral barriers	Mindset issues	*"He [textile company owner] does not think beyond that, he never thinks about becoming Mian Mansha or Bill Gates. Our textile industry is playing the game of volume, not the specialization." (TE-9)* *"For example, in Lahore, the textile firms are not recycling as they are only concerned with economic sustainability and "loss-profit calculations." (TE-1)*	*Normative isomorphisms*
		Misinterpretation of CE	*"There are two types of textile waste, post-industrial and post-consumer waste; nevertheless, they [manufacturer] go straight to the latter one." (TE-7)* *"The textile industry is ignoring the resource efficiency aspects and focusing on recycling." (TE-12)*	
	Technical barriers	Recycling-related issues	*"So, the clothes which contain a mix of cotton and polyester, cannot be recycled. Nothing can be done to them except sending them to landfill." (TE-7)*	*Pollution prevention, product stewardship, sustainable development*
		Performance-related issues	*"A team of researchers from a university contacted us for Rs. 10 million projects in which they developed sustainable washing stones to be used in the washing process, unfortunately, the test results were not aligned with the customers' requirements for the end garment." (TE-11)*	
	Economic barriers	High cost of recycling	*"There is a lack of economic feasibility of recycling in Pakistan because it [post-consumer textile waste] comes from Europe, it is transported, and segregated. Then, energy is consumed in converting it into thread. In addition, the recyclers have installed machines and plants due to which their OPEX and CAPEX are increased. Further, they need to pack it and send it to the textile and apparel factories which increases their cost." (TE-7)*	
		High cost of sustainable materials	*"We are making prototypes using sustainable materials and sharing these with the customer; however, the biggest problem is cost as the customer wants something cheap." (TE-11)*	
External barriers	Customer/ brand-related barriers	Inadequate price offers from brands	*"Brands are coming every next day with more requirements, standards, and expectations without a significant price increase." (TE-2)* *"The first and foremost challenge in the CE adoption is a "better price offer" from the brands." (TE-12)*	*Coercive isomorphisms*
		Unrealistic CE goals	*"It is all about brand awareness, so they are the ones who are driving and we are just executing. The targets should be logical and it is not possible with the help of existing technologies." (TE-9)* *"In the case of producing renewable energy such as thermal, steam is generated through burning some fossil fuel, which generates carbon emissions, So until you come up with such an alternative technology, you are putting the industry under pressure for no reason because of these targets. You have unnecessarily upset the industry over something that you are not even fully aware of." (TE-9)*	
		High priority to the economic sustainability	*"Sometimes it happens, for example, when the customer opens the cartons and suppose 5000 pieces are damaged or not up to the quality standard out of 10,000 pieces, then we have to airship those 5000 pieces immediately."*	
	Supply chain-related barriers	Lack of Stakeholder collaboration	*"It is a two-way traffic. First, industries are not breaking out of silos and second it is challenging to onboard the supply chain members in Pakistan's textile industry." (TE-7)*	*Product stewardship and sustainable development*
		Lack of supply chain readiness	*"The textile supply chain includes chemicals suppliers, accessories suppliers, and machinery suppliers. Moreover, some recyclers are collecting textile waste and recycle it. So, what happens now is that whatever purchases they make and whatever operations they do,*	

TABLE 3 (Continued)

Barriers	Categories	Sub-categories	Illustrative quotes	Organizational theories (NRBV and institutional theory)
			are based on their cost calculation. So, it is a problem that these people are not thinking about the sustainability aspect of the supply chain." (TE-12) *"Around 80% of the textile industry in Pakistan is not aware of sustainability and circular economy in the supply chain." (TE-18)*	
		Supply chain disruption	*"Right now, we are facing issues in our green chemicals' supply due to the import restrictions imposed by the government." (TE-2)*	
	Regulatory and policy barriers	Lack of government understanding, support, and policies	*"Government should reduce taxes on solar installation, make sustainable policies, and implement these continuously." (TE-1)* *"The government and industry need to discuss with brands and buyers to understand their requirements and then translate them into the country-level requirements." (TE-2)*	*Coercive isomorphisms*

that developed and rich economies are sending textile waste to developing countries such as Pakistan and those in Africa which is driving the textile industry to CE transition (Camilleri, 2020; Omari, 2018; Wissenburg, 2006). The reasons can be associated with global ecological justice issues, unsustainable consumption behavior of consumers (such as the throw-away culture), and lack of awareness on repairing and sharing economy aspects (Luoma et al., 2022; Saha et al., 2021; Wissenburg, 2006); however, these findings are lacking in the existing body of knowledge.

In addition, the trickle-down effect of CE adoption in SMEs in the textile industry of an emerging economy – Pakistan – by large companies (or big brands) is also identified as a significant driver which is not highlighted in prior studies. Further, textile manufacturers are implementing CE practices such as the use of sustainable materials to gain competitive advantage which is linked with mimetic isomorphism (Jia et al., 2020). Similarly, supplier pressure and social media are also driving the textile process industry to transit to CE adoption which is associated with coercive isomorphisms. The findings revealed that environmental legislation and regulatory requirements are propelling textile manufacturers in a developing economy to adopt CE practices. Nonetheless, the international requirements from developed countries such as the EU Green Deal have a significant role in driving Pakistan's textile industry to transition to CE compared to the national regulations (Jia et al., 2020; Wiebe et al., 2022). The reasons can be associated with the increasing awareness of CE and established regulatory frameworks and guidelines of CE in developed countries compared to developing economies such as Pakistan which has a weak regulatory infrastructure and lack of environmental regulations (Farrukh et al., 2021). Additionally, the developed countries are not only forcing the manufacturers in developing nations to comply with environmental regulations but also with social sustainability standards such as labor rights and employee health and safety which are discussed in only a few studies (e.g., Brydges, 2021). Next, the societal drivers are critical in the CE transition in the textile industry of Pakistan such as NGOs (e.g., the Ellen MacArthur Foundation), the development sector (e.g., GIZ), as well as advocacy organizations and stakeholder governance groups (e.g., BCI) (Farrukh et al., 2021; Sarasi et al., 2023); however, these findings are also lacking in prior studies. The above discussion leads to the following proposition:

Proposition 2. *The textile process industry in a developing economy is transitioning to CE due to formal and informal institutional pressures including market factors, unsustainable consumption behavior, societal reasons, and regulatory requirements linked with the mimetic, normative, and coercive isomorphisms.*

The findings also revealed various internal and external barriers impeding the successful adoption of CE practices aligned with the NRBV and institutional theory. The internal barriers are associated with behavioral, technical, and economic issues. The findings revealed that the manufacturers in Pakistan's textile industry prioritize economic benefits such as cost reduction and profit maximization over environmental and social sustainability aspects. Further, they have an authoritative attitude and want to maintain the status quo or do things the way they have always been done which is related to normative isomorphisms (Mzembe et al., 2019). Nevertheless, the excessive centralization of decision-making inhibits innovative ideas and sustainable development in organizations (Mulaa et al., 2021). Despite the awareness of CE benefits, textile manufacturers resist implementing sustainable practices which require a change management approach and a shift to CE-enabling business models. Moreover, other difficulties such as lack of education and low literacy level also hinder the adoption of the CE approach in the textile industry (Majumdar & Sinha, 2019). The findings also highlighted that the lack of understanding of the CE paradigm is another key barrier to its adoption since manufacturing organizations only focus on recycling post-consumer textile waste and ignore the resource efficiency aspect through the entire value chain (Majumdar & Sinha, 2019). Along with the behavioral issues, the findings revealed different technical barriers including recycling issues and performance issues (Kazancoglu, Kazancoglu, Kahraman, et al., 2020). While the manufacturers are willing to recycle post-industrial and post-consumer textile waste, the garments including mixed fibers cannot be recycled (Kazancoglu, Kazancoglu, Kahraman, et al., 2020). These issues are related to the lack of operational and technical capabilities aligning with the product stewardship and sustainable development aspects of the NRBV. While textile manufacturers endeavor to reduce the usage of virgin materials by using recycled materials, the properties and structure of textile materials and the lack of recycling technologies hinder efficient recycling. The recycling process also consumes a considerable quantity of natural resources such as water which is another barrier for the textile firms operating in areas with water scarcity such as Karachi, thereby manufacturers are reluctant to follow CE practices.

Economic issues such as the increased cost of recycling wastewater and used garments pose a significant challenge as manufacturers find it difficult to manage the OPEX and CAPEX while reducing the environmental burden of the textile waste (Kazancoglu, Kazancoglu, Kahraman, et al., 2020) which is related to the cost-related aspect of the pollution prevention capability of the NRBV (Hart et al., 2010). While manufacturers are willing to use sustainable materials, utilizing such materials increases the overall cost of the product (Kazancoglu, Kazancoglu, Kahraman, et al., 2020). Another internal barrier to using recycled and sustainable materials is the lack of desired quality and performance (Kazancoglu, Kazancoglu, Kahraman, et al., 2020) creating operational challenges. On the one hand, manufacturers try to reduce the environmental burden of the textile industry (by using sustainable and recycled materials) while on the other hand, the economic performance can be affected in terms of low customer satisfaction. Building on the above discussion, the following is proposed:

> **Proposition 3.** *The textile process industry in a developing economy is facing internal barriers including behavioral issues linked with normative isomorphisms and economic, operational, and technical complexities related to the pollution prevention, product stewardship, and sustainable development capabilities of the NRBV while transitioning to CE.*

Among the external barriers, the findings revealed customer/brand-related barriers such as inadequate price offers from the brands, unrealistic CE targets, and priority given to economic sustainability over environmental and social performance which are linked with coercive isomorphisms. Additionally, regulatory issues such as the lack of government awareness of CE, inadequate financial support, lack of CE regulations, and lack of government involvement in designing a CE policy for the textile industry are also emphasized by the participants related to the institutional complexities aligning with the coercive factors (Jianguo et al., 2023; Piller, 2022). Further, the lack of collection and segregation facilities in the textile supply chain hinders the execution of CE practices (Subramanian et al., 2021). Similarly, the lack of coordination and collaboration between different supply chain actors is another barrier related to the product stewardship and sustainable development dimensions of the NRBV due to an organization's lack of engagement with suppliers, consumers, and society (Jia et al., 2020). Further, stakeholders mainly prefer the economic benefits of CE adoption and generally work in isolation without sharing knowledge and information (Govindan, 2018). Lastly, the economic disruption in the textile supply chain is identified as one of the key external challenges hindering CE adoption due to high inflation and import restrictions in Pakistan preventing the textile manufacturers from implementing sustainable CE practices. These complexities and uncertainties are generated from outside sources and organizations have limited control over them (Chand et al., 2022). Building on the above discussion, the following is proposed.

> **Proposition 4.** *The textile industry in a developing economy is facing external barriers including customer-related constraints, as well as regulatory and policy issues linking with the coercive isomorphisms of institutional complexities, and supply chain-related issues linking with the product stewardship and sustainable development aspects of the NRBV while transitioning to CE.*

Incorporating the key aspects of the NRBV and institutional theory, Figure 2 presents a holistic view of the drivers and barriers to the CE transition in the textile industry.

5.1 | Theoretical, practical, and policy implications

The study offers several theoretical implications. First, the study's novelty and contribution lie in the investigation of drivers and barriers to the CE transition in a continuous process industry (textile) which is lacking in the current literature. Second, the key aspects of the NRBV and institutional theory are incorporated into the development of a holistic CE framework and introduce empirically informed propositions to be tested in future studies. Third, the study examined the research phenomenon in a developing economy which is also lacking in the existing body of knowledge. Fourth, the information obtained from the experience and knowledge of consultants and professionals working in the textile sector adds fresh empirical insights into the CE literature. Fifth, the proposed framework integrating the empirical information and organizational theories can enable researchers to understand the salient reasons behind the CE adoption and obstacles to executing sustainable business practices in a process industry.

From a practical standpoint, the study offers valuable insights for the consultants and practitioners working in the process industry such as the textile sector. First, the practitioners could utilize the findings to understand the significance of a CE paradigm and examine the drivers and barriers for the CE transition. Second, the in-depth information from consultants and senior corporate managers can facilitate the textile companies to realign their business models from the linear economy to CE. Third, using their diverse knowledge and expertise, the consultants can guide corporate managers and practitioners regarding the changing requirements of customers and consumers,

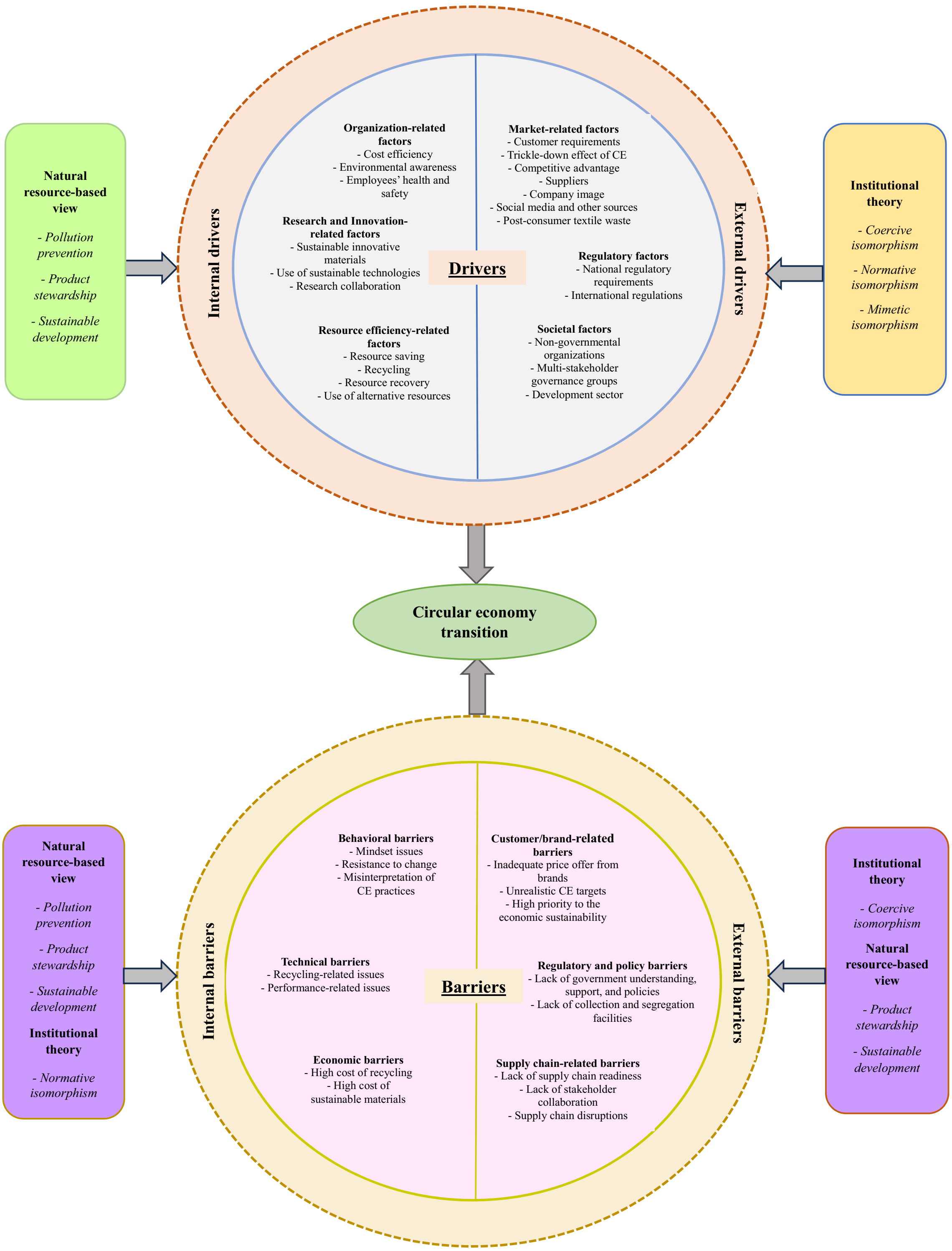

FIGURE 2 A holistic view of the drivers and barriers to the CE transition in the textile process industry.

evolving sustainable business practices, and emerging solutions to overcome challenges in CE adoption. Fourth, textile companies cannot only execute sustainable practices in manufacturing processes but also communicate the adoption of circular principles to their suppliers and other stakeholders and ensure consumer involvement in CE practices, thus fostering a circular textile economy.

The study also offers policy implications. First, the results can bring the attention of policymakers and decision-makers towards introducing CE regulations and developing adequate CE frameworks for the textile process industry in developing economies such as Pakistan. Second, the results can aid policymakers in improving waste management infrastructure for post-industrial and post-consumer textile waste. Third, the policymakers can use the study findings to develop sustainable financing opportunities and provide support for the textile companies to adopt CE practices that can improve their economic, environmental, and social performance. Fourth, the findings can guide decision-makers and policymakers in understanding the challenges faced by the textile industry resulting from economic disruption and designing adequate strategies and policies in times of crisis.

6 | CONCLUSION

This study is timely as it addresses the research gaps in the current literature by examining the drivers and barriers to the CE transition in the textile process industry of an emerging economy. In answering the first research question, the findings revealed key internal drivers that are synthesized under the organizational, resource efficiency, and research and innovation-related factors linked with the pollution prevention, product stewardship, and sustainable development strategic capabilities of the NRBV. Similarly, the key external drivers are categorized into market-related factors, regulatory factors, and societal factors related to the coercive, normative, and mimetic isomorphisms of the institutional theory. While answering the second research question, the findings highlighted various internal barriers such as behavioral, economic, and technical issues, as well as external barriers including customer and brand-related issues, policy and regulatory issues, and supply chain-related issues which are investigated using the NRBV and institutional theory.

Despite several significant contributions, there are some inevitable limitations of this study. First, the study mainly focused on the textile industry in Pakistan; however, in the future, the findings can be extended by conducting studies in other developing economies. Second, the data were collected from the consultants and senior managers working in the textile industry; nevertheless, the inclusion of other stakeholders from upstream and downstream functions (such as suppliers, retailers, distributors, waste collectors, recyclers, customers, and consumers) could provide more robust insights. Third, the study was conducted in the textile sector using a qualitative research methodology; future research can adopt a quantitative or mixed methodology approach for achieving statistical generalization. Fourth, the study highlighted the external complexities of CE transition due to the economic crisis; future research can investigate the impacts of climate change, political disruption, and natural disasters on CE adoption. Fifth, the study examined the drivers and barriers to the CE transition in the textile process industry; future research can explore the enablers facilitating the successful implementation of CE practices, such as multiple-stakeholder engagement, the role of top management, and organizational culture. Additionally, future research can be conducted in other continuous process industries such as the chemical, leather, and pharmaceutical sectors struggling to adopt CE practices which will extend the transferability of the study results.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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