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Green technology adoption paving the way toward sustainable performance in circular economy: a case of Pakistani small and medium enterprises

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Abstract

Purpose – A rapid increase in traditional industries is creating social and environmental problems through extensive usage of natural resources and polluting the environment. A circular economy provides curative and renewing lines of action about these problems. Therefore, this study aims to examine the factors that lead toward sustainable performance in a circular economy context and empirically test the relationships between green technology adoption (GTA), circular economy principles (CEP), sustainable supply chain practices (SSCM) and sustainable performance (SP).

Design/methodology/approach – Using the well-developed governmental databases, data from 435 small and medium enterprises (SMEs) in the textile sector of Pakistan were collected and tested through AMOS using a structural equation model.

Findings – The results disclosed that GTA, CEP and SSCM have significant and positive direct relationships and facilitate improving SMEs' SP. Circular economy entrepreneurship (CEE) and customer pressure (CP) were found to have a significant and positive influence on the relationships of GTA and CEP with SSCM.

Originality/value – The role of GTA in circular economy and the moderating effect of CEE and CP is an addition to the literature. SMEs' GTA allows them to reuse, reduce and recycle natural resources rather than obtain new ones from the ecosystem.

Keywords Circular economy principles, Green technology adoption, Customer pressure, Sustainable supply chain management, Sustainable performance

Paper type Research paper

Introduction

The ecological environment is facing rapid and dramatic degradation due to a boom in conventional industries, resulting in severe issues like environmental pollution and resource

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depletion (Ibrahim and Vo, 2021). People across the globe are becoming more and more concerned about these environmental matters and pushing organizations to follow sustainable development guidelines (Xia *et al.*, 2022). United Nations' agenda for 2030 also stresses the significant role of achieving sustainable natural resource utilization to prevent exhaustion (Assembly, 2015). In addition, sustainability provides possible competitive advantages to organizations (Mwangi *et al.*, 2021). However, many large-scale organizations have taken initiatives to achieve sustainability (Lii and Kuo, 2016). However, small and medium enterprises (SMEs) have been found to exhibit less tendency toward sustainability (Johnson and Schaltegger, 2016). According to a compiled report, 51% of industrial greenhouse gas (GHG) emission is caused by only 25% of the state-owned companies globally (Griffin, 2017). NAMA (2021) conducted a survey and reported that among all the industries, textile is the second largest contributor to polluting the environment in Pakistan, and SMEs, in this sector only, are emitting 6% of the country's GHG emissions in air pollution. According to a report, SMEs in Pakistan provide 60% of the overall jobs and have a GDP contribution of 30 to 40%, most notably, the SMEs contribute 25% of the country's export revenue (AYESHA, 2020). Different scholars have developed a consensus globally that SMEs impact the global environment (Bakos *et al.*, 2020; Manzoor *et al.*, 2021; Khoja *et al.*, 2022). Keeping this in mind, encouraging these firms toward efficient resource usage needs to be examined (Khoja *et al.*, 2022), intending to decrease the adverse effects of more extensive supply chains on the environment (Saqib and Satar, 2021). Due to a lack of financial, managerial and spatial resources, SMEs of emerging economies are not taking steps toward sustainable development (Souto, 2022). Therefore, it becomes significant to examine the factors that enable these SMEs to take the initiative and develop a support system for sustainable development (Klewitz and Hansen, 2014; Gu, 2022). Moreover, sustainability fosters competitive advantages in SMEs (Kumar *et al.*, 2020).

Firms taking initiatives to solve societal and environmental issues adopt green technologies to achieve sustainability goals (Van Holt *et al.*, 2020). This orientation toward green activities by using green technologies to eliminate environmental concerns evolved from the concept of eco-innovation, which provides specific guidelines for implementation to the practitioners (Qu *et al.*, 2018). Green technology adoption (GTA) is the adoption of green technologies by the firms during their process of new product development, manufacturing practices, training and development of the employees and transferring the green consumption practices to the consumers (Xia *et al.*, 2022). It is also essential to impart these innovative green practices, span beyond the organization and encourage other stakeholders (Brown *et al.*, 2021).

The circular economy (CE) is essential to green technology sustainability (Ntsondé and Aggeri, 2021). CE differs from conventional systems and provides opportunities to extend the value by reducing the flow of resources and slowing the loop of resources or ending the loop of resources (Bocken *et al.*, 2016). On the other hand, it also facilitates in reduction of input waste, reduction in GHG emissions and develops a system keeping the interests of stakeholders in view (Ülkü *et al.*, 2022). CE requires developing unique models for business by incorporating novel ways of thinking and executing operational activities of the business (Bocken *et al.*, 2016). Ghisellini *et al.* (2016) called these phenomena a restorative and regenerative paradigm aiming to increase production and consumption efficiency by implementing fundamental reduction principles, reuse and recycling. Though implementing these CE principles (CEP) is beneficial, these benefits multiply when joined with GTA (Rattalino, 2018).

Moreover, implementing selective CEP does not provide maximum benefits. However, implementing CEP and GTA can provide the foundations for developing a change in organizational paradigm to use the resources more efficiently and effectively (Lüdeke-Freund *et al.*, 2019). It is since implementing a combination of CEP, and GTA promotes the organization's sustainability practices (Niroumand *et al.*, 2020; AlQershi *et al.*, 2022). Thus, examining the link between GTA and CEP becomes valuable for organizations to move in a sustainability direction (Brown *et al.*, 2021).

This study proposes that promoting GTA orientation, developed on the ideology of the closed-loop manner of actions, creates opportunities to develop innovative ideas and can encourage organizations to extend support in implementing CEP (Khurana *et al.*, 2021; Khoja *et al.*, 2022; Mady *et al.*, 2022). Moreover, there are multiple research calls in SMEs promoting the implementation of GTA (Gopi Krishna and Lorsuwannarat, 2018; Gu, 2022) and CE (Mura *et al.*, 2020; Kevin van Langen *et al.*, 2021). In addition, research is also required to present empirical evidence to show their effects on sustainable supply chain management (SSCM) (Dey *et al.*, 2020; Wang *et al.*, 2021) and performance (Ahmad *et al.*, 2020). Furthermore, according to stakeholder theory and from a practical point of view, being reactive to environmental concerns has not been beneficial for the organizations only because there are specific pressures from the stakeholders (in this case, customer pressure – CP) and firms' attempt executing the CE entrepreneurship (CEE) to attain SSCM and to show business cohesion in achieving the sustainable performance (SP) (Barforoush *et al.*, 2021).

This study has formulated the following research questions (RQs) in line with the identified gaps from the literature:

RQ1. What are the effects of implementing GTA on CEP in SMEs?

RQ2. Does GTA affect the SSCM in SMEs?

RQ3. Does CEP affect SSCM in SMEs?

RQ4. What is the influence of CEE on SSCM in SMEs?

RQ5. Does CP influence SSCM in SMEs?

RQ6. What is the impact of SSCM on SP in SMEs?

Literature review

Underpinning theories

The resource-based view (RBV) (Barney, 1991) and stakeholder theory (Freeman, 2015) were used to explain the relationships of the proposed research framework of this study. RBV explains that access to resources is an essential requirement for any organization to achieve competitive advantages and increase the performance of an organization. It suggests that the differential capability of these resources facilitates providing a competitive edge to the organization. For this purpose, resources must have unique traits, not readily available and cannot be easily imitated by others. These theories have been incorporated following the call from Panwar and Niesten (2020), as well as the recommendations in the extent CE and sustainability literature requiring the investigation of the impact of internal capabilities and dynamics of the external market in CE on achieving the SP (Kalmykova *et al.*, 2018; Ibn-Mohammed *et al.*, 2021; Kumar *et al.*, 2021). In the current study, the context of CE suggests that the life of the materials can be extended through reducing, reusing and recycling the materials, and this improves resource efficiency and provides the organization with a competitive advantage. In the current study, CEP and GTA are considered crucial resources that facilitate SSCM and help achieve SP, as these factors stimulate material sourcing from the economy rather than resources from the ecological system.

Furthermore, the CEE of an organization is considered a strategic resource and provides several business opportunities aligned and in response to CEE. In addition, the stakeholder theory highlights the significance of the stakeholders' influence on the business and pushes it to alter its business practices. These stakeholders have to power to affect the business practices and outcomes. In the current study, the CP and CEE influence businesses to explore and exploit innovative methods and new business models that are financially viable, socially acceptable and environment friendly.

Circular economy principles (CEP)

Chinese first adopted this concept and transformed the conventional business models (take–make–consume–dispose of) into a restorative and regenerative approach and extended the value of reusing the resources circularly (Lopes de Sousa Jabbour *et al.*, 2018; Nazlı Köseoğlu, 2022). The core concept of CE signifies the production profits through the flow of resources and products over time rather than selling them to become more profitable (Huynh, 2022). CE encourages resource recirculation in the ecosystem using strategic methods of limiting the flow of resources, slowing the loops of resources, and closing the loops of resources (Mura *et al.*, 2020). These three strategies are connected with the CE capabilities in an organization (Ghisellini *et al.*, 2016; Goyal *et al.*, 2018) and have been used as the CEP in this study.

Green technology adoption (GTA)

Braun and Wield (1994) defined green technology as the processes and use of technology to minimize material wastage and energy consumption. GTA highlights the use of green technology to execute business operations, particularly during new product development, manufacturing and training and development of an organization's human capital. GTA is complemented as a crucial resource and supports green innovations (Huynh, 2022). These green technologies reduce the waste of inputs, energy and production (Rossini *et al.*, 2019). Similarly, Afum *et al.* (2021) mentioned that firms investing in green technologies also reduce their variable costs associated with designing the product at the product development stage and facilitate the production of goods with the highest quality.

Circular economy entrepreneurship (CEE)

The process of exploring and exploiting opportunities in the CE domain is called circular entrepreneurship (Zucchella and Urban, 2019). CE creates abundant entrepreneurial opportunities, and using these entrepreneurial opportunities is very important for entrepreneurs to develop innovative business models and introduce new methods of doing business (Veleva and Bodkin, 2018). The adoption of CE comprehensively creates access to new and unexpected entrepreneurial opportunities that increase business value due to its involvement and support of CE (Cullen and De Angelis, 2021). Circular products and services are the core benefits and opportunities created due to CEE. In circular products and services, the ownership is retained, whereas the usage rights are transferred to the users (Urban, 2019). CEE focuses on taking advantage of new opportunities through innovation breakthroughs and leading the firm toward sustainable development (Tiep Le and Nguyen, 2022).

Customer pressure (CP)

Perceived criteria set by the customer requiring the organizations to concentrate on addressing environmental concerns and reducing the negative impact of the business operations on the environment is called CP (El Baz and Laguir, 2017). Customers set social responsibility-related expectations from the organization, suppliers and supply chain members and act as influential economic stakeholders in the supply chain (Chu *et al.*, 2019). Customers may influence organizations to adopt environmentally friendly operational practices or operating standards to meet and enhance environmental performance (Sarkis, Gonzalez-Torre and Adenso-Diaz, 2010). Such requirements from the customer side may exert severe pressure on the organizations and their supply chain partners and drive them to adopt innovative and sustainable practices (Tate *et al.*, 2011). In this way, CP can stimulate the adoption of SSCM practices to gain product differentiation and competitive advantage over others (Chen and Liu, 2020).

Sustainable supply chain management (SSCM)

SSCM integrates environmental and social metrics into SCM processes to sustainably improve business performance (Kirchoff *et al.*, 2016). From the CE perspective, SSCM is connected with the central processes related to the management of multiple stages involved throughout the supply chain, such as the management practices related to the supply chain processes, supply and demand fulfillment, flow of production, development of new products, commercialization activities and policies related to the return of products. To an extent, they are aligned with the CEP of increasing the efficiencies of the resources, decreasing energy consumption, recycling and converting to the usage of renewable energies (Hazen *et al.*, 2020). In this regard, CEP provides opportunities to reduce the instabilities and help improve supply security (Hazen *et al.*, 2020). The increase in demand for recycled materials is resulting in a slight but gradual decrease in the demand for fresh raw materials, and as a result, it is causing a strong and close collaborative relationship between the suppliers and the end users, which reduces the disruption in the supply chain (Hazen *et al.*, 2020). Furthermore, in the context of CE, the role of SSCM is not just the management-related practices but providing the facilities and system throughout the supply chain stages (Tiep Le and Nguyen, 2022).

Sustainable performance (SP)

From the triple bottom line perspective, integrating the economic, social and environmental perspectives to guide the stakeholder's activities is called sustainability (Dey *et al.*, 2020). In the beginning, companies considered sustainability an expense with no outcome, but recently, some evidence indicates that sustainability delivered value to the organizations (Van Holt *et al.*, 2020). Many managers realized the advantages of adopting sustainable practices and found that these practices had transformed the priorities of performing operational activities (Kiron *et al.*, 2013). The collaborative efforts among the stakeholders (Rodríguez-Espíndola *et al.*, 2020) lead the organization to attain SP through incorporating economic, social and environmental practices into the operational activities of the company (Aktin and Gergin, 2016). There is a need to develop an improved comprehension of the possible advantages of opting for and performing sustainable activities to perform a company's operations (Ambekar, Deshmukh and Hudnurkar, 2021). Although adding social and environmental dimensions to the economic/financial performance of the firm has its challenges (Camilleri, 2022), evidence suggests positive feedback about these dimensions (Pinto, 2020). The purpose of sustainable activities is to facilitate organizations in designing business models to achieve financial efficiency by using limited resources and overcoming social barriers to achieve SP (Afum *et al.*, 2021).

Relationship between green technology adoption and circular economy principles

GTA involves adopting technology and management practices that increase organizational productivity and helps in reducing material waste. GTA develops flexibility to alter the processes to decrease the chances of any risk. Rodríguez-Espíndola *et al.* (2022) researched and checked digital platforms' effects on CE and concluded that these platforms help reduce risks and achieve SP. Adopting eco-innovation supports materials reuse, reduction and recycling (Cainelli *et al.*, 2020). Belhadi *et al.* (2021) mentioned that blockchain technologies improved CE practices. Suchek *et al.* (2021) highlighted that the primary objective of GTA is to retain the competitive advantage, increase the products and services in terms of quality, avoid resource wastage and reuse the resources rather than acquire them from the ecosystem. GTA in CE principles involves maximizing the lifecycle of the materials, streamlining the supply chain activities and increasing the supply chain value for the organizations (Reimann *et al.*, 2019; Krug *et al.*, 2021). Patwa *et al.* (2021) highlighted that SMEs face issues in achieving sustainability, particularly in developing countries, and GTA could provide benefits to SMEs when following the CEP. Therefore, to study the impact of GTA on CEP following hypothesis is proposed:

H1. GAT has a positive effect on the CEP in SMEs.

Relationship between green technology adoption and sustainable supply chain management

Lack of expertise in implementing innovative technologies is generally observed across the industry, which acts as a barrier to achieving sustainability. In such a scenario, introducing CEP creates opportunities to use material moderately and avoid material and energy waste, facilitating the implementation and execution of innovative technologies (Rattalino, 2018). The combination of practices based on sustainability and current digital technologies acts as a catalyst to increase SP. Afum *et al.* (2021) mentioned that firms investing in green technologies also reduce their variable costs associated with designing the product at the product development stage and facilitate the production of goods with the highest quality. The increase in demand for recycled materials is resulting in a slight but gradual decrease in the demand for fresh raw materials; as a result, it is causing a strong and close collaborative relationship between the suppliers and the end users, which reduces the disruption in the supply chain (Hazen *et al.*, 2020). SSCM execution develops the improved capability in the enterprises to strongly coordinate with the stakeholders in the supply chain and increase the value of the business (Le *et al.*, 2022). Based on the above discussion and the gap analysis, the following hypothesis has been developed for further investigation:

H2. GTA has a positive effect on the SSCM in SMEs.

Relationship between circular economy principles and sustainable supply chain management

In CE, the wastage of resources and energy is regenerated to create new economic opportunities (Pizzi *et al.*, 2021, 2022). This feature of regenerating the resources brings huge alternations in supply and demand patterns (Hazen *et al.*, 2020). CEP is implemented at three levels; individual level, supply chain level and macro level; at an individual level, implementation of CEP helps to increase the SP of the company; at the supply chain level, CEP implementation facilitates resource sharing across the supply chain; and at the macro level, it addresses the governmental policy concerns (Mathews and Tan, 2011). In this regard, CEP provides opportunities to reduce the instabilities and help improve supply security (Hazen *et al.*, 2020). CEP drives the SSCM through resource circulation and developing a system reducing resource wastage by increasing their usage lifecycle (Velenturf and Purnell, 2021). Many managers realized the advantages of adopting sustainable practices and found that these practices had transformed the priorities of performing operational activities (Kiron *et al.*, 2013). The collaborative efforts among the stakeholders (Rodríguez-Espíndola *et al.*, 2020) lead the organization to achieve SP through incorporating economic, social and environmental practices into the operational activities of the company (Aktin and Gergin, 2016). Therefore, to study the impact of CEP on SSCM, below given hypothesis is proposed:

H3. CEP has a positive effect on the SSCM in SMEs.

H4. CEP mediates the positive relationship between GTA and SSCM in SMEs.

Relationship between sustainable supply chain management and sustainable performance

SSCM integrates environmental and social metrics into SCM processes to sustainably improve business performance (Kirchoff *et al.*, 2016). In the context of CE, SSCM is connected with the central processes of managing multiple stages throughout the supply chain. From the triple bottom line perspective, integrating the economic, social and environmental perspectives to guide the stakeholder's activities is called sustainability (Dey *et al.*, 2020). In the beginning, companies considered sustainability an expense with no outcome, but recently, some evidence indicates that sustainability has delivered value to organizations (Van Holt *et al.*, 2020). Many managers realized the advantages of adopting sustainable practices and found that these practices had transformed the operational activities' priorities (Kiron *et al.*, 2013). The collaborative efforts among the stakeholders (Rodríguez-Espíndola *et al.*, 2020) lead the organization to achieve SP through incorporating economic, social and environmental practices into the operational activities of the company (Aktin and Gergin, 2016):

H5. SSCM has a positive relationship with SP in SMEs.

H6. SSCM mediated the positive relationship between CEE and SP in SMEs.

H7. SSCM mediated the positive relationship between GTA and SP in SMEs.

Moderating effect of circular economy entrepreneurship

CEE stimulated the novel business model to develop innovative products and services in a CE (Zucchella and Urban, 2019). These CEE are high-risk takers willing to capitalize on entrepreneurial opportunities to gain competitive advantages. Their survival depends on continuously introducing breakthrough innovations and helping the business retain its competitive advantage (Cullen and De Angelis, 2021). In a CE context, CEE influences the SSCM, promoting discovering innovative ways of doing business and exploring novel opportunities presented in CE. CEE helps enterprises develop practices to reuse the waste in the production process, thus enhancing the business's value. These resources are retained until they add value (Urban, 2019). In this regard, CEP provides opportunities to reduce the instabilities and help improve supply security (Hazen *et al.*, 2020). The increased demand for recycled materials results in a slight but gradual decrease in the demand for fresh raw materials. As a result, it is causing a strong and close collaborative relationship between the suppliers and the end users, reducing the disruption in the supply chain (Hazen *et al.*, 2020). Kuzma *et al.* (2021) mentioned that CEE influences organizations to develop the process developing valorization. Similarly, CEE influences the SSCM to adopt processes and innovative technologies that reduce the negative impact on society and the environment (Manea *et al.*, 2021):

H8. CEE moderates the positive relationship between GTA and SSCM in SMEs.

H9. CEE moderates the positive relationship between CEP and SSCM in SMEs.

Moderating effect of customer pressure

Customers set social responsibility-related expectations from the organization, suppliers and supply chain members and act as influential economic stakeholders in the supply chain (Chu *et al.*, 2019). Customers may influence organizations to adopt environmentally friendly operational practices or operating standards to meet and enhance environmental performance (Sarkis *et al.*, 2010). Such requirements from the customer side may exert severe pressure on the organizations and their supply chain partners and drive them to adopt innovative and sustainable practices (Tate *et al.*, 2011). In this way, CP can stimulate the adoption of SSCM practices to gain product differentiation and competitive advantage over others (Chen and Liu, 2020). Huang *et al.* (2016) mentioned that CP promoted innovation adoption and increased performance. CP is an organization's dynamic resource, forcing small and medium-sized suppliers to adopt CSR practices (Choi *et al.*, 2019). Gualandris and Kalchschmidt (2014) researched to explore the influence of CP on innovativeness and SCM practices. They elaborated that CP and innovativeness positively impact SCM practices, and that CP pushed manufacturing companies to adopt innovative practices to increase performance. Based on the above arguments, the following hypotheses are proposed:

H10. CP moderates the positive relationship between GTA and SSCM in SMEs.

H11. CP moderates the positive relationship between CEP and SSCM in SMEs (Figure 1).

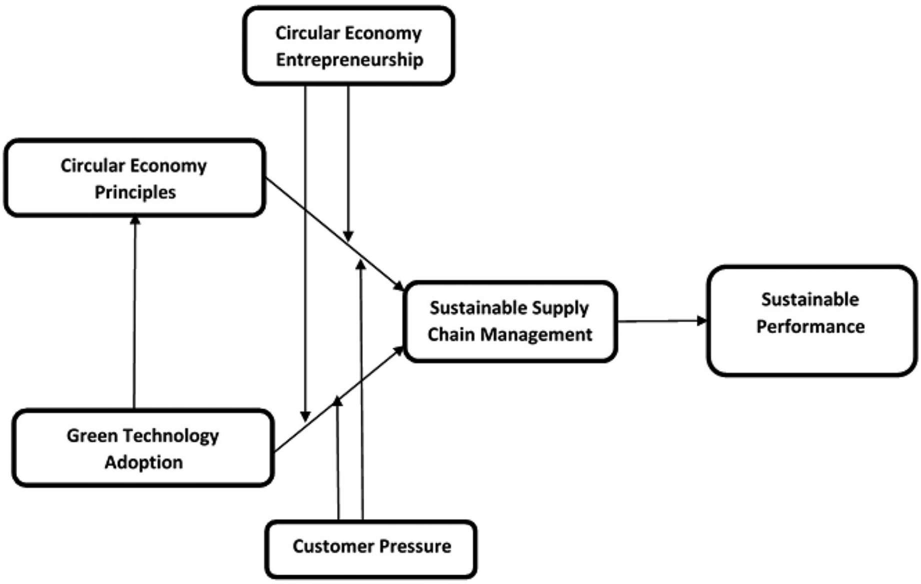

Figure 1.
Proposed research framework

The procedure, data and measurement

Measures

The survey methodology approach is the most appropriate technique to collect the data quickly. For this purpose, a research questionnaire was designed and structured into two sections. Section 1 consisted of questions regarding the respondents' characteristics, whereas the second was structured to collect the data regarding the study variables. A five-point Likert scale ranging between "strongly disagree = 1" and "strongly agree = 5" was used to create the questionnaire for this study. Scale items from prior studies were carefully chosen, based on their face validity, to quantify the variables of the inquiry. GTA was measured by adopting the eight questions and items from the previous studies by Bürklin and Wynants (2020), Cainelli *et al.* (2020) and Chen (2020). Product performance facets in a CE context were adopted (Zeng *et al.*, 2017). Furthermore, eight question items to measure CEP were adopted from different past studies (Hazen *et al.*, 2020; Kuzma *et al.*, 2021; Pizzi *et al.*, 2022). The SSCM construct was measured by adopting the eight-item scale (Monczka *et al.*, 1998; Kirchoff *et al.*, 2016; Petljak *et al.*, 2018). A six-item scale, based on past studies, was adopted to measure the SP of the SMEs (Hourneaux *et al.*, 2018; Abbas, 2020; Wang *et al.*, 2021). CP's construct was based on the ideology of customer awareness related to environmental issues and their role in influencing the firms to act environmentally friendly. It was measured using the four question items, and these four scale items were based on the study of Gadenne *et al.* (2009), which examined the choices of the customer based on the study conducted by Kohli and Jaworski (1990) and used the items from Slater and Narver (1994). CEE was also adopted from past studies, and five items have been used to measure it (Lynde, 2020; Cullen and De Angelis, 2021).

The data was collected from the textile industry of Pakistan by using the convenience sampling technique. The APTMA (2022) database, SMEDA (2021) and directories from the chamber of commerce in Islamabad, Lahore, Faisalabad, Multan and Karachi, data about the textile mills and factories of small and medium size in Pakistan were compiled. Using convenience sampling, data was collected for three months, from January 2022 to March 2022. Four research students were hired for the data collection and were compensated for performing this activity. All the respondents volunteered to participate and were briefed about the purpose of the study before completing the questionnaire. After collecting the data, the respondents were thanked for contributing to this study. A total of 450 questionnaires were distributed through email among the respondents during the survey, and 15 questionnaires were returned incomplete and had multiple blank responses, so they were discarded. In total, 435 questionnaires were valid and usable for the data analysis.

Analysis

Fundamental descriptive analysis and data screening tests were performed using SPSS v.24. Whereas, hypotheses testing was performed using AMOS v.24 by applying a structural equation model (SEM). This method is commonly used to estimate the direct and indirect relationships between the constructs and is recommended by previous researchers (Hu *et al.*, 2018; Kumar and Shukla, 2022). This technique is very beneficial and provides error-free, robust and optimum estimated values of the relationships under study (Hair *et al.*, 2010).

Results

Descriptive statistics

Data were collected using convenience sampling, and out of 435 respondents, 87% were male. The average age of the respondents was 34.29 years. In addition, 45% of the respondents mentioned that they hold a textile-related technical degree. Also, 39% of the respondents were senior or general managers in their organization. The average experience of the respondents was 11 years. Table 1 provides deep insight into the respondent's demographic profiles.

Reliability, validity and measurement model tests

Convergent and discriminant validity were estimated to evaluate the construct validity. As per Fornell and Larcker (1981), if the values of average variance extracted (AVE) are more significant than 0.50, this is considered positive as it implies that the measuring items generate at least 50% of the construct's variation. The findings of convergent validity are shown in Table 2. AVE readings were all more than 0.50. After that, the composite reliability (CR) values were computed, and it was discovered that they were above the 0.70 criterion. The factor loadings of all the items were then checked; one item of mental health was dropped owing to cross-loading difficulties, and two items of learning anxiety were

Variable	Categories	Frequency	%
Age			
	20–29 years	139	32
	30–39 years	113	26
	40–49 years	122	28
	More than 50 years	61	14
Gender			
	Male	378	87
	Female	57	13
Level of education			
	Undergraduate	95	22
	Graduate	144	33
	Technical degree	196	45
Number of employees			
	Less than 10	0	0
	11–50	96	22
	51–100	139	32
	101–250	170	39
	Not specified	30	7
Age of the company (years)			
	Less than 10	13	3
	1–5	74	17
	5–10	178	41
	10+	170	39
	Not specified	0	0
Job title			
	Officer/coordinator	91	21
	Supervisor/manager	135	31
	Senior manager/general manager	170	39
	Managing director/CEO	39	9
Job experience			
	0–5 years	170	39
	6–10 years	135	31
	11–15 years	74	17
	More than 15 years	56	13

Table 1. Respondent's demographic profile ($N = 435$)

Variable name	Scale item	Loading	AVE	CR	Cronbach's α
CEP			0.506	0.891	0.891
	CEP1	0.683			
	CEP2	0.719			
	CEP3	0.754			
	CEP4	0.690			
	CEP5	0.637			
	CEP6	0.730			
	CEP7	0.708			
	CEP8	0.714			
GTA			0.523	0.897	0.897
	GTA1	0.718			
	GTA2	0.768			
	GTA3	0.772			
	GTA4	0.731			
	GTA5	0.765			
	GTA6	0.769			
	GTA7	0.747			
	GTA8	0.773			
CEE			0.571	0.865	0.884
	CEE1	0.713			
	CEE2	0.739			
	CEE3	0.816			
	CEE4	0.783			
	CEE5	0.823			
CP			0.594	0.85	0.871
	CP1	0.803			
	CP2	0.786			
	CP3	0.762			
	CP4	0.783			
SSCM			0.501	0.888	0.889
	SSCM1	0.768			
	SSCM2	0.748			
	SSCM3	0.578			
	SSCM4	0.665			
	SSCM5	0.794			
	SSCM6	0.674			
	SSCM7	0.750			
	SSCM8	0.761			
SP			0.588	0.893	0.887
	SP1	0.763			
	SP2	0.642			
	SP3	0.837			
	SP4	0.833			
	SP5	0.807			
	SP6	0.842			

Table 2. Convergent validity, reliability and factor loadings

dropped due to values less than 0.70. All of the remaining values were more than 0.70. The Cronbach's alpha values were then calculated and were more than the 0.70 thresholds proposed by Hair *et al.* (2010). The data was judged to have convergent validity and to be suitable for further examination.

Variance inflation factor (VIF) values and their accompanying tolerance values were determined according to Hair *et al.* recommendations to check for multicollinearity concerns in the data (Black and Babin, 2018). The tolerance values varied from 0.558 to 0.949, whereas the VIF values ranged from 1.054 to 1.785. These numbers suggested no concerns with multicollinearity in the given data. Furthermore, the discriminant validity was verified using the approach proposed by Claes Fornell and Larcker (1981). The findings of discriminant validity are shown in Table 3.

The confirmatory factor analysis (CFA) approach was used in AMOS v24 as per the criteria recommended by Black and Babin (2018); the first measurement model was fit with few acceptable values. After drawing covariance between the error terms, a re-specified model was estimated to ensure that the model fit values met the criteria. Model fitness values of the primary measurement model and the re-specified model after re-specification are shown in Table 4, highlighting that the model fitness was achieved after a few specifications.

Structural equation modeling (SEM)

Following the actual test and estimation of the measurement model, the next step is to do structural equation modeling (SEM) and assess the causal links between the researched variables. We began the SME test by checking the model fitness values for this structural model, following the guidelines provided by Black and Babin (2018). Because the first SEM had a few poor fit values, we need to draw two variances on the error terms. The model was then fitted, and Figure 2 depicts the SEM causal model with direct effects.

Hypothesis testing

H1 of the current study was to examine the effect of GTA on CEP, and the result values of coefficient $\beta = 0.133$ and $p < 0.000$ indicate a positive relationship. *H2* was to examine GTA on SSCM, and the results ($\beta = 0.16$ and $p < 0.000$) indicate a positive effect. *H3* tests the

Table 3.
Discriminant validity

Construct	MSV	SSCM	CEP	GTA	SP	CEE	CP
SSCM	0.234	*0.707*					
CEP	0.303	0.484***	*0.712*				
GTA	0.05	0.217***	0.134*	*0.723*			
SP	0.051	0.150**	0.187***	0.223***	*0.767*		
CEE	0.243	0.398***	0.492***	0.094†	0.225***	*0.756*	
CP	0.303	0.406***	0.550***	0.066	0.072	0.341***	*0.771*

Notes: Significance of Correlations: † $p < 0.100$; * $p < 0.050$; ** $p < 0.010$; *** $p < 0.001$

Table 4.
Measurement model fitness values

CFA indicator	Threshold value	Initial model	Modified model
CMIN/DF	≤ 3	2.997	1.852
GFI	≥ 0.80	0.818	0.869
AGFI	≥ 0.80	0.793	0.850
CFI	≥ 0.90	0.858	0.94
RMSEA	≤ 0.08	0.068	0.044
NFI	≥ 0.90	0.802	0.879
TLI	≥ 0.90	0.847	0.935
IFI	≥ 0.90	0.859	0.94
PCLOSE	> 0.05	0.000	0.994
SRMR	< 0.08	0.051	0.051

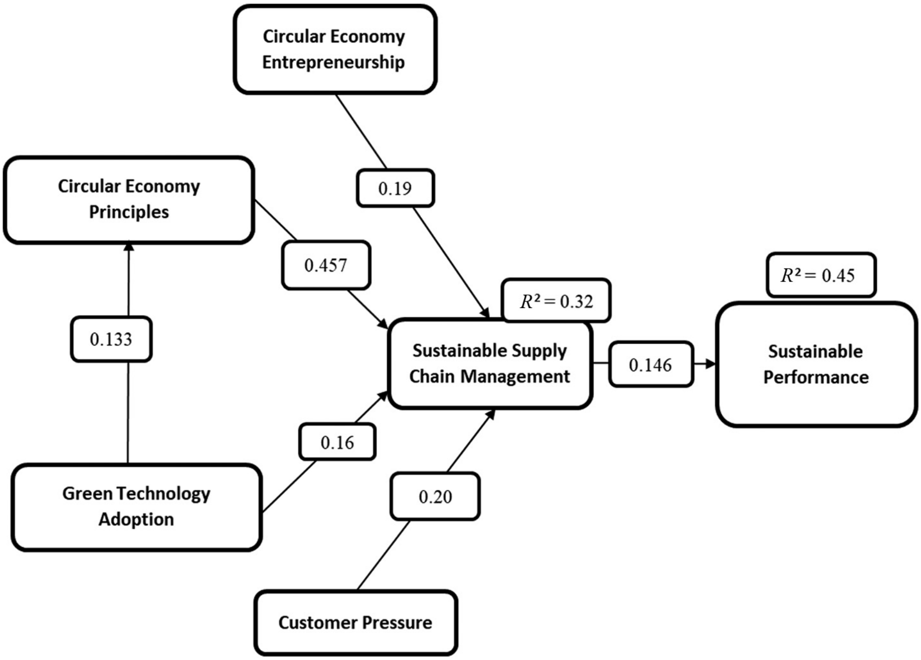

Figure 2. SEM results of direct effects

association between CEP and SSCM, and the result values ($\beta = 0.457$ and $p < 0.000$) show a positive association. The estimated results to test the relationship between SSCM and SP indicated that a positive relationship exists between values ($\beta = 0.146$ and $p < 0.000$). All the direct hypotheses were accepted. Table 5 shows the results of the direct hypotheses.

In the current study, three mediation hypotheses were also proposed, and the results in Table 6 show that all the mediation hypotheses were supported.

The proposed research framework also had four moderation hypotheses, and the results indicate that CEE and CP positively moderate and strengthen the relationships. Figure 3(a)

Hypothesis	Structural relationships	Coefficient (β)	(STDEV)	t-statistics	p-value	Status
H1	GTA → CEP	0.133	0.015	8.844	0.000	Significant
H2	GTA → SSCM	0.16	0.015	12.09	0.000	Significant
H3	CEP → SSCM	0.457	0.015	14.594	0.000	Significant
H5	SSCM → SP	0.146	0.015	0.762	0.000	Significant

Table 5. Results of direct hypotheses

Hypothesis path	Indirect path	β	Path	β	Mediation effect (β)	t-value	Decision
H4	GTA → CEP	0.13	CEP → SSCM	0.46	0.069	6.632	Supported
H6	CEP → SSCM	0.46	SSCM → SP	0.15	0.076	2.327	Supported
H7	GTA → SSCM	0.16	SSCM → SP	0.15	0.027	2.751	Supported

Table 6. Results of mediation hypotheses

and 3(b) and 4(a) and 4(b) show the influencing role of CEE and CP in relationships between CEP and SSCM and GTA and SSCEM.

Discussion and conclusion

People across the globe are becoming more and more concerned about these environmental matters and pushing organizations to follow sustainable development guidelines. In this regard, the current study examined the effect of GTA and CEP on SP. The first direct hypothesis examined the relationship between GTA and CEP, and the results showed a positive relationship, indicating that when the SMEs implement GTA practices, this positively contributes to CEP being implemented more efficiently. Belhadi *et al.* (2021) have also shared similar findings while examining the relationship between blockchain technologies and mentioned that it improved CE practices.

Results of *H2* signify a positive relationship between GTA and SSCM. The results conclude that with the implementation of GTA, firms develop a system to implement SSCM. They develop common goals, practices and processes that lead them to sustainable development. They increase the usage of green technology for better forecasting of demands. Afum *et al.* (2021) concluded that firms investing in green technologies also reduce their variable costs associated with designing the product at the product development stage and facilitate the production of goods with the highest quality.

According to the results of *H3*, CEP has a positive effect on the SSCM. It highlighted that SMEs converting their waste into useful material, saving energy and proactively collaborating with the supply chain members for valorization, they regularly have to review

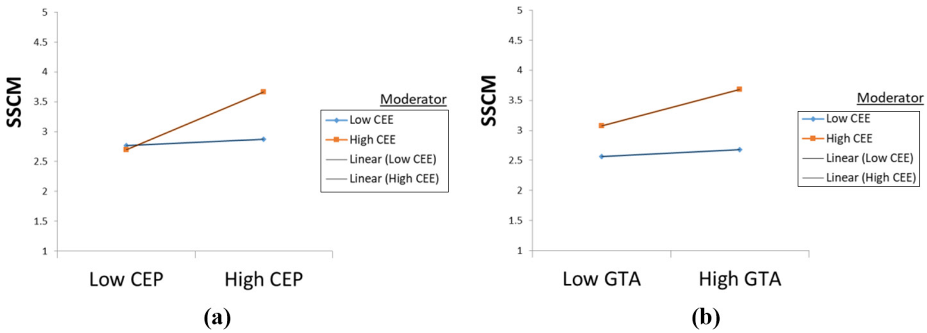

Figure 3.
Moderation effects of CEE (a, b)

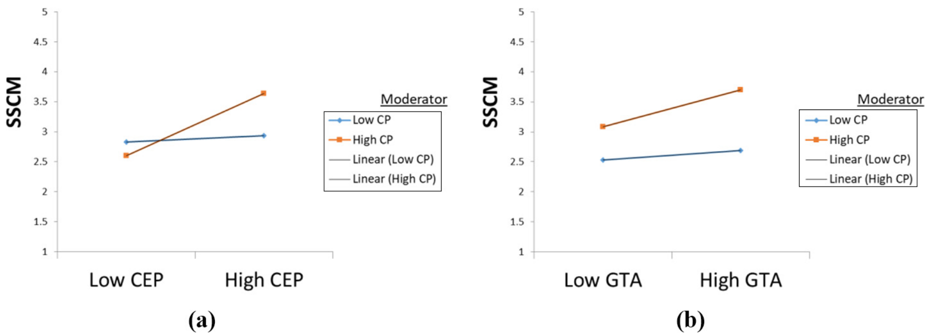

Figure 4.
Moderating effects of CP (a, b)

and improve their business processes, have to ensure that supply chain members also periodically review and update their practice to add value to the business. These findings are similar to Pizzi *et al.* (2022), who mentioned that firms using wasted resources and saving energy to regenerate production activities create new economic opportunities through value addition.

Results of *H5* also showed a positive relationship between SSCM and SP. These findings proved that when SMEs execute SSCM practices, they facilitate sustainable development. Through the complete implementation of SSCM, SMEs achieve their profitability targets, achieve success in increasing customer databases and contribute more toward social welfare and environmental protection. Wang *et al.* (2021) concluded that green innovation practices to achieve sustainable development enhance a firm's environmental performance.

Apart from the direct hypothesis, the indirect effects of CEP and SSCM were also estimated. *H4* tested the mediating role of CEP in the relationship between GTA and SSCM. Results mentioned that CEP positively mediated between them. It signified that to achieve the SSCM, SMEs must reply to both the GTA and CEP. With the integrated execution of the GTA and CEP, these SMEs can efficiently achieve SSCM. *H7* proved that SSCM is intermediate in the association between GTA and SP. Results supported the hypothesis. They highlighted that when SMEs adopt green technology, adopting the SSCM practices becomes more manageable, and SMEs achieve their SP objectives. The last mediation hypothesis proposed that SSCM mediates between CEE and SP. The results also supported the preposition, signifying the vital role of SSCM in achieving SP. Previous research work also concluded that SSCM is connected with the central processes related to management (Hazen *et al.*, 2020). Under a CE contextual setting, the role of SSCM is not just the management-related practice but providing the facilities and system throughout the supply chain stages (Tiep Le and Nguyen, 2022).

Furthermore, the present study also examined the influence of CEE and CP between GTA, CEP and SSCM. The first moderation hypothesis test is the influencing role of CEE between GTA and SSCM. The results showed a significant and positive moderation. The interaction results indicated that CEE strengthens the positive relationship between GTA and SSCM. It means that when GTA is low, low CEE results in the lower implementation of SSCM in SMEs. When GTA is high, it provides high CEE opportunities, resulting in improved SSCM. CEE helps enterprises develop practices to reuse the waste in the production process, thus enhancing the business's value. These resources are retained until they add value (Urban, 2019).

The influencing role of CEE was also tested between CEP and SSCM. The results were positive and significant. Findings revealed that with an increase in CEE in the context of CE, SMEs actively execute the SSCM, which means that CEE strengthens the relationship between CEP and SSCM. Then the moderating effects of CP were examined between GTA, CEP and SSCM. Both the moderation results indicated significant results. Findings suggest the CP strengthens the relationship between GTA, SSCM and CEP and SSCM. The findings match the conclusion that the customers set social responsibility-related expectations from the organization, suppliers and supply chain members and act as influential economic stakeholders in the supply chain (Chu *et al.*, 2019).

The study's findings reveal that the world is concerned about the depletion of resources and developing business models that ensure sustainable development. However, adopting modern green digital technologies and introducing business models and practices to ensure SP is difficult for SMEs and gets more complicated due to their limited resources. The current study introduced a novel research finding that promoting GTA orientation, developed on the idea that closed-loop activities create opportunities to develop innovative ideas, can encourage organizations to extend support in implementing CEP. In addition, research also presented empirical evidence to show their effects on SSCM and performance. The results disclosed that GTA, CEP and SSCM have significant and positive direct relationships and facilitate improving SMEs' SP. CEE and CP were found to have a significant and positive influence on the relationships of GTA and CEP with SSCM.

The research made several theoretical contributions. Using the RBV and stakeholder theory enhances its literature by studying the relationships. Next, the role of GTA and its direct and indirect effect on the sustainability of SMEs in the CE context further enhances the literature by filling the gaps. Moreover, though scholars have studied the impact of stakeholder pressure to act upon guidelines of sustainability goals (Sarkis *et al.*, 2010), CP was not studied in the CE context. Studying this relationship makes an addition to the literature on SP.

Apart from these theoretical implications, the current study suggests that when SMEs opt for GTA, they must use it efficiently. Keep track of records of products, avoid resource waste, reduce negative environmental and social impacts and develop business models that review current processes in collaboration with other supply chain members, work innovatively to reuse the recycled materials and ensure steps toward sustainability.

Limitations and future recommendations

There are several limitations of the current study. First, according to the triple bottom line concept, SP is divided into economic, social and environmental domains (Hourneaux *et al.*, 2018). The current study used a single construct to measure the SP, which is the first limitation of the current study. Future scholars can conduct studies and use all three dimensions to measure the SME's performance in every three dimensions. Next, the current study is quantitative to get more detailed insights into the phenomena of SP in SMEs, and we recommend conducting a qualitative study. Furthermore, Pakistan is facing severe economic and political crises, and the textile sector is severely affected by it; future studies should examine the influencing role of government pressure and market uncertainty to get the maximum benefits of a CE in achieving sustainability (Rodríguez-Espíndola *et al.*, 2022).

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