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Impact of Sustainable Supply Chain Management on Environmental Performance: Moderating Role of Top Management Commitment and Mediating Role of Supply Chain Ambidexterity

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Abstract
The sustainability of civilization and the operation of our global economy both depend heavily on the supply chain. This paper aims to assess how sustainable supply chain management (SSCM) influences sustainable supply chain ambidexterity (SCA) to achieve environmental performance (EP) for textile sector of an under developed economy such as Pakistan, besides exploring whether top management commitment (TMC) moderates the relationship between SSCM and EP. This study collected survey data from 240 exporters in the textile sector. It employed the PLS-SEM (Partial Least-Squares Structural Equation Modeling) technique to evaluate the hypothesized relationships. This study found that SSCM positively, directly and indirectly, impacted EP. SCA partially mediated the correlation between SSCM and EP. Additionally, TMC moderated the relationship between SSCM and SCA. TMC had a direct and positive effect on SCA. The insights into how SSCM influences SCA to achieve EP for textile sector in an emerging economy like Pakistan provides an original value. Moreover, the novelty of this study is further reinforced by the coverage of the newfound mechanism, where TMC moderates the relationship between SSCM and SCA, directly and positively enhancing SCA. These contributions could interest business practitioners and academics.
Keywords: Sustainable supply chain management, Supply chain ambidexterity, Environmental performance, Top management commitment

1. Introduction

Environmental issues are becoming more and more important to researchers and organizations as a result of the increased environmental implications of modern living. Because environmental challenges are so visible, they have grown very important in recent years. Sustainable supply chain management has been a key focus in recent years, with a growing body of literature exploring its various aspects. (Sembiring, Tambunan, Ginting, & Dewi, 2020) provide comprehensive reviews of the field, underscoring the importance of sustainable supply chains in the manufacturing industry, particularly in addressing environmental concerns. (Panpatil, Lahane, & Kant, 2023) and (Khan, Badar, Khan, & Zaman, 2021) investigate into the mathematical modeling and future research directions of sustainable supply chain management, respectively. Categories are made for these practices into economic, environmental, and social aspects, providing a comprehensive overview of the field (Kottala, 2021) .

Sustainable supply chain management (SSCM) is a complex and evolving field, as evidenced by a range of studies. (Bloemhof-Ruwaard & Van Nunen, 2005) and (Darom & Hishamuddin, 2016) both emphasize the need for transparency and the integration of economic and environmental aspects in SCM. (Baumgarten, Butz, Fritsch, & Sommer-Dittrich, 2003) and (Brandenburg & Rebs, 2015) further explore the challenges and opportunities in integrating reverse logistics processes and sustainability into SCM, with the latter highlighting the need for more comprehensive modeling approaches.

The textile industry's environmental and social impacts, including the use of harmful chemicals, high water consumption, and poor working conditions, have been well-documented (Islam, 2022; Konwar & Boruah, 2020; Niinimäki et al., 2020; Tounsadi, Metarfi, Taleb, El Rhazi, & Rais, 2020). These impacts are evident throughout the industry's value chain, from production to consumption, and are exacerbated by the rise of fast fashion (Niinimäki et al., 2020). To address these issues, the industry must transition to sustainable practices, including the use of eco-friendly dyes and chemicals, and the implementation of green supply chain management (Islam, 2022; Konwar & Boruah, 2020). Additionally, there is a need for increased awareness and action to protect the health of textile workers, who are often exposed to dangerous and toxic chemicals (Tounsadi et al., 2020).

Furthermore, combining sustainable supply chain management practices with supply chain ambidexterity can lead to enhanced resilience, innovation, and long-term competitiveness for organizations, while addressing environmental and social concerns (Zavala-Alcívar, Verdecho, & Alfaro-Saiz, 2020). The ability to balance exploration and exploitation in supply chain operations can significantly impact performance(Scott, 2016; Tamayo-Torres, Roehrich, & Lewis, 2017).

In response, the current study examines the integrated relationship between SSCM, SCA, and EP for the textile industry in Pakistan, a developing market. Furthermore, this study investigates if, within the parameters of the investigation, the use of a TMC mitigates the impact of SSCM on SCA. TMC and SCA are therefore considered pertinent to the purview of this study. In order to solve the environmental issues and enhance the textile industry's overall environmental performance in Pakistan, sustainable supply chain management techniques can be extremely important(Khan et al., 2021). Hence, choosing the textile sector for this study is of dire importance (Hayat, Hussain, & Lohano, 2020).

The main goal of this study is to gain a thorough understanding of the relationship between SSCM and SCA for EP, including the mediation mechanism of SCA and the moderating role of TMC in SSCM's impact on SCA.

2. Review of the literature and formulation of hypotheses

2.1. Theoretical Underpinnings

The theoretical framework is developed with the use of the resource-based view (RBV). (Barney, Ketchen Jr, & Wright, 2021). The researcher can find the essential resources for SSCM practices and EP with the aid of the RBV. For example, according to the RBV, organizational resources including managerial knowledge, competence, and skills are essential for SSCM implementation. Furthermore, the RBV assists researchers in analyzing the ways in which various resources combine to produce SSCM and EP.

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Finally, in terms of SSCM practices and environmental performance, the RBV can assist researchers in determining the resource gaps in Pakistan's textile industry. (Younis & Sundarakani, 2020). On the other hand, the Stakeholder Theory acknowledges that a company's activities have an impact on both internal and external parties. (Abdolazimi, Shishebori, Goodarzian, Ghasemi, & Appolloni, 2021). By including a varied network of participants in their strategy, businesses can defend their universal right to work and preserve their long-term and permanent continuity. According to this study, companies don't primarily concentrate on improving internal operations in order to increase performance. It makes sure there is a suitable relationship between the vendors it uses and other shareholders in order to maintain long-term links with its shareholders (Younis & Sundarakani, 2020).

2.2. Sustainable supply chain management (SSCM)

In the context of growing economies, sustainable supply chain management techniques can be both economically advantageous and environmentally required. (Das, 2018) claims that SSCM is defined as combining the objectives of green SCM and CSR to assist companies in achieving their micro-level social, economic, and environmental goals. Consequently, this aids companies in enhancing their perception among their stakeholders. Supply Chain Sustainability Management (SSCM) techniques, which minimize waste, maximize energy efficiency, and procure products from sustainable sources, can improve environmental performance. This strategy minimizes waste and lowers emissions while lessening the supply chain's negative environmental effects. In the same way, SSCM procedures can enhance EP in concert (Seman et al., 2019). For example, cutting waste and raising energy efficiency can both help to lessen emissions and the impact on the environment overall. Resource-based view (RBV) theory states that environmental performance can be enhanced by sustainable supply chain management (SSCM) methods through the use and expansion of strategic resources and capabilities. According to the TBV hypothesis, companies can obtain a competitive advantage by making use of unique and valuable resources that are difficult for competitors to imitate or duplicate. It is clear from the discussion above and the research that SSCM activities have the potential to significantly enhance environmental performance.

H1: SSCM practices positively affects the environmental performance

2.3. Supply chain ambidexterity

Sustainable supply chain management and supply chain ambidexterity are key areas of focus in the literature. (Bui et al., 2021) emphasizes the importance of organizational ambidexterity in balancing sustainability and disruption in supply chains. (Kumar, Chattopadhyaya, & Sharma, 2012) investigates into the role of ambidextrous sustainable innovations in supply chain coordination, highlighting the potential of two-part tariff contracts in achieving coordination. Lastly, (Güemes-Castorena & Ruiz-Monroy, 2020) applies the concept of ambidexterity to the apparel industry, demonstrating how organizations can balance daily operations and innovation to achieve ambidextrous supply chains. In the context of circular supply chains, ambidexterity can enable the pursuit of both reactive and proactive strategies, contributing to eco-efficiency and eco-effectiveness (Nathan, Tjahjono, Begley, & Lazell, 2021).

The relationship between supply chain ambidexterity and sustainable supply chain management has been the subject of numerous researches. Supply chain ambidexterity can also be supported by implementing SSCM practices. For example, by reducing waste and improving resource efficiency, organizations can reduce costs, become more agile, and respond to market and customer demands more quickly. This balances the demands of efficiency and innovation in supply chain management. Organizations can accomplish their short- and long-term objectives by enhancing sustainability, which also helps them cut expenses, boost productivity, and encourage innovation (Tseng, Bui, Lim, Fujii, & Mishra, 2022). Supply chain ambidexterity can be enhanced by SSCM practices due to their unique resources and skills. These practices, from an RBV perspective, can positively influence supply chain ambidexterity. Both SSCM practices and supply chain ambidexterity aim to improve performance in a sustainable and responsible manner. Implementing sustainable practices can enhance organizational agility, responsiveness, environmental performance, and overall sustainability. Therefore, considering the literature and the debate above, the following hypothesis can be proposed;

H2: SSCM practices positively affects supply chain ambidexterity

2.4. Environmental Performance

An organization's ability to effectively manage and reduce its environmental footprint is referred to as its environmental performance. Sustainable supply chain management has emerged as a key approach for enterprises aiming to become environmentally sustainable (Hasan, 2013). In recent years, due to growing concerns about sustainability and corporate responsibility, the idea of environmental performance within the context of supply chain management has received a lot of attention. Businesses can carefully examine and gather data on the environmental element of their operations with the use of environmental performance indicators. In the Indian automobile sector, the relationship between environmentally friendly supply chain management techniques and environmental performance has been examined, with particular attention to eco-friendly accounting, transportation, product, and manufacturing procedures (Kumar et al., 2012). Another significant outcome of using sustainable supply chain management strategies is environmental compliance. Companies that employ environmentally conscious supply chain management strategies are more likely to follow environmental laws (Gupta & Gupta, 2021).

Supply chain ambidexterity and environmental performance are mutually supportive concepts. Supply chain ambidexterity can enhance environmental performance by promoting sustainability-focused innovation and implementing environmentally responsible practices. It can also reduce costs, improve resource efficiency, and promote a positive corporate image, enabling organizations to balance efficiency and innovation in their supply chains (Úbeda-García, Marco-Lajara, Zaragoza-Sáez, Manresa-Marhuenda, & Poveda-Pareja, 2022). The Resource-Based View (RBV) theory focuses on strategies businesses can use to gain and maintain a competitive edge. It does not explicitly address supply chain ambidexterity and its connection to environmental performance. However, achieving supply chain ambidexterity efficiently integrates and aligns resources and capabilities to address environmental concerns. By balancing efficiency and innovation while minimizing negative environmental impacts, organizations can achieve superior supply chain performance and contribute to a more sustainable future. Hence, taking into account the literature and the discussion above, the following hypothesis can be put forth;

H3: Supply chain ambidexterity positively affects environmental performance
H4: Supply chain ambidexterity mediates the relationship between SSCM practices and environmental performance

2.5. Top Management Commitment

The successful implementation of sustainable supply chain management requires the backing of upper management. It describes how much support and participation senior executives—like the CEO or board of directors—have for advancing sustainability throughout the supply chain. A study of the literature on the subject of sustainable supply chain management (SSCM) indicates that there is a need for integrated performance frameworks and tools for decision-making. (Tascioglu, 2015). As senior management can offer the required power and resources to make important decisions about sustainability, such investing in new technology or altering production procedures, it seeks to facilitate decision-making. Collaboration across the supply chain can produce interfirm resources and competencies that have the potential to generate long-term interfirm competitive advantage. This includes setting sustainability goals, allocating resources, and implementing sustainable practices (Yusliza et al., 2019).

Top management commitment influences the use of information technology, customer relationship management, and green purchasing and production practices, all of which contribute to improved performance. The influence of sustainable supply chain management practices on supply chain ambidexterity can be greatly increased by top management's dedication to sustainable aims. This is accomplished by assigning funds, forming guidelines, and taking steps to facilitate the creation and application of these practices. This dedication also promotes innovation and an emphasis on sustainability and efficiency in the supply chain, which leads to the development of ambidexterity. By enhancing the correlation between supply chain ambidexterity and SSCM practices, this can have a moderating effect. Top management may assist companies in achieving better supply chain and supply chain ambidexterity by offering strong support and resources for sustainable supply chain management. Thus, in light of the conversation above, the following hypotheses have been put forth:

H5. Top management commitment positively affects supply chain ambidexterity.
H6. Top management commitment moderates the effect of SSCM practices on supply chain ambidexterity

2.6. Model creation

This study's model was developed in accordance with earlier conversations and theories. As a result, there are four variables total: eight items for the mediator SCA, seven items for the dependent variable EP, and five items for the moderator TMC. Twenty-three items for the independent variable that is SSCM practices with four dimensions. In theory, the relationships in this model's hypotheses are defended from the standpoint of RBV theory. Furthermore, the research context's particular attributes of the textile industry—dynamism, creativity, and adaptability—play a critical role in validating these correlations and bolstering the findings' generalizability to a larger population. The structural model presents these variables as shown in Figure 1:

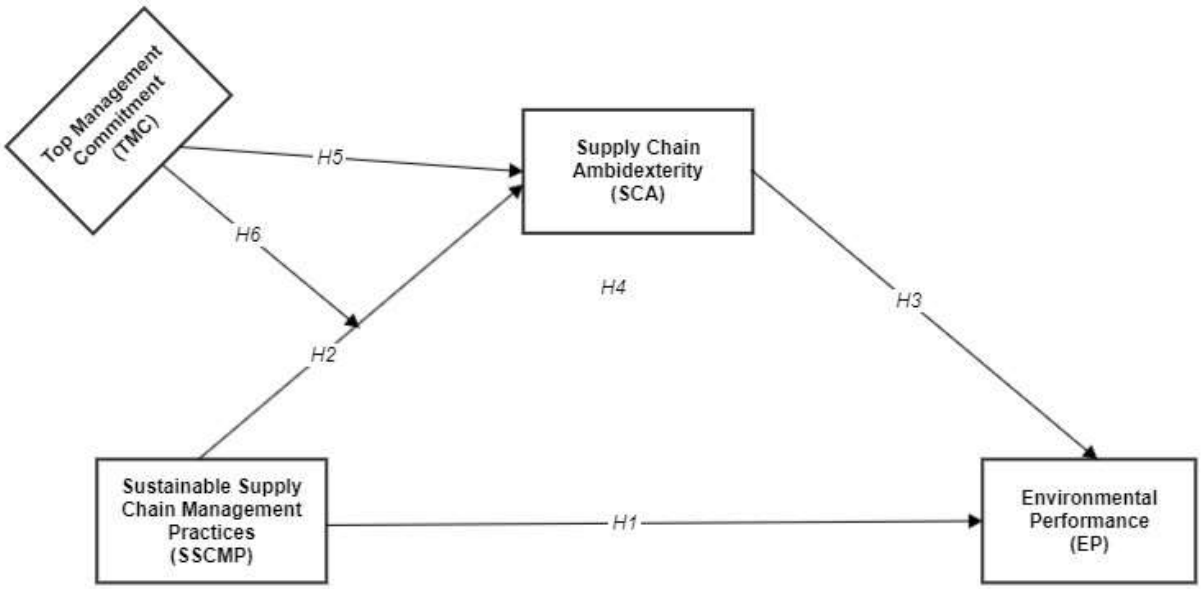

Figure 1: Proposed Conceptual model

3. Methodology and research design

Subsections regarding the survey instrument, data collection and analysis, target population and sample are included in this part.

3.1. Population and sample size

This study focuses on textile manufacturers registered under Pakistan's Pakistan Textile Exporters Association (PTEA) and All Pakistan Textile Mills Association (APTMA). The data was gathered using simple random sampling. In populations that are well-known, this sampling technique performs effectively (Park-Poaps & Rees, 2010). Our population in the current study is known to us. There are several benefits to using this kind of sampling approach, including increased representativeness, precision, and cost-effectiveness of the sample (Crowther & Lancaster, 2012).

For a variety of reasons, exporters in the textile industry will be the focus of the data collection. Exporters should take economic, environmental, and social efforts because of the demand from worldwide and international marketplaces (Brandi, Schwab, Berger, & Morin, 2020). Exporters are increasingly adopting sustainable practices due to increasing customer demand for sustainable

products, the importance of sustainability in corporate reputation, compliance with environmental and labor rights laws, cost savings, and long-term viability.

This study analyzed top export-oriented textile companies in Pakistan, targeting 204 registered exporters and 222 All-Pakistan Textile Mills Association companies as population. Data was collected from suitable personnel, including department heads, general managers, managers, and executives. 240 minimum samples (5 responses per item) were chosen based on the items-to-response ratio (Williams, 2007).

3.2. Survey Instrument

To collect quantitative data, the study employed a five-point Likert measuring scale, with 5 denoting Strongly agree, 4 Agree, 3 Neutral, 2 Disagree, and 1 signifying Strongly disagree. Prior to starting data collection, face validity procedures based on previous studies will be used to modify all of the measures.

SSCM practices evaluated utilizing a total of 23 items across four dimensions (Paulraj, Chen, & Blome, 2017). EP is measured using 7 items (Wang & Dai, 2018). Four items in each of two dimensions are used to measure SCA (Kristal, Huang, & Roth, 2010). Lastly, five items are used to measure TMC (Dubey, Gunasekaran, Sushil, & Singh, 2015). Fifty individuals with backgrounds similar to those of the target respondents participated in a pilot survey. After then, the questionnaire was modified to conduct the primary survey.

3.3. Ethical Considerations

Participants in the study received information about the goals, risks, rewards, and consent processes. The researcher safeguarded the privacy and confidentiality of their data and personal information. They were also given information on access to and use of data. Throughout the research procedure, the researcher protected participant privacy by not allowing observation or monitoring without permission or awareness.

3.4. Data collection and analysis

The information was compiled from the November 2023 to March 2024 online questionnaire-based survey. Three hundred randomly chosen survey respondents received the questionnaire. An 89.6% response rate was attained from 269 firms who provided unique answers to the surveys. There were 240 legitimate questionnaires left after incomplete answer sheets were screened out, representing an 80% response rate. After that, the data was moved to the PLS-SEM approach for analysis.

3.4.1. Time horizon

The data was collected and analyzed using a cross-sectional study approach. Additionally, quantitative research was used to address the study's objectives. A fleeting glimpse of a population's characteristics, attitudes, and behaviors can be obtained with the aid of this type of design. In sustainable supply chain management research, cross-sectional study designs are helpful because they may be used to examine the sustainability policies of companies in a given sector, identify trends in sustainable supply chain policies, or assess the effectiveness of the SSC programme (Crowther & Lancaster, 2012). However, cross-sectional research has drawbacks, such as the inability to demonstrate cause-and-effect relationships, since it only provides an image of a population at one particular moment in time.

4. Findings

This section includes the study hypotheses, measurement model evaluation, goodness of fit evaluation, structural model evaluation, and statistical results of the representative qualities of the research samples.

4.1. Sample characteristics

Table 1 summarizes the attributes of the samples gathered for this research, including the firm's size, years of experience, revenue, and title. Title is mentioning the percentages of respondents

ranging from C-Level to VP Level participated in this survey. Age of the firm ranges from 1-5 to more than 30 operating years. Revenue of the firm ranges from less than 50 million to more than 10000 million Pakistani rupees. Respondents' years of experience in supply chain field ranging from 0-5 to more than 30 years and it the last size of the firm ranging from 100-199 employees to more than 5000 employees in the respondent firm.

4.2. Outer model measurement and assessment

For the evaluation of this study's measurement, discriminant, scale, and convergent validity evaluations were conducted. According to (Joseph F Hair, Risher, Sarstedt, & Ringle, 2019) the Cronbach's alpha values, composite reliability (C.R.), and total correlation were examined in order to assess the validity of the scale.

When the appropriate Cronbach's alpha is more than 0.7, the scale is considered credible. Both the total correlation and C.R. exceeded 0.3. The related results are shown in Table II, which confirms that the scales' dependability (Joseph F Hair et al., 2019). The findings indicate that each variable's factor loading above 0.7 for convergent validity and that each variable's AVE (Average Variance Extract) value exceeded 0.5. Convergent validity was therefore confirmed (F. Hair Jr, Sarstedt, Hopkins, & G. Kuppelwieser, 2014).

To assess discriminant validity, the Fornell and Larcker criteria were examined. Discriminant validity is valid if the square root of AVE is greater than the correlations between the latent variables (Fornell & Larcker, 1981). Table III demonstrates the correlation matrix showing discriminant validity in addition to proving that all diagonal values are larger in the relevant rows and columns. Because TMC is a moderating variable, the analysis's findings indicate its moderating role in enhancing the influence of SSCMP and SCA. As discussed in Section 4.5, the moderated mediation model is validated. As a result, nomological validity was established and discriminant validity was confirmed.

Table 1: Sample statistics

Demographics	Frequency	%
Title		
C-Level (CEO/ CFO/ COO)	32	13.3
VP Level	18	7.5
Director Level	46	19.2
Manager level	144	60
Age of the Firm (operating years)		
1-5	20	8.3
6-10	37	15.4
11-15	27	11.3
16-20	21	8.8
21-30	14	5.8
Above 30	120	50
Revenue (in million rupees)		
<50	32	13.3
51-500	78	32.5
501-10000	75	31.3
>10000	55	22.9
Years of Experience		
0—5	50	20.8
6—10	59	24.6
11—15	63	26.3
16-20	35	14.6
21-30	23	9.6
Above 30	10	4.2
Size of the Firm (Number of employees)		
100-199	50	20.8
200-499	14	5.8
500-999	47	19.6
1000-4999	24	10
Above 5000	105	43.8

Note: *n*=240
Source: Author's Work

Table 2: Convergent and Scale Reliability

Variables	Items	Factor loading	Cronbach's alpha	CR	AVE	Mean
EP	EP1	0.749	0.898	0.900	0.620	3.920
	EP2	0.818				
	EP3	0.756				
	EP4	0.786				
	EP5	0.816				
	EP6	0.761				
	EP7	0.821				
SCA	SCA1	0.679	0.888	0.898	0.565	3.989
	SCA2	0.759				
	SCA3	0.819				
	SCA4	0.828				
	SCA5	0.813				
	SCA6	0.835				
	SCA7	0.811				
	SCA8	0.723				
SSCMP	SSCMP1	0.530	0.938	0.943	0.601	3.743
	SSCMP2	0.798				
	SSCMP3	0.754				
	SSCMP4	0.748				
	SSCMP5	0.733				
	SSCMP6	0.729				

	SSCMP7	0.736				
	SSCMP8	0.778				
	SSCMP9	0.667				
	SSCMP10	0.648				
	SSCMP11	0.744				
	SSCMP12	0.732				
	SSCMP13	0.651				
	SSCMP14	0.652				
	SSCMP15	0.732				
	SSCMP16	0.780				
	SSCMP17	0.694				
	SSCMP18	0.710				
	SSCMP19	0.698				
	SSCMP20	0.718				
	SSCMP21	0.786				
	SSCMP22	0.825				
	SSCMP23	0.729				
TMC	TMC1	0.737	0.781	0.787	0.535	3.898
	TMC2	0.805				
	TMC3	0.722				
	TMC4	0.752				
	TMC5	0.711				

Table 3: Fornell-Larcker criterion

	EP	SCA	SSCMP	TMC
EP	0.787			
SCA	0.528	0.752		
SSCMP	0.733	0.545	0.775	
TMC	0.634	0.548	0.745	0.731

Source: Author's work

The HTMT results for the various constructs—EP, SCA, SSCMP, and TMC—are shown in Table IV. Each cell in the matrix represents the HTMT value between two constructs. The values fall between 0 and 1, where 0 indicates complete discriminant validity (i.e., the constructs are fully separate) and 1 indicates no discriminant validity (i.e., the constructs are indistinguishable). Two notions have strong discriminant validity, meaning they measure distinct concepts, when their HTMT values are close to zero or fall below a predetermined threshold (typically 0.85).

Table 4: Heterotrait-monotrait ratio (HTMT) results

	EP	SCA	SSCMP	TMC	TMCxSSCMP
EP					
SCA	0.579				
SSCMP	0.791	0.581			
TMC	0.757	0.640	0.609		
TMCxSSCMP	0.432	0.119	0.579	0.612	

Source: Auther's work

An HTMT score that is close to 1 or above the threshold indicates poor discriminant validity and suggests that the constructs may be evaluating similar underlying ideas.

4.3. Inner model assessment and hypotheses testing

Data analysis was done for inner model measurement after the outer model assessment was reviewed (Joe F Hair, Ringle, & Sarstedt, 2011). PLS SEM is generally used by researchers to handle complex models more efficiently than other covariance-supported approaches (Henseler, Ringle, & Sarstedt, 2015). The hypothesis testing was conducted using Smart PLS 4.1.0.0.

4.3.1. Predictive relevance of the model

Predictive relevance in statistical models refers to the model's ability to accurately anticipate results with new, unidentified data. It comprises assessing the model's discrimination, calibration, and external validation performance. External validation is necessary to assess a model's generalizability by testing it on various datasets (Collins et al., 2014). To evaluate the factors' prediction potential, R square and Q square are employed. A primary criterion is used to investigate and evaluate the cross-validated redundancy (Q^2)

and the coefficient determination (R^2) in order to evaluate the inner model (Joe F Hair et al., 2011). Table V, Q-square results, which show that the model is well-defined, are greater than 0.

Table 5: The predictive power of the construct

	R^2	Q^2
EP	0.561	0.490
SCA	0.422	0.440
SSCMP	0.596	0.524
TMC	0.278	0.306

Source: Author's work

According to (Hair Jr, Sarstedt, Hopkins, & Kuppelwieser, 2014) cross-validate redundancy determines the significance of the inner model. Since the blindfolding method demonstrates the model's correctness, it has been used to estimate Q^2. R^2, which measures the total impact of exogenous (independent) factors on endogenous (dependent) variables, is used to assess the predictive veracity of a model (Hair Jr et al., 2014).

4.3.2. Goodness of fit

The suggested model for this study was assessed using the pertinent indices to determine its goodness of fit. According to (Wetzels, Odekerken-Schröder, & Van Oppen, 2009) when compared to the acceptable criterion of 0.36, the GoF (Goodness of Fit) value of 0.64 indicates a "large fit". In addition, other indices were employed to evaluate the model's goodness of fit. NFI according to (Joseph F Hair et al., 2019), SRMR according to (Hu & Bentler, 1999) and R^2 according to (Falk & Miller, 1992). The results indicate that the NFI value was 0.916 (>0.9), the SRMR value was 0.075 (<0.08), and the R^2 for EP was 0.561 (>0.1) and 0.422 (>0.1) for SCA. When compared to the acceptability criteria specified by the aforementioned sources, this outcome is deemed satisfactory. Consequently, this finding supports the notion that the model is a good fit.

4.4. Hypotheses testing

The assessment's findings confirmed that appropriate conditions must be met in order to carry out the structural model and research hypothesis evaluation. This paper examines six hypotheses using the SEM. The significant impact of SSCM practices on SCA and SCA on EP in this study provides insight into mediating effects, whereas the impact of TMC on SCA provides insight into moderating effects. As discussed in Section 4.5, the moderated mediation model is validated.

Table VI presents the findings of the bootstrapping technique that were used to evaluate the structural model. Prior to evaluating the structural model, VIF was assessed in order to assess the multicollinearity issue. The VIF's maximum acceptance threshold is 3.3 (Diamantopoulos & Siguaw, 2006; Kock, 2015), indicating that a model is deemed to be multicollinearity-free when its VIF values are less than 3.3. The study's findings indicate that the VIF value fell between 1.003 to 2.904 (<3.3), indicating that multicollinearity is not an issue. Figures 2 and 3 show the

Table 6: Hypotheses testing results

Hypotheses	Coefficient	*t*-statistics	*p*-values	CI 2.5%	CI 97.5%	Conclusion
SSCMP -> EP	0.634	13.758	0.000	0.536	0.716	Supported
SSCMP -> SCA	0.436	8.670	0.000	0.336	0.532	Supported
SCA -> EP	0.183	3.995	0.000	0.099	0.280	Supported
SSCMP -> SCA->EP	0.080	3.584	0.000	0.042	0.129	Supported
TMC -> SCA	0.413	7.926	0.000	0.314	0.517	Supported
TMC*SSCMP -> SCA	0.213	5.349	0.000	0.134	0.293	Supported

Source: Author's work

diagrams of the SEM analysis findings, respectively, with (Figure 3) and without the bootstrapping technique applied (Figure 2).

The analysis's findings demonstrate the validity of the study hypotheses. SSCMP had a significant and beneficial impact on EP ($\beta = 0.716$, $t = 13.758$, $p < 0.001$). Consequently, H1 is approved. The correlation between SSCMP and SCA was important and favorable ($\beta = 0.549$, $t = 8.670$, $p < 0.001$). This result validates H2. Based on the direct correlation between SSCMP and SCA, as well as EP, the results indicate that SSCMP has a marginally less impact on SCA than EP ($\beta = 0.549$ vs. $\beta = 0.717$). Additionally, there was a positive and significant connection ($\beta = 0.138$, $t = 3.995$, $p < 0.001$) between SCA and EP. H3 is therefore verified.

The association between SSCMP and EP is partially mediated by SCA, as these results show (β 5 0.716, t 5 3.584, $p < 0.001$). This result implies that enhancing SSCMP also improves EP and SCA. H4 is therefore supported. Furthermore, the outcomes verified that TMC attenuates the degree of SSCMP's influence on SCA. The association between TMC and SCA ($\beta = 0.426$, $t = 7.926$, $p < 0.001$) and TMC*SSCMP and SCA ($\beta = 0.264$, $t = 5.349$, $p < 0.001$) provided evidence for this confirmation.

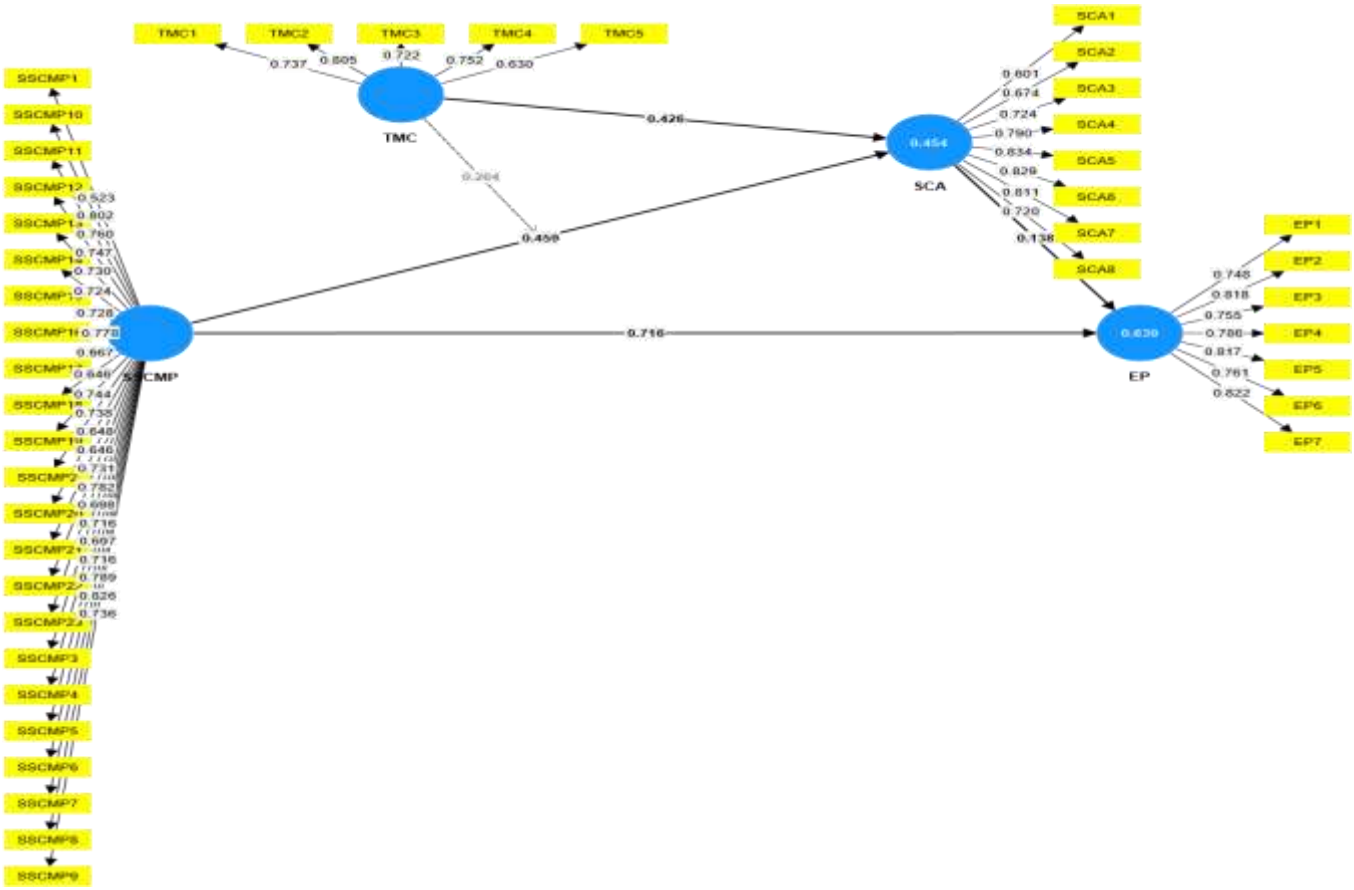

Figure 2: Diagram of SEM analysis (without bootstrapping)

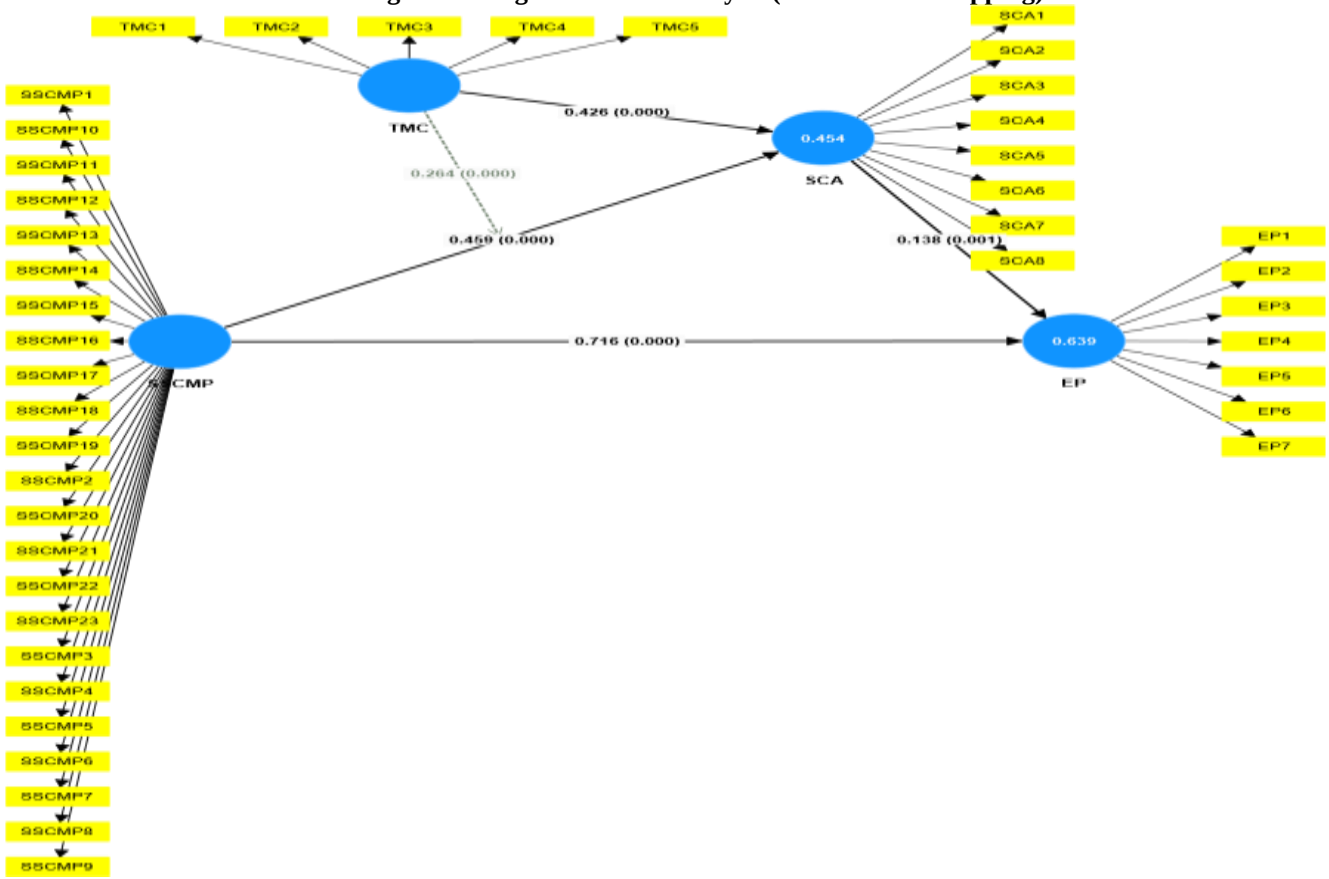

Figure 3. Diagram of SEM analysis results (by applying bootstrapping technique)

In light of this outcome, H5 and H6 are confirmed. This result implies that the impact of SSCMP on SCA differs depending on TMC variability. This implies that SSCMP has a greater influence on SCA when TMC improves, and vice versa. Overall, this study

demonstrates how SSCMP influences EP both directly and indirectly. The strong and positive correlations between these variables suggest that a company's ability to effectively implement sustainable supply chain management (SCM) practices has a direct and indirect impact on EP, hence augmenting environmental advantages. Therefore, it may be concluded that SSCMP has a greater direct impact on EP than it does an indirect one through SCA.

4.5. Analyzing moderated mediation model

The purpose of this section is to evaluate whether TMC moderates the indirect effect of SCA on the connection between SSCMP and EP. In this test, the association between TMC and the indirect effect of SCA in the SSCMP–EP correlation was evaluated through the use of the PROCESS 3.5 macro on SPSS software in conjunction with the bootstrapping approach (5,000 samples). The findings indicate that the 95% bootstrap confidence interval does not include zero (0.019; 0.144), indicating that the indirect effect of SCA in the association between SSCMP and EP is moderately mediated by TMC (Hayes, 2015, 2018). The values of the indirect effect of SCA in the relationship between SSCMP and EP are all greater than zero and are statistically significant when taking into account the three levels of TMC at −1 SD (standard deviation); 0; and þ1 SD. This is because at all three bootstrap confidence intervals, 95% does not include zero. Thus, whether TMC rises or falls, the intermediate link will always be present. H2 is supported by this confirmation, which shows that TMC moderates the indirect link between EP and SSCMP. The values of the indirect effect (SSCMP → SCA → EP) at the three TMC levels are shown in Figure 3, along with the index of moderated mediation.

5. Discussions and implications

The study's results are discussed in this part, along with some theoretical and managerial implications.

5.1. Discussions of the results

The primary outcome of this research offers a comprehensive framework that was influenced by SCA in the relationship between SSCMP and EP and moderated by TMC in the impact of SSCMP on SCA. Because there are few empirical researches that examine the mediation mechanism of SCA in the link between SSCMP and EP, these findings are novel in light of the current literature on the relevant subject. This is comparable to TMC's moderating mechanism for SSCMP's impact on SCA. Based on these results, the study makes a substantial contribution to the body of knowledge already in circulation and presents a fresh strategy for promoting SCA towards sustainability, particularly for the manufacturing sector in an emerging nation like Pakistan's textile industry.

Few studies on SCA and SSCM practices have been conducted recently. The one that examines the association between SCA and green SCM the closest is Khan et al. (2021). Despite being conducted in Pakistan, this study's focus is manufacturing-oriented organizations, and network capabilities are employed as a moderator. Regarding SSCA and EP, research is conducted on the connection between green ambidexterity and EP, with an emphasis on HRM (Úbeda-García et al., 2022). The closest study on SSCM practices and corporate sustainability performance on Chinese enterprises is conducted in regards to SSCM practices and EP (Wang & Dai, 2018). But as of yet, no such all-encompassing framework has been offered in relation to Pakistan in general and the textile industry in particular.

The findings of this study, which complement the existing literature by demonstrating that TMC's participation in the supply chain has an association with SCA towards sustainability, regarding the moderating function of TMC in the influence of SSCMP on SCA. There is a research gap in Pakistan's textile sector regarding SSCM practices and environmental performance. Further studies are needed to understand the specific practices, their impact on environmental performance, and the challenges and opportunities for sustainability in the textile sector. Few studies have examined environmental performance in a comparable setting in terms of performance (Simmou, Govindan, Sameer, Hussainey, & Simmou, 2023), whereas operational performance has been included in previous research (Hasan, 2013), firm performance (Wang & Dai, 2018), cost performance (Khanam & Ghosh, 2022) and sustainable corporate performance (Le, 2023).

The study explores sustainable supplier management in Pakistan's textile industry, a key sector facing competition due to expanding markets and a decline in its established business. Pakistan is the eighth-biggest exporter of textile products in the world, contributing 8.5% of its GDP and employing over 1.5 million people (38% of the labour force) Learner, T. (Thursday, June 2020). Pakistan's top textile exporters include Style Textile (pvt), Nishat Mills Ltd, and Yunus Textile Mills Ltd, contributing significantly to the economy and creating millions of jobs. But the sector is also linked to a number of environmental issues, such as the production of solid waste, air pollution, and water contamination (Quddoos, Akhtar, & Zafar, 2022). The study emphasizes the importance of sustainable supply chain management practices in Pakistan's textile sector to address environmental challenges and improve sustainability credentials, thereby reducing the sector's environmental impact.

The study explores the impact of supply chain ambidexterity on environmental performance and SSCM methods, emphasizing the significance of top management commitment in influencing these relationships. It also reveals how ambidexterity moderates the relationship between environmental performance and SSCM practices. The regression model's validity is confirmed by the F-test, indicating statistical significance between independent and dependent variables. The measurement instrument accurately captures the relevant construct, with strong interrelatedness and consistency.

5.2. Theoretical implications

The study's first contribution is that it provides evidence in favor of the RBV theory by showing how crucial SSCMP is in advancing SCA towards sustainability. The RBV theory is expanded upon in this contribution, enhancing its applicability within the specific setting of Pakistan's textile industry. As a result, by offering an experimental framework that combines sustainable supply chain management techniques with SCA to accomplish EP and involves TMC in the function of moderation in this driving mechanism, this study adds to the body of knowledge in the sustainability literature.

Second, by offering empirical evidence assessing the significant function of SSCMP in boosting SCA for environmental performance, this study adds to the body of knowledge already available on the textile industry. This validates the mediating role of SCA in the relationship between SSCMP and EP. This addition is significant since this process has not been thoroughly examined

in the pertinent literature as of yet. This paper shows how supply chain management contributes to SCA towards sustainable performance, shedding light on the area of scientific knowledge that is still lacking in the literature currently available on the relationship between supply chain management and SCA.

The third theoretical contribution consists of the development of scales that explicitly depict the aspects related to SSCMP, SCA, EP, and TMC. These scales are applicable to textile manufacturing enterprises operating in emerging economies like Pakistan. This contribution is important since it makes clear what SSCMP, SCA, EP, and TMC can realistically contain within the parameters of the current study. By providing context-specific indicators, this contribution enhances the existing literature, especially for manufacturing firms in Pakistan's textile industry. This work sheds light on the degree to which SSCMP, SCA, and TMC are associated with Pakistani textile manufacturing enterprises.

Lastly, this work adds to the body of knowledge already available on SCM by presenting actual data supporting the use of TMC components in SSCMP to encourage SCA. This contribution is critical because there hasn't been much in-depth experimental study on this mechanism in the literature to date. It clarifies the role played by senior management involvement in moderating the influence of SSCMP on SCA, which sheds light on SSCMP. Stronger SSCMP influence on SCA results from greater TMC levels, which also ensures stronger SCA influence on the link between SSCMP and EP.

5.3. Managerial implications

This study's first significant conclusion offers a method for enhancing SCA in the direction of sustainable performance, and enhanced SSCMP leads to enhanced SCA and EP. As previously said, SSCMP plays a significant part in encouraging SCA to reach EP. Therefore, in order to appropriately strategize towards sustainability while boosting the competitiveness of the enterprises, manufacturing companies in the textile industry are advised to analyze the study's conclusions. The research emphasizes the importance of sustainable supply chain management (SSCM) in Pakistan's textile sector. It suggests that CEOs should integrate SSCM into their business structures, focusing on sustainable waste, procurement, production, and distribution networks. Collaboration with manufacturers, suppliers, and stakeholders is crucial. Digital resources and new technologies, such as blockchain and IoT, can improve environmental performance. Textile companies can track sustainability goals, identify development opportunities, and make data-driven decisions.

The study's second key conclusion reveals the moderating mechanism by which top management contributes to enhancing the impact of SSCMP on SCA. Consequently, the SSCMP's influence on the SCA is stronger the better the TMC, which promotes long-term sustainability. Businesses are urged to take into account TMC-related variables, enhance systems and procedures to support energy conservation and waste recycling, boost productivity, and enhance systems and procedures to drive the required adjustments to quickly adapt to changes in the market. The study reveals that cooperation and open supply chains in Pakistan's textile industry can enhance environmental performance. It emphasizes the importance of collaboration with stakeholders, sharing sustainability data, and fostering innovation. Digital platforms and technologies are needed for tracking supply chains and ensuring transparency and accountability.

Pakistan's textile sector needs to innovate and adopt Sustainable Supply Chain Management (SSCM) to improve environmental performance. Proactive management is crucial for reducing operational inefficiencies and environmental impacts. Research and development are essential for sustainability and technological advancement. Modern materials and methods can reduce waste and resource usage. A learning environment, employee participation, and cross-hierarchical sharing are essential for enhancing environmental performance. Institutions can address sustainability issues with creativity and agility, while industry, academic, and government partnerships can boost innovation.

SSCM practices are crucial in Pakistan's textile sector for several reasons. They help reduce environmental impact, save money, comply with global regulations, meet consumer demand for sustainable products, improve reputation, and enhance supply chain performance. By minimizing pollution, waste, and resource consumption, SSCM reduces pollution and waste, leading to improved environmental performance. Additionally, implementing SSCM helps companies comply with global regulations, meet consumer demands, and build trust with stakeholders. Overall, SSCM is essential for Pakistan's textile industry to protect the environment, save money, and enhance profitability and competitiveness.

6. Conclusions, limitations and future research directions

This section summarizes the study's limitations and offers the study's conclusions.

6.1. Conclusions

The results of this investigation satisfy the initial research goals. As a result, the results provide light on the relationship between SSCMP and SCA for EP, the mediation mechanism of SCA, and the moderating role of TMC in the impact of SSCMP on SCA. Good supply chain management techniques support the expansion of the company, offer value to its customers, and aid in the rational formulation of decisions that improve the economic, social, and environmental well-being of the country (Ansari, Baig, Ullah, Khan, & Akhtar, 2022). Moreover, because environmental variables have a substantial impact on supply chain procedures, textile producers must take these factors into account when conducting business. This demonstrates how this study's conclusions significantly advance the body of knowledge on manufacturing organization’s supply chains—particularly those in the textile industry—in the direction of sustainability. Businesses are advised to take full use of this strategic thinking since it is the foundation of a manufacturing industry value chain sustainability strategy, even if the relationship between TMC and SCA in the textile sector value chain is still relatively young. The above highlights the innovations of this study.

6.2. Limitations and future research directions

There are certain limitations to this study that may be explored in further research. First off, as Pakistan is a growing economy, other economies should be taken into account in future research in order to explore the results from other contexts. This study was carried out in Pakistan. Second, because the textile industry was the sole focus of this study, future research may examine other industrial

sectors to determine how various target demographics affect the results. Third, the primary research method in this study was the quantitative method; however, other ways (maybe coupled) may be considered in subsequent studies to examine the findings utilizing various research method approaches. Fourth, while other studies can incorporate additional pillars of sustainable performance on the premise of economic development while guaranteeing economic and social advantages, this study offers a fresh logic on the way driving enterprises to environmental performance. It would be possible to conduct research to assess Pakistani textile companies' environmental performance with and without the use of SSCM techniques. Through the examination of variations in environmental impact, scientists may assess the degree to which SSCM techniques mitigate environmental risks and improve sustainability outcomes. Future studies ought to think about broadening their focus to investigate how comparable events support global and national sustainable development objectives.

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