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Impact of Supply Chain Practices on Their Performance in an Environment of Uncertainty and Disruptions

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Abstract
A dynamic business environment presents a high degree of uncertainty for the evolving world. This calls for new business practices. Organisations' supply chain management must address disruptions and uncertainties arising from globalisation. The study's major objectives were to understand the role of supply chain practices in moderating the influence of supply chain disruptions on supply chain performance and environmental uncertainty on supply chain performance. This research is set in the context of two South Indian states, which account for 94% of India's coir manufacturing and export. Partial least squares-based structural equation modelling was used to test the hypotheses in the work. The moderating effect of supply chain practice on the relationship between environmental uncertainty, supply chain disruptions, and supply chain performance has not been confirmed. Hence, this finding calls for adopting disruption-resilient practices in the supply chain management by organisations to stay competitive in an evolving world and an environment of uncertainty.

Keywords
Supply chain, Performance, Practices, Disruption, Environmental Uncertainty.

Introduction

Higher competitive intensity and increasing dynamic business conditions pose high environmental uncertainty to organisations (Haarhaus & Liening, 2020; Sanchez, 1997). Supply chain management (SCM) in organisations must address disruptions in the chain, along with uncertainties arising from globalisation and the subsequent changes thereof. Thus, supply chain managers are expected to establish supply chain strategies appropriate for the market changes to improve performance to circumvent this scenario. Organisations align their strategies with their external environment to remain competitive and perform better. Strategies adopted by organisations are the result of environmental factors (as per the environment-strategy-performance theoretical framework and the contingency theory), and empirical evidence indicates that these strategies undergo significant modifications to fit their external environments. Environmental uncertainty (EnU) refers to events and variables that have a random and unpredictable variation, impacting the very existence of a business. Supply chain disruptions (SCD) are unplanned events that might affect the normal, expected flow of materials, information, and components" (Craighead et al., 2007). Supply chain practices (SCP) are defined as "the set of activities undertaken in an organisation to promote effective management of its supply chain". Supply chain performance (SCPerf) is defined in the existing literature as the "extent to which the supply chain can meet customer requirements with on-time delivery" (Tarafdar & Qrunfleh, 2017; Li et al., 2006; Beamon, 1999).

This study fits into the theoretical framework of environment-strategy-performance (ESP), contingency theory and dynamic capability theory.

The environment-strategy-performance framework theorises the importance of environmental context in shaping strategy. It argues that the operating environment demarcates strategy choice boundaries, posing

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opportunities and threats (Jiao et al., 2011; Child, 1997). Essentially, the "firm's operational effectiveness is predicated on the appropriate selection of strategy in conjunction with environmental conditions" (Jiao et al., 2011). Thus, performance is determined by the extent of congruence between context and strategy. The central idea of strategy-environment co-alignment refers to selecting appropriate strategy implementation options as proactive responses. Thus, it is a planned pattern of matching essential resources in response to context to support performance outcomes. Environmental context influences firms to invest in building critical resources and deploying effective combinations for generating competitive outcomes (Jap, 1999).

The adoption of SCP to deal with EnU and SCD (contingency variables) demonstrates how an organisation gains and sustains competitive advantage by adopting SCP (dynamic capabilities) to overcome changes in the operating environment. Hence, the study's objectives are (i) to analyse the effect of EnU and SCD on SCPerf. (ii) To investigate the role of SCP in moderating the influence of EnU on SCPerf, and (iii) to investigate the role of SCP in moderating the influence of SCD on SCPerf.

94% of coir producers were included in the study from two South Indian states. Out of the 701 coir exporters, only 247 organisations throughout India qualified for the survey. Data cleaning and preprocessing were followed by confirming the factor structure of variables used and partial least squares-based structural equation modelling (PLS-SEM) for testing the hypotheses.

Literature review

"If the 1980s were about vertically aligning operations with business strategy" (Wheelwright, 1984), "the 1990s have been about horizontally aligning operations across processes" (Bartlett & Ghoshal, 1997). "To cope with global competition, SCM has become more popular" (Burgess et al., 2006). "SCM has been regarded as one of the most effective ways for organisations to improve their competitive advantage" (Sundram et al., 2011).

Successful supply chain practices (SCP) implementation is crucial for a successful SCM. Supply chains throughout the world are affected by different types of disruptions. "The onset of the year 2020 has witnessed the outbreak of the COVID-19 pandemic, which has shaken almost the entire globe" (Kaur, 2021). In a study conducted in India, companies were found to "lose 2.88 per cent in stockholder wealth in days surrounding disruptions" (Kumar et al., 2015). In the recent past, many researchers have reported on supply chain disruption and the severity of its impact on organisations and the supply chain (Rosales et al. 2020; Revilla & Sáenz 2014). Studies found that "transportation delays and port stoppages" (Chapman et al., 2002), "accidents and natural disasters" (Cooke, 2002), "poor communication, part shortages and quality issues" (Craighead et al., 2007), "operational issues" (Chopra and Sodhi, 2004), "labour disputes" (Machalaba and Kim, 2002), and "terrorism" (Sheffi, 2001) have all been detrimental to supply chains.

In light of these studies, an organisation must have a highly resilient supply chain that can respond to such market uncertainties and implement better practices to mitigate disruptions. SCP is "the set of activities undertaken in an organisation to promote effective management of its supply chain" (Li et al., 2005). SCP makes a supply chain perform under uncertainty by making it more agile, resilient and integrated (Craighead et al., 2007; Sheffi, 2001; Giunipero & Eltantawy, 2004). Sukati et al. (2011) indicate that "SCP improve supply chain responsiveness, which will enlarge supply chain competitive advantage and thus lead to perceived organisational performance."

"Environmental factors are critical in determining strategies" (Child, 1972). Context and strategy are expected to be aligned for better performance. "Proactive co-alignment strategies in supply chains are relatively under-investigated" (Sousa & Voss, 2008). Therefore, it seems justified to investigate how the environment (context) EnU and the adoption of SCP (strategy) influence SCPerf.

EnU and SCPerf

Every business operates under uncertainty. EnU refers to the "degree of change that is unpredictable in the external environment" (Kim and Kim, 2016). Unable to predict future events leads to inefficiency, influencing business decisions and impacting performance outcomes. The business environment largely determines organisations' practices to stay relevant and ahead of the competition (James & George, 2018). To remain relevant and viable in today's business environment, organisations must formulate strategies to overcome the negative impacts of uncertainty (Milliken, 1987).

The competitive and supply chain strategies must align for an organisation to attain a strategic fit. However, one of the major issues preventing organisations from attaining strategic fit is the implied demand uncertainty, which leads to poor responsiveness of the organisation. Delivering customer value and achieving superior SCPerf is hindered by increasing uncertainty. SCPerf is directly impacted by the extent of environmental turbulence. "Supply chain strategy and EnU affect perceived SCPerf" (Sun et al., 2009). They concluded that "the alignment between supply chain strategy and EnU is positively associated with SCPerf". (Ruel et al. (2018) draw out the impact of EnU on supply chain networks. They investigated the effect of information systems in managing the supply chain under uncertainties and risk. Reducing supply chain uncertainty leads to enhanced SCPerf (Childerhouse & Towill, 2004). When high uncertainty levels exist, organisations may rethink their earlier collaboration decisions, influencing performance (Kandemir et al., 2006). The need for further studies on SCPerf, under varying technological and demand uncertainties, is emphasised by Boonitt & Wong (2011). Thus, it is hypothesised that:

H1: Environmental uncertainty significantly influences Supply chain performance.

SCD and SCPerf

Many organisations consider disruptions inevitable due to the complex nature of the supply chains. In SCM, "disruptions (risks) could be described as any event that halts any of the three main flows (money, material, information) of the chain to deviate the distribution of possible outcomes" (Tang, 2005) and cause negative changes to performance. Supply chain risk, which is the "damage or loss resulting from a supply disruption" (Bode et al., 2008), comprises any risks for the information, material, and product flows from the original supplier to the delivery of the final product for the enduser" (Jüttner et al., 2003). Five different categories of risk on SCPerf are identified, which include "demand-side risk, supply-side risk, regulatory/legal and bureaucratic risk, infrastructure risk, and catastrophic risk, and demand- and supply-side risk is found to impact SCPerf." (Wagner and Bode, 2008).

The probability of occurrence and severity of disruptions affect the performance of supply chains. With increasing complexity and interdependence of various echelons of supply chains, risk levels take a spike (Christopher, 2004). "Disruption to any of the crucial decision-making factors, such as access to reliable and affordable transport, communications and information technology, could weaken the supply chain performance" (Aramyan et al., 2007). Thus, it is hypothesised that:

H2: Supply chain disruption significantly influences SCPerf.

SCP moderate the impact of EnU on SCPerf

The impact of EnU on internal organisational structures, processes and outcomes has become commonly held. Resource-based view points out that "firms support their strategy and gain strategic advantage through resources" (Miles & Snow, 2007). Based on the above tenet, SCP may be considered a resource in executing supply chain strategies. "Effective SCP helps improve firm performance" (Tan et al., 2002; Shin et al., 2000). It may be deduced that Strategic supplier partnerships and customer relationships are dynamic capabilities developed to mitigate uncertainties and disruptions in the supply chain. Li et al. (2005) put forward a validated measure for studying SCP, with six dimensions: "1) strategic supplier partnership, 2) customer relationship, 3) information sharing, and 4) information quality, 5) internal lean practices and 6) postponement".

To combat EnU, internal and external integration practices in supply chains result in "product quality, delivery and production flexibility" (Wong et al., 2011). "The alignment between environmental attributes, such as demand and supply, as well as various EnU and supply chain strategies, leads to an improvement in the supply chain performance" (Sun et al., 2009). Pedersen & Sudzina (2012) also found a "positive relationship between high EnU and adoption of performance measurement systems". Information sharing was observed to reduce uncertainty. In their collaboration studies, Lee (2002) inferred that uncertainties could be mitigated through efficient information sharing by becoming better responsive to customer needs (Fawcett et al., 2008). Based on the literature review, the authors distinguished four dimensions of EnU, which they included: customer uncertainty, supplier uncertainty, competitor uncertainty, and technology uncertainty. On this basis, a hypothesis was formulated:

H3: Supply chain practices moderate the impact of Environmental uncertainty on SCPerf.

SCP moderate the impact of SCD on SCPerf

SCP can be seen as being inevitable to reduce the impact of disruptions (Lee, 2002). The world witnessed a series of crises and catastrophes in recent years, which made organisations worldwide realise the vulnerability of their supply chains. Risks faced by every echelon in the supply chain impacted each other. It became imperative for organisations to look for SCPs that could combat disruptions. "SCP can reduce vulnerabilities in both a reactive and a proactive manner because it helps to monitor changes in the supply chain, customer needs, technology, partner strategies, and competitors and to update the risk assessment correspondingly" (Hallikas et al., 2004).

Buying from two or more suppliers has helped organisations reduce the risk of supply disruptions that may occur with single sourcing. Strategic supplier partnerships and buffering strategies have proved effective against uncertainty and disruptions (Giunipero & Eltantawy, 2004; Zsidisin & Wagner, 2010). Researchers have reported that "information sharing, product consistency, decision support systems and partnering schemes may also reduce uncertainty" (Mason-Jones & Towill, 2000). Several studies, including Swafford et al. (2006) and Fawcett et al. (2008), have found that though disruptions threaten organisations, the flexibility level in supply chains equips them to combat disruption events better. Based on the theoretical framework laid down by Environment-Strategy-Performance, Resource View, Contingency Theory, Dynamic Capability Theory and the arguments presented above, the following dimensions were proposed: supply chain flexibility, customer responsiveness, supplier performance, and logistics performance. The following hypothesis was formulated:

H4: SCP moderates the impact of SCD on SCPerf.

As it was evident from the literature review, there is a dearth of recent studies on organisations facing highly uncertain market conditions where there are possibilities of disruptions; our study intended to explore the influence of SCDs and EnU (environmental factors) and SCP (strategy choice and organisational processes) on SCPerf.

Materials & Methods

Single cross-sectional descriptive research followed an exploratory study, which was done to get insights into disruption risks, uncertainty and supply chain practices. The initial experience survey was conducted with eight experts from the coir industry to content-validate the standard questionnaire used in this study. These experts included professionals with extensive experience in supply chain management, coir production, product exports, industry associations, and academia. For the large-scale survey, the data for the four measures were collected using a structured closed-ended questionnaire designed to assess key constructs related to supply chain management. The survey was administered to 156 respondents, including top officials such as Directors (MDs), Chairpersons, Proprietors, or other deputed personnel such as Purchase Managers, Logistics Managers, or Supply Chain Heads across small, medium and large coir enterprises. These individuals were selected due to their comprehensive understanding of their organisations' operations, logistics, and strategic decision-making processes. Their roles ensured familiarity with the uncertainties and disruptions analysed in the study, contributing to the reliability and relevance of the data collected. The scope of this research is restricted to coir manufacturers and exporters fulfilling the following three criteria: (i) The organisation is registered under the Coir Board of India; (ii) the organisation is issued an export license; (iii) the geographical location is restricted to Kerala and Tamil Nadu, where 94% of the coir enterprises are located.

Coir enterprises not registered under the Coir Board of India, cottage-based units and those involved only in trading and exporting were not considered. Out of the 701 coir exporters, only 247 organisations throughout India qualified for the survey. Out of which, a Kerala and Tamil Nadu cluster is selected for the survey. The sample frame comprised the coir exporters' database from the Coir Board of India. The official list that the Coir Board of India maintains of the coir exporters in India was used. There are 701 coir exporters in India, of which only 247 are involved in manufacturing and export. The rest of the companies are merchant exporters/traders. One hundred thirty-one companies are located in Tamil Nadu and 101 in Kerala. Companies located in the districts of Coimbatore and Alappuzha were considered, as 73% of the companies are clustered around these districts. Multi-stage random sampling – Kerala and Tamil Nadu were selected for data collection, as most of the coir companies are located in these states, with the highest export revenue. The pilot sample size was 30, and the total sample size was 156 (as per Yamane (1967:886), 152 is required). Thus, a cross-sectional survey design was the best suited for the purpose. The advantages of this research design are that it is economical and consumes less time. A mail survey procedure is usually used for large-scale cross-sectional studies. The researcher used this technique for the survey initially. But the response was very low. Since the researcher required around 152 usable respondents, it was decided to meet the respondents at the confirmatory stage for direct interaction with pre-appointments. Data was collected from 156 respondents.

The sample comprises 9.6% large enterprises, 58.3 % medium-sized enterprises and 32.1 % small-sized enterprises. The average number of years the enterprises have been in business is 32 years. The ages of the enterprises range from 152 years to 5 years. The average number of employees in the enterprises is 75. The average export volume of coir-based products is 7554 tonnes. Sixty-five enterprises (41.67%) surveyed are from Kerala, and 91 (58.3%) are from Tamil Nadu. The respondent profile is given below in Table 1.

For data collection purposes, a structured, closed-ended questionnaire was used in the survey. The questionnaire contained 99 items representing the constructs of interest in the following order: SCD (21 items), EnU (18 items), SCP (34 items) and SCPerf (26 items).

Table 1
Sample characteristics

Data characteristics	Total Number	Percentage
Enterprises from Kerala	65	41.67
Enterprises from Tamil Nadu	91	58.3
Large Enterprises *	15	9.6
Medium Enterprises **	91	58.3
Small Enterprises ***	50	32.1
Average number of years in business	32	NA
Average number of employees	75	NA
Average export volume	7554 Tonnes	NA

Note: Investment in plant and machinery: above INR 100 million*, between INR 50 million and INR 100 million**, from INR 2.5 million to INR 50 million***

The four measures used in the survey are presented below.

1. SCD: developed by Wagner and Bode (2008).
2. EnU: developed by Li et al. (2005).
3. SCP: It is a second-order construct with six sub-constructs developed by Li et al. (2005).
4. SCPerf: It uses scales developed by Rexhausen et al. (2012).

The Organisational Profile included the 1) name of enterprise, 2) year of establishment, 3) number of employees, 7) location, and 8) volume of export.

The focal construct of this research is SCPerf of coir enterprises, which is an organisational-level construct. Purification and construct reliability of scales (using SPSS 20), confirmatory factor analysis, and path analysis were done using AMOS and PLS-SEM. After data collection, we conducted a Kolmogorov-Smirnov test with Lilliefors' significance correction to assess univariate normality for each measure. This test indicated that none of the variables followed a normal distribution. Additionally, skewness values for the measures ranged between -0.9 and 0.1, suggesting a slight negative skew in the data. To further evaluate the appropriateness of the data for confirmatory factor analysis, we applied the Bollen-Stine bootstrap method, which is well-suited to handle non-normal data, ensuring robust results in subsequent analyses. This approach was particularly critical given the non-normality of the data, supporting the use of PLS-SEM.

Reliability and Validity

Reliability tests measure the extent to which the phenomena provide stable and consistent results. The measurement model was then tested for its convergent and discriminant validity. The Final values obtained are shown in Table 3.

CFA was used to indicate which variables load on which factors and which are correlated. The CFA process determines whether the hypothesis fits the data well and confirms the factor structure. The researcher found that all the values are below the threshold limit (Table 2), which provides the best fit for the proposed extraction of variables. After conducting the confirmatory factor analysis, the model that explained the Supply chain practices was finalised. These factors were

Table 2
Reliability and Validity

Inventory	Cronbach's alpha	CR	AVE
Strategic Supplier Partnership (SSP)	0.954	0.97	0.915
Customer Relationship (CR)	0.947	0.966	0.905
Information Sharing (IS)	0.914	0.94	0.797
Information Quality (IQ)	0.989	0.993	0.978
Lean Practices (LP)	0.917	0.948	0.859
Logistics Practices (LoP)	0.795	0.881	0.712
Supply-side risks (SSR)	0.668	0.821	0.612
Infrastructural risks (IR)	0.859	0.914	0.781
Catastrophic risks (CaR)	0.605	0.835	0.717
Customer uncertainty (CuU)	0.784	0.903	0.823
Supplier uncertainty (SU)	0.945	0.965	0.901
Competitor uncertainty (CU)	0.807	0.912	0.838
Technology uncertainty (TU)	0.97	0.978	0.918
Supply Chain Flexibility (SCF)	0.952	0.977	0.954
Responsiveness to customers (RC)	0.935	0.969	0.939
Supplier performance	0.96	0.98	0.961
Logistics performance	0.944	0.964	0.9

Table 3
Threshold values of variables

Measures	Threshold Values	Observed Values			
		Supply chain practices	**Supply chain disruptions**	**Environmental uncertainty**	**Supply chain performance**
CMIN/DF	"< 3 Ideal. The values are acceptable between 3 and 5" (Hair et al., 2010)	2.539	2.4	1.739	2.43
CFI	> 0.95 (Hooper & Mullen, 2008)	0.995	0.96	0.97	0.998
GFI	> 0.95 (Baumgartner, 1996)	0.984	0.94	0.96	0.978
AGFI	> 0.80 (Baumgartner, 1996)	0.959	0.93	0.87	0.982
RMSEA	"< 0.05 good and 0.05 to 0.10 Moderate" (Hooper & Mullen, 2008)	0.059	0.06	0.06	0.05
P CLOSE	> 0.05	0.254	0.07	0.07	0.24
CMIN/DF	"< 3 Ideal. The values are acceptable between 3 and 5" (Hair et al., 2010)	2.539	2.4	1.739	2.43

strategic supplier partnerships, customer relationships, information sharing, information quality, internal lean practices, and logistics practices. Environmental uncertainty was finalised with factors such as Customer, Supplier, Competitor, and Technology uncertainty. The model that explained the Supply chain disruptions was finalised after deleting two factors, viz., demand-side and regulatory risks, that contributed much less to the model. The remaining factors were supply-side risks, infrastructural risks, and catastrophic risks. After conducting the confirmatory factor analysis, the model that explained the Supply chain performance was finalised after deleting certain items that contributed less to the model. All the factors that loaded above 0.7 were included. A reliability test using the classic Cronbach's Alpha Model was attempted on the entire data set. The measurement model was then tested for its convergent validity and discriminant validity. Coefficient alpha, or Cronbach's alpha, is the average of all split-half coefficients resulting from different ways of splitting the scale items. 0 to 1 is the range of coefficient value, and a value of less than 0.6 or less generally indicates unsatisfactory internal consistency reliability. The composite reliability (CR) values identified in this study for the six components are as above. The average variance extracted (AVE) for each construct was evaluated against its correlation with the other constructs to evaluate convergent validity. The rule of thumb for composite reliability should be above 0.7, and the average variance extracted (AVE) should be above 0.5 (Hair et al., 2014). The study obtained the exact model fit with an acceptable threshold for a good model.

Results

Response anomalies and outliers were checked using visual inspection and Mahalanobis distance values. Data cleaning and preprocessing were followed by confirming the factor structure of the variables used. PLS-SEM was done to test hypotheses. Confirmatory factor analysis was done for all the constructs to identify the factor structure of indicators, followed by examining the goodness of measures by establishing reliability and validity. For the same, individual item reliabilities and convergent and discriminant validity of individual constructs are checked (Hulland, 1999). Cronbach's alpha and composite reliability checks scale reliability.

Out of the six factors in the standard questionnaire of Supply chain practices, five factors were recommended by experts, and one of the factors, the postponement, was dropped, and a logistics factor, identified from the literature, was added to the construct. The researcher found that all the values are under the threshold limit (Table 2) and provide the best fit.

Path Analysis and Model Validation

The proposed model is given in Figure 1, and the estimated model is given in Figure 2, with path coefficients that show the causal linkages and corresponding P values. "The effect sizes are calculated as the absolute values of the individual contributions of the corresponding predictor latent variables to the R-squared coefficients of the criterion latent variable in each latent variable block. To assess the model fit with the data, the p-values for both the average path coefficient (APC) and the average r-squared (ARS) must be lower than .05. In addition, it was recommended that the average variance inflation factor (AVIF) be lower than 5" (Kock & Lynn, 2012).

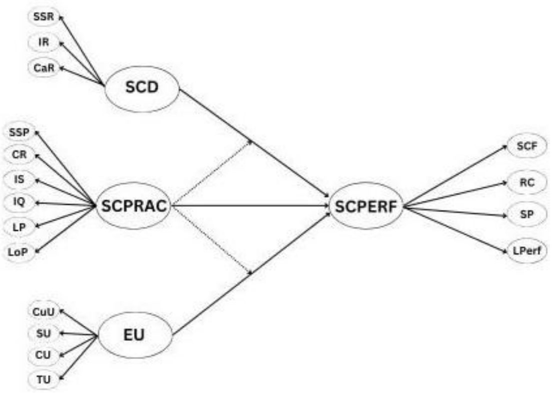

Fig. 1. Proposed model

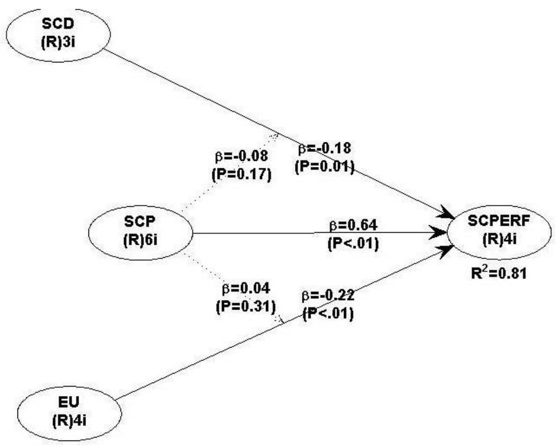

Fig. 2. Structural model

As the model met all three fit criteria, it was found to have acceptable predictive and explanatory quality. Wetzels et al. (2009) said, "GoF is small if equal to or greater than 0.1, medium if equal to or greater than 0.25, and large if equal to or greater than 0.36." In the present study, Tenenhaus GoF (GoF) = 0.680, which shows the high explanatory power of the model. Cohen (1988) suggested "values of R-squared coefficients and adjusted R-squared coefficients below 0.02". "Full collinearity VIFs can also be used for common method bias tests that are more conservative than, arguably superior to, the traditionally used tests relying on exploratory factor analyses. A rule of thumb rooted in the use of Warp PLS for many SEM analyses in the past suggests that full collinearity VIFs of 3.3 or lower suggest the existence of no multicollinearity in the model and no common method bias" (Kock & Lynn, 2012). "This is also the recommended threshold for VIFs for latent variables in PLS-based SEM" (Kock & Lynn, 2012). A Q-squared coefficient greater than zero suggests acceptable predictive validity. The Rohatgi-Székely test (Rohatgi & Székely, 1989) indicates unimodality. The Jarque-Bera test (Jarque & Bera, 1980) checks normality. Unimodality and normality test results (Table 4) are presented as binary outcomes ('Yes' or 'No'), indicating whether the latent variable distributions satisfy the criteria for unimodality or normality, respectively. If at least one latent variable or indicator is neither unimodal nor normal, it reinforces the appropriateness of using the nonparametric methods available in Warp PLS software for analysis. The discriminant validity of the constructs was checked by comparing the square root of average variance extracted (AVE), "which should be greater than the correlations involving the constructs" (Fornell & Larcker, 1981).

The validity of the measurement model is tested, followed by the testing of the structural model. "The structural model (inner model) tests the relationships between the latent variables by evaluating the path coefficients" (Wiedmann et al., 2011). Figure 2 shows the model in this study.

All three latent variables (Supply chain practices, Environmental uncertainty and Supply chain disruption) explained 81% of the variation in Supply chain performance. Environmental uncertainties and Supply chain disruptions were found to have a significant influence on Supply chain performance ($p < 0.01$) through path analysis (Table 5).

Environmental uncertainty and Supply chain disruption have a negative relationship ($\beta = -0.22$, $\beta = -0.18$) with Supply chain performance, indicating that as the Environmental uncertainty and Supply chain disruption increase, SCPerf of the organisation reduces (H1 and H2). It also indicates that- unit change in the Environmental uncertainty would change SCPerf by 0.22 units, and a one-unit change in SCD would change SCPerf by 0.18 units.

Table 4
Summary of path analysis

	SCD	EnU	SCP	SCP* SCD	SCP* EnU	SCPerf
PC	–0.18	–0.27	0.64	–0.08	0.04	
PV	0.01	0.003	< 0.001	0.17	0.31	
Es	0.1	0.12	0.54	0.03	0.015	
MFI	APC = 0.23	ARS = 0.81	AARS = 0.81	AVIF = 1.56		
Pv	< 0.001	< 0.001	< 0.001	acceptable if < = 5, ideally < = 3.3		
R_s	–	–	–	–	–	0.81
AR_s	–	–	–	–	–	0.81
Cr	0.70	0.75	0.96	0.6	0.91	0.96
CA	0.36	0.56	0.95	0.83	0.90	0.94
AVE	0.46	0.53	0.79	0.34	0.43	0.86
FVIF	1.77	2.23	4.41	2.16	1.37	6.66
Qs	–	–	–	–	–	0.82
TRS	Yes	Yes	No	Yes	Yes	No
TKM	Yes	Yes	Yes	Yes	Yes	Yes
TJB	No	No	No	No	No	No
RJB	No	No	No	No	No	No
Correlations among l.vs. With sq. rts. of AVEs						
	SCD	**EU**	**SCP**	**SCPERF**	**SCP*SCD**	**SCP*EU**
SCD	**0.68**	0.22	–0.15	–0.33	0.51	0.06
EU	0.22	**0.73**	–0.27	–0.54	–0.27	–0.28
SCP	–0.15	–0.27	**0.89**	0.83	–0.22	0.09
SCPERF	–0.33	–0.54	0.83	**0.93**	–0.19	0.27
SCP*SCD	0.51	–0.27	–0.22	–0.19	**0.59**	0.31
SCP*EU	0.06	–0.28	0.09	0.27	0.31	**0.65**

Table 5
Abstract of hypothesis tests based on the model proposed

SL.#	No.	Hypothesis	Path Coefficient	P Value	Significance
1	H1	EnU-> SCPerf	–0.22	< 0.01	Yes
2	H2	SCD-> SCPerf	–0.18	= 0.01	Yes
3	H3	SCP moderate the influence of EnU on SCPerf	0.4	0.31	No
4	H4	SCP moderate the influence of SCD on SCPerf	–0.08	0.17	No

Note: SCD-Supply chain disruption, EnU-Environmental Uncertainty, SCP-Supply chain practices, SCPerf-Supply Chain Performance. APC-Average path coefficient, ARS-Average R-squared, AARS-Average adjusted R-squared, AVIF-Average block VIF, PC-Path coefficients, PV-P values, Es- Effect sizes, MFI- Model fit indices, Pv-P values, R_s- squared, AR_s- Adjusted R- R-squared, Cr- Composite reliability, CA- Cronbach's alpha, FVIF-Full collinearity VIF, Qs-Q squared, TRS- Tests of unimodality: Rohatgi-Székely, TKM-Tests of unimodality: Klaassen-Mokveld-van Es, TJB- Tests of normality: Jarque–Bera, RJB- Robust Jarque–Bera.

Discussion

The indicators and dimensions satisfy the reliability requirement since their loadings are generally greater than 0.7 (Table 4). All multidimensional constructs and dimensions meet the requisite of construct reliability because their composite reliabilities (CR) are greater than 0.7. These latent variables attain convergent validity since their average variance extracted (AVE) surpasses the 0.5 level or is very near to it. Also, all variables achieve discriminant validity following the Fornell-Larcker (1982) criterion.

Previous research studies have reiterated the positive influence of SCP on SCPerf. This study intended to investigate the role of SCP in moderating the influence of Environmental uncertainties on SCPerf (H3 and H4). Moderating effects may occur when variables influence the strength or the direction of a relationship between an independent and a dependent variable. Here, the moderating influence of SCP was found to be insignificant at a 0.01 level of significance, and the path coefficient was negative ($\beta = -0.04$) regarding its influence on the relationship between EnU and SCPerf (H3).

Discrete studies have proved the negative influence of SCD on SCperf. However, this study tried to explore the sufficiency of Supply chain practices in moderating this negative impact. With path analysis, the moderating influence of SCP was found to be insignificant at a 0.01 level of significance, and the path coefficient was negative ($\beta = -0.08$) about its influence on the relationship between SCD and SCPerf (H4) (Table 5). This throws light on the inadequacy of conventional SCP in positively influencing SCPerf when the Supply chain faces disruptions. The study is expected to give MSMEs insight into adopting disruption-resilient practices in their supply chains. As supply chains become more networked, complexities and related uncertainties arise. This could be demanding customers, unreliable suppliers, technology obsolescence and competition. Many organisations operate on a global scale and have global supply chains operating on behalf of the organisation. Supply chain disruptions negatively impact SCPerf. Hence, strategies are to be adopted to face uncertainties and disruptions. As the role of conventional supply chain practices is limited, disruption-resilient supply chains are to be designed in the face of uncertainties. The study shows that an uncertain environment and disruptions in the supply chain may become a handicap for business if proper and efficient Supply chain practices do not properly counter them. Little research deals with the relationship between SCP and SCPerf in the presence of uncertainties and disruptions (Chowdhury et al., 2023; Alamsjah & Asrol, 2022). Supply chain managers and researchers are usually caught in the narrow belief that SCP is the only tool available to them to manage supply chains. The study has empirically demonstrated that the SCP does not moderate the negative influence that uncertainties and disruptions cause on supply chains. This is the major contribution of the work.

Future research can study supply chains using the scales used in this research to validate them across industries to confirm their usability. Invariance tests on the scales may be conducted to validate them for different organisation sizes and structures. Other dimensions of Supply chain practices, like just-in-time, demand management, capacity and resource management, material flow management, process integration, etc., may be included in research on the Supply chain activities of organisations. Service industries can also be studied for SCM activities, as the service sector is the biggest today. Industry-specific studies and studies among MSMEs considering end-to-end supply chains call for a wider scope for future studies.

Conclusions

The study indicates that SCD and EnU threaten the SCPerf of organisations in the coir industry, even though the organisations had adopted SCP. The study reinforces the earlier studies on the significance of SCP in positively influencing SCPerf. The study also shows that EnU and SCDs lower the performance of the Supply chain. The study questions the role of SCP in moderating the influence of (i) SCDs on SCPerf and (ii) EnU on SCPerf. Organisations that adopt SCP are believed to have an edge over others regarding better SCPerf. However, the present study reveals that in the presence of disruption risks and environmental uncertainties, Supply chain practices may turn ineffective as they do not act as a moderator in bringing down their negative impacts on SCPerf.

Hence, the study indicates that SCD and EnU threaten the SCPerf of organisations, even though the organisations have adopted SCP. The study reinforces the earlier studies on the significance of SCP in positively influencing SCPerf. The study also shows that EnU and SCP lower the performance of the Supply chain. The study questions the role of SCP in moderating the influence of (i) SCD on SCPerf and (ii) EnU on SCPerf. Organisations that adopt SCP are believed to have an edge over others regarding better SCPerf. However, the present study reveals that in the presence of disruption risks and EnU, SCP may turn ineffective as they do not act as a moderator in bringing down their negative impacts on SCPerf. Hence, this finding calls for organisations to adopt disruption-resilient practices in the SCM to stay competitive in an evolving world of uncertainty.

A limitation of this study is its confinement to a specific industry and its cross-sectional design. Future research encompassing multiple industries and employing longitudinal studies would provide more comprehensive and insightful findings.

This study provides practical insights for MSMEs to adopt disruption-resilient practices in their supply chains, particularly in the coir manufacturing and export sectors. These insights address the complexities and uncertainties of this industry's modern, networked supply chains. It emphasises the importance of developing strategies to counter disruptions, highlighting the need for efficient practices beyond conventional SCM.

References

Alamsjah, F., & Asrol, M. (2022). Supply chain ambidexterity and performance under uncertainty: The case of inter-island logistics in Indonesia. *Uncertain Supply Chain Management*, 10(3), 759–770.

Aramyan, L.H., Lansink, A.G.O., Van Der Vorst, J.G., & Van Kooten, O. (2007). Performance measurement in agri-food supply chains: a case study. *Supply chain management: an international Journal*. 12(4), 304–315.

Bartlett, C.A., & Ghoshal, S. (1997). The myth of the generic manager: new personal competencies for new management roles. *California Management Review*, 40(1), 92–116.

Baumgartner, H., & Homburg, C. (1996). Applications of structural equation modeling in marketing and consumer research: A review. *International Journal of Research in Marketing*, 13(2), 139–161.

Beamon, B.M. (1999). Measuring supply chain performance. *International journal of operations & production management*. 19(3), 275–292.

Bode, C., Wagner, S.M., Petersen, K.J., & Ellram, L.M. (2008). Understanding responses to supply chain disruptions: Insights from perspectives on information processing and resource dependence. *Academy of Management Journal*, 54(4), 833–856.

Boon-itt, S., & Wong, C.Y. (2011). The moderating effects of technological and demand uncertainties on the relationship between supply chain integration and customer delivery performance. *International Journal of Physical Distribution & Logistics Management*. 41(3), 253–276.

Burgess, K., Singh, P.J., & Koroglu, R. (2006). Supply chain management: a structured literature review and implications for future research. *International Journal of operations & production Management*. 26(7), 703–729.

Chapman, R.L., Soosay, C., & Kandampully, J. (2002). Innovation in logistic services and the new business model: a conceptual framework. *Managing Service Quality: An International Journal*. 33(7), 630–650.

Child, J. (1972). Organizational structure, environment and performance: The role of strategic choice. Sociology, 6(1), 1–22.

Childerhouse, P., & Towill, D.R. (2004). Reducing uncertainty in European supply chains. *Journal of Manufacturing Technology Management* 15(7), 585–598.

Christopher, M. (2004). Supply chains: a marketing perspective. *Understanding supply chains*, (Oxford, 2004; online edn, Oxford Academic, 31 Oct. 2023), DOI: 10.1093/oso/9780199259328.003.0002.

Chowdhury, M.M.H., Quaddus, M., & Chowdhury, M. (2023). Managing relational practices for performance improvement in a complex supply chain network: the mediating roles of proactive and reactive resilience in apparel industry of Bangladesh. *The International Journal of Logistics Management*, 34(1), 34–59.

Chopra, S., & Sodhi, M.S. (2004). Managing risk to avoid supply-chain breakdown. *MIT Sloan Management Review*.

Cohen, M.P. (1998). Determining sample sizes for surveys with data analyzed by hierarchical linear models. *Journal of Official Statistics*, 14(3), 267.

Cooke, D. L. (2003). *Learning from incidents*. In 21st System Dynamics Conference, NYC, New York (pp. 1–30).

Craighead, C.W., Blackhurst, J., Rungtusanatham, M.J., & Handfield, R.B. (2007). The severity of supply chain disruptions: design characteristics and mitigation capabilities. *Decision sciences*, 38(1), 131–156.

Fawcett, S.E., Magnan, G.M., & McCarter, M.W. (2008). A three-stage implementation model for supply chain collaboration. *Journal of Business Logistics*, 29(1), 93–112.

Fornell, C., & Larcker, D.F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research*, 18(3).

Giunipero, L.C., & Eltantawy, R.A. (2004). Securing the upstream supply chain: a risk management approach. *International Journal of Physical Distribution & Logistics Management*, 34(9), 698–713.

Haarhaus, T., & Liening, A. (2020). Building dynamic capabilities to cope with environmental uncertainty: The role of strategic foresight. *Technological Forecasting and Social Change*, 155, 120033.

Hair, J.F., Sarstedt, M., Ringle, C.M., & Mena, J.A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, 40(3), 414–433.

Hallikas, J., Karvonen, I., Pulkkinen, U., Virolainen, V.M., & Tuominen, M. (2004). Risk management processes in supplier networks. *International Journal of Production Economics*, 90(1), 47–58.

Hooper, D.C. (2010). & Mullen J., MR (2008). Structural equation modeling: Guidelines for determining model fit. *The Electronic Journal of Business Research Methods*, 6(1), 53–60.

Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. *Strategic Management Journal*, 20(2), 195–204.

James, N., & George, R. (2018). Exploring the Influence of Environmental Uncertainty and Supply Chain Practices: A Quarterly. *SCMS Journal of Indian Management*, 15(4), 22–31.

Jap SD. 1999. Pie-expansion efforts: collaboration processes in buyer–supplier relationships. *Journal of Marketing Research*, 36(4), 461–475.

Jarque, C.M., & Bera, A.K. (1980). Efficient tests for normality, homoscedasticity and serial independence of regression residuals. *Economics Letters*, 6(3), 255–259.

Jiao, H., Alon, I., & Cui, Y. (2011). Environmental dynamism, innovation, and dynamic capabilities: the case of China. *Journal of Enterprising Communities: People and Places in the Global Economy*, 5(2), 131–144.

Jüttner, U., Peck, H., & Christopher, M. (2003). Supply chain risk management: outlining an agenda for future research. *International Journal of Logistics: research and applications*, 6(4), 197–210.

Kandemir, D., Yaprak, A., & Cavusgil, S.T. (2006). Alliance orientation: conceptualisation, measurement, and impact on market performance. *Journal of the academy of marketing science*, 34(3), 324–340.

Kaur, K. (2021). The early impact of COVID-19 on textile industry: an empirical analysis. *Management and Labour Studies*, 46(3), 235–247.

Kim, H.J., & Kim, B.K. (2016). An entrepreneurial paradox: the moderating effect of the external environment. *Asian Journal of Technology Innovation*, 24(2), 222–233.

Kock, N., & Lynn, G. (2012). Lateral collinearity and misleading results in variance-based SEM: An illustration and recommendations. *Journal of the Association for Information Systems*, 13(7).

Kumar, S., Liu, J., & Scutella, J. (2015). The impact of supply chain disruptions on stockholder wealth in India. *International Journal of Physical Distribution & Logistics Management.*

Lee, Y.H., Cho, M.K., Kim, S.J., & Kim, Y.B. (2002). Supply chain simulation with discrete–continuous combined modelling. *Computers & Industrial Engineering*, 43(1-2), 375–392.

Li, S., Rao, S.S., Ragu-Nathan, T.S., & Ragu-Nathan, B. (2005). Development and validation of a measurement instrument for studying supply chain management practices. *Journal of Operations Management*, 23(6), 618–641.

Li, S., Ragu-Nathan, B., Ragu-Nathan, T.S., & Rao, S.S. (2006). The impact of supply chain management practices on competitive advantage and organisational performance. *Omega*, 34(2), 107–124.

Machalaba, D., & Kim, Q. (2002). West Coast docks are shut down after a series of work disruptions. *The Wall Street Journal*, 1.

Mason-Jones, R., & Towill, D.R. (2000, January). Coping with uncertainty: Reducing "bullwhip" behaviour in global supply chains. *Supply Chain Forum: An International Journal*, Taylor & Francis. 1(1), 40–45

Miles, R.E., & Snow, C.C. (2007). Organisation theory and supply chain management: An evolving research perspective. *Journal of Operations Management*, 25(2), 459-463.

Milliken, F.J. (1987). Three types of perceived uncertainty about the environment: State, effect, and response uncertainty. *Academy of Management Review*, 12(1), 133–143.

Pedersen, E.R.G., & Sudzina, F. (2012). Which firms use measures? Internal and external factors shaping the adoption of performance measurement systems in Danish firms. *International Journal of Operations & Production Management*, 32(1), 4–27.

Revilla, E., & Sáenz, M.J. (2014). Supply chain disruption management: Global convergence vs national specificity. *Journal of Business Research*, 67(6), 1123–1135.

Rexhausen, D., Pibernik, R., & Kaiser, G. (2012). Customer-facing supply chain practices—The impact of demand and distribution management on supply chain success. *Journal of Operations Management*, 30(4), 269–281.

Rohatgi, V.K., & Székely, G.J. (1989). Sharp inequalities between skewness and kurtosis. *Statistics & probability letters*, 8(4), 297–299.

Rosales, F.P., Oprime, P.C., Royer, A., & Batalha, M.O. (2020). Supply chain risks: findings from Brazilian slaughterhouses. *Supply Chain Management: An International Journal*, 25(3), 343–357.

Ruel, S., Ouabouch, L.& Shaaban, S. (2017). Supply chain uncertainties linked to information systems: a case study approach. *Industrial Management & Data Systems*, 117(6), 1–22.

Sanchez, R. (1997). Preparing for an uncertain future: Managing organisations for strategic flexibility. *International studies of management & organisation*, 27(2), 71–94.

Sheffi, Y. (2001). Supply chain management under the threat of international terrorism. *The International Journal of Logistics Management*, 12(2), 1–11.

Shin, H., Collier, D.A., & Wilson, D.D. (2000). Supply management orientation and supplier/buyer performance. *Journal of Operations Management*, 18(3), 317–333.

Sousa, R., & Voss, C.A. (2008). Contingency research in operations management practices. *Journal of Operations Management*, 26(6), 697–713.

Sukati, I., Hamid, A.B.A., Baharun, R., Tat, H.H., & Said, F. (2011). A study of supply chain management practices: An empirical investigation on the consumer goods industry in Malaysia. *International Journal of Business and Social Science*, 2(17), 166–176.

Sun, S.Y., Hsu, M.H., & Hwang, W.J. (2009). The impact of alignment between supply chain strategy and environmental uncertainty on SCM performance. *Supply Chain Management: An International Journal*, 14(3), 201–212.

Sundram, V.P.K., Ibrahim, A.R., & Govindaraju, V.G.R. (2011). Supply chain management practices in the electronics industry in Malaysia: Consequences for supply chain performance. *Benchmarking: An International Journal*, 18(6), 834–855.

Swafford, P.M., Ghosh, S., & Murthy, N. (2006). The antecedents of supply chain agility of a firm: scale development and model testing. *Journal of Operations Management*, 24(2), 170–188.

Tan, K.C., Lyman, S.B., & Wisner, J.D. (2002). Supply chain management: a strategic perspective. *International journal of operations & production management,* 8(1), 15–34.

Tang, C.S. (2005). Perspectives in supply chain risk management: A review. *Perspectives in Supply Chain Risk Management: A Revie*w (November 3, 2005).

Tarafdar, M., & Qrunfleh, S. (2017). Agile supply chain strategy and supply chain performance: complementary roles of supply chain practices and information systems capability for agility. *International Journal of Production Research*, 55(4), 925–938.

Wagner, S.M., & Bode, C. (2008). An empirical examination of supply chain performance along several dimensions of risk. *Journal of Business Logistics*, 29(1), 307–325.

Wetzels, M., Odekerken-Schröder, G., & Van Oppen, C. (2009). Using PLS path modelling for assessing hierarchical construct models: Guidelines and empirical illustration. *MIS Quarterly*, 177–195.

Wheelwright, S.C. (1984). Manufacturing strategy: defining the missing link. *Strategic Management Journal*, 5(1), 77–91.

Wiedmann, K.P., Hennigs, N., Schmidt, S., & Wuestefeld, T. (2011). Drivers and outcomes of brand heritage: consumers' perception of heritage brands in the automotive industry. *Journal of Marketing Theory and Practice*, 19(2), 205–220.

Wong, C.Y., Boon-Itt, S., & Wong, C.W. (2011). The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations Management*, 29(6), 604–615.

Yamane, T. (1967). *Statistics: An introductory analysis*. Harper International Edition, New York.

Zsidisin, G.A., & Wagner, S.M. (2010). Do perceptions become reality? The moderating role of supply chain resiliency on disruption occurrence. *Journal of Business Logistics*, 31(2), 1–20.