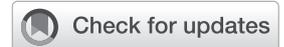


Mediating and moderating effects of green practices on environmental and operational performance in South African textiles

**Author:**Teboho M. Mofokeng¹ **Affiliation:**

¹Department of Business Management and Economics, Faculty of Economic and Financial Services, Walter Sisulu University, Mthatha, South Africa

Corresponding author:

Teboho Mofokeng,
tmofokeng@wsu.ac.za

Dates:

Received: 20 Apr. 2025

Accepted: 07 July 2025

Published: 28 Aug. 2025

How to cite this article:

Mofokeng, T.M., 2025, 'Mediating and moderating effects of green practices on environmental and operational performance in South African textiles', *Journal of Transport and Supply Chain Management* 19(0), a1182. <https://doi.org/10.4102/jtscm.v19i0.1182>

Copyright:

© 2025. The Author.
Licensee: AOSIS. This work is licensed under the Creative Commons Attribution License.

Read online:

Scan this QR code with your smart phone or mobile device to read online.

Background: The Textile and Clothing industry is widely recognised as one of the most polluting industries in the world. This includes the South African industry, which is also challenged by the influx of Asian products competing for the same market. To remain competitive, an approach of environmental sustainability can be a viable strategy that can be further enhanced by the adoption of green practices as a strategy.

Objectives: The purpose of the study was to investigate the mediating role of green logistics practices (GLP) and the moderating effects of green marketing practices (GMP) on the relationship between environmental performance (EP) and operational performance (OP) in the Textile and Clothing industry in South Africa.

Method: The study adopted a quantitative research methodology with a correlational research design. A sample size of 446 manufacturing firms was acquired and data were collected through a survey method with the use of convenience sampling. The data were analysed through Partial Least Squares-Structural Equation Modeling (PLS-SEM).

Results: GMP were found to show statistically insignificant moderating effects, while GLP demonstrated positive and significant mediating effects.

Conclusion: The findings imply that GMP must be prioritised as a key determinant of OP, given the significant direct effect of these practices.

Contribution: The study explains the relationship between EP and OP for the industry, and thus also addresses a knowledge gap in the literature regarding this matter. The study also demonstrates the use of the industrial approach and the practice theory as a cohesive theoretical foundation within the field of supply chain management.

Keywords: environmental performance; operational performance; green practices; textile and clothing industry; South Africa.

Introduction

The awareness of the environmental performance (EP) of manufacturing firms by internal and external stakeholders has been on the increase. The anticipation is that there should be efforts on preventing pollution, minimising waste and reusing resources. In increasing efficiency and reducing production costs (Fiorello et al. 2023), environmental strategies can also be a tactical approach aimed at improving competitive advantage. Ideally, therefore, firms must contribute towards environmental sustainability while simultaneously realising operational success.

The textile and clothing manufacturing industry in South Africa is a globally recognised producer of high-quality wool, mohair and cotton, primarily exported for processing (Trade & Industrial Policy Strategies [TIPS] 2022). There have also been signs of improvement in this industry, despite the decline of the manufacturing base since the late 1990s (Statista 2021). This is attributed to South African retailers driving domestic sourcing and online sales of clothing, which is an upward trend (Githahu 2020). At the same time, there has been far-reaching mass production that is driven by changing needs, shorter life-cycles and reduced order lead times (Silvestri et al. 2021). This mass production has resulted in the sector, both locally and internationally, being one of the most polluting industries in the world (Silvestri et al. 2021). Indeed, the sector accounts for approximately 4% to 10% of annual global greenhouse gas emissions. This sector is also inefficient in a number of areas, including

production and product end-of-life, with an estimated 21 billion tonnes of textiles landfilled annually, and 20% of global waste water attributed to the sector (United Nations Economic Commission for Europe [UNECE] 2022).

It is therefore conceivable that improvements in the sector have largely been centred on maximum output to drive sales and less on ethical practices as a reinforcement strategy of production. However, maintaining the right level of EP that strengthens operations requires significant investment, which may not be available in abundance, especially in a sector that has only recently accomplished a resurgence in local demand and industry growth (Githahu 2020). Ali et al. (2021) further argue that EP has a negative relationship with a firm's performance, with Jain and Sharma (2023) revealing that it can only yield value if it is met with environmental provisions reflected in the balance sheet. Agyabeng-Mensah et al. (2020), however, advocate that EP has a positive influence on operational performance (OP) by generating efficiency, such as resource and waste minimisation, which results in an overall increase in a firm's performance. Furthermore, green practices have been found to enhance the impact of EP. For example, green logistics practices (GLP) contribute by lowering carbon emissions, which stimulates environmentally friendly distribution (Zhu & Wen 2021), while green marketing practices (GMP) encourage the use of bio-friendly materials for packaging to reduce waste and promote environmental sustainability (Wandosell et al. 2021).

In order for textile manufacturing firms to improve, re-establish dominance locally and remain competitive against cheap Asian imports competing for the same market (Statista 2021), this study therefore proposes that there is a relationship between EP and OP that is supported by GLP and accelerated by GMP which, collectively, enforce working efficiency. The study further aims to address the existing knowledge gap in this area. For instance, GMP have largely been operationalised by consumer studies as predictors (see Alharthey 2019; Sahioun et al. 2023) while the mediating effect of GLP is regularly examined through the multi-dimensional construct of green supply chain management rather than independently (Ahmad & Karadas 2021; Jermstiparsert, Siriattakul & Sangperm 2019). Moreover, studies of the extent to which EP influences OP have produced inconsistent results (e.g. Agyabeng-Mensah et al. 2020; Ali et al. 2020). This study is therefore motivated by this reason, and by the need for the local textile and clothing industry to remain competitive.

The purpose of the study is therefore to examine the mediating and moderating role of green practices between EP and OP in the textile and clothing industry in South Africa. Three research objectives were developed:

1. To investigate the relationship between EP and OP
2. To examine the mediating role of GLP between EP and OP
3. To determine the moderating role of GMP between EP and OP.

The remainder of the article is structured in four main sections. To start with, a literature review is presented, in which the theoretical grounding is explained. An empirical review with hypotheses development is undertaken thereafter. This section is followed by an illustration of the developed conceptual model, with research methodology and design explained subsequently. Thereafter, the analysis of data and results are presented, and a discussion of the results follows. Implications and conclusions are presented subsequently, with limitations and suggestions for future studies explained towards the end of the article.

Literature review

The following section is a review of the study's theoretical grounding and the literature on the research constructs which includes empirical evidence that supports the development of hypotheses.

Theoretical grounding

The industrial approach and practice theory

This study utilises the industrial approach and the practice theory to explain how practices influence performance in a business context. The industrial approach considers the influence of industrial structures on the nature of strategies adopted by firms, which determine their business performance (Ezzi & Jarboui 2016). One strategy underlined in the context of the Practice-Based View emphasises how the use of commonly known practices may have a significant impact on performance (Betts, Super & North 2018). Essentially, the Practice-Based View advocates for procedures and actual practices that relate to a moment in time; in this instance, an unfavourable industrial structure (La Rocca, Hoholm & Mork 2017). Drawing from the industrial approach, this study therefore proposes that EP is likely to have a significant impact on OP. This would be invaluable to textile and clothing manufacturing firms operating in an industrial structure that is inundated with cheap Asian imports, and thus challenging to compete in (Statista 2021). In line with the Practice-Based View, this study further contends that GLP can successfully mediate this relationship by introducing modern logistics that emphasises preserving resources and minimising waste and pollution while meeting environmental requirements. Furthermore, this study posits that through moderation, GMP can accelerate this hypothesis through encouraging the design, promotion and distribution of textile and clothing products in an environmentally sustainable way.

Empirical review and hypotheses development

Environmental performance

Organisations are, at present, expected to produce effective EP by both internal and external stakeholders. This would contribute towards environmental sustainability at a national level, and could further improve organisational

efficiency, in a way that leads to a competitive advantage through reduced operational costs and an increase in corporate reputation. Environmental performance is a process that requires the involvement of organisational resources, including a commitment from top management to align corporate strategy with environmental matters, and applying environmental management accounting. This study adopts a definition by Cho et al. (2012), who define EP as an organisation's awareness of its liability and accountability to sustainable development. It is measured as a unidimensional construct.

One of the reasons why firms and institutions behave in an environmentally responsible manner is the will to be strategic in their operations. Some organisations would incur significant costs in their effort to minimise externalities, but would ultimately prosper by increasing revenue and brand equity by behaving in a responsible manner. Although the overall impact of EP on organisational objectives has been argued to be inconclusive (Kalash 2021), there are studies that have exhibited findings in support of a positive impact. For example, Garza-Reyes (2015) found that lean methods are indispensable for elevating manufacturing firms to operational excellence in the form of profitability, efficiency, responsiveness, quality and customer satisfaction. Garza-Reyes et al. (2018), however, emphasise that systems and processes designed to effect EP must first succeed so that the approach itself can meet operational objectives. In addition, the literature highlights the correlation between EP and GLP (for example, Al-Minhas, Ndubisi & Barrane 2020).

It can also be accepted that the efficacy of EP is determined by its impact on indicators such as emissions associated with transportation logistics. Therefore, the ability to reduce carbon emissions in transportation (e.g. through the use of lightweight material) implies efficacy and an influence that stimulates GLP by the organisation. This study adds that GLP further mediate the correlation between EP and OP, while GMP impart a notable moderating effect. For example, low-carbon transportation is needed to complement EP intended to reduce operational costs, while sustainable packaging can eliminate redundant operational processes, and thus accelerate cost reductions.

These green practices can contribute significantly to the sustainability of South Africa's textile and clothing industry alongside national projects such as the National Cleaner Production Centre of South Africa (NCPC-SA) (TIPS 2022). The NCPC-SA was developed to support initiatives such as the European Union's strategy aimed at a 50% reduction in carbon emissions by 2030 (European Commission 2022) and to curb challenges such as pre-consumer waste that is generated during product packaging in the manufacturing process (Du Plessis 2022; Udeagha & Muchapondwa 2023). Based on the literature, this study therefore hypothesises that:

H_{1a}: Environmental performance has a positive influence on OP within the textile and clothing manufacturing industry in South Africa.

H_{1b}: Green marketing practices moderate the relationship between EP and OP in a positive way.

H₂: Environmental performance has a positive influence on GLP within the textile and clothing manufacturing industry in South Africa.

H₃: Green logistics practices mediate the relationship between EP and OP positively.

Green logistics practices

The ascendance of logistics into prominence has highlighted the importance of GLP. The need for such practices stems from environmental considerations, legal regulations and the perceived economic advantage these practices can hold. South Africa has also been challenged by international bodies such as the United Nations (UN), urging the country to mitigate the environmental harm that is accelerated by its industrial activities (Udeagha & Muchapondwa 2023). The contributions made by GLP can therefore be invaluable, providing a strategic positive step to an economy in need of stability. Green logistics practices are defined as organisational activities that involve the eco-efficient management of the flow of products (forward and reverse) and information between the point of origin and the point of consumption, whose objective is to adequately meet customer demand (Carter & Rogers 2008). This study, however, adopts the definition by Van Vo and Nguyen (2023), who define GLP as a supply chain management strategy of minimising the environmental footprint of product distribution by logistics activities. Green logistics practices are vital for minimising the carbon footprint of the textile and clothing industry, a footprint that is often attributed to distribution (Du Plessis 2022). The concept is measured as a unidimensional construct.

Green logistics practices have a bearing on socio-economic environmental factors. These include, among others, a reduction in environmental impact, increases in health equity, and an improvement in economic health. For the individual firm, these practices can improve efficiency, increase competitiveness and facilitate sustainable supply chain process. Sureeyatanapas, Poophiukhok and Pathumnakul's (2018) quantitative analysis demonstrates that green logistics facilitates these improvements through enabling practices (such as eco-friendly transportation) that contribute towards the reduction of operational costs. However, these authors emphasise that partner-based contracts are essential for implementing green practices effectively. This overall benefit is relative to manufacturing firms, whose industry has been the primary focus for supply chain management research and practices (e.g. Khanfar et al. 2021). Based on the literature, the study therefore hypothesises that:

H₄: Green logistics practices have a positive influence on OP within the textile and clothing manufacturing industry in South Africa.

Operational performance

Operational performance is an important construct in strategic management research. This significance emanates from the organisation's will and need to succeed and to

remain competitive. Emphasis is usually placed on key operational variables such as quality, delivery, cost and flexibility (Prabhu, Thangasamy & Abdullah 2020). These metrics have been the basis on which many organisations have succeeded. Survey results of a study by Ul Haq and Faizan (2022) indeed revealed that a certain organisation realised customer satisfaction and financial growth once operational efficiencies in the areas of cost, quality, delivery and flexibility were met. Ahmad and Schroeder (2003) define OP as including human capital factors such as employee productivity in addition to principal operational variables. This study, however, adopts a definition from Ferdows and De Meyer (1990) who define OP as improvements in delivery, cost reduction, quality and flexibility. The concept is measured as a unidimensional construct.

Realising effective OP is not without its challenges. Mhlanga (2020) identifies structural, executional and regulatory factors as the three issues that determine OP. These encapsulate, among others, macro-environmental factors such as the economy, leadership and managerial ability within the organisation, as well as policies imposed to govern business (Shank & Govindarajan 1993). While structural and regulatory factors are beyond the full control of the firm, Lubis (2022) suggests that the Resource-Based View (RBV) should at least be incorporated internally to support the execution of the organisation. The primary objective of RBV is to align resources, such as processes, to meet objectives and to achieve the desired OP (Lubis 2022). These processes include methods that have been introduced to stimulate responsible production and increase efficiency in an industry, much like the textile and clothing industry that is struggling to reduce costs and wastage (Ndlovu 2023).

Green marketing practices

The stakeholders of firms have become increasingly conscious of the need for greater environmental awareness. Management would normally be concerned with the effect of green practices on the bottom line, while consumers would expect to see the firm's sound reaction in their marketing of products and/or services they consume. The concept of green marketing has therefore become important, with Alkhatib, Kecskés and Keller (2023) describing it as reducing a product's environmental impact by redesigning products, encouraging sustainable manufacturing and integrating marketing in business processes where value is added to the product. According to Dahhan and Arenkov (2021), green marketing further aims to promote the production of bio-friendly products and to contribute to sustainable consumption. This study adopts a definition from Polonsky (2011:1311), who defines green marketing as 'the effort by a company to design, promote, price and distribute products in a manner which promotes environmental protection'. Such an effort is imperative for manufacturers, including those in the textile and clothing industry, whose marketing distribution is characterised by product packaging that relies heavily on polythene bags, cardboard boxes and plastic courier bags. These packaging practices result in excessive

packaging material use that becomes even harder to dispose of post-consumption (Du Plessis 2022). The concept is measured as a unidimensional construct.

The concept of green marketing was first introduced in 1975 by the American Marketing Association through a workshop on Ecological Marketing (Nekmahmud & Fekete-Farkas 2020). Over the years, it has been associated with terms such as environmental marketing, ecological marketing, social marketing and sustainable marketing (Zhu & Sarkis 2016). Few studies have demonstrated how organisations can incorporate green marketing into everyday business practice. For example, Dangelico and Vocalelli (2017) performed such an analysis. Their findings concluded that to have effective GMP, firms must: (1) have a well-defined target market; (2) decide on the approach to greening their product portfolio; (3) always approach the Product and Place as correlational elements of the marketing mix. These practices are also crucial for attaining the right OP required for final delivery. Liu et al. (2024), however, add that a close relationship with service points and/or retailers is also imperative, given that they play a significant role in influencing green shopping behaviours. This context, therefore, suggests that the effective implementation of GMP requires a collective effort within the supply chain. In drawing from this literature, this study also hypothesises that:

H₅: Green marketing practices have a positive influence on OP within the textile and clothing manufacturing industry in South Africa.

Conceptual model

Drawing from the literature, a conceptual model was developed. The model is formative and five hypotheses were developed in this context. Environmental performance is predicted to have a relationship with OP, while green practices mediate and moderate this hypothesis, respectively. Figure 1 illustrates the proposed conceptual model. This model was examined within the textile and clothing industry in South Africa.

Research methodology and design

A quantitative research methodology was adopted for this study. The target population was the textile manufacturing firms in Gauteng, with firms registered in the cities of Johannesburg, Vereeniging and Vanderbijlpark forming the sample frame of the study. Johannesburg was selected based on its position as a resilient economy amid cheap Asian textile and clothing imports at the time (2018 to 2019) (BusinessTech 2021), while Vereeniging and Vanderbijlpark in its Southern Corridor were experiencing a rapid economic decline (Donaldson, Marais & Nel 2020). These cities constitute local economies in need of solutions for local market competitiveness and economic growth; this was the motivation for this study. The population consisted of managers in the profiled textile manufacturing firms (see Table 2). These professionals formed the single frame for actual respondents who were scattered among these firms.

No exact sample frame of the textile manufacturing firms in Gauteng existed at the time of the study (for example, see Chiromo 2018; also Chiromo & Nel 2018). The Gauteng business registry as well as local telephone directories were the sources from which participants were drawn using convenience sampling. This involved selecting participants who were reachable (cf. Golzar, Noor & Tajik 2022). The potential sample size was determined using Siddiqui's (2013), recommendation of at least 15 cases per observed variable in Structural Equation Modelling. It was then calculated using this formula, 15×27 (observed variables) = 405; the estimate was found to be compatible with that of Mafini and Muposhi (2017) ($n = 320$), who studied the relationship between green supply chain management practices and performance. The 4.87 margin of error ascertained on a 95% confidence level further supported precision. This potential sample size was further validated against the Dun and Bradstreet's 2025 data report of textile manufacturers in Gauteng ($n = 446$) to increase plausibility (Dun & Bradstreet 2025). Eligibility to participate required that firms must have been in operation for at least 3 years and employed between 10 and 200+ employees. Because of anticipated non-response, deferrals and a low application rate, the potential sample size was increased to 512 (cf. Bagiella & Chang 2019). The calculation applied the inflation factor using the formula, "adjusted = n /expected response rate (Groves et al. 2011), where n is the potential sample size. The expected response rate is based on the large sample (in percentage) by Mafini and Muposhi (2017) that was also analysed through Structural Equation Modelling. Large samples are also set to increase confidence regarding the properties of the population (Kutzner et al. 2017).

Participants were surveyed using a self-administered structured questionnaire with closed-ended questions.

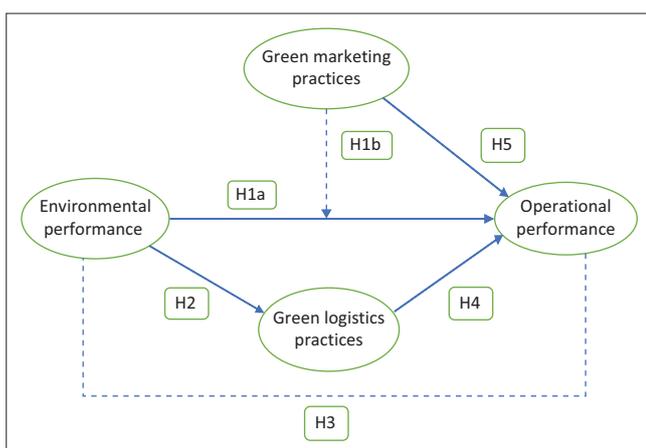


FIGURE 1: Conceptual model.

TABLE 1: Descriptive analysis and normality tests.

Construct	Missing	Mean	Median	Min	Max	Standard deviation	Excess kurtosis	Skewness
EP	0	3.35	3	1	5	1.007	-0.369	-0.144
GLP	0	3.25	3	1	5	1.031	-0.435	-0.096
GMP	0	3.39	3	1	5	0.996	-0.312	-0.224
OP	0	3.42	3	1	5	1.064	-0.509	-0.227

EP, Environmental performance; GLP, Green logistics practices; GMP, Green marketing practices; OP, Operational performance.

Green logistics practices and GMP were measured on five-item and six-item scales, respectively, adopted from Luthra, Garg and Haleem (2016). A six-item scale was adopted from Ezzi and Jarboui (2016) to measure EP, while OP was measured on a five-item scale appropriated from Luthra et al. (2016). All measurement items were tailored to fit the study's context and purpose, and were gauged on a 5-point Likert scale anchored by 1 = Strongly Disagree to 5 = Strongly Agree.

Data analysis and results

The Partial Least Squares-Structural Equation Model was the method used for data analysis. This method was adopted for its default properties that support formative models and the research objectives of prediction and theory development (Dash & Paul 2021). Furthermore, this study relied on its ability to evaluate data quality and enhance the explained variance in the dependent variable (cf. Hair Jr et al. 2017).

Data cleaning process

Of the 512 questionnaires distributed, 497 were retrieved (representing a response rate of 97%). These retrieved questionnaires were pre-screened to check for discrepancies in terms of incompleteness and entries for indicators that are in excess of one. This was done to ensure that the remaining questionnaires were useful. Fifty-one questionnaire files were then discarded because of anomalies, and the remaining 446 were subsequently coded in an Excel spreadsheet to prepare for data analysis. These 446 questionnaires also represented 446 respondents who formed the actual sample size of the study.

A descriptive analysis of the data was thereafter performed to ascertain their integrity. This step required assessing how respondents responded to the indicators in the survey. This involved examining the SmartPLS values of predefined indicators, including missing, mean, median, minimum, maximum, standard deviation, excess kurtosis and skewness (Aburumman et al. 2022). The results are reported in Table 1. Here, it is indicated that all constructs have zero missing values, 3.25 to 3.42 for mean, 3 for median, 1 for minimum, 5 for maximum and a 0.996 to 1.064 standard deviation, which implies low divergence for 5-point Likert scales (Leung 2011). To determine whether the data had a normal distribution, the values of excess kurtosis and skewness were checked against a -3 threshold (Aburumman et al. 2022). For all constructs, Table 1 indicates excess kurtosis values in the range of -0.312 to -0.509, while skewness values ranged between -0.096 and -0.227. These results denoted a normal distribution of the data. Descriptive statistics of the study sample were then ascertained hereafter.

Descriptive statistics

Descriptive statistics obtained following the data cleaning process are discussed in the next section. These relate to company background information and the respondent's profile.

Company background information and respondent's profile

Data collected regarding company background information indicated that a majority of the manufacturing firms (49.6%) had been in operation between 6 and 10 years, with 39.7% of the total situated in the Johannesburg Metropolitan Area. Many of the profiled manufacturing firms (27.4%) were in a partnership form of business ownership. Table 2 presents a more detailed profile of the surveyed textile manufacturing firms. A majority of the respondents (29.8%) were first-line managers, with many of the respondents (53.4%) designated to the operations and manufacturing department.

Measurement model assessment

The reliability of the measurement items was determined by running tests for Cronbach's alpha (α) and Composite Reliability (CR). Standardised regression weights were then analysed for validity and further tested against the Average Variance Extracted for validation (AVE). The results are presented in Table 3.

Reliability

As indicated in Table 3, alpha coefficients ranged between 0.843 and 0.883, and therefore signified that there was construct reliability (Chinomona 2011). Tests for CR further produced results of at least 0.88 for all research constructs, thus validating reliability (≥ 0.7) (Chin 1998).

Validity

The standardised regression weights (factor loadings) (presented in Table 3) illustrate that measurement items loaded well on their relative constructs (cf. the seminal work of Anderson & Gerbing 1988; Chinomona 2011). A test for the AVE was further conducted to confirm convergent validity. The results indicated AVE estimates between the research constructs as ranging from 0.60 to 0.68, thus aligning with the ≥ 0.5 threshold that verifies validity (Sarstedt et al. 2014). The presence of discriminant validity was ratified when the square roots of each construct's AVE were found to be greater than their respective correlations with other constructs (Yusoff et al. 2020). These results can be viewed in Table 4.

Structural model assessment

The structural model was assessed for explanatory power and predictive accuracy. This assessment includes the path analysis and tests for moderation and mediation thereafter. These are discussed in the following sections.

Explanatory power assessment

Following the measurement model assessment, the next step was to determine the model's explanatory power by ascertaining the coefficient of determination (R^2) (Hair et al.

2019). To start with, a standard test for collinearity was undertaken to assess whether there were two or more predictor variables that were linearly correlated (Shrestha 2020). This would assist in determining whether the predictor variables within the statistical model are misconceptualised. Table 5 presents the results from collinearity analysis.

Variance Inflation Factors (VIF) were computed and assessed against the recommended threshold of < 3 (Becker et al. 2015). All Inner VIF values presented in Table 5 verified that collinearity is non-existent. Hereafter, the next step was to examine R^2 . The results validated (see Figure 2) GLP (0.379) and OP (0.563) as having moderate (0.25 to 0.50) and marginally substantial (0.50 to 0.75) explanatory power, respectively (cf. Hair, Ringle & Sarstedt 2011). A greater statistical power implies that PLS-SEM is more likely to recognise relationships as significant when they exist within the population (Sarstedt & Mooi 2019).

Predictive accuracy assessment

For theory-building and validation, a test for predictive performance was required (Sharma et al. 2023). This was performed by calculating the Q^2 , which is a blindfolding procedure that eliminates single points in the data matrix,

TABLE 2: Company background information.

Variable	Frequency	%
Number of employees in the profiled manufacturing firms		
10 > 20	91	20.4
20–49	163	36.5
50–99	82	18.4
100–200	55	12.3
201 and more	55	12.3
Total	446	100
Number of years the profiled manufacturing firms have been in operation		
3 > 6	124	27.8
6–10	221	49.6
≥ 11	101	22.6
Total	446	100
Regions of the profiled manufacturing firms		
Vereeniging	143	32.1
Johannesburg	177	39.7
Vanderbijlpark	108	24.2
Other	18	4.0
Total	446	100
Profiled manufacturing firms: Forms of business ownership		
Sole proprietor	69	15.5
Partnership	122	27.4
Close corporation	63	14.1
Private company	103	23.1
Public company	84	18.8
Other	5	1.1
Total	446	100
Annual turnover of profiled manufacturing firms (million)		
1–9	279	62.6
10–25	91	20.4
26–50	60	13.5
≥ 51	16	3.6
Total	446	100

credits them with the mean, and estimates the model parameters (Sarstedt et al. 2014). Following the test for predictive accuracy using blindfolding, the Q^2 predict indicators observed were 0.373 and 0.485 for GLP and OP, respectively. This result implies that the endogenous constructs depict a medium predictive accuracy (0.025 to 0.5) of the structural model (Hair et al. 2019). In other words, the structural model demonstrates an acceptable probability of expressing the Industrial Approach and Practice Theory, which are adopted as the study's theoretical underpinning. The result further suggests that the study's conceptual model is valid and is significant when examined within the context of the textile and clothing industry.

Path analysis

PLS-SEM maintains that latent variables directly or indirectly influence other latent variables and that testing can generate estimations that indicate how these variables are related (Memon et al. 2021). Table 6 presents the results obtained from path analysis. The positive Beta coefficients (β) denote that there is a strong relationship between latent variables (Eliyana & Ma'arif 2019), while the t -statistics expresses statistical significance (Becker, Rai & Rigdon 2013).

TABLE 3: Scale accuracy analysis.

Research constructs	Scale item		Cronbach's test (α value)	CR	AVE	Factor loadings
	Mean	SD				
Green marketing practices	3.39	0.77	0.866	0.90	0.60	-
GMP1	-	-	-	-	-	0.695
GMP2	-	-	-	-	-	0.782
GMP3	-	-	-	-	-	0.790
GMP4	-	-	-	-	-	0.836
GMP5	-	-	-	-	-	0.778
GMP6	-	-	-	-	-	0.761
Green logistics practices	3.26	0.84	0.883	0.92	0.68	-
GLP1	-	-	-	-	-	0.738
GLP2	-	-	-	-	-	0.846
GLP3	-	-	-	-	-	0.869
GLP4	-	-	-	-	-	0.848
GLP5	-	-	-	-	-	0.827
Operational performance	3.38	0.86	0.878	0.91	0.67	-
OP1	-	-	-	-	-	0.743
OP2	-	-	-	-	-	0.844
OP3	-	-	-	-	-	0.854
OP4	-	-	-	-	-	0.836
OP5	-	-	-	-	-	0.821
Environmental performance	3.36	0.75	0.843	0.88	0.60	-
EP1	-	-	-	-	-	0.783
EP2	-	-	-	-	-	0.737
EP3	-	-	-	-	-	0.782
EP4	-	-	-	-	-	0.705
EP5	-	-	-	-	-	0.751
EP6	-	-	-	-	-	0.728

GMP, green marketing practices; GLP, green logistics practices; OP, operational performance; EP, environmental performance; SD, standard deviation; CR, composite reliability; AVE, average variance extracted.

The analysis was performed at a 95% confidence interval to ensure that false positives are avoided (Kock 2016). The observed t -statistics indicate high statistical significance of at least 4.57 when compared against the recommended threshold of 1.96 (Kock 2016). This means that there is a significant relationship between the constructs; EP, OP and green practices within the Textile and Clothing Industry.

Mediating and moderating effect analysis

In order to explore potential false effects or suppressor effects, a test for mediating effect was undertaken for H1a (O'Rourke & MacKinnon 2018). This involved the two-step approach by Nitzl, Roldan and Cepeda (2016) that recommends firstly testing the indirect effect for significance and secondly rationing the indirect-to-total effect to determine the Variance Accounted For (VAF) value for a more comprehensive mediation analysis. Furthermore, a test for moderating effect was performed to determine the extent to which the strength of H1a was affected by GMP. The results of these tests can be seen in Table 7 below.

Following the testing of GLP for mediation, the results indicate a positive mediating effect between EP and OP. A test for the VAF value further revealed that it facilitates partial mediation, because it is between >20% and <80% in terms of pragmatism (Hair et al. 2014). Green marketing practices were, however, found to exhibit a weak moderating effect (<0.02) (cf. Cohen 1988) on the relationship between EP and OP. This finding implies that the construct cannot influence the strength of the relationship in any significant way.

Discussion of results

The purpose of the study was to investigate the mediating and moderating effects of green practices between EP and OP in the Textile and Clothing industry in South Africa. Six hypotheses were developed and examined. Of the six, five were validated. The results indicate that GMP did not

TABLE 4: Results from discriminant validity testing using the average variance extracted method.

Research constructs	EP	GLP	GMP	OP
EP	0.774 [†]	-	-	-
GLP	0.708	0.824 [†]	-	-
GMP	0.605	0.649	0.774 [†]	-
OP	0.751	0.748	0.655	0.818 [†]

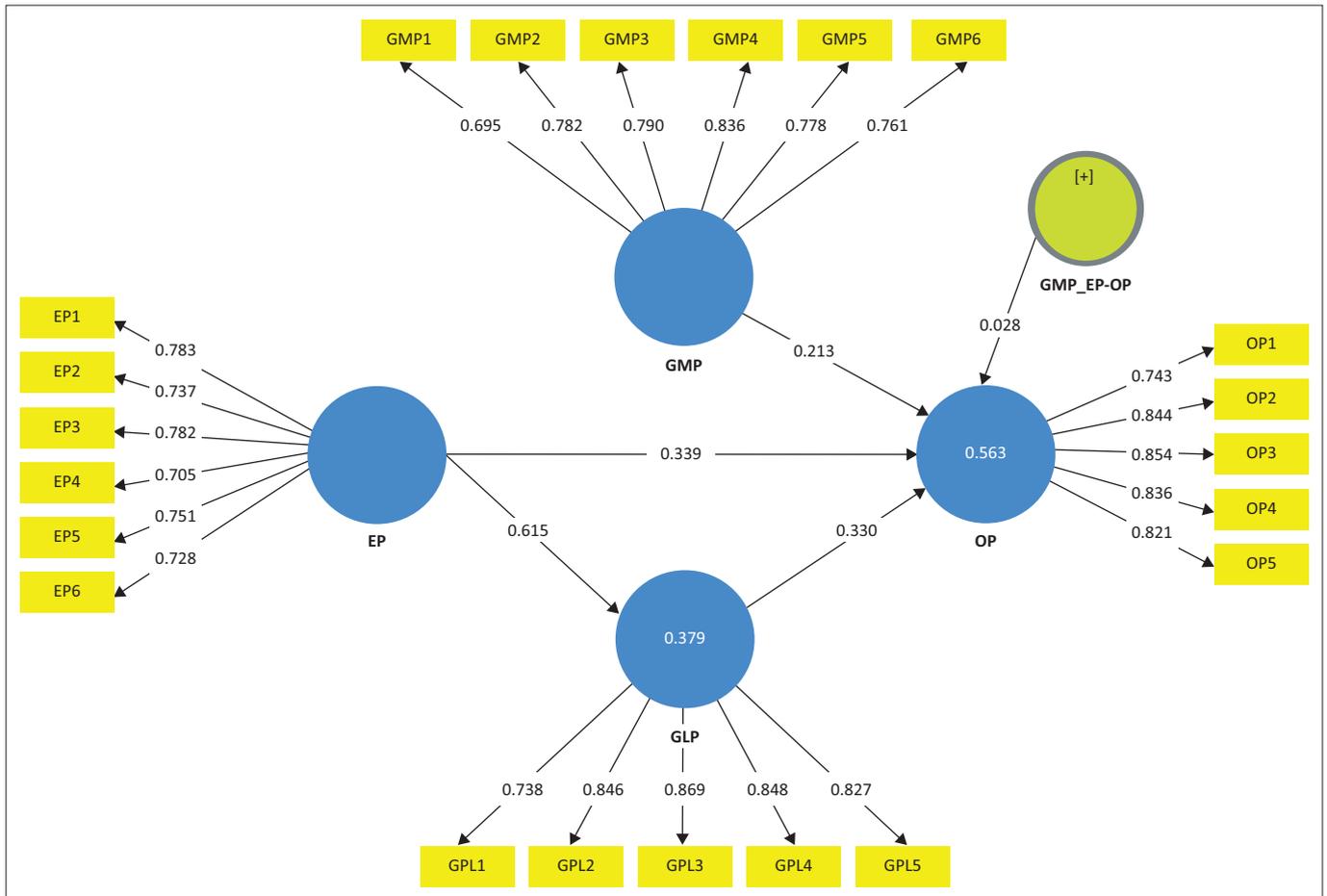
EP, environmental performance; GLP, green logistics practices; GMP, green marketing practices; OP, operational performance.

[†], represent the square roots of all four constructs' AVE values.

TABLE 5: Collinearity analysis.

Inner VIF values	EP	GLP	OP	EP-OP
EP	-	1.000	1.730	-
GLP	-	-	1.885	-
GMP	-	-	1.625	1.026

VIF, variance inflation factors; EP, environmental performance; GLP, green logistics practices; GMP, green marketing practices; OP, operational performance.



EP, environmental performance; GLP, green logistics practices; GMP, green marketing practices; OP, operational performance.

FIGURE 2: Structural model.

TABLE 6: Path analysis results.

Description	Hypothesis	Beta coefficient (β)	t-statistics	Rejected or supported
EP → OP	H1a	0.339	6.225	Supported
EP → GLP	H2	0.615	19.616	Supported
GLP → OP	H4	0.330	5.693	Supported
GMP → OP	H5	0.213	4.579	Supported

EP, environmental performance; GLP, green logistics practices; GMP, green marketing practices; OP, operational performance.

TABLE 7: Mediating and moderating effect analysis.

Test	Hypothesis	Beta coefficient (β)	VAF value (%)	F ²	Rejected or Supported
Mediation					
EP → GLP → OP	H3	0.203	37.5	-	Supported
Moderation					
GMP X EP → OP	H1b	0.028	-	0.002	Rejected

EP, environmental performance; GLP, green logistics practices; GMP, green marketing practices; OP, operational performance; VAF, variance accounted for.

demonstrate a statistically significant moderating effect on the relationship between EP and OP. This implies that there are no variations within the construct to alter the strength of the hypothesis (H1a). The results from the path analysis are categorical and suggest that if applied correctly, GMP will have a positive and significant impact on OP in the Textile and Clothing Industry. On the other hand, GLP were found to successfully mediate H1a. This means that GLP by the Textile manufacturing firms

improve the relationship between EP and OP. Furthermore, H2 exhibited a positive relationship with the highest statistical significance, suggesting that EP and GLP are highly complementary.

An overall inference from these findings is that EP influences OP in a positive and significant way, and that there is value in having GLP as a mediator. Any moderating effect by GMP in terms of the hypothesis is non-existent, and appreciation in this regard must be lodged in the positive and significant relationship that these practices have with OP. Drawing from the Industrial Approach and the Practice Theory, these findings further mean that the implementation of EP as a strategy will result in an increase in OP, which will likely further improve with the adoption of green practices.

Implications and conclusions

The first empirical objective of this study was to investigate the relationship between EP and OP. The results from PLS-SEM indicated that the relationship is positive and significant. Manufacturing firms in the Textile and Clothing industry can adopt effective EP as a competitive strategy, given that this will likely increase OP. Since EP commands lean methods, it will allow firms to realise

operational excellence through an increase in efficiency, quality and ultimately, customer satisfaction and profitability.

The second empirical objective was to examine the mediating role of GLP between EP and OP. The results found the relationship to be positive and significant as well. This means that when implemented correctly, GLP can improve the relationship between EP and OP. For instance, the use of recyclable materials aimed at reducing costs in operations can be more effective if it is supplemented by GLP (for example, reducing carbon emissions), which further facilitate sustainability in the organisation's practices.

The third and last empirical objective was to determine the moderating role of GMP between EP and OP. The results revealed that GMP did not demonstrate significant moderating effects on the relationship between EP and OP. In other words, there exists no probability that the strength of this relationship will be impaired or accelerated by variations within GMP. This result weakens this theoretical potential and may suggest the need to examine underlying constructs that exhibit significant variations and therefore moderating effects. For practitioners, an in-depth analysis may be required to determine the fluctuations in GMP that influence the impact of EP on OP. However, the path analysis results for direct effect suggest that there is value in the positive and significant relationship between GMP and OP that must be appreciated. This result demonstrated that an insignificant moderating effect by the construct is a weakness that can be leveraged by prioritising its predictive power.

Theoretically, the findings support environmental performance as a predictor of OP, with GLP successfully mediating this hypothesis. The study further submits that GMP is a constant that cannot moderate the hypothesis, but rather influence OP directly in a significant way with a higher level of predictive accuracy. The Industrial Approach and Practice Theory were validated, where EP emerged as a viable competitive strategy that can increase OP in tandem with green practices.

Limitations and suggestions for future research

The study had a number of limitations. The use of PLS-SEM does not permit the measurement of model fit through model fit indices, which provide a more comprehensive description. It would have been interesting to see the full extent to which the data were represented by the conceptual model. While *t*-statistics can explain the strength of a relationship, it would have been worthwhile to examine power through *p*-values as well.

Furthermore, GMP were measured uniformly without consideration for potential variations in the sector. An in-depth analysis that looks for potential variations is, therefore, recommended. The study further suggests that a test should be undertaken to determine the mediating effect of GMP on

the relationship between EP and OP. This should be performed using the two-step approach demonstrated in this study as recommended by Nitzl et al. (2016). Such a study would expand our knowledge of the effect of GMP as a mediator.

A longitudinal study should also be considered by future researchers. Such a study could yield additional evidence on the trajectory of the relationships, which is a limitation of the cross-sectional research design adopted in this study. It is further recommended that the present study be extended to include the impact on the retail sector, which is an extension of the wider industry. To an extent, this would shed light on the extent to which EP influences the performance of the supply chain.

Acknowledgements

I confer my gratitude to Walter Sisulu University for funding the publication of this research article.

Competing interests

The author declares that no financial or personal relationships inappropriately influenced the writing of this article.

Author's contributions

T.M.M. is the sole author of this research article.

Ethical considerations

This work is from a PhD thesis completed by the author at the University of the Witwatersrand and ethical clearance was obtained from the university's Human Research Ethics Committee (Non-Medical) (Protocol number: H17/06/32). Permission was also granted by the Textile Federation of South Africa to conduct the study, but participation by respondents was entirely on a voluntary basis. Respondents were also informed that they could withdraw at any time during the study. No personal or company details were demanded throughout the survey, and this ensured the anonymity of respondents.

Funding information

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Data availability

The data that support the findings of this study are available on request from the corresponding author, T.M.M. The data are not publicly available.

Disclaimer

The views and opinions expressed in this article are those of the author and do not necessarily reflect the official policy or position of any affiliated agencies of the author.

References

- Aburumman, O.J., Omar, K., Al Shbail, M. & Aldoghlan, M., 2022, 'How to deal with the results of PLS-SEM?', in B. Alareeni, A. Hamdan (eds.), *Proceedings of international conference on business and technology*, November 2022, pp. 1196–1206, Springer International Publishing, Cham.
- Agyabeng-Mensah, Y., Ahenkorah, E., Afum, E. & Owusu, D., 2020, 'The influence of lean management and environmental practices on relative competitive quality advantage and performance', *Journal of Manufacturing Technology Management* 31(7), 1351–1372. <https://doi.org/10.1108/JMTM-12-2019-0443>
- Ahmad, A.F. & Karadas, G., 2021, 'Managers' perceptions regarding the effect of leadership on organizational performance: Mediating role of green supply chain management practices', *Sage Open* 11(2), 21582440211018686. <https://doi.org/10.1177/21582440211018686>
- Ahmad, S. & Schroeder, R.G., 2003, 'The impact of human resource management practices on operational performance: Recognizing country and industry differences', *Journal of Operations Management* 21(1), 19–43. [https://doi.org/10.1016/S0272-6963\(02\)00056-6](https://doi.org/10.1016/S0272-6963(02)00056-6)
- Alharthey, B.K., 2019, 'Impact of green marketing practices on consumer purchase intention and buying decision with demographic characteristics as moderator', *International Journal of Advanced and Applied Sciences* 6(3), 62–71. <https://doi.org/10.21833/ijaas.2019.03.010>
- Ali, Y., Younus, A., Khan, A.U. & Pervez, H., 2020, 'Impact of lean, Six Sigma and environmental sustainability on the performance of SMEs', *International Journal of Productivity and Performance Management* 70(8), 2294–2318. <https://doi.org/10.1108/IJPPM-11-2019-0528>
- Alkhatib, S., Kecskés, P. & Keller, V., 2023, 'Green marketing in the digital age: A systematic literature review', *Sustainability* 15(16), 12369. <https://doi.org/10.3390/su151612369>
- Al-Minhas, U., Ndubisi, N.O. & Barrane, F.Z., 2020, 'Corporate environmental management: A review and integration of green human resource management and green logistics', *Management of Environmental Quality: An International Journal* 31(2), 431–450. <https://doi.org/10.1108/MEQ-07-2019-0161>
- Anderson, J.C. & Gerbing, D.W., 1988, 'Structural equation modeling in practice: A review and recommended two-step approach', *Psychological Bulletin* 103(3), 411–423. <https://doi.org/10.1037/0033-2909.103.3.411>
- Bagiella, E. & Chang, H., 2019, 'Power analysis and sample size calculation', *Journal of Molecular and Cellular Cardiology* 133, 214–216. <https://doi.org/10.1016/j.yjmcc.2019.01.006>
- Becker, J.M., Rai, A. & Rigdon, E., 2013, 'Predictive validity and formative measurement in structural equation modeling: Embracing practical relevance', in *Proceedings of the 34th international conference on information systems*, January 2013, pp. 1–19, Milan, Italy.
- Becker, J.M., Ringle, C.M., Sarstedt, M. & Völckner, F., 2015, 'How collinearity affects mixture regression results', *Marketing Letters* 26(4), 643–659. <https://doi.org/10.1007/s11002-014-9299-9>
- Betts, T.K., Super, J.F. & North, J., 2018, 'Exploring the influence of institutional pressures and production capability on the environmental practices – Environmental performance relationship in advanced and developing economies', *Journal of Cleaner Production* 187, 1082–1093. <https://doi.org/10.1016/j.jclepro.2018.03.186>
- Business Tech, 2021, 'Joburg and foreign buyers are flocking to these areas in South Africa', *Business Tech*, 18 December, viewed 10 January 2024, from <https://business.tech.co.za/news/trending/546606/what-to-expect-in-south-africas-housing-market-in-2022/>.
- Carter, C.R. & Rogers, D.S., 2008, 'A framework of sustainable supply chain management: Moving toward new theory', *International Journal of Physical Distribution and Logistics Management* 38(5), 360–387. <https://doi.org/10.1108/09600030810882816>
- Chin, W.W., 1998, 'The partial least squares approach to structural equation modeling', *Modern Methods for Business Research* 295(2), 295–336.
- Chinomona, R., 2011, 'Non-mediated channel powers and relationship quality: A case of SMEs in Zimbabwe channels of distribution', PhD thesis, National Central University.
- Chiromo, F., 2018, 'An investigation into the relationship between performance and product/supply chain alignment in the clothing and textile industry in Gauteng, South Africa', Doctoral thesis, University of Johannesburg, Johannesburg.
- Chiromo, F. & Nel, A., 2018, 'Application of computer aided technologies in the clothing and textile companies in Gauteng', in A. Ali (eds.), *International conference on industrial engineering and operations management*, 29 October–1 November 2018, pp. 1512–1538, Pretoria.
- Cho, C.H., Guidry, R.P., Hageman, A.M. & Patten, D.M., 2012, 'Do actions speak louder than words? An empirical investigation of corporate environmental reputation', *Accounting, Organizations and Society* 37(1), 14–25. <https://doi.org/10.1016/j.aos.2011.12.001>
- Cohen, J., 1988, 'The effect size', in *Statistical power analysis for the behavioral sciences*, 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates, pp. 77–83.
- Dahhan, A. & Arenkov, I.A., 2021, 'Green marketing as a trend towards achieving sustainable development', *Journal of Economics, Entrepreneurship and Law* 11(11), 2497–2512. <https://doi.org/10.18334/epp.11.11.113768>
- Dangelico, R.M. & Vocalelli, D., 2017, '“Green Marketing”: An analysis of definitions, strategy steps, and tools through a systematic review of the literature', *Journal of Cleaner Production* 165, 1263–1279. <https://doi.org/10.1016/j.jclepro.2017.07.184>
- Dash, G. & Paul, J., 2021, 'CB-SEM vs PLS-SEM methods for research in social sciences and technology forecasting', *Technological Forecasting and Social Change* 173, 121092. <https://doi.org/10.1016/j.techfore.2021.121092>
- Donaldson, R., Marais, L. & Nel, E., 2020, 'Secondary cities in South Africa', in R. Massey & A. Gunter (eds.), *Urban geography in South Africa: Perspectives and theory*, pp. 121–137, Springer, Cham.
- Dun & Bradstreet, 2025, *Textile mills companies in Johannesburg, South Africa*, viewed 07 June 2025, from https://www.dnb.com/business-directory/company-information.textile_mills.za.na.johannesburg.html?page=3.
- Du Plessis, R., 2022, 'Towards a proactive approach in supporting sustainable product life cycles in fashion through the development of a new clothing retail cycle', Doctoral Dissertation, Cape Peninsula University of Technology.
- Eliyana, A. & Ma'arif, S., 2019, 'Job satisfaction and organizational commitment effect in the transformational leadership towards employee performance', *European Research on Management and Business Economics* 25(3), 144–150. <https://doi.org/10.1016/j.iedeen.2019.05.001>
- European Commission, 2022, *Textiles strategy*, European commission, viewed 30 March 2022, from https://ec.europa.eu/environment/publications/textiles-strategy_en.
- Ezzi, F. & Jarboui, A., 2016, 'Does innovation strategy affect financial, social and environmental performance?', *Journal of Economics, Finance and Administrative Science* 21(40), 14–24. <https://doi.org/10.1016/j.jefas.2016.03.001>
- Ferdows, K. & De Meyer, A., 1990, 'Lasting improvements in manufacturing performance: In search of a new theory', *Journal of Operations Management* 9(2), 168–184. [https://doi.org/10.1016/0272-6963\(90\)90094-T](https://doi.org/10.1016/0272-6963(90)90094-T)
- Fiorello, M., Gladysz, B., Corti, D., Wybraniak-Kujawa, M., Ejsmont, K. & Sorlini, M., 2023, 'Towards a smart lean green production paradigm to improve operational performance', *Journal of Cleaner Production* 413, 137418. <https://doi.org/10.1016/j.jclepro.2023.137418>
- Garza-Reyes, J.A., 2015, 'Green lean and the need for six Sigma', *International Journal of Lean Six Sigma* 6(3), 226–248. <https://doi.org/10.1108/IJLSS-04-2014-0010>
- Garza-Reyes, J.A., Kumar, V., Chaikittisilp, S. & Tan, K.H., 2018, 'The effect of lean methods and tools on the environmental performance of manufacturing organisations', *International Journal of Production Economics* 200, 170–180. <https://doi.org/10.1016/j.ijpe.2018.03.030>
- Githahu, M., 2020, 'Call for clarity on spaza shops during COVID-19 lockdown', *Cape Argus*, viewed 31 March 2024, from <https://www.iol.co.za/capeargus/news/call-for-clarity-on-spaza-shops-during-covid-19-lockdown-45856999>.
- Golzar, J., Noor, S. & Tajik, O., 2022, 'Convenience sampling', *International Journal of Education and Language Studies* 1(2), 72–77.
- Groves, R.M., Fowler Jr, F.J., Couper, M.P., Lepkowski, J.M., Singer, E. & Tourangeau, R., 2011, *Survey methodology*, John Wiley & Sons, Hoboken, NJ.
- Hair Jr, J.F., Hult, G.T.M., Ringle, C.M. & Sarstedt, M., 2014, *A primer on partial least squares structural equation modeling (PLS-SEM)*, Sage, Thousand Oaks, CA.
- Hair Jr, J.F., Matthews, L.M., Matthews, R.L. & Sarstedt, M., 2017, 'PLS-SEM or CB-SEM: Updated guidelines on which method to use', *International Journal of Multivariate Data Analysis* 1(2), 107–123. <https://doi.org/10.1504/IJMDA.2017.087624>
- Hair, J.F., Ringle, C.M. & Sarstedt, M., 2011, 'PLS-SEM: Indeed a silver bullet', *Journal of Marketing Theory and Practice* 19(2), 139–152. <https://doi.org/10.2753/MTP1069-6679190202>
- Hair, J.F., Risher, J.J., Sarstedt, M. & Ringle, C.M., 2019, 'When to use and how to report the results of PLS-SEM', *European Business Review* 31(1), 2–24. <https://doi.org/10.1108/EBR-11-2018-0203>
- Jain, P. & Sharma, B.K., 2023, 'Impact of green banking practices on sustainable environmental performance and profitability of private sector banks', *International Journal of Social Ecology and Sustainable Development* 14(1), 1–19. <https://doi.org/10.4018/IJSESD.330135>
- Jermittiparsert, K., Siriattakul, P. & Sangperm, N., 2019, 'Predictors of environmental performance: Mediating role of green supply chain management practices', *International Journal of Supply Chain Management* 8(3), 877–888.
- Kalash, I., 2021, 'The impact of environmental performance on capital structure and firm performance: The case of Turkey', *Society and Business Review* 16(2), 255–277. <https://doi.org/10.1108/SBR-11-2020-0138>
- Khanfar, A.A., Iranmanesh, M., Ghobakhloo, M., Senali, M.G. & Fathi, M., 2021, 'Applications of blockchain technology in sustainable manufacturing and supply chain management: A systematic review', *Sustainability* 13(14), 7870. <https://doi.org/10.3390/su13147870>
- Kock, N., 2016, 'Hypothesis testing with confidence intervals and P values in PLS-SEM', *International Journal of e-Collaboration* 12(3), 1–6. <https://doi.org/10.4018/IJEC.2016070101>
- Kutzner, F.L., Read, D., Stewart, N. & Brown, G., 2017, 'Choosing the devil you don't know: Evidence for limited sensitivity to sample size-based uncertainty when it offers an advantage', *Management Science* 63(5), 1519–1528. <https://doi.org/10.1287/mnsc.2015.2394>
- La Rocca, A., Hoholm, T. & Mørk, B.E., 2017, 'Practice theory and the study of interaction in business relationships: Some methodological implications', *Industrial Marketing Management* 60, 187–195. <https://doi.org/10.1016/j.indmarman.2016.04.002>
- Leung, S.O., 2011, 'A comparison of psychometric properties and normality in 4-, 5-, 6-, and 11-point Likert scales', *Journal of Social Service Research* 37(4), 412–421. <https://doi.org/10.1080/01488376.2011.580697>
- Liu, M., Zhu, J., Yang, X., Chen, D. & Lin, Y., 2024, 'From green awareness to green behavior: The impact of information disclosure scenarios on greener shopping channel choices', *Sustainability* 16(18), 7944. <https://doi.org/10.3390/su16187944>
- Lubis, N.W., 2022, 'Resource based view (RBV) in improving company strategic capacity', *Research Horizon* 2(6), 587–596. <https://doi.org/10.54518/rh.2.6.2022.587-596>

- Luthra, S., Garg, D. & Haleem, A., 2016, 'The impacts of critical success factors for implementing green supply chain management towards sustainability: An empirical investigation of Indian automobile industry', *Journal of Cleaner Production* 121, 142–158. <https://doi.org/10.1016/j.jclepro.2016.01.095>
- Mafini, C. & Muposhi, A., 2017, 'The impact of green supply chain management in small to medium enterprises: Cross-sectional evidence', *Journal of Transport and Supply Chain Management* 11(1), 1–11. <https://doi.org/10.4102/jtscm.v11i0.270>
- Memon, M.A., Ramayah, T., Cheah, J.H., Ting, H., Chuah, F. & Cham, T.H., 2021, 'PLS-SEM statistical programs: A review', *Journal of Applied Structural Equation Modeling* 5(1), 1–14. [https://doi.org/10.47263/JASEM.5\(1\)06](https://doi.org/10.47263/JASEM.5(1)06)
- Mhlanga, D., 2020, 'Industry 4.0 in finance: The impact of artificial intelligence (AI) on digital financial inclusion', *International Journal of Financial Studies* 8(3), 45. <https://doi.org/10.3390/ijfs8030045>
- Ndlovu, S.N., 2023, 'Operational efficiency using LEAN methodology', Doctoral Dissertation, University of Johannesburg.
- Nekmahmud, M. & Fekete-Farkas, M., 2020, 'Why not green marketing? Determinates of consumers' intention to green purchase decision in a new developing nation', *Sustainability* 12(19), 7880. <https://doi.org/10.3390/su12197880>
- Nitzl, C., Roldan, J.L. & Cepeda, G., 2016, 'Mediation analysis in partial least squares path modeling: Helping researchers discuss more sophisticated models', *Industrial Management & Data Systems* 116(9), 1849–1864. <https://doi.org/10.1108/IMDS-07-2015-0302>
- O'Rourke, H.P. & MacKinnon, D.P., 2018, 'Reasons for testing mediation in the absence of an intervention effect: A research imperative in prevention and intervention research', *Journal of Studies on Alcohol and Drugs* 79(2), 171–181. <https://doi.org/10.15288/jsad.2018.79.171>
- Polonsky, M.J., 2011, 'Transformative green marketing: Impediments and opportunities', *Journal of Business Research* 64(12), 1311–1319. <https://doi.org/10.1016/j.jbusres.2011.01.016>
- Prabhu, M., Thangasamy, N. & Abdullah, N.N., 2020, 'Analytical review on competitive priorities for operations under manufacturing firms', *Journal of Industrial Engineering and Management* 13(1), 38–55. <https://doi.org/10.3926/jiem.2876>
- Sahioun, A., Bataineh, A.Q., Abu-ALsouds, I.A. & Haddad, H., 2023, 'The impact of green marketing on consumers' attitudes: A moderating role of green product awareness', *Innovative Marketing* 19(3), 237–253. [https://doi.org/10.21511/im.19\(3\).2023.20](https://doi.org/10.21511/im.19(3).2023.20)
- Sarstedt, M. & Mooi, E.A., 2019, *A concise guide to market research: The process, data, and methods using IBM SPSS statistics*, Springer, Heidelberg.
- Sarstedt, M., Ringle, C.M., Smith, D., Reams, R. & Hair Jr, J.F., 2014, 'Partial least squares structural equation modeling (PLS-SEM): A useful tool for family business researchers', *Journal of Family Business Strategy* 5(1), 105–115. <https://doi.org/10.1016/j.jfbs.2014.01.002>
- Shank, J.K. & Govindarajan, V., 1993, *Strategic cost management: The new tool for competitive advantage*, Simon and Schuster, New York, NY
- Sharma, P.N., Liengaard, B.D., Sarstedt, M., Hair, J.F. & Ringle, C.M., 2023, 'Extraordinary claims require extraordinary evidence: A comment on "recent developments in PLS"', *Communications of the Association for Information Systems* 52(1), 739–742. <https://doi.org/10.17705/1CAIS.05234>
- Shrestha, N., 2020, 'Detecting multicollinearity in regression analysis', *American Journal of Applied Mathematics and Statistics* 8(2), 39–42. <https://doi.org/10.12691/ajams-8-2-1>
- Siddiqui, K., 2013, 'Heuristics for sample size determination in multivariate statistical techniques', *World Applied Sciences Journal* 27(2), 285–287.
- Silvestri, L., Forcina, A., Silvestri, C. & Traverso, M., 2021, 'Circularity potential of rare earths for sustainable mobility: Recent developments, challenges and future prospects', *Journal of Cleaner Production* 292, 126089. <https://doi.org/10.1016/j.jclepro.2021.126089>
- Statista, 2021, *Forecast: Industry revenue of "retail trade in textiles, clothing, footwear and leather goods" in South Africa 2011–2023*, viewed 30 September 2021, from www.statista.com/forecasts/424593/retail-trade-in-textiles-clothing-footwear-and-leather-goods-revenue-in-south-africa.
- Sureeyatanapas, P., Poophiukhok, P. & Pathumnakul, S., 2018, 'Green initiatives for logistics service providers: An investigation of antecedent factors and the contributions to corporate goals', *Journal of Cleaner Production* 191, 1–14. <https://doi.org/10.1016/j.jclepro.2018.04.206>
- Trade & Industrial Policy Strategies (TIPS), 2022, *The real economy bulletin – First quarter 2023*, viewed 27 July 2024, from https://www.tips.org.za/images/The_Real_Economy_Bulletin_-_First_Quarter_2023.pdf.
- Udeagha, M.C. & Muchapondwa, E., 2023, 'Environmental sustainability in South Africa: Understanding the criticality of economic policy uncertainty, fiscal decentralization, and green innovation', *Sustainable Development* 31(3), 1638–1651. <https://doi.org/10.1002/sd.2473>
- Ul Haq, I. & Faizan, R., 2022, 'Role and effectiveness of five-performance indicators (price, dependability, speed, quality & flexibility) in attaining competitive edge in the aviation industry', *International Journal of Applied Business and Management Studies* 7(2), 11–51.
- United Nations Economic Commission for Europe (UNECE), 2022, *Implementation of the UNECE strategy for ESD across the ECE region (2015–2018)*, UNECE, Geneva.
- Van Vo, H. & Nguyen, N.P., 2023, 'Greening the Vietnamese supply chain: The influence of green logistics knowledge and intellectual capital', *Heliyon* 9(5), e15953. <https://doi.org/10.1016/j.heliyon.2023.e15953>
- Wandosell, G., Parra-Meroño, M.C., Alcayde, A. & Baños, R., 2021, 'Green packaging from consumer and business perspectives', *Sustainability* 13(3), 1356. <https://doi.org/10.3390/su13031356>
- Yusoff, A.S.M., Peng, F.S., Abd Razak, F.Z. & Mustafa, W.A., 2020, 'Discriminant validity assessment of religious teacher acceptance: The use of HTMT criterion', *Journal of Physics: Conference Series* 1529(4), 042045. <https://doi.org/10.1088/1742-6596/1529/4/042045>
- Zhu, A. & Wen, Y., 2021, 'Green logistics location-routing optimization solution based on improved GA algorithm considering low-carbon and environmental protection', *Journal of Mathematics* 2021(1), 6101194. <https://doi.org/10.1155/2021/6101194>
- Zhu, Q. & Sarkis, J., 2016, 'Green marketing and consumerism as social change in China: Analyzing the literature', *International Journal of Production Economics* 181, 289–302. <https://doi.org/10.1016/j.ijpe.2016.06.006>