International Journal of Innovative Research and Scientific Studies, 8(11) 2025, pages: 1-18

ISSN: 2617-6548

URL: www.ijirss.com

The impact of supply chain networks and logistics service quality on supply chain effectiveness in retail industry in the Gauteng province

Justus Wesonga[1*], Johan Van Der Westhuizen[2]

[1]*Department of Human Resource Management Vaal University of Technology Private Bag X021, Andries Potgieter Blvd, Vanderbijlpark 1911, South Africa.*

[2]*Department of Procurement and Supply Chain Management Vaal University of Technology Private Bag X021, Andries Potgieter Blvd, Vanderbijlpark 1911, South Africa.*

Corresponding author: Justus Wesonga (*Email: justuswesonga@yahoo.com*)

Abstract

The retail business in South Africa contributes significantly to national GDP and has undergone fast changes in logistics and supply chain processes, making effective logistics management critical to cost reduction and profitability. This study investigates the impact of reverse logistics, warehousing, and supply chain networks on logistics service quality, as well as how logistics service quality influences overall supply chain effectiveness in the retail sector. A quantitative study design was used, with data collected from 300 respondents in Gauteng, including managers, departmental personnel, and supply chain professionals. To validate the hypothesised associations, the data were analysed with descriptive statistics, exploratory factor analysis, and structural equation modelling. The study found that reverse logistics ($\beta = 0.71$) and supply chain networks ($\beta = 0.20$) have a considerable favourable impact on logistics service quality, while warehousing had a minor effect ($\beta = 0.08$). Logistics service quality significantly predicts supply chain effectiveness ($\beta = 0.94$), highlighting its importance in improving retail logistics performance. These findings imply that the efficacy of reverse logistics systems and the strength of supply chain networks are critical variables in obtaining higher service quality and, eventually, supply chain effectiveness. The report suggests that South African retailers must improve reverse logistics and optimise supply chain network integration to remain competitive, as well as solve warehousing inefficiencies. In practice, retailers should undertake focused training programs, pursue strategic recruitment to improve leadership ability, and invest in modernised storage infrastructure. Furthermore, the implementation of enterprise resource planning (ERP) systems is suggested to increase information flow, coordination, and operational efficiency across logistics functions.

Keywords: Levelling and internal information systems, Logistics service quality, Retail, Reverse logistics, Social exchange theory, Supply chain effectiveness, Supply chain networks, Warehousing.

DOI: 10.53894/ijirss.v8i11.10790
Funding: This study received no specific financial support.
History: Received: 1 September 2025 / **Revised:** 17 October 2025 / **Accepted:** 22 October 2025 / **Published:** 31 October 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction and Background of the Study

The retail business environment has seen dramatic transformation in recent years, especially in logistics operations and supply chain practices [1]. These shifts are not merely operational adjustments—they are strategic imperatives, as the efficiency and effectiveness of logistics and supply chain practices directly shape a firm's profitability [2]. According to Abushaikha, et al. [3] this rapid change is fuelled by multiple internal and external pressures, including fierce competition, heightened customer expectations, and pricing constraints. In response, retailers are becoming more deliberate in managing supplier relationships to achieve supply chain effectiveness [4-6].

Today, competition is no longer company versus company—it is supply chain versus supply chain [7]. For South African retailers, sustaining a competitive edge requires ensuring the smooth flow of goods and services from origin to destination, as well as managing reverse flows [8]. Logistics plays an increasingly pivotal role in achieving this, offering opportunities for higher profits, market expansion, and lasting competitive advantage. Supply chain management integrates these functions, linking major business processes within and across firms into a high-performing, cohesive system [9, 10].

Collaboration between supply chain actors and integration of activities often depend on factors outside a firm's direct control [8]. This reality affects how companies strategize, set goals, and measure success. From a resource dependence perspective, supply chain effectiveness is the comprehensive evaluation of an entire chain's performance, delivering value not just to customers, but also to manufacturing partners, supplier networks, and other stakeholders [7, 11].

Many factors can influence this effectiveness—warehousing, levelling, information technology, agility, and strategic relationships among them [4]. However, past studies often examined these factors individually, without integrating them into a predictive model. This study addresses that gap by consolidating warehousing, supply chain networks, internal information systems, levelling, and reverse logistics into a unified model that examines their impact on supply chain effectiveness through the mediating role of logistics service quality (LSQ). This approach recognises that these elements, when working together, can significantly strengthen performance, competitiveness, and sustainability in the retail sector.

1.1. Problem Statement

The retail industry is a major contributor to South Africa's GDP [12] yet many firms struggle to remain competitive globally due to gaps in understanding supply chain effectiveness [13]. Sustaining growth requires adapting business strategies, refining supply chain processes, and upgrading internal logistics systems. Identifying which logistics factors most influence supply chain effectiveness is key to targeting improvements and optimising performance.

To reduce costs and improve efficiency, large retailers are increasingly consolidating operations and integrating warehousing, supply chain networks, internal information systems, levelling, and reverse logistics factors that can enhance supply chain effectiveness through logistics service quality (LSQ). However, empirical research on these dynamics in the South African retail sector is limited [14]. This study addresses that gap by examining how logistics operations influence supply chain effectiveness in retail businesses within Gauteng province.

1.2. Theoretical Framework

Social Exchange Theory (SET), introduced by Blau [15] in the 1960s [16] is based on two key principles: self-interest and interdependence. It suggests that individuals engage in exchanges to fulfil economic and psychological needs, and such interactions persist only when the perceived benefits outweigh the costs [17-19]. If exchanges result in positive outcomes, relationships are maintained; otherwise, they dissolve.

SET highlights that rewards—tangible or intangible—satisfy needs and influence customer behavior [19]. It explains that customers aim to maximize returns and minimize losses, engaging in exchanges where organisations offer value in return for customer loyalty [17, 20]. Exchange systems are shaped by various endogenous and exogenous variables [16]. While SET helps explain value-based relationships, it is limited in cases where engagement processes are equally important as outcomes [15].

This study applies SET to explore retail logistics, service quality, and supply chain effectiveness, aligning with scholars who used SET to analyze social behavior and organizational interactions [21, 22]. It posits that knowledge-sharing in supply chains is motivated by expected rewards (egoistic) or altruism. Effective supply chains rely on trust, capability, and mutual benefit [23] where relationship-building is driven by cost-benefit evaluations [24, 25]. SET helps understand consumer loyalty, business collaboration, and the dynamics of value exchange within the lean supply chain environment, where trust and long-term engagement are increasingly vital [21, 22, 25].

1.3. The Relationship Between Supply Chain Networks and Logistics Service Quality

There is a significant positive relationship between supply chain networks (SCN) and logistics service quality (LSQ). Research shows that enhancing service quality directly improves supply chain performance [26]. This improvement can be achieved by moving beyond traditional arm's-length relationships between supply chain members to establish closer, partnership-based collaborations [27]. In such partnerships, service quality acts as a vital metric for evaluating SCN effectiveness, serving as a key indicator of how well the network functions [28]. Despite its importance, there remains a scarcity of focused research on service quality specifically within supply chain networks [29]. Moreover, few studies have developed comprehensive service quality measurement scales tailored to supply chain processes [27]. Nonetheless, delivering high service quality to customers is widely recognized as a critical success factor in managing supply chain networks [26].

Additional research supports this relationship. According to Zhang and Dilts [30]. SCNs with strong coordination mechanisms show superior logistics responsiveness and reliability. Furthermore, Ketchen Jr, et al. [31] found that integrated supply networks are essential for service innovation and competitive advantage. Cao and Zhang [32] argue that SCN integration enhances agility and service quality under uncertain market conditions. Lastly, Gunasekaran, et al. [33] demonstrate that technology-enabled SCNs improve coordination, leading to better logistics outcomes.

1.4. The Relationship Between Reverse Logistics and Logistics Service Quality

Reverse logistics (RLRVL) involves managing the lifecycle of products after they reach consumers, including returns, recycling, disposal, or repurposing [34]. As a relatively evolving concept, reverse logistics is increasingly recognized for its impact on service quality outcomes [35]. Most notably, the return of products from consumers back to retailers directly influences perceptions of logistics service quality [34]. Traditionally, retailers have measured service success primarily by timely delivery, neglecting post-delivery factors such as returns [27]. However, returns due to defects, wrong items, or other issues [36] affect customer satisfaction and must be managed efficiently. Effective reverse logistics processes for product returns, lease contract terminations, obsolete product replacements, and packaging recycling are essential components of modern logistics service quality [35, 37, 38].

Additional studies indicate that reverse logistics enhances customer loyalty by efficiently handling returns and minimizing inconvenience [39]. Fleischmann, Bloemhof-Ruwaard, et al. [40] stress that reverse logistics contributes to sustainability and cost savings. Guide Jr and Van Wassenhove [41] highlight the strategic importance of returns management in customer satisfaction. Govindan, et al. [42] link reverse logistics to improved environmental and economic performance. Finally, Carter and Ellram [43] show that reverse logistics integration leads to enhanced supply chain resilience and service quality.

1.5 The Relationship Between Logistics Service Quality and Supply Chain Effectiveness

Logistics service quality is a critical driver of overall supply chain effectiveness. While logistics has traditionally been viewed as a cost center, it increasingly represents a source of competitive advantage in retail by enhancing customer satisfaction [44]. Studies demonstrate that supply chain effectiveness in retail is strongly linked to the quality of logistics services provided, which directly influences customer perceptions and loyalty [45]. Customers demand not only high-quality products but also superior service that complements product delivery, a core focus within supply chain management [46, 47]. Consequently, improvements in logistics service quality can substantially boost the effectiveness and competitiveness of the entire supply chain.

Additional research affirms this: Mentzer, et al. [48] assert that logistics service quality enhances customer satisfaction and firm performance. Prajogo and Olhager [49] demonstrate the role of logistics quality in supply chain agility and responsiveness. Tan, et al. [50] find that logistics capabilities strongly impact overall supply chain competitiveness. Christopher [7] highlights that logistics excellence drives differentiation in increasingly competitive markets. Lastly, Mentzer, et al. [48] emphasize that seamless logistics services are essential for achieving superior supply chain integration and effectiveness

2. Materials and Methods

Research methodology is the systematic strategy used to address research problems and includes methods of data collection, analysis, and interpretation [51]. This study explores the relationship between logistics operations and supply chain effectiveness through a structured and evidence-based approach.

2.1. Research Design

A correlational, single cross-sectional quantitative design was employed Burns, et al. [52] where data was collected once from a specific sample. This approach allows for identifying relationships among variables and is cost-effective for large populations [53]. Quantitative data was collected through surveys and supplemented with a literature review [54].

2.2. Research Paradigm

The study adopts a positivist paradigm, emphasising objective measurement and hypothesis testing. It supports empiricism (data-driven insight), determinism (cause-effect relationships), and generalisability [55].

2.3. Research Approach

A quantitative approach was selected to analyse the relationships among warehousing, internal information systems, levelling, reverse logistics, logistics service quality, and supply chain effectiveness [56]. This approach supports statistical testing and generalisation of results [57].

2.4. Target Population

The study targeted departmental staff, managers, and supply chain professionals in retail firms across Gauteng Province

2.5. Sampling Method

Purposive sampling, a non-probability method, was used to intentionally select knowledgeable and accessible respondents [58]. This method ensured data relevance while remaining practical for fieldwork.

2.6. Sample Size

The sample size was set at 430 respondents, consistent with prior research in retail supply chains. Historical precedent guided this choice to ensure adequate statistical power [59].

2.7. Data Collection & Instrument

Data was gathered through a self-administered questionnaire, divided into four sections: demographics, logistics operations, logistics service quality, and supply chain effectiveness [60]. Measurement scales were adapted from validated sources [61]. A 5-point Likert scale was applied, and pilot testing ensured clarity and contextual fit.

2.8. Data Analysis

Data was cleaned and coded in Excel and analysed using SPSS v26.0 and AMOS for advanced modelling. Techniques included descriptive statistics, exploratory factor analysis (EFA), Pearson’s correlation, and structural equation modelling (SEM) to test hypothesised relationships [62].

2.9. Reliability and Validity

Reliability reflects the consistency of a measurement instrument, indicating how free it is from random error and how stable its results are over time [63]. In this study, reliability was assessed using Cronbach’s alpha, with values between 0.70 and 1.00 showing good internal consistency [64]. The composite reliability (CR) from the SEM analysis also confirmed the measurement model’s reliability within the same acceptable range [65].

Validity measures how well an instrument captures the intended concept [66]. This study evaluated face, content, and construct validity. Face validity assesses whether items appear relevant [58] while content validity ensures the items comprehensively cover the construct without sacrificing ease of use [7]. Both were confirmed through a pilot test of 50 respondents and expert review.

Construct validity was confirmed via CFA, requiring factor loadings above 0.5 [65, 67]. Convergent validity was verified by item-total correlations and average variance extracted [58]. Discriminant validity was ensured by comparing inter-factor correlations with AVE square roots, confirming distinct constructs [68]. Lastly, nomological validity was supported by correlation values below 0.70, indicating expected theoretical relationships [69].

3. Results and Discussions

3.1. Response Rate

According to Weaver, et al. [70] the response rate is defined as the numbers of respondents that completed the assigned questionnaire, divided by the number of respondents who make up the total sample group. Table 1 outlines the response rate.

Table 1.
Response rate.

Description	Frequency
Total number of questionnaires distributed	400
Total number of questionnaires returned	350
Unusable responses discarded	50
Valid questionnaires retained	300
Response rate (%)	75

Table 1 shows the distribution, discard, and retention of questionnaires. A total of 400 questionnaires were distributed to retail firms in Gauteng province, with 350 returned, yielding an 83.3% response rate. Of these, 50 were unusable due to incomplete or double-marked items, leaving 300 valid responses for analysis.

Stolzmann, et al. [71] note that higher expectations exist for survey response rates. Glas, et al. [72] suggest that a 60% response rate is desirable for most research, while Weaver, et al. [70] caution that lower rates may affect validity. However, recent studies find no direct correlation between response rate and validity [72]. Indeed, Glas, et al. [72] argue that even studies with response rates as low as 20% can produce accurate results and that lower response rates do not necessarily imply low validity, though they may indicate a potential risk.

3.1.1. Gender of Respondents

The gender of the respondents which was collected is illustrated graphically on Figure 1.

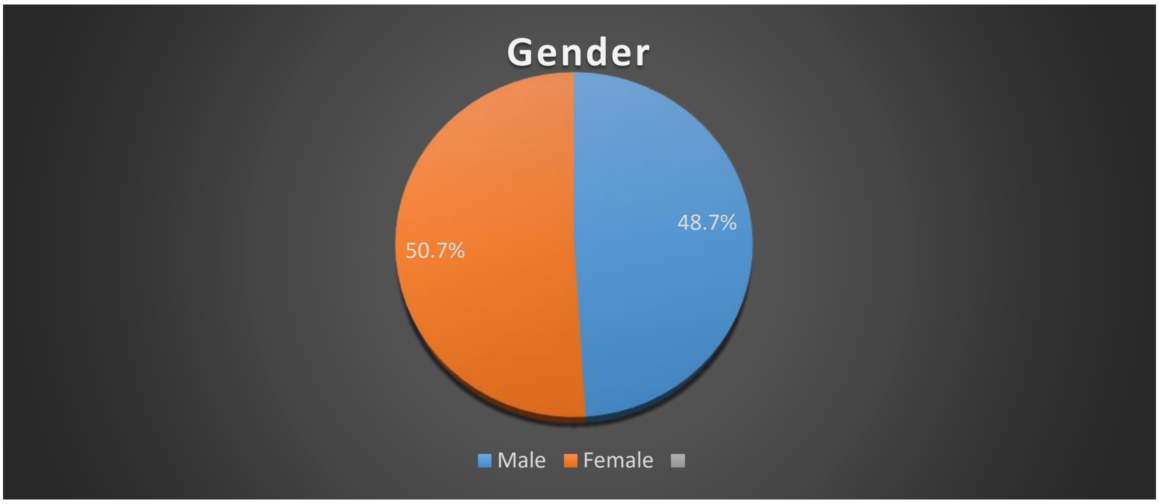

Figure 1.
Gender distribution of respondents.

Figure 1 provides a graphical illustration of the gender structure of the surveyed respondents. The male population made up 48.7 percent, whereas the female population registered the most respondents with 50.7 percent of the total N=300 respondents. This equates to frequencies of n=146 for males and n=154 for females.

3.1.2. Age of Respondents

The age of the respondents is illustrated graphically on Figure 2.

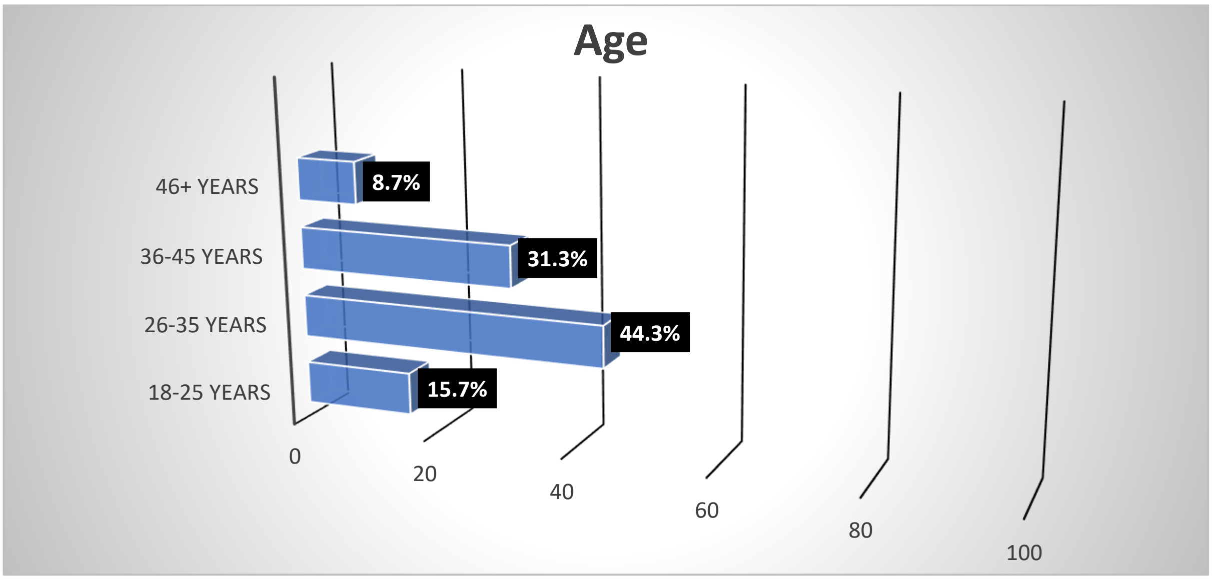

Figure 2.
Age distribution of respondents.

As presented in the age distribution of respondents, Figure 2 shows that a large population of the retail firms' employees are aged between 26-35 years representing 44.3 percent (n=133). This is followed by the age group of 36-45 years who have a frequency of 31.3 percent (n=94). Moreover, the respondents of employees aged 18-25 represent the frequency of 15.7 percent (n=47). The respondents aged of 46 and above years equate to 7 percent (n=14). Finally, the employees aged 46 and older make up 8.7 percent (n=26).

3.1.3. Ethnic Group of Respondents

The ethnic group of the respondents which was collected is illustrated graphically on Figure 3.

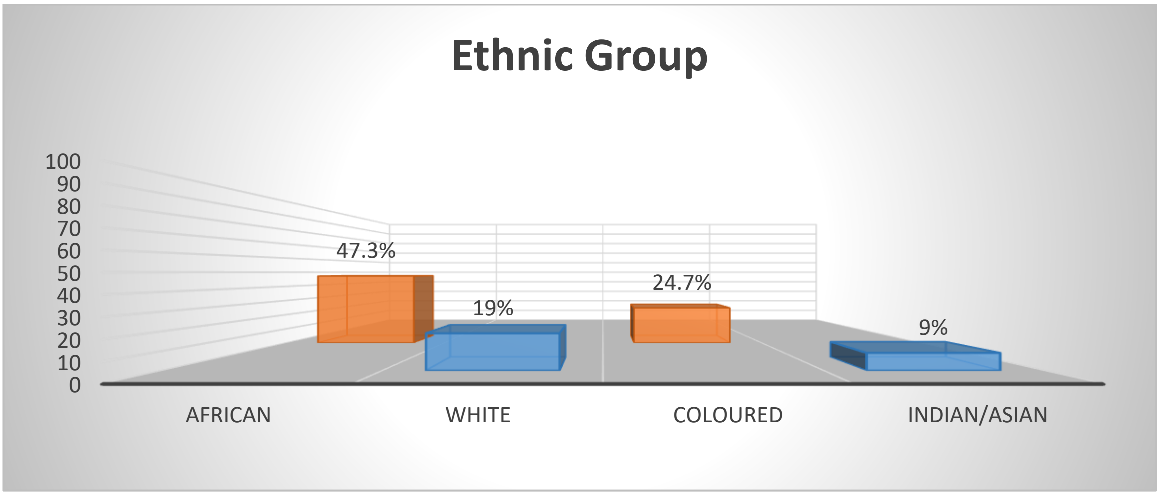

Figure 3.
Ethnic group of respondents.

In Figure 3, a representation of racial profiles is presented. The highest percentage belonged to Black Africans who constituted 47.3 percent (n=142). This concludes that the surveyed population is predominantly Africans. The White, Coloured, and Indian/Asian minorities amassed 19 percent (n=50), 24.7 percent (n=60) and 9 percent (n=27) in that similar order.

3.1.4. Retail category of Respondents

The retail category of the respondents is illustrated graphically on Figure 4.

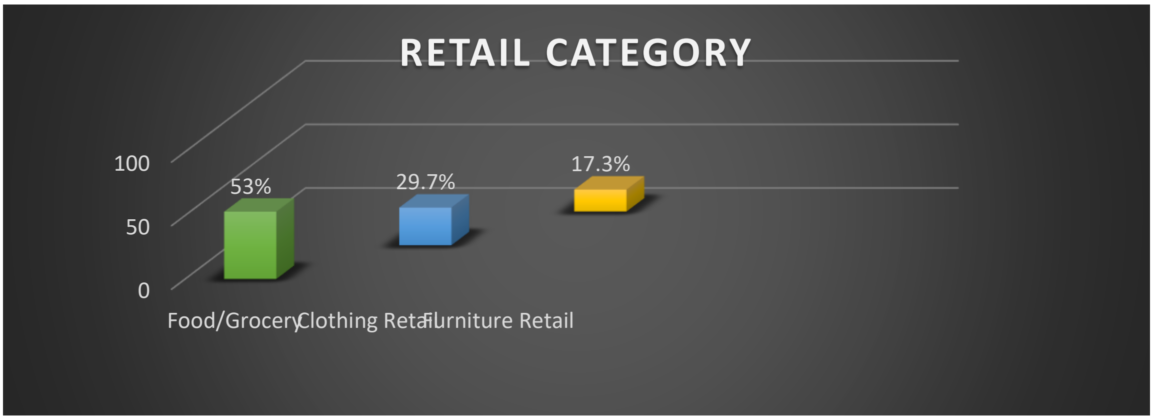

Figure 4.
Ethnic group of respondents.

As presented in the business type of respondents, Figure 4 shows that a large population of the retail category is food/grocery which accounts to 53 percent (n=159) of the total respondents. This is followed by the clothing retail group who have a frequency of 29.7 percent (n=89). Moreover, the respondents of the furniture retail category have the least number of representation accounting to 17.3 percent (n=52) of the total population of the business type indicator.

3.2. Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) is a multivariate technique used to identify underlying constructs factors, dimensions, or synthetic variables and to validate theories and measurements [73]. Two main methods are Factor Analysis (FA) and Principal Component Analysis (PCA), with PCA reducing dimensionality by capturing total variance, including measurement error, from the correlation matrix [73, 74].

This study determined factor structure using factor loadings, communalities, and scree plots. Factor loadings (≥0.5) indicate variable factor association strength [75]. Communalities measure shared variance; values >0.6 allow smaller samples (~200), while <0.5 require ≥500 [76] with 0.3 as the minimum threshold. Scree plots graph eigenvalues, retaining factors with eigenvalues ≥1 [77].

Sampling adequacy was assessed using the Kaiser-Meyer-Olkin (KMO) test, with ≥0.6 acceptable, 0.7–0.8 good, 0.8–0.9 great, and >0.9 excellent [78]. Bartlett's test of sphericity confirmed suitability when $p < 0.05$ [79, 80] with correlations ideally not exceeding a 0.001 significance cut-off [80]. Both tests were applied in this study Table 2.

Table 2.
The KMO measure and the Bartlett Test Results.

Constructs	Kmo Measure	Bartlett's Test		
		Approximate chi-square	Degrees of freedom	Significance level
SCE	0.684	189.235	3	0.000
LSQ	0.698	1428.552	10	0.000
RVL	0.537	1338.442	10	0.000
WRH	0.780	1436.047	10	0.000
IIS	0.758	965.329	10	0.000
SCN	0.649	319.937	3	0.000
LVL	0.713	289.015	3	0.000

Note: SCE=Supply chain Effectiveness; LSQ=Logistics Service Quality; RVL=Reverse Logistics; WRH=Warehousing; IIS=Internal Information Systems; SCN=Supply Chain Networks; LVL=levelling

These test results were all significant at p=0.000; for the Bartlett's test and <0.05 for KMO. Since the results of the Bartlett's and the KMO tests were all within the recommended thresholds, it was determined that the collected data were factorable; hence, EFA could be performed. The upcoming sections show the results of the EFA procedure performed on SCE, LSQ, RVL, WRH, IIS, SCN, LVL, respectively.

3.2.1. Exploratory Factor Analysis for the Supply Chain Effectiveness Scale

According to Schreiber [74] the suggested EFA procedure should have items that have factor loadings that are equal or greater than 0.05, these items should also have eigenvalue either equal to or greater than the value of 1. The percentage of variances have been made available. Furthermore, a scree plot illustrated the purpose of this is to show the fraction of the overall variances within the data and it is used as an illustration of each section. Scree plots are used to indicate the distribution of the factors by making use of their eigenvalues. Eigenvalues according to Denton, et al. [81] are sets of values for a parameter which a differential equation has a non-zero solution under awarded circumstances. Under eigenvalues any number that gas a given matrix minus that number times it by the identity matrix that has a zero determinate.

Schreiber [74] mentions that eigenvalues have are important variables that are needed in order to solve dynamic problems. Eigenvalues usually display a bend on the plot, this bend usually demonstrates the threshold that is used in order to retain the initial factors that are taken from the practical variables [74]. The EFA procedure for the SCE scale produced a two-factor structure, indicated in Table 3.

Table 3.
Uni-dimensional factor structure for the supply chain effectiveness construct.

Item Code	Description	Factor 1
SCE1	Our firm maps material flows from the suppliers up to the customers	0.933
SCE2	Our logistics team works in a timely manner to minimise transportation cost	0.93
SCE3	We deliver orders in the right quantity and specification, without damage	0.585
SCE4	Our logistics team is very effective in managing logistics administration cost	0.833
SCE5	We have established a good relationship with our suppliers and customers in order to bargain for product cost	0.933
Eigenvalue		3.642
Total variance explained		72.83
Common variance explained		72.83

Tables 3 is an illustration that only one-factor demonstrating SCE was obtained. This factor consisted of five items, and it had eigenvalues of 3.642, which contributed 72.83 percent of the variance of SCE.

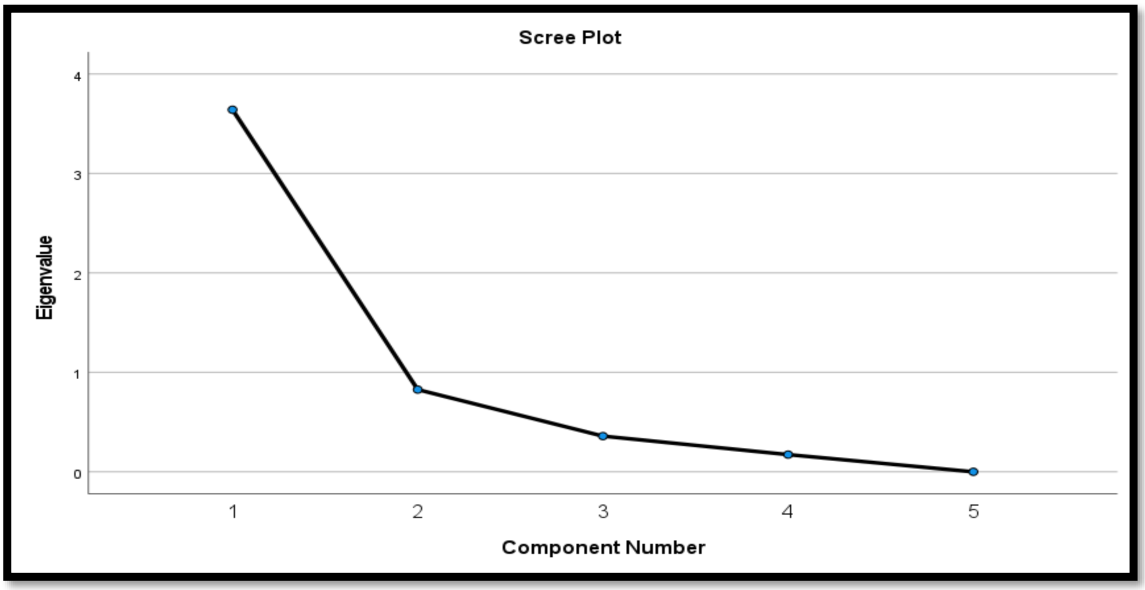

Figure 5.
Scree plot of supply chain effectiveness.

Figure 5 is a clear depiction of the scree plot of SCE; this scree plot acts as a supporting indicator of the eigenvalues that are showed in Table 3. This point of the curve on the Scree plot indicates the threshold that is chosen for retention, this point also indicated that this is a one-factor threshold, and it is acceptable**.**

3.2.2. Exploratory Factor Analysis for the Logistics Service Quality Scale

The EFA procedure concluded with the LSQ scale. The resultant factor solution from this process is presented in Table 4.

Table 4.
Uni-dimensional factor structure for the logistics service quality construct.

	Description	**Factor 1**
LSQ1	We are outstanding at performing our logistics activities	0.902
LSQ2	We quickly respond when one of our competitors launches a campaign based on logistics service offerings targeted at our customers	0.808
LSQ3	Information available on products is completely accurate	0.791
LSQ4	Deliveries arrive on the promised date	0.832
LSQ5	Store employees are able to find a solution to any problem	0.902
Eigenvalue		3.598
Total variance explained		71.964
Common variance explained		71.964

Table 4 above is an illustration that only one-factor demonstrating LSQ was obtained. This factor consisted of five items, and it had eigenvalues of 3.598, which contributed 71.964 percent of the variance of LSQ.

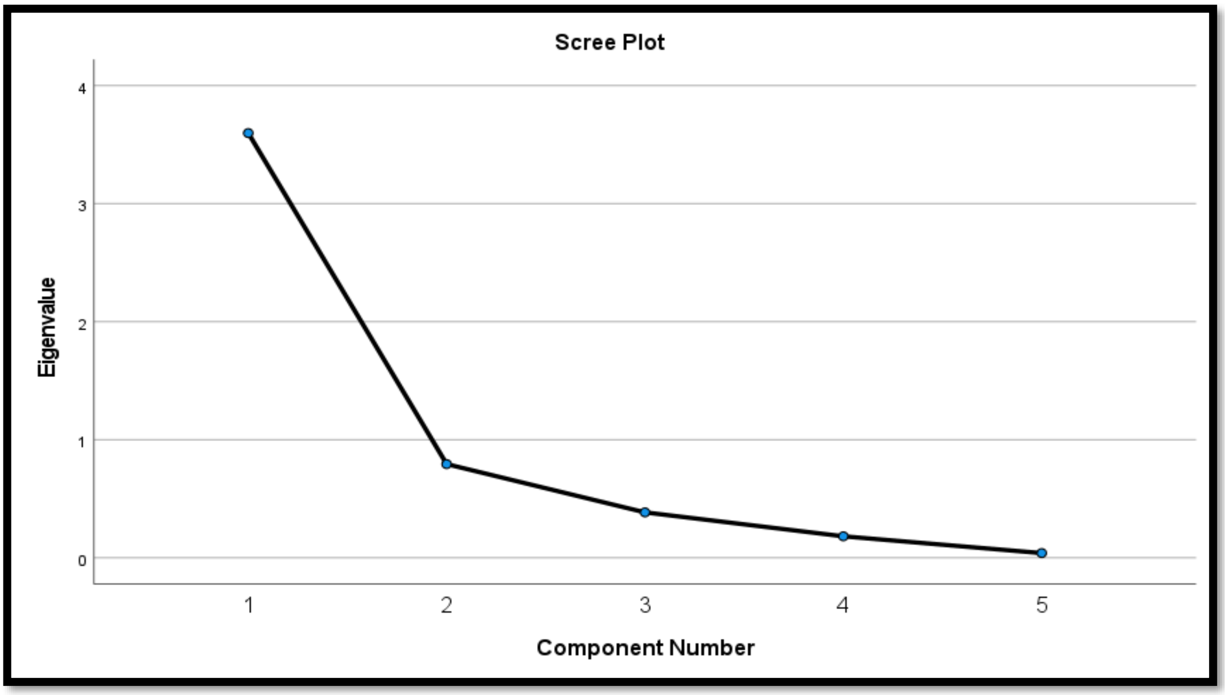

Figure 6.
Scree plot of logistic service quality.

Figure 6 above is a clear depiction of the scree plot of LSQ, this scree plot acts as a supporting indicator of the eigenvalues that are showed in Table 3. This point of the curve on the Scree plot indicates the threshold that is chosen for retention, this point also indicated that this is a one-factor threshold, and it is acceptable**.**

3.2.3. Exploratory Factor Analysis for the Logistics Service Quality Scale

The EFA procedure concluded with the LSQ scale. The resultant factor solution from this process is presented in Table 5.

Table 5.
Two factor structure for the reverse logistics construct.

Item code	**Description**	**Factor**	
		1	**2**
RVL1	We accept product returns from customers	0.961	0.084
RVL2	We recall products with quality problems	0.959	0.130
RVL3	We return products to suppliers	0.888	0.286
RVL4	We try, by all means to minimise waste	0.214	0.891
RVL5	We try to improve customer satisfaction all the time	0.094	0.923
Eigenvalue		3.090	1.348
Total variance explained		61.807	26.964
Cumulative variance explained		61.807	88.771

As revealed in Table 5, two factors were extracted from the RVL scale as they fall under the same factor when component matrix loading was completed. This entails that the RVL construct was composed of five items, had an eigenvalue of 4.438 and contributed 88.771% of the variance of RVL.

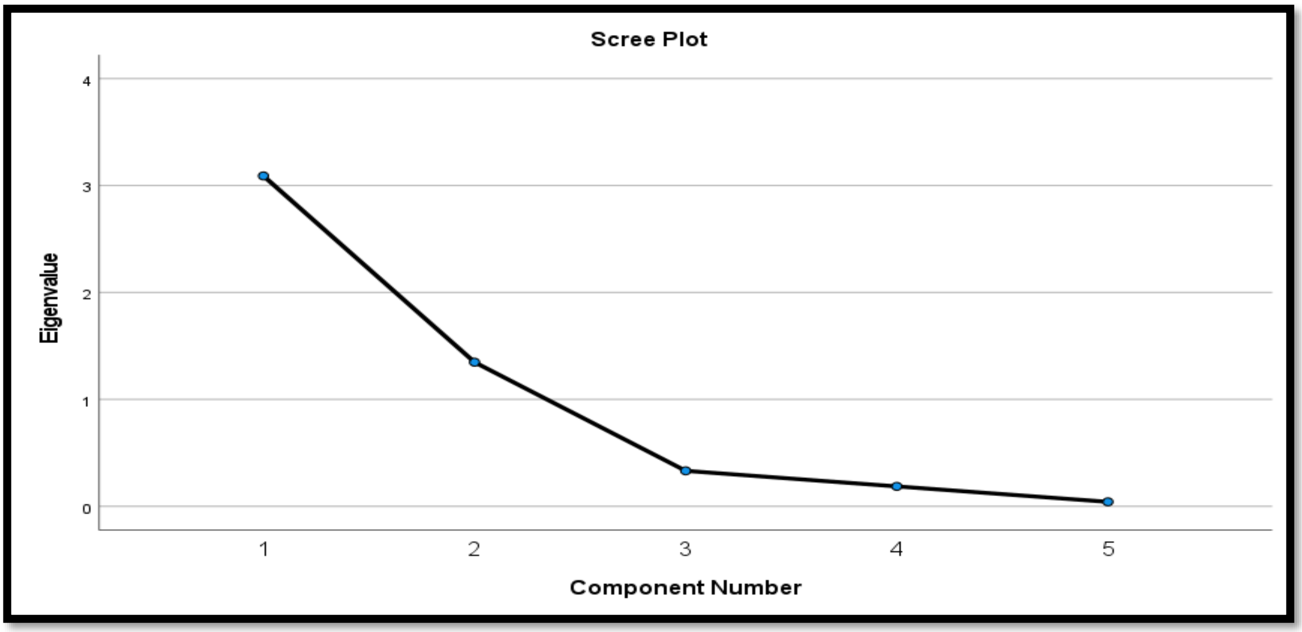

Figure 7.
Scree plot for reverse logistics values.

Figure 7 is the scree plot for RVL with two factors, which had eigenvalues over 1.00 and over 88.771% of the total variability in the data.

3.2.4. Exploratory Factor Analysis for the Warehousing Scale

The EFA procedure concluded with the WRH scale. The resultant factor solution from this process is presented in Table 6.

Table 6.
Two factor structure for the reverse logistics construct.

Item Code	Description	Factor 1
WRH1	We are able to plan sufficient space to unload the delivery before it arrives	0.463
WRH2	The rack configuration is flexible enough to accommodate the size of pallets received from suppliers	0.901
WRH3	We create a time schedule to separate the operations of the put-away and picking team	0.919
WRH4	We use a warehouse management system (WMS) to create an efficient route within the warehouse in the picking process	0.969
WRH5	There is sufficient space at the loading bay to stage the loads	0.917
Eigenvalue		3.651
Total variance explained		73.029
Common variance explained		73.029

Table 6 shows that only one-factor representing WRH was extracted. The factor was composed of five items, had an eigenvalue of 3.651 and contributed 73.029 percent of the variance of WRH.

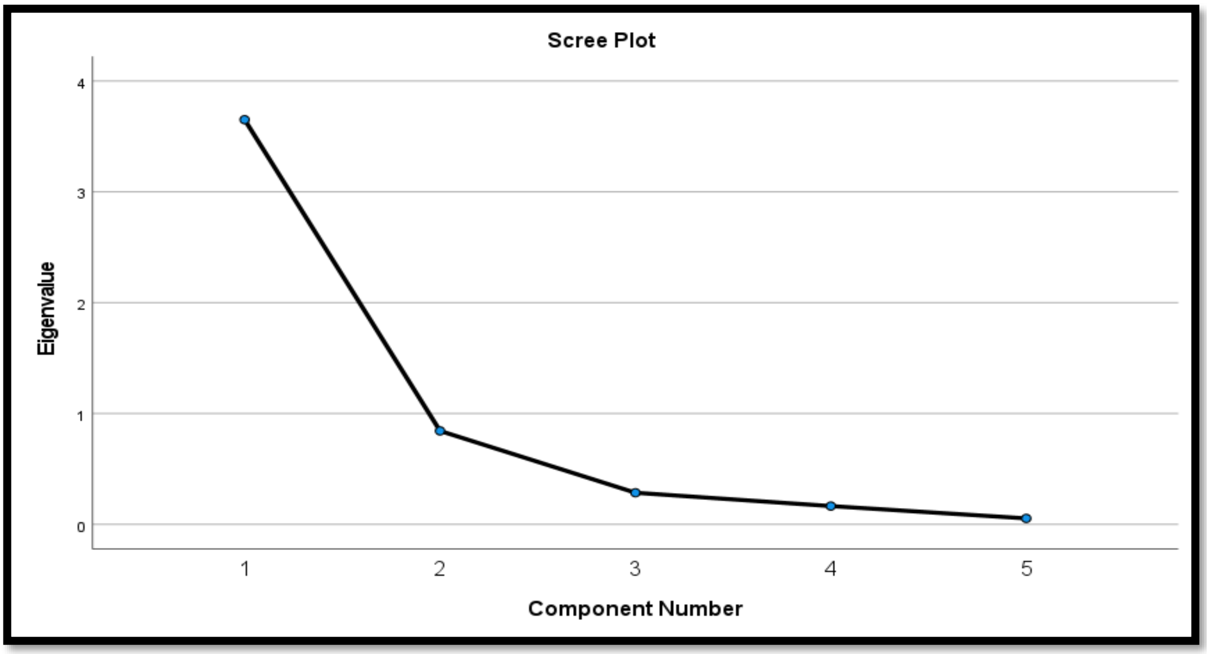

Figure 8.
Scree plot for warehouse values.

Figure 8 represents the scree plot for WRH, further supporting the eigenvalues shown in Table 6. The point of the curve represents the threshold chosen for retention and it indicates that a one-factor threshold is adequate.

3.3. Inferential Statistics

Inferential statistics involves making predictions and generalising from sample data to the larger population. It comprises two main areas: estimating parameters, where sample data describe population parameters like the mean, and hypothesis testing, which uses sample data to draw conclusions on research questions [82]. Inferential statistics assess whether sample-based outcomes are valid for the population [83]. Statistical models compare current sample data with previous studies' samples [82].

In this study, data from sections B to I were analysed using inferential statistics via Structural Equation Modelling (SEM), which evaluates relationships between research constructs. SEM comprises two components: Confirmatory Factor Analysis (CFA) and Path Analysis, both applied here [84].

3.3.1. Results of the Confirmatory Factor Analysis

Confirmatory Factor Analysis (CFA) establishes the links between factors and their latent constructs, testing hypotheses on the relationships between observed variables and their underlying constructs [85]. In this study, CFA was conducted to assess the psychometric properties of the measurement scales, including reliability, validity, and model fit, with results shown in Table 7.

Following the Exploratory Factor Analysis (EFA), which identified the factor structure and grouped constructs based on inter-correlations, CFA was used to confirm the structure extracted from EFA. Detailed results are presented in Table 4.19 and illustrated in Figure 4.20.

Figure 4.13 depicts the CFA model, where latent constructs are represented by ovals, observed variables by rectangles, and measurement errors by circles placed adjacent to the observed variables. Bi-directional arrows indicate the relationships between latent constructs.

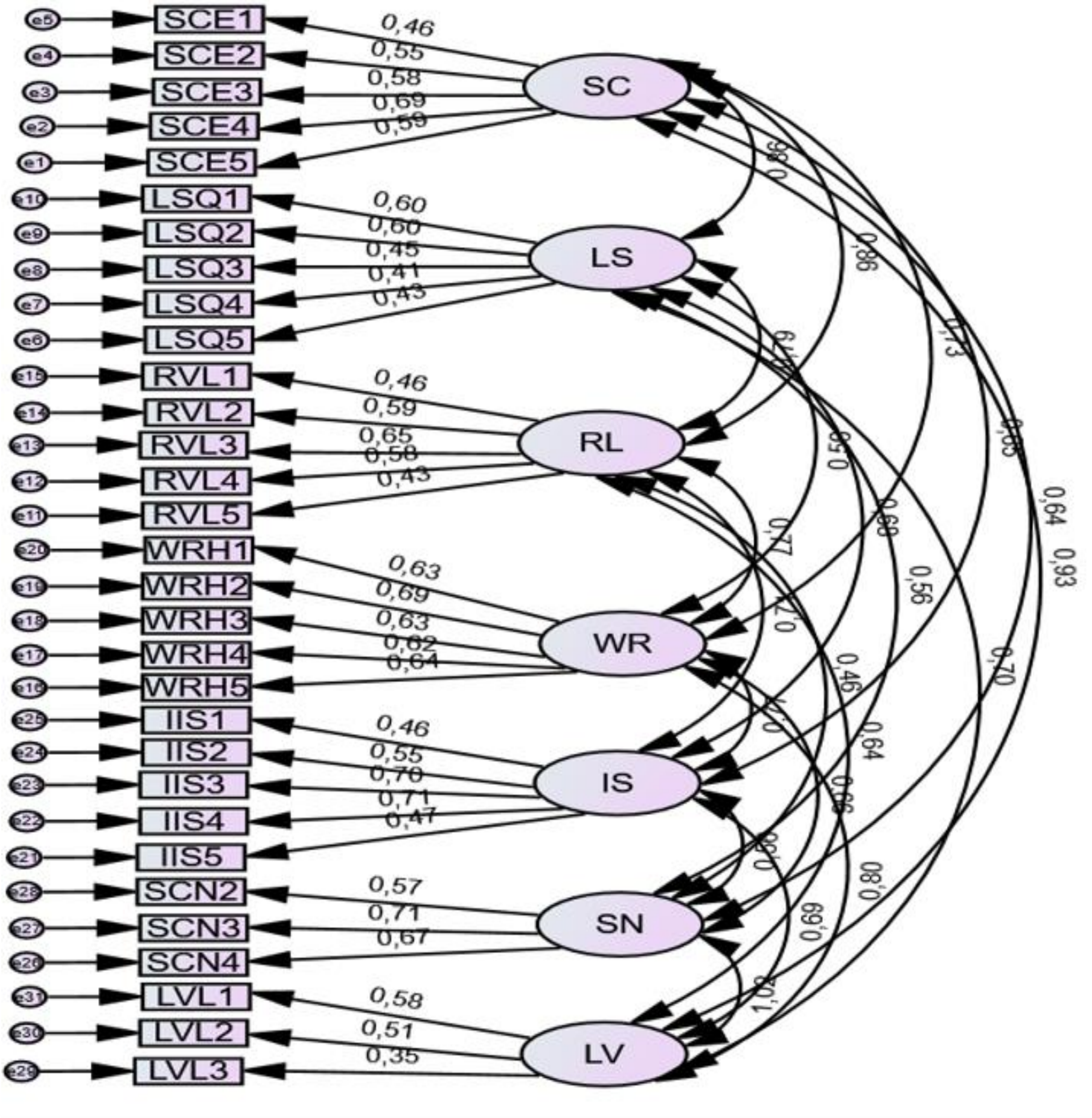

Figure 9.
Confirmatory analysis model.

The standardised estimations as well as the factor correlations are depicted in Figure 4.13. The results indicate an adequate model fit for the five-factor model because most factor loads were above 0.6, showing a strong relationship with each factor, as suggested by de Paula, et al. [86].

3.3.2. Reliability

All three constructs were tested for reliability using Cronbach's alpha. Higher alpha values indicate greater reliability, with 0.7 as the recommended minimum [67]. As shown in Table 7, all constructs scored between 0.894 and 0.902, exceeding the threshold. Item–total correlations were also above the 0.3 benchmark, confirming internal consistency.

Table 7.
Accuracy analysis statistics.

Research Constructs		Descriptive Statistics		Cronbach's Test		C.R.	AVE	Factor Loading
		Mean	SD	Item-total	α Value			
Supply chain effectiveness	SCE_{-1}	3.274	0.8504	0.50	0.902	0.97	0.85	0.869
	SCE_{-2}			0.55				0.877
	SCE_{-3}			0.58				0.500
	SCE_{-4}			0.69				0.741
	SCE_{-5}			0.59				0.869
Logistics Service Quality	LSQ_{-1}	2.955	1.103	0.60	0.901	0.99	0.93	0.835
	LSQ_{-2}			0.60				0.701
	LSQ_{-3}			0.5				0.689
	LSQ_{-4}			0.50				0.733
	LSQ_{-5}			0.50				0.829
Warehousing	WRH_{-1}	3.645	1.199	0.63	0.894	0.98	0.92	0.354
	WRH_{-2}			0.69				0.818
	WRH_{-3}			0.63				0.838
	WRH_{-4}			0.62				0.920
	WRH_{-5}			0.64				0.824

Note: SCE=Supply chain Effectiveness; LSQ=Logistics Service Quality; WRH=Warehousing; C.R=Composite Reliability; AVE=Average Variance Reliability.

3.3.2.1. Cronbach's Alpha Test

All three constructs in this study were assessed for reliability using Cronbach's alpha. A higher Cronbach's alpha indicates stronger reliability, with 0.7 being the recommended minimum threshold. As shown in Table 7, all constructs exceeded this benchmark, with alpha values ranging from 0.894 to 0.902.

In addition, item–total correlations for all latent constructs were well above the 0.3 threshold prescribed by Field [67] which indicates that each item correlates well with the overall scale and measures the same construct as the other items. Values below 0.3 would suggest weak correlation and potential misalignment with the construct. Therefore, these results confirm that all constructs in the study demonstrate strong reliability, meeting the recommended standards for both Cronbach's alpha and item–total correlation.

3.3.2.2. Composite Reliability

All three constructs were tested for reliability using Cronbach's alpha. Higher alpha values indicate greater reliability, with 0.7 as the recommended minimum [67]. As shown in Table 7, all constructs scored between 0.894 and 0.902, exceeding the threshold. Item–total correlations were also above the 0.3 benchmark, confirming internal consistency

(CR): $CR\eta= (\Sigma\lambda yi) 2 / [(\Sigma\lambda yi) 2 + (\Sigma\varepsilon i)]$

where composite reliability = (square of the summation of the factor loadings) / ((square of the summation of the factor loadings) + (summation of error variances)).

Similar to Cronbach's alpha, Composite Reliability (CR) measures the internal consistency of scale items [59]. A CR value of 0.7 or higher indicates adequate reliability. As shown in Table 7, the CR values for the constructs were 0.97 for SCE, 0.99 for LSQ, and 0.98 for WRH, all well above the recommended threshold. These results confirm that the constructs are highly reliable and internally consistent.

3.3.2.3. Average Variance Extracted

AVE is the average amount of variance in indicator variables that a construct can explain [87]. It is a measure that assesses convergent validity. It is calculated using the following formulae provided by Chinomona and Chivhungwa [88]:

$V\eta=\Sigma\lambda yi2/ (\Sigma\lambda yi2+\Sigma\varepsilon i)$

where AVE = ((summation of the squared of factor loadings) / ((summation of the squared of factor loadings) + (summation of error variances)).

According to Chinomona and Chivhungwa [88] and Hair, et al. [59]. Average Variance Extracted (AVE) values should be at least 0.5 to be considered acceptable and representative of the latent construct. As shown in Table 7 the AVE values for the constructs were 0.85, 0.93, and 0.92, all well above the recommended threshold. These results confirm that convergent validity is established for all constructs at the construct level.

3.3.3. Construct Validity

Construct validity refers to how accurately a latent concept is represented and operationalized in a study [89]. It is typically assessed using two indicators: convergent validity and discriminant validity [90] both of which are examined in this section.

3.3.3.1. Convergent Validity

Convergent validity assesses whether constructs that are theoretically related show high correlations among their measurement items [91]. In this study, for example, SCE1 was expected to correlate strongly with SCE3, LSQ5, LSQ4, and LSQ3, while items measuring RVL were not expected to correlate highly with items from other constructs such as LVL, WRH, IIS, or SCE.

Convergent validity was evaluated using factor loadings from the CFA. All items exceeded the recommended threshold of 0.5 [59] except LVL3 and LSQ3, which had loadings of 0.4 still acceptable when rounded. Additionally, over 50% of each item's variance was shared with its respective construct, confirming that all items converged appropriately and establishing convergent validity for the constructs.

3.3.3.2. Discriminant Validity

Discriminant validity was assessed using correlations computed during the CFA and by verifying that the AVE values exceeded the 0.5 threshold [59]. As shown in Table 8, all constructs had AVE values above 0.5, confirming the presence of discriminant validity.

Table 8.
Correlations between constructs.

	SCE	**LSQ**	**WRH**
Supply Chain Effectiveness (SCE)	1.000		
Logistics Service Quality (LSQ)	0.701	1.000	
Warehousing (WRH)	0.128	0.201	1.000

Table 8 exemplifies the correlations derived during the CFA process while making assessments on the discriminant validity. Based on this figure, this proves that there is a positive correlation among all the individual constructs which were located under the cut-off value of 1, this then confirms that discriminant validity is present within the measurement scales. Subsequently, it is important to note that there are other types of validity measures such as face validity and content validity, which were both not measured in this section, however, they were mentioned in the previous chapter. Consequently, the recommended strategies for content, convergent, construct and discriminant validity were all met within this study.

3.3.4. Conceptual Model Fit Assessments

According to Kumar, et al. [92] the theory of model fit is usually carried out on the foundation of testing statistics that make use of the probability ratio statistics, which are based on the normality of the assumptions. Kumar, et al. [93] believe that model fit is the measure of how well a model generalises data similar to what is being measured. Kumar, et al. [92] further explain that a good model fit is the one that precisely estimates the outputs that are provided with unseen inputs.

The chi-square value was used to evaluate the acceptability of the model fit over the degree of freedom ($\chi 2$/df), whereby the values need to be between two and not more than five. Values of GFI, CFI, IFI and TLI should all be above or equal to 0.90 and the RMSEA value needs to be equal or below 0.08 [93]. The outcomes derived from the model fit assessment obtained in this study are stipulated below in Table 9.

Table 9.
Model Fit Assessment.

Model Fit Indices	**Acceptable threshold values**	**Results obtained**
($\chi 2$/df)	≤ 3.0	3.296
RMSEA	≤ 0.08	0.071
RMR	≤ 0.9	0.405
GFI	≥ 0.9	0.936
CFI	≥ 0.9	0.962
IFI	≥ 0.9	0.966
TLI	≥ 0.9	0.984
NFI	≥ 0.9	0.933

Based on the results in Table 9 the measurement instruments used by the previous literature meet the required threshold of measures such as reliability, validity, and correlations, while the data obtained from the theoretical sample fit the model positively. Quite a few academics have commented on a few limitations of the fit indices, which are discussed in Section 4.7.4.1.

3.3.4.1. Limitations of Fit Indices

There is extensive disagreement and limitations when it comes to the fit indices which were presented by several researchers. Boamah and Tremblay [94] believe that fit indices do not give the extrapolative value of a model and it does not provide complete information of the theoretical meaning of the construct. Kyriazos [95] notes that values related to the indices only give information on the average or the overall fit of the model, therefore, it leaves room for assumption that some parts of the model may not be part of the data.

Xu, et al. [96] argue that the values of the fit indices that are suggested to fit adequately do not indicate the extrapolative effect of the model and it is mostly deemed as high. Toraman, et al. [97] further explain that the sampling distribution which are used for many fit indices are unknown. Based on the above perceptions, the model fit indices used in this study were reserved for information determinations only, even though they did not meet the suggested cut-off values by small margins.

3.4. Path Analysis Results

Path analysis is a statistical technique used to examine hypothesized relationships between an independent variable and two or more dependent variables [90]. In this study, path analysis was applied to test six hypotheses and determine whether they were supported, based on the SEM results presented in Table 10 and Figure 9. Following modifications to the full conceptual model, results were obtained and analyzed in detail to provide a comprehensive understanding of the relationships between variables.

3.4.1. Hypotheses Testing Results

The results of the hypotheses tests are reported in Table 10.

Table 10
Results of structural equation model analysis.

Structural Paths	Hypothesis	Path Coefficient	Outcome
Warehousing → Logistics service quality	H_1	0.08***	Not Accepted
Supply chain networks → Logistics service quality	H_2	0.20***	Accepted
Logistics service quality → Supply chain effectiveness	H_3	0.94***	Accepted
Structural model fits: χ^2/df=3.811; GFI=0.936; IFI=0.966; CFI=0.962; NFI=0.724; TLI=0.933; RMSEA=0.071			

Note: significance level <0.001***.

Table 10 shows the structural equation model examined relationships among warehousing, supply chain networks, logistics service quality, and supply chain effectiveness. Warehousing showed a weak but statistically significant effect on logistics service quality (path coefficient = 0.08), leading to rejection of that hypothesis due to low practical impact. Supply chain networks had a moderate, significant positive effect on logistics service quality (0.20), supporting that hypothesis. Logistics service quality had a strong, significant impact on supply chain effectiveness (0.94), confirming its key role.

Model fit indices indicated an acceptable to good fit, with χ^2/df = 3.811, GFI = 0.936, IFI = 0.966, CFI = 0.962, TLI = 0.933, and RMSEA = 0.071. Though NFI was lower at 0.724, the overall fit was adequate.

In summary, logistics service quality strongly influences supply chain effectiveness, supply chain networks positively impact logistics service quality, while warehousing has minimal effect in this model.

4. Conclusion

The structural model analysis shows that supply chain networks significantly enhance logistics service quality, which strongly improves supply chain effectiveness. This underscores the importance of robust networks for delivering high-quality logistics and driving overall performance. In contrast, warehousing had an insignificant direct effect on logistics service quality, suggesting its impact may be indirect or influenced by other factors. The model demonstrated good fit, confirming the validity of the tested relationships. Overall, the findings highlight the need to prioritise network strength and logistics quality as core strategies for improving supply chain effectiveness and competitiveness, offering practical insights for both academia and industry.

5. Practical Implications

The study highlights reverse logistics, levelling, internal information systems, and supply chain networks as key drivers of supply chain effectiveness. Firms should invest in these areas to boost performance, responsiveness, and competitiveness. The validated model provides managers with a practical tool to pinpoint and improve logistics elements that enhance service quality, customer satisfaction, and efficiency. Its measurement scales offer a reliable, data-driven framework for assessing supply chain performance, guiding targeted training for professionals, and informing policy and industry standards.

6. Theoretical Implications

The research empirically validates a five-factor model linking logistics service quality to supply chain effectiveness, strengthening existing theories and clarifying the influence of individual logistics components. Through Confirmatory Factor Analysis (CFA), it refines constructs such as internal information systems and levelling, offering more precise measurement tools. The findings provide a robust foundation for future studies to examine logistics performance across sectors and advance theory in supply chain and operations management.

References

[1] F. Jie and D. Gengatharen, "Australian food retail supply chain analysis," *Business: Theory and Practice,* vol. 20, no. 1, pp. 81–92, 2019.

[2] R. Kurniawan, S. H. Zailani, M. Iranmanesh, and P. Rajagopal, "The effects of vulnerability mitigation strategies on supply chain effectiveness: risk culture as moderator," *Supply Chain Management: An International Journal,* vol. 22, no. 1, pp. 1-15, 2017. https://doi.org/10.1108/SCM-12-2015-0482
[3] I. Abushaikha, G. Al-Weshah, and M. Alsharairi, "How do retail firms benefit from co-locating in logistics-intensive clusters? A focus on the inbound supply function," *The International Review of Retail, Distribution and Consumer Research,* vol. 30, no. 1, pp. 27-45, 2020. https://doi.org/10.1080/09593969.2019.1635906
[4] K. Aziz, R. A. Rana, M. Rashid, and Q. Rahat, "Supply chain effectiveness and efficiency–Case of Chinese Onyx industry," *International Journal of Research,* vol. 4, no. 9, pp. 1493-1500, 2017.
[5] G. Atambo and W. J. Nyongesa, "Effects of a total rewards system on the motivation and quality of working life of female employees in institutions of higher learning: A case of the Catholic University of East Africa," *Public Policy and Administration Research,* vol. 5, no. 8, pp. 97-105, 2015.
[6] V. Patiat, R. Kinanga, and J. NyongesaWesonga, "Effect of talent attraction on competitive advantage of commercial banks in Kenya: A case of the Kenya Commercial Bank," *American Journal of Multidisciplinary Research & Development,* vol. 6, no. 3, pp. 76-83, 2024.
[7] M. Christopher, *Logistics and supply chain management*. Harlow, England: Pearson UK, 2016.
[8] G. De Villiers, G. Nieman, and W. Niemann, *Strategic logistics management: A supply chain management approach*. Pretoria, South Africa: Van Schaik Publishers, 2017.
[9] M. Njoku and K. Kalu, "Effective supply chain management: A strategic tool for profitability enhancement in the competitive marketing environment," *European Journal of Business and Social Sciences,* vol. 3, no. 12, pp. 90-112, 2015.
[10] W. J. Nyongesa, S. Ntongai, and C. Ondoro, "Does performance contracting drive citizen-centric service delivery: The case of Huduma Centers' in Kenya," *The International Journal of Business & Management,* vol. 8, no. 5, pp. 217–223, 2020.
[11] W. J. Nyongesa and J. Van Der Westhuizen, "Evaluation of employee turnover among public secondary teachers in Kisii Central District, Kisii County, Kenya," *EUREKA: Social and Humanities,* no. 1, pp. 12-23, 2024.
[12] I. Langton and C. Mafini, "Small and medium business transformational leadership and supply chain management," *Journal for Transdisciplinary Research in Southern Africa,* vol. 19, no. 1, pp. 1-11, 2023.
[13] H. S. Sanil, S. Ramakrishnan, M. Alwethainani, A. G. Kazi, and M. Siddique, "Effectiveness of supply chain management with reference to apparel industry: A case study in India," *International Review of Management and Marketing,* vol. 6, no. 4, pp. 176-184, 2016.
[14] C. Mena and M. Bourlakis, "Retail logistics special issue," *International Journal of Physical Distribution & Logistics Management,* vol. 46, no. 6/7, 2016. https://doi.org/10.1108/IJPDLM-03-2016-0098
[15] P. Blau, *Exchange and power in social life*. New York: Wiley, 1964.
[16] R. M. Emerson, "Social exchange theory," *Annual Review of Sociology,* vol. 2, pp. 335–362, 1976. https://doi.org/10.1146/annurev.so.02.080176.002003
[17] D. J. Kim, "An investigation of the effect of online consumer trust on expectation, satisfaction, and post-expectation," *Information systems and e-business Management,* vol. 10, no. 2, pp. 219-240, 2012. https://doi.org/10.1007/s10257-010-0136-2
[18] M. Rewers *et al.*, "The environmental determinants of diabetes in the young (TEDDY) study: 2018 update," *Current Diabetes Reports,* vol. 18, no. 12, p. 136, 2018.
[19] P. Thaichon and T. N. Quach, "The relationship between service quality, satisfaction, trust, value, commitment and loyalty of Internet service providers' customers," *Journal of Global Scholars of Marketing Science,* vol. 25, no. 4, pp. 295-313, 2015. https://doi.org/10.1080/21639159.2015.1073419
[20] R. P. Bagozzi, *Advanced marketing research*. New York: John Wiley & Sons, 1994.
[21] X. D. Chauke, "Online shopping satisfaction, loyalty and repurchase intentions of generation X consumers in Southern Gauteng," Master's Degree in Marketing, Vaal University of Technology, Vanderbijlpark: South Africa, 2014.
[22] A. Bandura, *Self-efficacy: The exercise of control*. New York: W.H. Freeman and Company, 1997.
[23] W. Timans, K. Ahaus, R. van Solingen, M. Kumar, and J. Antony, "Implementation of continuous improvement based on Lean Six Sigma in small-and medium-sized enterprises," *Total Quality Management & Business Excellence,* vol. 27, no. 3-4, pp. 309-324, 2016. https://doi.org/10.1080/14783363.2014.980140
[24] J. Kabus, "Logistics of warehousing," *World Scientific News,* no. 48, pp. 63-68, 2016.
[25] K. S. Cook, "Exchange: Social international encyclopedia of the social & behavioral sciences," ScienceDirect, 2015. https://www.sciencedirect.com/topics/social-sciences/social-exchange-theory
[26] G. Arsel, "Supply chain networks and service quality," *Journal of Supply Chain Management,* vol. 53, no. 2, pp. 939-950, 2017.
[27] V. V. Thai, *International encyclopedia of logistics*. Hoboken, NJ: Wiley, 2013.
[28] M. Revindran, N. K. R. Ragen, and B. Mahmud, "A study on logistics service quality in e-retailing amongst online shoppers in Kuala Lumpur," *IOP Conference Series: Materials Science and Engineering,* vol. 7, no. 8, pp. 1-8, 2020.
[29] I. P. Vlachos, "Reverse food logistics during the product life cycle," *International Journal of Integrated Supply Management,* vol. 9, no. 1-2, pp. 49-83, 2014. https://doi.org/10.1504/IJISM.2014.064356
[30] Q. Zhang and D. M. Dilts, "Supply chain network coordination and service quality," *European Journal of Operational Research,* vol. 258, no. 1, pp. 1-15, 2017.
[31] D. J. Ketchen Jr, W. Rebarick, G. T. M. Hult, and D. Meyer, "Best value supply chains: A key competitive weapon for the 21st century," *Business Horizons,* vol. 51, no. 3, pp. 235-243, 2008. https://doi.org/10.1016/j.bushor.2008.01.012
[32] M. Cao and Q. Zhang, "Supply chain collaboration: Impact on collaborative advantage and firm performance," *Journal of Operations Management,* vol. 29, no. 3, pp. 163-180, 2011.
[33] A. Gunasekaran, C. Patel, and E. Tirtiroglu, "Performance measures and metrics in a supply chain environment," *International Journal of Operations & Production Management,* vol. 21, no. 1/2, pp. 71-87, 2001.
[34] I. P. Vlachos, "A hierarchical model of the impact of RFID practices on retail supply chain performance," *Expert Systems with Applications,* vol. 41, no. 1, pp. 5-15, 2014. https://doi.org/10.1016/j.eswa.2013.07.006
[35] I. Abushaikha, "The influence of logistics clustering on distribution capabilities: A qualitative study," *International Journal of Retail & Distribution Management,* vol. 46, no. 6, pp. 577-594, 2018. https://doi.org/10.1108/IJRDM-01-2018-0018

[36] L. M. Basson, P. J. Kilbourn, and J. Walters, "Forecast accuracy in demand planning: A fast-moving consumer goods case study," *Journal of Transport and Supply Chain Management,* vol. 13, no. 1, pp. 1-9, 2019.

[37] S. Revindran, R. Ragen, and A. Mahmud, "Service quality and supply chain network effectiveness," *International Journal of Logistics Research and Applications,* vol. 23, no. 1, pp. 1-16, 2020.

[38] W. J. Nyongesa and J. Van Der Westhuizen, *Human resources aspects in tourism and its technology application: Kenyan perspective. In Tourism and Hospitality for Sustainable Development: Volume Three: Implications for Customers and Employees of Tourism Businesses*. Cham: Springer Nature Switzerland, 2024.

[39] D. S. Rogers and R. S. Tibben-Lembke, *Going backwards: Reverse logistics trends and practices*. Pittsburgh, PA: Reverse Logistics Executive Council, 1999.

[40] J. M. Bloemhof-Ruwaard, M. Fleischmann, P. Beullens, and L. N. Van Wassenhove, "The impact of product recovery on logistics network design," *Production and Operations Management,* vol. 10, no. 2, pp. 156-173, 2001.

[41] V. D. R. Guide Jr and L. N. Van Wassenhove, "Managing product returns for remanufacturing," *Production and Operations Management,* vol. 10, no. 2, pp. 142-155, 2001.

[42] K. Govindan, H. Soleimani, and D. Kannan, "Reverse logistics and closed-loop supply chain: A comprehensive review to explore the future," *European Journal of Operational Research,* vol. 240, no. 3, pp. 603-626, 2015. https://doi.org/10.1016/j.ejor.2014.07.012

[43] C. R. Carter and L. M. Ellram, "Reverse logistics: A review of the literature and framework for future investigation," *Journal of Business Logistics,* vol. 19, p. 1, 1998.

[44] Basson G. et al, "Logistics service quality in retail," *International Journal of Retail & Distribution Management,* vol. 47, no. 1, pp. 5-15, 2019.

[45] Bouzaabia O. et al, "Supply chain effectiveness and customer satisfaction," *Journal of Business Logistics,* vol. 34, no. 4, pp. 627-639, 2013.

[46] K. T. R. Letshedi, "A review of the effectiveness of supply chain management practices in Limpopo department of public works, roads, and infrastructure," Doctoral Dissertation, University of Limpopo, 2015.

[47] J. N. Wesonga and J. Van Der Westhuizen, "Effect of talent development on organizational performance," *EUREKA: Social and Humanities,* no. 2, pp. 25-37, 2024. https://doi.org/10.21303/2504-5571.2024.003374

[48] J. T. Mentzer, D. J. Flint, and G. T. M. Hult, "Logistics service quality as a segment-customized process," *Journal of marketing,* vol. 65, no. 4, pp. 82-104, 2001. https://doi.org/10.1509/jmkg.65.4.82.18390

[49] D. Prajogo and J. Olhager, "Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration," *International journal of production economics,* vol. 135, no. 1, pp. 514-522, 2012. https://doi.org/10.1016/j.ijpe.2011.09.001

[50] K. C. Tan, V. R. Kannan, R. B. Handfield, and S. Ghosh, "Supply chain management: an empirical study of its impact on performance," *International journal of operations & production Management,* vol. 19, no. 10, pp. 1034-1052, 1999. https://doi.org/10.1108/01443579910287064

[51] S. P. Mukherjee, *A guide to research methodology: An overview of research problems, tasks and methods*. Boca Raton, FL: CRC Press, 2019.

[52] A. C. Burns, A. Veeck, and R. F. Bush, *Marketing research*. London: Pearson Education, 2018.

[53] J. W. Creswell, *Research design: Qualitative, quantitative, and mixed methods approach*. Thousand Oaks, CA: Sage, 2014.

[54] D. F. Polit and C. T. Beck, *Nursing research: Generating and assessing evidence for nursing practice*, 9th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins, 2012.

[55] C. Kivunja and A. B. Kuyini, "Understanding and applying research paradigms in educational contexts," *International Journal of higher education,* vol. 6, no. 5, pp. 26-41, 2017. https://doi.org/10.5430/ijhe.v6n5p26

[56] C. Abdallah, M. Lusiani, and A. Langley, *Performing process research. In standing on the shoulders of giants*. Pretoria: Emerald Publishing, 2019.

[57] L. Blair, *Choosing a methodology. In writing a graduate thesis or dissertation, teaching writing*. Rotterdam: Sense Publishers, 2016.

[58] H. Taherdoost, "Sampling methods in research methodology; how to choose a sampling technique for research," *International journal of academic research in management (IJARM),* vol. 5, no. 2, pp. 18-27, 2016.

[59] J. F. Hair, W. C. Black, B. J. Babin, and R. E. Anderson, *Multivariate data analysis*. New York: Pearson, 2010.

[60] C. Quinlan, B. Babin, J. Carr, and M. Griffin, *Business research methods*. Boston, MA: South-Western Cengage, 2019.

[61] B. Rym, O. Bouzaabia, and A. Capatina, "Retail logistics service quality: a cross-cultural survey on customer perceptions," *International Journal of Retail & Distribution Management,* vol. 41, no. 8, pp. 627-647, 2013. https://doi.org/10.1108/IJRDM-02-2012-0012

[62] T. A. Brown and M. T. Moore, "Confirmatory factor analysis," *Handbook of Structural Equation Modeling,* vol. 361, p. 379, 2012.

[63] U. Sekaran and R. Bougie, *Research methods for business. A skill- building approach*, 6th ed. UK: Wiley, 2013.

[64] A. V. Gandhi, A. Shaikh, and P. A. Sheorey, "Impact of supply chain management practices on firm performance: Empirical evidence from a developing country," *International Journal of Retail & Distribution Management,* vol. 45, no. 4, pp. 366-384, 2017. https://doi.org/10.1108/IJRDM-06-2015-0076

[65] G. Malhotra, "Strategies in research," *International Journal of Advance in Research and Development,* vol. 2, no. 5, pp. 1-9, 2017.

[66] A. C. Burns and R. F. Bush, *Marketing research*. NJ, USA: Pearson Prentice Hall, 2014.

[67] A. P. Field, "Is the meta-analysis of correlation coefficients accurate when population correlations vary?," *Psychological Methods,* vol. 10, no. 4, p. 444, 2005.

[68] A. Tarhini, T. Teo, and T. Tarhini, "A cross-cultural validity of the E-learning Acceptance Measure (ElAM) in Lebanon and England: A confirmatory factor analysis," *Education and Information Technologies,* vol. 21, pp. 1269-1282, 2016. https://doi.org/10.1007/s10639-015-9381-9

[69] P. D. Lavhelani and E. C. OsayuwamenOmoruyi, "Dynamic capabilities as determinants of supply chain performance in small to medium enterprises in Gauteng Province," *Journal of Economics and Behavioral Studies,* vol. 10, no. 2, pp. 165-175, 2018.

[70] L. Weaver, T. J. Beebe, and T. Rockwood, "The impact of survey mode on the response rate in a survey of the factors that influence Minnesota physicians' disclosure practices," *BMC medical research methodology,* vol. 19, p. 73, 2019. https://doi.org/10.1186/s12874-019-0719-7

[71] K. Stolzmann, M. Meterko, C. J. Miller, L. Belanger, M. N. Seibert, and M. S. Bauer, "Survey response rate and quality in a mental health clinic population: results from a randomized survey comparison," *The Journal of Behavioral Health Services & Research,* vol. 46, pp. 521-532, 2019. https://doi.org/10.1007/s11414-018-9617-8

[72] Z. E. Glas *et al.*, "Effect of monetary incentives on mail survey response rates for midwestern farmers," *Society & Natural Resources,* vol. 32, no. 2, pp. 229-237, 2019.

[73] M. W. Watkins, "Exploratory factor analysis: A guide to best practice," *Journal of black psychology,* vol. 44, no. 3, pp. 219-246, 2018. https://doi.org/10.1177/0095798418771807

[74] J. B. Schreiber, "Issues and recommendations for exploratory factor analysis and principal component analysis," *Research in Social and Administrative Pharmacy,* vol. 17, no. 5, pp. 1004-1011, 2021. https://doi.org/10.1016/j.sapharm.2020.07.027

[75] K. Jokiniemi, A. M. Pietilä, and S. Mikkonen, "Construct validity of clinical nurse specialist core competency scale: An exploratory factor analysis," *Journal of clinical nursing,* vol. 30, no. 13-14, pp. 1863-1873, 2021. https://doi.org/10.1111/jocn.15587

[76] O. A. Ogunsanya, C. O. Aigbavboa, D. W. Thwala, and D. J. Edwards, "Barriers to sustainable procurement in the Nigerian construction industry: an exploratory factor analysis," *International Journal of Construction Management,* vol. 22, no. 5, pp. 861-872, 2022. https://doi.org/10.1080/15623599.2019.1658697

[77] C. Ricci, J. Baumgartner, E. Wentzel-Viljoen, and C. M. Smuts, "Food or nutrient pattern assessment using the principal component analysis applied to food questionnaires. Pitfalls, tips and tricks," *International journal of food sciences and nutrition,* vol. 70, no. 6, pp. 738-748, 2019. https://doi.org/10.1080/09637486.2019.1566445

[78] Z. Rasool, R. Asghar, S. A. Gill, and A. J. Khan, "The historical role of work social support, corporate social responsibility (CSR) and innovation capabilities," *Perennial Journal of History,* vol. 2, no. 2, pp. 331-352, 2021.

[79] L. Spoorthy, R. Likhitha, S. K. Nasreen, and S. Nagalakshmi, "Predicting road accident severity and recommending hospitals using deep learning techniques," *Journal of Computational Analysis & Applications,* vol. 33, no. 8, 2024.

[80] C. Conradty and F. X. Bogner, "From STEM to STEAM: How to monitor creativity," *Creativity Research Journal,* vol. 30, no. 3, pp. 233-240, 2018.

[81] P. Denton, S. Parke, T. Tao, and X. Zhang, "Eigenvectors from eigenvalues: A survey of a basic identity in linear algebra," *Bulletin of the American Mathematical Society,* vol. 59, no. 1, pp. 31-58, 2022.

[82] M. Mohammadi, W. Hofman, and Y.-H. Tan, "A comparative study of ontology matching systems via inferential statistics," *IEEE Transactions on Knowledge and Data Engineering,* vol. 31, no. 4, pp. 615-628, 2018. https://doi.org/10.1109/TKDE.2018.2842019

[83] B. Bortot *et al.*, "In vitro treatment of congenital disorder of glycosylation type Ia using PLGA nanoparticles loaded with GDP-Man," *International Journal of Molecular Medicine,* vol. 44, no. 1, pp. 262-272, 2019.

[84] E. Pignotti, R. Guerra, S. Covelli, E. Fabbri, and E. Dinelli, "Sediment quality assessment in a coastal lagoon (Ravenna, NE Italy) based on SEM-AVS and sequential extraction procedure," *Science of the total environment,* vol. 635, pp. 216-227, 2018. https://doi.org/10.1016/j.scitotenv.2018.04.093

[85] S. Harrington, S. Mohamed, and R. Bloch, "Small bowel obstruction by a primary phytobezoar in Crohn's disease," *The American Surgeon,* vol. 75, no. 1, pp. 93-94, 2009.

[86] J. J. de Paula, M. R. Albuquerque, G. M. Lage, M. A. Bicalho, M. A. Romano-Silva, and L. F. Malloy-Diniz, "Impairment of fine motor dexterity in mild cognitive impairment and Alzheimer's disease dementia: Association with activities of daily living," *Revista brasileira de psiquiatria,* vol. 38, no. 3, pp. 235-238, 2016.

[87] G. Ahmad, U. Widyastuti, S. Susanti, and H. Mukhibad, "Determinants of the Islamic financial literacy," *Accounting Journal,* vol. 6, no. 6, pp. 961-966, 2020.

[88] E. Chinomona and T. Chivhungwa, "The influence of green image, physical environment quality and green trust on green purchase intention," *The Retail and Marketing Review,* vol. 15, no. 1, pp. 13-26, 2019.

[89] E. A. Drost, "Validity and reliability in social science research," *Education Research and Perspectives,* vol. 38, no. 1, pp. 105-123, 2011.

[90] S. Manohar and G. Kapur, "Measuring perceived service innovation typologies in retail industry," *Journal of Industrial Integration and Management,* vol. 4, no. 02, p. 1850019, 2019. https://doi.org/10.1142/S2424862218500197

[91] M. Sivaram, A. Hudaya, and H. Ali, "Building a purchase and purchase decision: Analysis of brand awareness and brand loyalty case study of private label products at Alfamidi stores in Tangerang city," *Dinasti International Journal of Education Management and Social Science,* vol. 1, no. 2, pp. 235–248, 2019.

[92] V. S. Kumar, A. Manonmani, and V. R. Kumar, "Conceptual model fit for career planning and development of employees with special reference to private sector banks by using structural equation model," *American Journal of Industrial and Business Management,* vol. 8, no. 9, pp. 1972-1990, 2018.

[93] A. Kumar, R. K. Singh, and S. Swain, "Adoption of technology applications in organized retail outlets in India: A TOE model," *Global Business Review,* p. 09721509211072382, 2022. https://doi.org/10.1177/09721509211072382

[94] S. A. Boamah and P. Tremblay, "Examining the factor structure of the MLQ transactional and transformational leadership dimensions in nursing context," *Western Journal of Nursing Research,* vol. 41, no. 5, pp. 743-761, 2019.

[95] T. A. Kyriazos, "Applied psychometrics: sample size and sample power considerations in factor analysis (EFA, CFA) and SEM in general," *Psychology,* vol. 9, no. 08, p. 2207, 2018.

[96] L. Xu, Y. He, S. Fan, B. Cai, Z. Fang, and K. Dai, "Validation of a Chinese version of the Jaw Functional Limitation Scale in relation to the diagnostic subgroup of temporomandibular disorders," *Journal of Oral Rehabilitation,* vol. 47, no. 1, pp. 1-8, 2020. https://doi.org/10.1111/joor.12868

[97] Ç. Toraman, E. Karadağ, and M. Polat, "Validity and reliability evidence for the scale of distance education satisfaction of medical students based on item response theory (IRT)," *BMC medical education,* vol. 22, p. 94, 2022. https://doi.org/10.1186/s12909-022-03153-9