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ORIGINAL PAPER

A MODEL FOR INVENTORY MANAGEMENT AND WAREHOUSE PERFORMANCE IN THE SOUTH AFRICAN RETAIL INDUSTRY

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ABSTRACT. Background: The South African retail sector faces numerous inventory management-related problems that have detrimental effects on both inventory and warehouse performance. Some of the negative effects include the inability to fulfil orders, poor-quality control and inventory management operating systems, and ineffective warehouse security and layout design. It is necessary to develop and identify interventions for mitigating these problems. Additionally, literature on inventory and warehouse management in the South African retail sector is currently limited. The study tests a model for linking inventory management to warehouse performance in the retail industry in South Africa.
Method: The study used a quantitative survey method involving 203 supply chain professionals selected from retail outlets in the Gauteng and KwaZulu Natal provinces. Data were analysed using structural equation modelling based on the partial least squares technique.
Results: Three inventory management practices: inventory investment and ABC analysis contributed positively to inventory performance. Inventory performance contributed positively to warehouse performance.
Conclusions: Inventory management and performance are important drivers of warehouse performance in the retail sector. However, a correct mix of inventory management practices is essential. The study offers several contributions. Theoretically, the study provides insights into the contribution of inventory management to warehouse performance in retail environments. Specifically, the study identifies the inventory management practices that are important in optimising both inventory and warehouse performance in retail supply chains.

Keywords: Inventory management practices; inventory performance; warehouse performance; South African retail industry

INTRODUCTION

South Africa, which is the most industrialised country in Africa, boasts of some of the largest retail outlets on the continent. Growth in the retail sphere of South Africa has increased exponentially over the years and is witnessed through the ever-increasing number of shopping malls and the upsurge of online marketing [Mafini and Dhurup 2015; Makhitha and Ngobeni 2021]. According to Frazer [2022], South African retail sector sales grew by R547 billion, which equates to 14% in 2022, compared to 2021. In 2022, the sector's gross domestic product (GDP) contribution increased steadily from 0.7% in the second quarter to 1.6% in the third quarter of the year [Statistics South Africa 2022]. This positive performance is bolstered by several factors, which include the surge in online purchasing activities, the diversification of operational processes, which has resulted in an increase in product offerings, as well as a customisation drive. These are all meant to optimise customer satisfaction [Goga, Paelo and Nyamwena 2019, PRNewswire 2023]. Also, the efforts of the South African government to boost the economy in the post-COVID-19 pandemic period helped to prop up critical economic sectors, including retail business [Rajagopaul, Magwentshu, and Kalidas 2020 Nazir 2021].

The recent boom in the South African retail sector has attracted several hindrances that

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threaten the viability and success of this supply chain. These challenges include the inability to fulfil orders and poor-quality control and inventory management operating systems, such as warehouse management systems [Mhuri 2020]. Malgas and Zondi [2020] point to how the sector's sloppy warehouse security and layout design hinder effective storage spacing, becoming major setbacks. Inaccurate lead times in the movement of goods between facilities, inefficient stock tracking and data availability, together with stock damages and theft are all commonplace in the retail sector [Barloworld Logistics 2021]. A few authors [Govind, Luke, and Pisa 2017, Cilliers 2018] have reported the retail sector's inability to cope with volatile demand results in high inventory levels due to inaccurate inventory counts and stockouts. Shozi [2021] noted the poor adoption of recent technologies as one of the major constraints affecting retail sector warehouse operations. Lastly, the COVID-19 pandemic hangover, the 2021 July unrest, and the shortage of electrical power in South Africa (load-shedding) have all worsened the operational capabilities and performance of retail firms [PropertyWheel 2020, Inglesi-Lotz and Ajmi 2021].

The present study aims to test a research model for linking inventory management to warehouse performance in the retail industry in South Africa. The specific objectives of the study include (1) assessing the impact of inventory management practices on inventory performance and (2) measuring the impact of inventory performance on warehouse performance. The study places its prime emphasis on a few inventory management practices, namely Inventory Shrinkage prevention (ISP), inventory investment, inventory turnover optimisation (ITO), inventory control, and ABC analysis. The study examines their individual effects on inventory performance as a catalyst for the improvement of warehouse operations. To address the challenges presented above, a possible solution would be to optimise the capacity and capability of the warehousing systems used in the retail supply chain. However, this may require well-functioning-inventory management systems that serve as a continuous feeder into the available warehouses as they provide the stock for storage. As suggested by Granillo-Macías [2020], inventory management must be strengthened due to its role in improving warehouse performance. The significance of inventory and its importance as an asset in the retailing sector is evident, as it signifies what the firm has to offer to its consumers, for example, goods for purchase; while substantial expenses are connected with inventory holding, the latter subsists within warehouses [Breivik 2019]. The present study is thus intended to investigate this profound relationship between inventory and warehouse management with a view to providing information that may be used to mitigate some of the challenges that are constraining these functions within the retail sector.

Some decent evidence of studies on inventory management within the South African retail sector exists [Eicker and Cilliers 2018, Mondo, Twum-Darko, Ansen and Tengeh 2022, Munyaka and Yadavalli 2022]. However, studies that focused on the specific impact of inventory management on warehouse performance in the same sector are rare to find. The current study addresses this research gap by evaluating the impact of inventory management on warehouse performance in the South African retailing sector. The results of this study could prove useful to the retailing sector by identifying the inventory management practices that are relevant to that supply chain in the context of devising approaches to improve the performance of warehousing facilities.

This article is structured as follows: the next section discusses the South African retail industry literature review and the study's constructs. The conceptual model and hypotheses development are addressed next. The research methodology, data analysis, and study results discussion are then presented. The article concludes with conclusive remarks and provides theoretical and managerial implications and limitations of the study.

LITERATURE REVIEW

South African retail industry

The South African retail sector is one of the fastest growing and contributing sectors in the economy. It contributed to about R365 353 million in trade sales between October and December 2022, which is a substantial increase

compared to R342 571 in the same period in 2021 [Statistics South Africa 2022]. In terms of employment creation, the sector contributed a modest 2.6% of the total employment figures in the second quarter of 2022 despite the staggeringly high unemployment rate [Statistics South Africa 2022]. These socioeconomic indicators further highlight the role the sector plays as an active contributor to the economic growth and social development of the livelihoods of South Africans [Abraham 2022]. The growth of the retail sector may be attributed to the expansion of South Africa's retail companies to online platforms and markets outside South Africa [Mantandon 2013, Games 2020, Lomberg 2023]. For example, companies such as Shoprite and PicknPay have opened stores in neighbouring countries such as Botswana, Namibia, and Zimbabwe [Dakora and Mason 2016]. The South African trade space is dualistic, involving formal and informal sectors [Charman, Petersen, Piper, Liedeman, and Legg 2015]. Formal retail is regarded as highly tax regulated and is dominated by six major retailing giants, namely Shoprite Checkers, Woolworths, PicknPay, Massmart, and Spar. The informal retail sector exists within the margins of regulation and legality and is dominated by spaza shops, flea markets, and small-scale produce vendors [Charman et al. 2015, Stiehler-Moulder and Mahlape 2021].

The current study considered the formal retailing sector since it is the one with more established inventory and warehouse facilities found in South Africa.

Inventory management practices

Inventory management, also commonly known as stock management, refers to a set of processes for organising, managing, and making the products of a firm available to its customers [Achieng, Paul, and Mbura 2018]. Firms have a wide choice of inventory management practices from which to select. Examples include inventory control, process auditing stock valuation, inventory shrinkage (preventive), inventory investment, inventory turnover, and ABC analysis [Oballah, Waiganjo, and Wachiuri, 2015, Hussein and Makori 2018]. The six inventory management practices being considered, namely inventory investment, shrinkage prevention (ISP), turnover optimisation (ITO), inventory control, and ABC Analysis (ABC), are important elements of inventory and warehouse management because they are central to the optimisation of internal controls for inventory management in the provision of value to customers [Opoku, Fiati, kaku, Ankomah, and Opoku-Agyemang 2020].

In addition, a study by Ekegbo, Quede, Mienahata, Siwangaza, Smit, and Bruwe [2018] argued that these practices are critical indicators of inventory performance.

Adopting preventive measures to minimise inventory shrinkage and turnover is important to sustaining inventory performance [Hussein and Makori 2018]. Several scholars [Wambua, Okibo, Nyang'Au, and Ondieki 2015, Breivik 2019] indicate that the use of ITO, inventory control, and the ABC analysis is an important yardstick for assessing inventory performance. Therefore, for the purposes of the current study, the selected inventory management practices are deemed relevant predicting factors that drive both inventory and warehouse performance in the retail sector.

Inventory shrinkage prevention

Inventory shrinkage is the loss of inventory due to various factors [Knego and Misevic 2016]. This loss of inventory may be attributed to various factors that include the theft of products by employees, shoplifting, vendor fraud, and errors in administration among others [Alleleyn 2016, Yu, Chen and Wang 2019]. Thus, ISP refers to preventive measures adopted by a firm to minimise or mitigate the loss of its inventory [Li, Song, Sun, and Zheng 2019]. According to Atnafu and Balda [2018], ISP is part of inventory management practice and can affect inventory performance if they are not well managed. Therefore, the literature supports that ISP can negatively and positively impact inventory performance depending on how they are integrated into the systems. Moreover, Choi, Rabinovich, and Richards [2019] established that ISP plays a vital role in improved performance and the competitiveness of the organisation.

Inventory investment

Inventory investment refers to a change in inventory and goods that are in the production process in the company over a specific time frame [Lee, Zhou, and Hsu 2015, Chod 2016]. It can also be described as a dimension of an organisation's change in inventory levels from one time to the next [Jim 2020]. Inventory investment contributes to the most significant part of current assets and working capital in most activities. Thus, it becomes important to have adequate control and inventory management [Dhere 2015]. Therefore, firms are encouraged to hold a larger inventory due to the likelihood of increased production volumes at lower costs, leading to injection into inventory investment [Kim 2020].

Inventory turnover optimisation

Inventory turnover refers to a company's cost of goods sold, divided by average inventory, with less profitable operations [Feng, McVay, and Skaife 2015]. It may also be defined as the rate at which stock is used, sold, and replenished [Amanda 2019]. Inventory turnover optimisation is the process of increasing and sustaining the rate at which inventory items are sold and efficiently replenished within the warehouse facilities of firms to ensure the satisfaction of customers [Lobo, Kumar, and Ravikumar 2013]. This can be achieved, for instance, by disposing of all stock that is not selling by reducing the price to increase its sale. Kwak [2019] stressed that inventory turnover is a critical tool as a performance measure. It is effective as it measures the movement of products to the customers. Lastly, the higher the inventory turnover, the more the cash flow decreases due to slow-moving products that are not sold. It can be said that inventory turnover's significance indicates how quickly inventory turns into receivables through sales [Sonko and Akinlabi 2020].

Inventory control

Inventory control is the process of coordinating, controlling, and ensuring the accessibility and availability of stock and the prevention of any loss or surplus in inventory [Borade and Sweeney 2015]. Asana, Radhitya, Widiartha, Santika, and Wiguna [2020] describe inventory control as the process of holding the correct inventory and reducing the costs of the inventory to a minimum. Effective inventory control is critical in every company because an ineffective inventory system can result in loss of customers and sales. More revenue can be generated if inventory is effectively managed, which could directly affect a company's performance [Mohamad, Suraidi, Rahman, and Durratun 2016].

ABC analysis

ABC analysis is an analytical tool used to compare demand values of items' inventory control systems based on the rule of 80-20, known as the Pareto principle [Mehdizadeh 2020]. Douissa and Jabeur [2020] describe it as a widespread inventory management technique designed to classify inventory items based on their weighted scores into three ordered categories: A, B, and C. Category A contains the most important items, category B includes the items that are neither important nor less important, and category C specifies the least important ones. ABC analysis aims to determine the items of material expenses that significantly affect the cost and, consequently, the operational management process for making decisions [Nuzhna, Tluchkevych, Semenyshena, Nahirska, and Sadovska 2019]. It eliminates the shortages of expired volume-based costing systems and provides more reliable information regarding the production costs, profitability, and decisions taken by management on each cost activity respectively [Fei, Namazi, and Isa 2017].

Inventory performance

Inventory performance relates to how organisations measure the effectiveness and competence of using and replenishing inventory [Elsayed and Wahba 2016]. Furthermore, it is known for measuring inventory usage effectiveness and replenishment [Ladhar, Lajili, and Babai 2015]. The significance of inventory management cannot be undervalued, especially for retail merchandising, due to the complexity of managing their assets, which influence inventory and firm performance [Alrjoub and Ahmad 2017]. Lastly, effective inventory performance is paramount in running a business,

given the need to optimise inventory costs [Muchaendepi, Mbohwa, Hamandishe, and Kanyepe 2019]. Hence, inventory performance is a key factor in achieving competitive advantages.

Warehouse performance

Warehouse performance may be perceived as a measure of the optimal use of storage space, customer relations activity, quality level, asset usage, and costs [Liviu, Ana-Maria, and Emil 2009]. The role of warehouse performance in the retail industry is presented in this aspect and its importance in the adequate distribution of goods to different retailing outlets [Pyza, Jachimowski, Jacyna-Gołda, and Lewczuk 2017]. Hence, it is noted that warehouses are critical nodes in the supply chain, such that improving their performance is essential when avoiding unproductive bottlenecks in the supply chain [Ribino, Cossentino, Lodato, and Lopes 2018]. Overall, warehouse performance is critical in a firm's value chain because it affects customer satisfaction and market reaction efficiency [Caridade, Pereira, and Silva 2017].

Research Model and Hypotheses Development

The research model of the study is presented in Figure 1 and comprises five predictors, namely Inventory Shrinkage prevention, (ISP), inventory investment, inventory turnover optimisation (ITO), inventory control and ABC analysis, one mediator (inventory performance), and one outcome (warehouse performance).

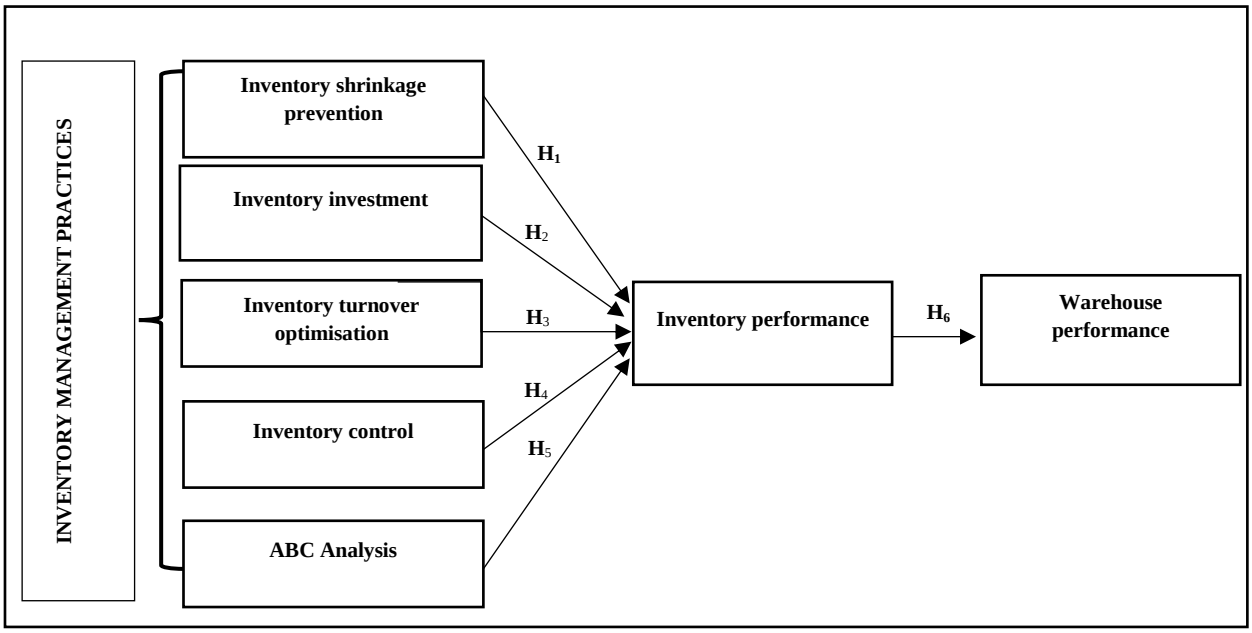

Fig. 1: Research Model. Source: Authors' own 559ptimization559tion.

Hypotheses Development

Inventory management practices and inventory performance

Several studies [Abimbola and Kolawole 2017, Mbah, Obiezekwem, and Okuoyibo 2019] confirm that ISP positively affects inventory performance in retail stores. A separate study by Akinlabi [2021] found a positive link between inventory investment and inventory performance. Evidence by Comez-Dolgan and Tanyeri [2015] suggests that ITO is a measure of inventory performance through its influence on the cost of goods sold to customers. Further research by Solis, Tavizon, and Alarcon [2020] shows that inventory control optimises inventory capacity. Also, Douissa and Jabeur [2020] assert that the successful implementation of ABC analysis indicates that the performance of each inventory item is measured, thereby reducing inventory costs. Another study by Mehdizadeh [2020] shows that the implementation of ABC

analysis results in a significant improvement in inventory performance. These insights lead to the following hypotheses:

H_1: ISP positively affects inventory performance in the retail sector

H_2: Inventory investment positively affects inventory performance in the retail sector

H_3: ITO positively affects inventory performance in the retail sector

H_4: Inventory control positively affects inventory performance in the retail sector

H_5: Application of ABC analysis positively affects inventory performance in the retail sector

Inventory performance and warehouse performance

Analysing inventory and warehouse performance is critical for managers in evaluating the organisation's performance objectives and making sound decisions in value [Staudt, Alpan, Rodriguez, and Mascolo 2015]. Kritchanchai, Hoeur, and Engelseth [2017] found a positive relationship between inventory and warehouse performance. Recent research by Islam, Ali, Fathollahi-Fard, and Kabir [2021] indicates that inventory performance is an antecedent factor of warehouse performance. Additionally, Wang, Dang, and Nguyen [2020] found that a firm's inventory level strongly influences its warehouse performance. Therefore, the following hypothesis can be stated:

H_6: Inventory performance positively affects warehouse performance in the retail sector

MATERIALS AND METHODS

Research Design

The study was positivistic, following a deductive reasoning approach since the study was intended to test relationships between several research constructs. A quantitative survey design was followed to enable the generalisation of results to other retail environments.

Sampling Procedure

The final sample in this study consisted of 203 supply chain professionals drawn from the FMCG retail sector in the Gauteng and KwaZulu Natal provinces of South Africa. A selective sampling technique was employed to enlist respondents who were knowledgeable about SCM in the retail sector. To be included in the study, respondents were expected to possess at least two years of experience in any SCM role in the retail sector. Respondents were drawn from 70 branches of the major South African six retail firms. The final sample size of 203 respondents was considered adequate, based on the recommendation by Bentler and Chou [1987], who recommend five to 10 participants per each estimated parameter as the appropriate ratio number of respondents to the number of observed variables. This view finds support through Bollen [1989], who recommends that a ratio of three to five respondents should be the suitable determining parameter for structural equation modelling (SEM) studies. Additionally, Loehlin [1992] and Quintana and Maxwell [1999] recommend a minimum sample size of at least 200 or more as being suitable for multivariate studies using 10 to 15 measurement instruments. Therefore, the sample size of n=203 respondents applied in the current study satisfies the sample size recommendations cited above.

Measures and Fieldwork

Measurement scales used in the study consisted of 35 items that were adapted from previously validated scales. ISP was measured using a six-item scale adapted from Ekegbo et al. [2018]. In that study, the scale attained a Cronbach alpha (α) of 0.85. Inventory investment and inventory control were measured using five items, respectively, derived from Hussein and Makori [2018]; with scales of α=0.78. ITO was measured using four items derived from Oballah et al. [2015]; with a scale of α=0.71. ABC analysis used a four-item scale adapted from Wauna and Obwogi [2015], with a scale of α=0.71. Inventory performance was measured using a five-item scale adapted from Awuah-Gyawu, Adzimah, and Brako [2015];

with α=0.83. Warehouse performance used a six-item scale adapted from Hussein and Makori [2018]; with α=0.88. Response options were presented on a five-point Likert scale anchored by 1= strongly disagree to 5= strongly disagree.

Data were collected using an online survey. Respondents accessed the online questionnaire through a link that was emailed to them. A submit button was provided, which transmitted the completed responses back to the principal researcher. The collection of data lasted for four months, between May and August 2022. Upon collecting and screening all received questionnaires, the final total number of questionnaires was n=203, which represents a response rate of 40.6.

Ethical Considerations

Ethics clearance was obtained from the Central Research Ethics Committee at a South African University of Technology. Permission to collect data was also obtained from each participating retail firm. The identities of respondents were not required during the survey, and respondents completed an informed consent form before participating in the study.

DATA ANALYSIS AND RESULTS

Once screened and finalised, the questionnaires were sorted into an Excel spreadsheet to perform the analysis. The Excel document was then exported to SPSS (Version 27.0) and Smart partial least squares (PLS version 3.0) platforms for data analyses. Hypotheses were tested using structural equation modelling (SEM) based on PLS.

Research Results

Sample profile

Regarding the gender distribution, male respondents (49.8%; n=166) were almost comparable to females (50.2%; n=167). A total of 11 (5.4%) of the respondents were holders of matric qualifications, while 87 (42.9%) possessed bachelor's degrees and 37 (18.2%) had completed postgraduate qualifications. I majority of respondents (n=64; 31%) had been employed for more than 10 yeIrs in the retail sector, followed by those possessing less than two years of experience (n=54; 26.6%) and groups with three to five years of experience (n=48; 23.6%), and those with six to nine years of experience being the least in number (n=37; 18.2%). The analysis also showed that 29.6 percent (n=60) of the respondents possessed at least 10 years of experience in the SCM profession, followed by the group with less than two years of SCM experience (n=56; 27.6%), and the final group possessing three to nine years of SCM (n=87; 42.9%). Most respondents (n=138; 68%) held positions such as general, warehouse, procurement, supply chain, distribution center, and inventory managers. Therefore the sample was considered to be representative since most categories in each demographic factor were included in the study and accurately represented the distribution of SCM professionals in the South African retail sector.

Exploratory factor analysis

Exploratory factor analysis (EFA) was used to assess the dimensionality of the measurement scales, based on the collected data. EFA is defined as an inter-correlation that occurs when there are many items in the questionnaire response and apportions the items into smaller groups known as factors [Hooper 2012]. Table 1 presents the EFA results, obtained through the Principal Components Technique based on Varimax Rotation. The Kaiser-Meyer Olkin (KMO ≥ 0.50) test statistic and the Bartlett Test of Sphericity ($\chi 2 = 8105.213$; $p < 0.01$) were run to determine the factorability of the data. Despite all items loading well, only three garbage items, namely SHR_1, TUR_4, and WP_4, were discarded due to low factor loadings below the recommended minimum value of 0.5 [Peterson 2000].

A five-factor structure, explaining 77% of the variance, was extracted for the inventory management practices scale. The remaining 33% of the variance is explained by other inventory management practices that were not considered. The inventory performance scale was unidimensional, attaining 63% of the variance explained. Likewise, warehouse performance was also unidimensional, explaining 69% of the variance. Factor loadings for all items were

higher than the minimum cut-off value of 0.5 and communalities were also higher than the minimum prescribed lower limit of 0.3 [Ferguson and Cox 1993]. The percentages of variances for all factor structures were higher than the 60% minimum threshold recommended by Lorenzo-Seva [2013].

Table 1. Exploratory factor analysis results

Construct code	Item codes	Communalities	Factor loadings	KMO Sampling adequacy	Bar'lett's Test of Sphericity	Eigenvalue	Percentage variance explained
ISP	SHR2	0.618	0.786	0.835	X^2=515.410 df=10 P=0.000	3.342	77.300%
	SHR3	0.609	0.780				
	SHR4	0.771	0.878				
	SHR5	0.628	0.793				
	SHR6	0.716	0.846				
INV	INV1	0.527	0.726			2.787	
	INV2	0.504	0.710				
	INV3	0.715	0.846				
	INV4	0.625	0.790				
	INV5	0.415	0.645				
ITO	TUR1	0.626	0.791			2.035	
	TUR2	0.737	0.859				
	TUR3	0.672	0.819				
ACC	ACC1	0.573	0.757			2.478	
	ACC2	0.602	0.776				
	ACC3	0.666	0.816				
	ACC4	0.637	0.798				
ABC	ABC1	0.574	0.758			3.092	
	ABC2	0.896	0.947				
	ABC3	0.898	0.947				
	ABC4	0.724	0.851				
IPER	IPER1	0.334	0.578	0.810	X^2=483.294 df=10 P=0.000	3.163	63.259
	IPER2	0.587	0.766				
	IPER3	0.772	0.879				
	IPER4	0.733	0.856				
	IPER5	0.737	0.859				
WPER	WPER1	0.688	.830	0.851	X^2=540.750 df=10 P=0.000	3.431	68.616
	WPER2	0.766	.875				
	WPER3	0.668	.817				
	WPER4	0.593	.770				
	WPER5	0.716	.846				

ISP = inventory shrinkage prevention, INV = inventory investment, ITO = inventory turn562ptimizationation, ACC = inventory control, ABC = ABC analysis, IPER = inventory performance WPER= warehouse performance

Source: Authors' own compilation.

Psychometric Properties of Measurement Scales

The psychometric properties of measurement scales were assessed to determine their accuracy in producing reliable and valid results. The results are presented in Table 2.

Scale reliability was tested using four indicators, namely Cronbach's alpha coefficient (α), composite reliability test (CR), Rho_A statistic, and item-to-total correlations. The minimum acceptable value for Cronbach's alpha, CR, and Rho_A statistic to confirm scale reliability is 0.7 [Bacon, Sauer, and Young 1995, Christmann and Van Aelst 2006]. The results indicated in Table 2 confirm that this requirement was met for the three indicators across all measurement scales, thereby confirming scale internal consistency reliability. Additionally, item-to-total correlation results were higher than the minimum prescribed value of 0.3 [Howard and Forehand 1962], which also confirms scale reliability.

Three forms of validity were ascertained in the study. Content validity was assured through a review of the questionnaire by a panel of academics who have extensive experience in SCM Research. In addition, a pilot study was conducted, involving 60 respondents to provide a preliminary assessment of the measurement scales. Feedback from the panel review of the questionnaire and the pilot study was used to adjust the questionnaire in several ways, such as reviewing its wording and length and replacing ambiguous questions with clearer statements.

Table 2. Psychometric properties analysis results

Research constructs and item codes		Factor loadings	Cronbach Alpha α Value	Item-to-total correlation	Rho A	C.R. value	AVE value
ISP	SHR_2	0.779	0.867	0.661	0.828	0.86	0.67
	SHR_3	0.767		0.648			
	SHR_4	0.887		0.790			
	SHR_5	0.803		0.661			
	SHR_6	0.843		0.746			
INV	INV_1	0.657	0.788	0.569	0.857	0.80	0.55
	INV_2	0.636		0.556			
	INV_3	0.847		0.688			
	INV_4	0.816		0.607			
	INV_5	0.723		0.469			
ITO	TUR_1	0.663	0.754	0.546	0.852	0.76	0.66
	TUR_2	0.889		0.646			
	TUR_3	0.868		0.756			
ACC	ACC_1	0.706	0.795	0.567	0.864	0.79	0.61
	ACC_2	0.748		0.592			
	ACC_3	0.858		0.644			
	ACC_4	0.817		0.622			
ABC	ABC_1	0.817	0.902	0.618	0.929	0.90	0.77
	ABC_2	0.930		0.895			
	ABC_3	0.924		0.899			
	ABC_4	0.825		0.742			
IPER	$IPER_1$	0.614	0.839	0.436	0.894	0.85	0.63
	$IPER_2$	0.745		0.637			
	$IPER_3$	0.859		0.777			
	$IPER_4$	0.864		0.726			
	$IPER_5$	0.859		0.725			
WPER	$WPER_1$	0.829	0.881	0.724	0.916	0.88	0.69
	$WPER_2$	0.881		0.794			
	$WPER_3$	0.801		0.711			
	$WPER_5$	0.777		0.648			
	$WPER_6$	0.848		0.739			

ISP = inventory shrinkage prevention, INV = inventory investment, ITO = inventory turnover optimisation, ACC = inventory control, ABC = ABC analysis, IPER = inventory performance WPER= warehouse performance

Source: Authors' own compilation.

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Three forms of validity were ascertained in the study. Content validity was assured through a review of the questionnaire by a panel of academics who have extensive experience in

SCM Research. In addition, a pilot study was conducted, involving 60 respondents to provide a preliminary assessment of the measurement scales. Feedback from the panel review of the questionnaire and the pilot study was used to adjust the questionnaire in several ways such as reviewing its wording and length and replacing ambiguous questions with clearer statements.

The study also tested for convergent validity, in this instance using two indicators, namely factor loadings and the average Average Variance Extracted (AVE). To confirm convergent validity, a minimum value of 0.5 is required for all factor loadings [Anderson and Gerbing 1988]. Moreover, a 0.4 minimum AVE score is required for each scale [Browne and Cudeck 1992]. As revealed in Table 2, these parameters were also satisfied in the current study, which confirms that scale items were converging on their corresponding latent variables. However, one item (WPER4) was discarded because it attained a factor loading of 0.345, which is below the recommended 0.5 lower limit.

The final form of validity that was tested in the study is discriminant validity. According to the Fornel Lacker Criterion, discriminant validity is said to be sufficient if the square root of the AVE for each construct is higher than its correlations with other constructs [Fornell and Larcker 1981]. The results of the discriminant validity tests are indicated in Table 3.

Table 3. Discriminant validity

Research Construct	Construction Correlation						
	ABC	ACC	INV	IPER	ISP	ITO	WPER
ABC	0.876**						
ACC	0.333**	0.784**					
INV	0.660**	0.326**	0.740**				
IPER	0.385**	0.353**	0.391**	0.794**			
ISP	0.446**	0.335**	0.506**	0.265**	0.817**		
ITO	0.209**	0.375**	0.328**	0.261**	0.193**	0.813**	
WPER	0.503**	0.348**	0.476**	0.598**	0.318**	0.329**	0.828**
** Correlation is significant at the 0.01 level (2-tailed); ISP = inventory shrinkage prevention, INV = inventory investment, ITO = inventory turnover optimisation, ACC = inventory control, ABC = ABC analysis, IPER = inventory performance WPER= warehouse performance own							

Source: Authors' own compilation.

As indicated in Table 3, all square roots of the AVE values were higher than the correlations for each construct, which confirms that there were no associations between items and constructs that were expected to be unrelated in this study.

Model Fit Assessment

In the current study, model fit was tested using the Standardised Root Mean Square Residual (SRMR) and the Normed Fit Index (NFI) as recommended by Shi, Maydeu-Olivares, and Rosseel [2019]. The results are presented in Table 4.

Table 4. Model Fit

Model Fit indices	SRMR	NFI
Acceptable threshold values	< 0.10	Between 0 and 1 (NFI value to be closer to 1)
Sources	Petrowski, Kliem, Sadler, Meuret, Ritz, and Brahler [2018]	Schuberth, Henseler, and Dijkstra [2018]
Results obtained	0.097	0.713 (0.7)
Decision	Supported	Supported
Note: SRMR = Standardised Root Mean Square Residual; NFI= Norm Fit Index.		

Source: Authors' own compilation.

The results in Table 4 indicate an SRMR value of 0.097 and an NFI score of =0.713, both of which align with the prescribed thresholds. Hence, the data used in the final analysis were able to fit the model.

Path Analysis Results

In using PLS-SEM, the actual hypothesised relationships are tested using a technique known as path analysis. Path analysis refers to an assessment of the strengths and effects of the relationship between a set of observed constructs [Lleras 2005]. The results are presented in a graphic structural model derived from the SMART PLS platform. The resultant model for the current study is presented in Figure 2.

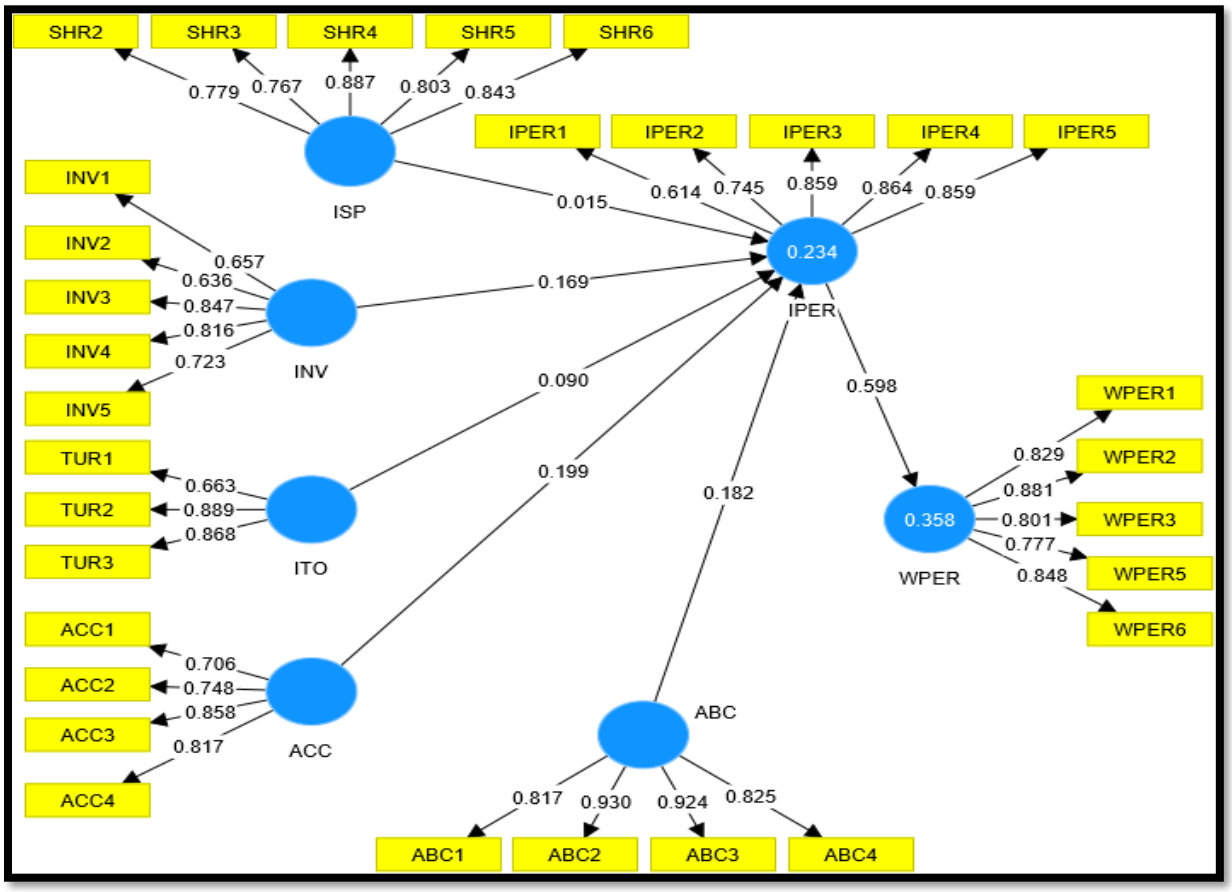

Fig.2. Structural model results. Source: Authors' own computation.

In Figure 2, each oval shape represents a research construct (latent variables), while the rectangles represent the scale items (observed variables). The scores placed in the arrows connecting the latent and observed variables are the factor loadings. The values placed between the latent variables are the path coefficients indicating the magnitude of the hypothesised relationships. The scores placed within IPER and WPER are the r^2 values. An r^2 score of 0.234 within IPER demonstrates that the five inventory management practices considered in the current study contribute to 23.4% of the variance in inventory performance. Likewise, the 0.358 r^2 score within WPER illustrates that inventory performance as measured in the present study contributes to 35.8% of warehouse performance. Overall, other factors were not included in the present study, which also contributes to the remaining variance in both inventory and warehouse performance. The results of the hypotheses tests are summarised in Table 5.

Table 5: Results of structural equation model analysis

Suggested path	Hypothesis	Path coefficients *β*	T statistics	P values	Decision
ISP → IPER	H_1	0.015	0.192	0.848	Rejected
INV → IPER	H_2	0.169	2.027	0.043	Supported
ITO→ IPER	H_3	0.090	1.414	0.158	Rejected
ACC → IPER	H_4	0.199	2.457	0.014	Supported
ABC → IPER	H_5	0.182	2.060	0.040	Supported
IPER→ WPER	H_6	0.598	12.307	0.000	Supported
Significance level <0.05; * significance level <0.01; *** significance level <0.001** ISP=inventory shrinkage prevention; INV=inventory investment; ITO=inventory turnover optimisation; ACC=inventory control; ABC=ABC analysis; IPER=inventory performance; WPER=warehouse performance					

Source: Authors' own compilation.

Table 5 shows that H2: Inventory investment and inventory performance (β=0.169), H4: Inventory control and inventory performance (β=0.199), H5: ABC and inventory performance (β=0.182) and H6: inventory performance and warehouse performance (β=0.598) were supported and accepted. However, H1: ISP (β=0.015) and H3: ITO and inventory performance (β= 0.090) exerted no influence on inventory performance. Therefore, these hypotheses were rejected.

DISCUSSION OF RESULTS

Inventory Management Practices and Performance

Three inventory management practices exerted a positive influence on inventory performance. The first of these is inventory investment (β = 0.169; t = 2.027; p = 0.043), the result of which demonstrates that it predicts inventory performance in the retail sector. This result is consistent with a study by Kardan, Vadeei, and Imeny [2019], which found that inventory investment optimises inventory performance. By implication, efficient management of the volumes of inventories held by retail firms may improve other inventory-related factors such as decreasing inventory holding, warehouse, insurance, and theft costs. Thus, by optimising inventory-related costs, investment tends to improve the overall inventory performance [Shaaban and Romero-Silva 2021].

Inventory control (β = 0.199; t = 2.457; p = 0.014) also exerted a positive influence on inventory performance. This result confirms the importance of inventory control measures as drivers of a firm's inventory performance, which is in line with previous results [Oballah et al. 2015; Cakir, Bezbradica, and Helfert 2019]. As such, ensuring that optimum levels of inventory are available when required ensures that the inventory management process is effective and efficient.

Further, the results indicate that the use of ABC analysis (β = 0.182; t = 2.060; p = 0.040) contributes to positive inventory performance. This result demonstrates the usefulness of the ABC analysis tool in inventory management processes. ABC analysis is essential in facilitating the effective categorisation of an inventory, making it easier to make decisions on the degree of importance or priority for each item of stock [Nallusamy, Balaji, and Sundar 2017]. Hence, ABC analysis may be considered a strategic inventory management tool and a critical contributor to inventory performance in the retail sector.

It is interesting to note that two inventory management constructs did not contribute to inventory performance. The first is ISP (β = 0.015; t = 0.192; p = 0.848). This result suggests that ISP is not an important contributing factor to inventory performance in the retail sector. A previous study by Shteren and Avrahami [2016] supports the view that the prevention of inventory shrinkage may not necessarily boost inventory performance. In contrast, Munyaka and Yadavalli [2022] found that efforts to prevent the loss of inventory are critical for superior inventory performance and increase the firm's competitiveness. The results of the current study could be indicative of the lack of adequate measures to counter the loss of inventory within the retail sector in South Africa. As reported in a study by Ekegbo et al. [2018], stock shrinkage is prevalent in the South African retail sector and is exacerbated by either the lack of adequate

countermeasures or misdirected procedures for minimising it. It is then conceivable that the lack of a link between ISP and inventory performance is linked to the absence of an apparatus that effectively prevents the loss of stock within the retail sector.

The second non-predictive construct was ITO ($\beta = 0.090$; $t = 1.414$; $p = 0.158$). The result implies that optimising inventory turnover may have no effect on inventory performance in the retail sector. This result contradicts a previous study by Comez-Dolgan and Tanyeri [2015], which promoted ITO as a predictor of inventory performance through its influence on the cost of goods sold to industrial consumers. The unusual result in this study could perhaps be attributed to the period in which data were collected. Data for this study were collected in 2021 at the height of the COVID-19 pandemic. This period was punctuated by several lockdown measures, imposed by the South African government, with negative economic implications for most businesses, including the retail sector. As such, ITO, which accounts for the rate at which inventory was sold and replenished, was skewed during this period for most retail sectors [Redda 2021, **Botha 2022]**. This possibly accounts for the unfamiliar results obtained in the current study.

Inventory Performance and Warehouse Performance

Inventory performance exerted a positive influence on warehouse performance ($\beta = 0.598$; $t = 12.307$; $p = 0.000$). This result demonstrates that improving the performance of inventory management processes positively impacts warehouse performance. This association emphasises the need for retail firms to optimise their inventory performance as a strategic tool for boosting their warehouse performance. As suggested by some scholars [Islam et al. 2021, Akinlabi 2021], there is a positive link between inventory and warehouse performance. Thus, sustaining warehouse operations calls for developing and investing in the right set of tools for managing inventory [Kusrini, Novendri, and Helia 2018].

CONCLUSIONS AND IMPLICATIONS

The present study tested a research model linking inventory management to warehouse performance in the retail industry in South Africa. The result showed that inventory investment, control, and the utilisation of the ABC analysis tool make a contribution. However, attempts to minimise the loss (shrinkage) of inventory and the number of times inventory is sold and replenished may not be important factors in attempts to enhance inventory performance in that sector. The study also reveals that optimum inventory performance is a determinant factor for successful warehousing.

The study provides new information on the role of inventory management in shaping warehousing performance in the South African retail sector. It identifies those inventory management practices that are essential (inventory investment, control, and the application of ABC analysis) and those that are of minor importance (ISP and ITO) in shaping inventory and warehouse performance.

Practically, the study provides supply chain professionals in the retail sector with information for managing both stock and warehouses. In doing so, attention should be directed to the three practices that exerted a positive impact on inventory performance. Additionally, warehouse performance-related problems can also be traced back to the inventory management practices in place.

To improve inventory performance, the retail sector should invest in advanced technologies such as closed-circuit televisions (CCTV) and radio frequency identification systems (RFID) to strengthen their inventory loss control systems. Automated inventory management systems could be employed to improve its function. However, external consultants who are experts in inventory and warehouse management should be employed to assist retail firms in identifying the most appropriate systems for their businesses. Continuous training of staff working with inventory and within warehouses is essential to update their knowledge and skills.

LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

The study is limited in that the results are based on the retail sector in two South African provinces, namely Gauteng and KwaZulu Natal. Future studies should also consider other regions that were excluded in the present study. The study considered only five inventory management practices that contributed 23% (r^2=.234) of the variance in inventory performance. Future studies could also include other practices and systems such as inventory accuracy, inventory location, the Six Sigma technique, Just-in-time, vendor-managed inventory, and material requirements planning (MRP) that were excluded in the current study. Additionally, the study was conducted during the COVID-19 era, which could have influenced some of the results (e.g., H3). It may be necessary then to conduct the study using a longitudinal design to obtain an accurate pertain of results. Future studies may also test for moderation using demographic factors such as company size, turnover, and number of years in existence for participating firms.

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