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Evaluating the Supply Chain Performance of the Major Clothing Retail Companies in South Africa: A Supply Chain Index Approach

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The aim of the study was to evaluate supply chain performance of the six major clothing retail companies listed on the Johannesburg Stock Exchange (JSE) using the supply chain index. The study adopted a quantitative study and used secondary data from the companies' publicly shared financial statements. Panel data analysis was employed in the study with a fixed-effects regression model used to analyse the the relationship between the dependent and independent dependent variables. The study found that WHL has the highest supply chain index ranking based on an overall ranking of the firms based on a combination of the strength, balance, and resiliency metrics. This was followed by MRP, which consistently maintained second place. TFG was at the bottom. This framework for the measurement of supply chain performance provides a valuable guide useful in the clothing retail industry and across other industries. Overall, the results encourage organisations to measure supply chain performance and share performance information with their network partners.

Keywords: *supply chain performance, supply chain index, strength metrics, balance metrics, resiliency metrics*

JEL Classification: *M30, L67*

1. Introduction

In the 1990s, firms began to recognise the importance of effective supply chains in creating competitive advantages (Higginson and Alam, 1997; Cooper, Lambert, and Pagh, 1997). As firms began to appreciate that completion is now no longer between individual irms but between supply chains, many began to focus on their supply cain performance to enhance their overall performance (Botes, Niemann and Kotzé 2017; Hove-Sibanda and Pooe, 2018). Due to competitive pressures, companies increasingly focus on improving their supply chains management strategies to succeed. Many firms find that their margins are reducing and there is increased emphasis on green supply chain performance measurement (Saleheen and Habib, 2022). In this regard, Luthra and Mangla (2018) observed the challenges firms face in ensuring sustainable supply chains in this fourth industrial revolution era. These point to the need to continuously

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improve their performance to sustain their competitiveness in the long term. Pinto (2020) points out that firms are under pressure to cut costs in all areas and focus on SCM and that an effective supply chain helps lower costs and enables a company to compete more efficiently based on price. The clothing retail industry is no exception. In fact, t he clothing retail supply chains are complex in that the product lifecycles are relatively very short and fast-paced (Liu, Ren, Choi, Hui and Ng, 2013; Martínez, Errasti, Rudberg and Mediavilla, 2014). The industry is constantly planning for the next season and getting new styles into production and market (Čiarnienė and Vienažindienė, 2014). The clothing industry in South Africa is a diverse and mature cyclical industry that plays a crucial role as an employer in the region (Smal, 2016). The clothing retailers struggle with low margins and a need to turn cycles quickly.

For companies to have an efficient supply chain, they need to achieve both cost leadership and service leadership. If a company only measures internal performance measurements, such as order handling, time, and yield in production, the measurements cannot be used to evaluate the company's efficiency. Many managerial problems occur in supplier management, product forecasting, inventory management, timely distribution, and customer satisfaction (Gibson and LaBruno, 2018). SCM is concerned with reducing inefficiencies and solving the problems throughout the supply chain, from supplier to final customers. Many industries have identified and researched supply chain management, including logistics, food retailers, and clothing retailers. According to Molefe, Tauoatsoala, Sifolo, Manavhela, and Henama (2018), the nature and significance of SCM research have evolved with the increase in complexity and dynamism in the business world and globally dispersed supply chains. In its basic form, SCM relates to the control and management of activities relating to a product or service, from the procurement of raw materials to the final delivery of the product to the consumer. It has been largely acknowledged that effective SCM practices can enhance organisational competitiveness through process optimization (Bimha, Hoque and Munapo, 2020).

According to Koprulu and Albayrakoglu (2007) in order to build the most effective supply chains, performance measurements, which provide an approach to identify the success and potential of supply management strategies, need to be understood. Hausman (2004) defines supply chain performance as "the extended supply chain's activities in meeting end-customer requirements, including product availability, on-time delivery, and all the necessary inventory and capacity in the supply chain to deliver that performance in a responsive manner". In their study, Mouhsene, Faycal, Kaoutar, Charif and El Alami (2019) identified 26 different types of models related to supply chain performance evaluation applied in different areas. One of the widely used SC evaluation models is supply chain operation reference (SCOR), which was created by the Supply Chain Council to provide self-assessment method and monitoring and knowing where an organisation is relative to competitors (Putri, Huda and Sinulingga, 2019). The SCOR's strength is "its ability to integrate business processes, benchmarks and analysis of best practices into the supply chain framework in various dimensions" (Putri et al., 2019). Sellitto, Pereira, Borchardt, Da Silva and Viegas (2015) note that SCOR model provides only an overview of the status of goal achievement. From their study, Reddy, Neelakanteswara Rao and Krishnanand (2019) concluded that there is a dearth of research into supply chain performance management systems. There remains a lack of empirical studies and case studies on supply chain performance measurement (Dos Santos and Leite, 2018). Stefanovic (2014) observed that most supply chain performance systems are static and unable to deliver effective and efficient information to decision makers. Yet, Hausman (2004) posits that supply chains need continuous improvement.

Despite extensive SCM research, limited supply chain performance measurement information is available. Since measuring performance is considered essential to stay competitive, many models and approaches have been developed, but relatively few have been designed from a supply chain perspective. Even though some models exist, there is still room for new approaches to complement existing theories in this field of research. In addition, there is a general scantness in the literature relating to the link between corporate strategy and supply chain measurement. According to Foroudi (2020), the corporate strategy refers to the organisational blueprint that circumscribes products, market characteristics, and the overall objectives and policies to ensure survival and continuity. This study evaluates the supply chain's performance measurements and identifies how efficiency can be measured. It developed an index for evaluating supply chain performance to facilitate organisational efforts when measuring supply chain performance. The index helps firms improve continuously by selecting and categorising new performance measures and evaluating existing performance measures.

2. Literature Review

The concept of retail encompasses many industries and covers a wide range of products and services. Retailing means selling merchandise in small quantities, while wholesaling means selling in bulk quantities (Vaja, 2015). Wholesale and retail are two distribution channels that constitute a significant part of the supply chain. Goods are manufactured and sold in large quantities (wholesale) to the wholesalers who sell them to the retailers who finally sell them to the customers (Shruti, 2018). Thus, retailing is the final stage along the distribution channel before a product or service can reach end-user customers, bridging the gap between manufacturer and customer (Shruti, 2018). The retail part of the supply chain forms an essential part of the supply chain (Pantano, 2014). McColl and More (2013) found that retailers perform their value-adding activities by offering assortments of products, holding inventory, and assisting customers in selecting and buying products. Generally, retailing is classified according to a number of characteristics, although ownership, merchandise and price have emerged as the most prominent types of classification (Hameli, 2018). Franchisees are several retailers authorized by a manufacturer who stipulate the terms and conditions for franchisees to adhere to and collect a profit from selling store patents/concepts (Baron, 2018).

2.1 Supply Chains

According to Chopra and Meindl (2016), a supply chain consists of all parties directly or indirectly, involved in fulfilling a customer request. SCM is the integration of key business processes from end-user to original suppliers to provide goods, facilities, and knowledge that add value to consumers and other stakeholders (Sadraoui and Nejib Mchirgui, 2014). In a broader definition, Ross (2011) defines SCM as "a strategic channel management philosophy composed of the continuous regeneration of networks of businesses integrated through information technologies and empowered to execute superlative, customer-winning value at the lowest cost through the digital, real-time synchronisation of products and services, vital marketplace information, and logistics delivery capabilities with demand priorities." A company's supply chain now plays an integral part in those three decisive factors and therefore represents an essential strategic resource in achieving the strategic goals (Melkonyan, Krumme, Gruchmann, Spinler, Schumacher and Bleischwitz, 2019; Feyissa, Sharma and Lai, 2018). An increasing need, and competitive advantage follows, to customise supply chains individually (concerning different customers, countries, and products) and implement multiple supply chain strategies and solutions (Li, 2014). A supply chain manager's strategic challenge is to configure and develop all the multi-layered fields of a supply chain holistically, aiming as a whole a strong alignment with the competitive and corporate strategy. The supply chain strategy is the bridge between corporate and competitive strategy to supply chain types (Werbach, 2009). The supply chain strategy determines the goals and the configuration of the supply chain concerning supply chain partners, structures, processes, and systems. The clothing supply chain connects 'a broad network of clothing designers, fabric and finished apparel producers, transportation providers, wholesalers and direct-to-consumer retailers' (Purolator International, 2021).

2.2 Supply Chain Performance

Mouhsene et al. (2019) define supply chain performance as "the process by which the company manages its supply chain in line with functional strategies and objectives." The most objective method for evaluation is measurement, which quantitatively reflects performance. It has beenestablished that measurement of performance is necessary to the necessary actions to be taken based on data that reflects company performance and its external impact on sustainability (Armstrong and Baron, 2004; Nicolăescu, Alpopi and Zaharia, 2014). Collected information about past and current performance should be communicated to relevant parties and used. Company and overall supply chain performance should be analysed and improved. In this regard, Halachmi (2005) stated that performance measurement is the only way to manage performance. The measures collected by the organisation should be reviewed regularly by company staff and if necessary, shared with business partners and other stakeholders (Sadikoglu and Olcay, 2014). This should improve overall supply chain performance by improving individual companies' performance and processes or reducing the adverse effects on sustainability at all levels.

The method for qualifying the efficacy of the operation is known as performance assessment. A performance indicator is a statistic used to calculate an operation's efficacy. Tests of SC success should be related to these techniques. (Holmberg 2000; Lambert and Pohlen 2001; Morgan 2004) According to Chan (2003), performance measurement contributes much more to business management and performance improvement in the industry. Performance assessment provides decision-makers with the necessary data for management input. Performance assessment is a method for determining the effectiveness and potential of management techniques and promoting comprehension of the situation. It aids in focusing on management, re-engineering corporate procedures, and revising group priorities. SC Performance Measurement is a method that establishes a systematic specification of the SC performance model based on mutually agreed-upon expectations, metrics, and measurement methods that define processes, roles, and responsibilities of SC participants, as well as SC participants' control of the measurement system (Khan and Yu, 2018). Many businesses use strategic performance measurement systems to gather data that helps them recognise the best methods to achieve their goals and align management processes. The techniques used to achieve strategic goals include goal setting, decision-making, and performance assessment. Performance is expected to suffer when a strategic performance assessment scheme focuses on a measurement practice than its policy and value factors (McKenny et al., 2018).

The measurement focus shifts as organisations evolve. SCPMS have shifted from traditional transaction-focused measurement systems to process-focused measurement systems. There has also been a shiftfrom ‘process only' to ‘process and process interface' systems, followed by a shiftfrom monoculture to polyculture measurement systems, and finally from measurement proliferation to measurement simplification (Morgan, 2007). Some of the significant characteristics of the Performance Measurement System of the near future that are likely to yield competitive advantage are as follows: (i) distinguishing attributes in extended supply networks; (ii) lean supply chain; (iii) agile supply chain; and (iv) responding to a volatile demand-led environment that may include leagible supply chain elements.

2.3 Supply Chain Index

The Supply Chain Index is a methodology using supply chain financial ratios as opposed to absolute numbers, to evaluate supply chain improvement for a time period for companies within a peer group (Cecere and Mayer, 2014). The ratios allows for the tracking of progress over time. The Supply Chain Index methodology assumes that supply chain progress takes time. The methodology is also based on the belief that the supply chain is a complex system with increasing complexity. It is the role of the supply chain leader to build and manage supply chains that can drive year-on-year performance improvements that are balanced, strong and resilient (Cecere and Mayer, 2014). The Index is built using the metrics of year-on-year growth, return on invested capital (ROIC), operating margin and inventory turns. It enables companies to better understand the relationship between supply chain and financial (market capitalization) performance and to define what metrics correlate strongly with market capitalisation growth (Kase, 2014).

The index compares financial supply chain metrics performance with stock market performance (market capitalization) to identify top performers (Kase, 2014). The Index assumes that the three components of balance, strength and resiliency provide an effective tool to measure supply chain performance and improvement over a set time period and should be equally valued. The strength measure in the Supply Chain Index is a mathematical calculation of the vector trajectory of the pattern between inventory turns and operating margin for a given period. The balance measure in the Index is a mathematical calculation of the vector trajectory of the pattern between growth and ROIC for a given period. Companies that were able to drive improvement in both metrics score the best while companies that deteriorated in both metrics did the worst. Cecere and Mayer (2014) define resiliency as “the tightness of the pattern at the intersection of inventory turns and operating margin”. The pattern's tightness indicates a supply chain's ability to maintain a tight consistent pattern across these two metrics as the business environment shifts and changes over a given period (Cecere, 2018).

3. Research Methodology

The study focused on the six (6) major clothing retail companies listed on the Johannesburg Stock Exchange (JSE). The companies are H&M, Zara, Truworths, The Foschini Group, Woolworths, and Mr Price. The published annual reports for the companies were used as a source for the secondary data. Panel data was

used for analysis. Panel data can be defined as the pooling of observations on a cross-section of firms, countries, etc. over several time periods (Baltagi, 2005). A data panel or "pooling" data is usually used to compensate for a lack of time-series depth available in data where it can increase degrees of freedom and potentially lower standard errors of the coefficients of a regression. (De Jager, 2008). Panel data is structured to measure different variables for entities (individuals) over a certain time period. Structuring data in panels allows more complicated datasets to be tested and analyzed (Brooks, 2014). Data for the 11-year period from 2010 to 2020 were collected from the six companies, resulting in panel data of 168 observations for all the companies.

4. Analysis and Results

The Supply Chain Index relies on three ratios, which are described below.

Strength:

A scatter plot of operating margin and inventory turns for a specific company is considered. Where OMi denotes the operating margin of the ith time period (e.g., ith year), ITi denotes the inventory turns of the ith time period and n denotes the total number of periods under consideration. The strength measure (S) is defined as $\boldsymbol{S = 1/(n-1) * [(OMn - OM1)/OM1 + (ITn - IT1)/IT1].}$

Balance:

The institute considers a scatter plot of revenue growth and return on invested capital for a specific company. The balance measure (B) is defined similar to the strength measure but at the intersection of revenue growth and return on invested capital. Let $REV\ i$ denote the revenue growth of the ith time period, $ROICi$ denote the return on invested capital of the ith time period, and n denote the total number of periods under consideration. Thus, balance is defined as $\boldsymbol{B = 1/(n-1) * [(REVn - REV1)/REV1 + (ROICn - ROIC1)/ROIC1].}$

Resiliency:

The resiliency measure (R) is defined as the mean distance of all possible pairs of points at the intersection. That is, $\boldsymbol{R = 1/m * \sum\sum dij.}$ Consider a scatter plot of operating margin and inventory turns for a specific company. Let dij denote the Euclidean distance between a pair of points i and j, and let m denote the total number of pairs. Using a regression analysis model, one way of ensuring reliable and consistent results is to perform a multicollinearity test.

4.1 Correlation Analysis

Correlation analysis measures the linear relationship between two quantitative variables (Pallant, 2010). The correlation coefficient denoted by *r* is a measure of the strength of association between two variables. The correlation coefficient ranges between -1 and +1 where -1 where -1 represent perfect negative correlation and +1 represents positive respectively while 0 indicates no correlation (Pallant, 2010). The results of the correlation analysis are interpreted using the guidelines of Pallant (2010) where weak correlation (0.10 to 0.29), moderate (0.30 to 0.49) and strong (0.50 to 1.0). Table 1 shows the correlation results.

Table 1: Pairwise Correlation Coefficients

E (V)	Inventory turnover	Revenue	Operating margins	ROIC	cons
Inventory turnover	1.000				
Revenue	0.413	1.000			
Operating margins	0.305	0.349	1.0000		
ROIC	-0.420	-0.327	-0.445	1.000	
cons	-0.720	-0.504	-0.590	0.015	1.000

Source: own research

Table 1 reveals that none of the variables have very high correlation coefficients since collinearity becomes a concern when r is greater than 0.8, suggesting that the variables in question are not independent (Lane, 2015). The coefficient of determination as given by R-squared is very low at 0.1456 and similar to the R-squared value from the random effects model as calculated in Table 1.

Multicollinearity occurs when two predictor (independent) variables are strongly correlated (Field, 2009, p.223). Accordingly, there is no evidence of multicollinearity.

4.2 Model Specification

Model specification is a process of inspecting and modelling data to learn useful information and inform conclusions (Zeadally and Exposito, 2016). This is a longitudinal study where data is gathered for the same subjects repeatedly over some time. Two estimation approaches will be used to analyze the data. Using patent counts as the dependent variable, a negative binomial fixed effects panel regression model (Cameron and Trivedi, 1998) was employed. The general form for the negative binomial fixed effects model estimated is

log lft =¼ mt+ xft + ai

where lft is the expected value of yft, i.e., the dependent variable patent count for firm f at time t, mt is time intercepts, xft is the vector of time-varying predictor variables that are a firm's supply chain performance, supply chain stability, R&D intensity, firm size, asset growth, ROA, industry growth and industry competitiveness and ai is the unobserved fixed effects. To analyze the data for overall originality and generality as dependent variables, a fixed-effects regression model was used. Fixed effects models allow one to estimate only within firm variation over time and control for time-invariant characteristics of the firm. Table 2 reports the results of the fixed effects model.

Table 2: The Fixed Effects Model Results

Fixed effects (within) regression				Number of obs =	168	
Group variable: Companyid				Number of groups =	6	
R-squared:				Obs. Per group:		
Within = 0.1456				min =	28	
Between = 0.6829				avg =	28	
Overall = 0.4907				max =	28	
				F (4, 158) =	6.73	
Corr (u_i, Xb) = 0.3889				Prob > F =	0.0001	
Share price	**Coef.**	**Std. Error**	**t**	**P>|t|**	**[95% Conf. Interval]**	
Inventory turnover	-10.271	4.020	-2.55	0.012	-18.211	-2.330
ROIC	97.052	40.582	2.39	0.018	16.900	177.206
Revenue	.001	.000	2.72	0.007	.000	.001
Operating margins	111.782	64.487	1.73	0.085	-15.585	239.150
cons	81.782	26.700	3.06	0.003	29.056	134.509
sigma_u	43.956921					
sigma_e	43.935252					
rho	.50024653 (fraction of variance due to u_i)					
F test that all u_i=0: F (5, 158) = 21.78					Prob > F = 0.0000	

Source: own research

Using Stata to analyse the data, the fixed effects panel regression model reveals that firm share price has a positive relationship with ROIC, revenue, and operating margins, but a negative relationship with inventory turns. The coefficients, like those in the random effects model, are significant at the 5% level of significance, as evidenced by the p-values for all of the coefficients in Table 5. However, this is not true for operating margins since p-values are greater than 0.05. The coefficient of determination as given by R-squared is very low at 0.1456 and similar to the R-squared value from the random effects model as calculated in Table 3.

Table 3: The Random Effects Model Results

Random effects GLS regression				Number of obs	=	168
Group variable: Companyid				Number of groups	=	6
R-squared:				Obs. Per group:		
Within = 0.1455				min	=	28
Between = 0.6883				avg	=	28
Overall = 0.4945				max	=	28
				Wald chi 2 (4)	=	29.80
Corr (u_i, Xb) = 0 (assumed)				Prob > chi 2	=	0.0000
Price	**Coef.**	**Std. Error**	**z**	**P>|t|**	**[95% Conf. Interval]**	
Inventory turnover	-10.144	3.902	-2.60	0.009	-17.791	-2.497
ROIC	99.910	39.809	2.51	0.012	21.887	177.934
Revenue	.001	.000	2.99	0.003	.000	.001
Operating margins	111.650	63.526	1.76	0.079	-12.858	236.158
cons	79.323	42.046	1.89	0.059	-3.085	161.731
sigma_u	82.33863					
sigma_e	43.935252					
rho	.77837933 (fraction of variance due to u_i)					

Source: own research

4.3 Hausman's Test

Additionally, a Hausman's test indicated that the fixed effects model was preferable. The general form of the model used for analysis is

yft =¼ mt+ bxft + ai + eft

where yft is the dependent variable (originality or generality) for firm f at time t, mt is time intercepts, xft is the vector of time-varying predictor variables, ai is the unobserved fixed effects, and eft is a random disturbance term. The Hausman specification test is a test for endogeneity of predictor variables in regression model and is menat to test the null hypothesis; that there is no correlation between the unit of observation and the regressor. (Wooldridge, 2002, p287).

The Hausman specification test helps to determine whether a fixed or random effects model is the best estimator for the regression model (Glen, 2017). The random effects becomes the preferred estimation model when the null hypothesis is accepted as it yields consistent and efficient results. On the other hand, the fixed effects model becomes the best estimator for the regression model where the null hypothesis is rejected. Table 4 reports on the results of the Hausman's specification model.

Table 4: Hausman Specification Test Output

	Coefficients			
	(b) Fixed	(B) Random	(b-B) Difference	Sqrt (diag) S.E
Inventory turnover	-10.271	-10.144	-0.127	0.969
ROIC	97.052	99.91	-2.858	7.886
Revenue	0.001	0.001	0	0
Operating margins	111.782	111.65	0.1321	11.091
b = consistent under Ho and Ha; obtained from xtreg B = inconsistent under Ha, efficient under Ho; obtained from xtreg Test: Ho: difference in coefficients not systematic Chi2 (3) = (b-B)' [(V_b-V_B) ^(-1)] (b-B) = 0.16 Prob>chi2 = 0.9844				

Source: own research

Fixed effects and random effects panel regression models were used to model the panel data.

The coefficients were then put through the Hausman test to see if the coefficients from both approaches were consistent or if there was a systematic difference between them. The test assumes that there is no systematic difference between the coefficients. The test yielded a p-value of 0.9844, which falls within the acceptable range at the 5% level of significance.

Consequently, the null hypothesis is accepted and that the two models yielded coefficients with non-systematic differences. Therefore, the random effects model is utilised in the study since the fixed effects model's coefficients are not statistically different from the random effects model's coefficients.

4.4 The Supply Chain Index

The Supply Chain Index has evolved to become the modern-day benchmark, designed to be employed as a ranking system that helps companies better understand the relationship between supply chain and performance. This index also shows how various metrics will correlate strongly with market growth and performance.

This index is built on three metrics: balance, strength, and resiliency. These are benchmarked on the year-over-year increase, return on invested capital (ROIC), operating margin, and inventory turns. The supply chain index assumes that balance, strength, and resiliency must be equal in value. Generally, the balance metric tracks the changes in growth rate and return on invested capital, while strength and resiliency focus on progress achieved in profitability and inventory turns. The general belief among supply chain practitioners has been that these three metrics are effective when evaluating supply chain performance and improvement over time.

Strength

The strength metric is a critical component in calculating the Supply Chain Index. A high score in the strength metric indicates the organisation of an improvement in both inventory turns and operating margin. For most supply chain practitioners, this is a critical measure of both strategy and performance, which directly influences supply chain decisions and the overall organisational direction.

In this study, the strength measure is a mathematical calculation of the vector trajectory of the pattern between inventory turns and operating margins for the period of 2010 to 2020. The results of the sample analysis on the strength metric are presented in Table 5.

The results presented below indicate that the companies under study performed well in terms of the strength metric as all managed to score a positive figure on the metric. Based on the arithmetic mean of the quarterly scores, MRP took poll position with an average of 3.19, followed by WHL, which scored an average of 3.33.

This is based on an overall trajectory from Year 2010 to 2020 and a strong SC and is reflected in a high strength score.

Table 5: Strength Metric Calculation

$S = 1/(n-1) * [(OMn - OM1)/OM1 + (ITn - IT1)/IT1]$.	S1 2020	S2 2019	S1 2019	S2 2018	S1 2018	S2 2017	S1 2017	S2 2016	S1 2016	S2 2015	S1 2015	S2 2014	S1 2014	S2 2013	S1 2013	S2 2012	S1 2012	S2 2011	S1 2011	S2 2010	S1 2010
H&M	-0.33	0.08	-0.03	0.01	-0.05	-0.05	-0.03	0.00	-0.04	-0.03	0.00	0.00	0.02	0.01	0.01	-0.03	0.03	-0.02	0.00	-0.03	0.00
ZARA	0.06	-0.02	0.06	-0.05	0.05	-0.05	0.06	-0.06	0.07	-0.07	0.10	-0.07	0.06	-0.07	0.08	-0.06	0.11	-0.08	0.10	-0.07	0.23
TRU	0.45	-0.14	0.11	-0.07	0.07	-0.03	0.05	-0.02	-0.03	-0.05	0.03	-0.05	0.02	-0.05	0.01	-0.01	-0.02	0.02	0.01	0.01	0.02
TFG	0.05	-0.03	0.02	-0.02	0.06	-0.06	0.04	-0.05	0.02	-0.10	0.22	-0.12	0.03	-0.05	0.06	-0.02	0.01	0.00	0.04	0.00	0.05
WHL	0.03	0.00	-0.28	-0.42	0.53	-0.04	0.00	-0.02	0.00	-0.02	0.01	-0.02	0.02	-0.02	0.03	-0.02	0.02	0.00	0.11	-0.06	0.13
MRP	0.03	-0.01	0.00	-0.02	0.03	-0.01	0.03	-0.06	0.04	-0.04	0.05	-0.04	0.05	-0.02	0.04	-0.02	0.04	-0.02	0.07	0.00	0.12

Source: own research

Table 6: Rankings on the Strength Metric

Ranking		AVE	S1 2020	S2 2019	S1 2019	S2 2018	S1 2018	S2 2017	S1 2017	S2 2016	S1 2016	S2 2015	S1 2015	S2 2014	S1 2014	S2 2013	S1 2013	S2 2012	S1 2012	S2 2011	S1 2011	S2 2010	S1 2010
H&M	6	4,05	6,00	1,00	5,00	1,00	6,00	4,00	6,00	1,00	6,00	2,00	6,00	1,00	6,00	1,00	5,00	5,00	3,00	4,00	6,00	4,00	6,00
ZARA	3	3,38	2,00	4,00	2,00	4,00	4,00	5,00	1,00	6,00	1,00	5,00	2,00	5,00	1,00	6,00	1,00	6,00	1,00	6,00	2,00	6,00	1,00
TRU	3	3,38	1,00	6,00	1,00	5,00	2,00	2,00	2,00	2,00	5,00	4,00	4,00	4,00	4,00	4,00	6,00	1,00	6,00	1,00	5,00	1,00	5,00
TFG	5	3,67	3,00	5,00	3,00	3,00	3,00	6,00	3,00	4,00	3,00	6,00	1,00	6,00	3,00	5,00	2,00	3,00	5,00	2,00	4,00	3,00	4,00
WHL	2	3,33	4,00	2,00	6,00	6,00	1,00	3,00	5,00	3,00	4,00	1,00	5,00	2,00	5,00	2,00	4,00	2,00	4,00	3,00	1,00	5,00	2,00
MRP	1	3,19	5,00	3,00	4,00	2,00	5,00	1,00	4,00	5,00	2,00	3,00	3,00	3,00	2,00	3,00	3,00	4,00	2,00	5,00	3,00	2,00	3,00

Source: own research

Balance

The current study also sought to evaluate the balance metric of the SC index, a metric that tracks the extent of increase in the growth rate and the return on invested capital. This metric is important because the majority of firms today rely on SC networks that were designed under stable business environment conditions with the assumption that the future will be similar to the past. However, modern-day businesses are confronted by significantly uncertain circumstances, rendering conventional SC structures and practices less useful (Christopher and Holweg, 2017). This is how balance becomes a significant metric in developing the SC index. The results of the evaluation of SC using the balance metric for this study are presented in Tables 7 and 8.

Table 7: Balance Metric Calculation

$B = 1/(n-1) * [(REVn - REV1)/REV1 + (ROICn - ROIC1)/ROIC1]$.	S1 2020	S2 2019	S1 2019	S2 2018	S1 2018	S2 2017	S1 2017	S2 2016	S1 2016	S2 2015	S1 2015	S2 2014	S1 2014	S2 2013	S1 2013	S2 2012	S1 2012	S2 2011	S1 2011	S2 2010	S1 2010
H&M	-1.04	0.17	0.03	-0.11	-0.13	-0.28	0.10	-0.08	-0.04	-0.16	0.31	-0.04	0.36	-0.01	0.16	-0.17	0.36	-0.13	0.00	-0.11	0.32
ZARA	0.11	-0.12	0.04	-0.03	0.02	0.06	0.10	0.04	0.08	0.09	0.14	-0.07	0.06	-0.08	0.15	0.09	0.11	-0.03	0.19	0.14	0.19
TRU	0.08	-0.23	0.28	-0.35	0.26	-0.24	0.02	-0.04	0.45	-0.24	0.23	-0.22	0.25	-0.23	0.35	-0.16	0.31	-0.14	0.35	-0.19	0.30
TFG	0.22	-0.33	0.34	-0.11	0.49	-0.03	-0.06	-0.02	-0.22	0.22	0.18	-0.22	0.25	-0.02	0.21	-0.04	0.13	0.08	0.27	0.09	-0.26
WHL	-0.29	-2.41	-2.58	-0.77	3.92	0.03	-0.21	0.17	-0.19	-0.07	0.17	-0.34	0.07	0.10	0.26	-0.02	0.38	0.03	0.22	0.34	0.65
MRP	0.10	-0.33	0.01	-0.04	0.09	0.05	-0.11	-0.19	0.13	0.01	0.10	0.04	0.14	0.06	0.12	0.13	0.10	0.09	0.12	0.17	0.34

Table 8: Rankings on the Balance Metric

Ranking		***AVE***	***S1 2020***	***S2 2019***	***S1 2019***	***S2 2018***	***S1 2018***	***S2 2017***	***S1 2017***	***S2 2016***	***S1 2016***	***S2 2015***	***S1 2015***	***S2 2014***	***S1 2014***	***S2 2013***	***S1 2013***	***S2 2012***	***S1 2012***	***S2 2011***	***S1 2011***	***S2 2010***	***S1 2010***
H&M	6	3,80	6,00	1,00	4,00	3,00	6,00	6,00	1,00	5,00	4,00	5,00	1,00	2,00	1,00	3,00	4,00	6,00	2,00	5,00	6,00	5,00	3,00
ZARA	2	3,25	2,00	2,00	3,00	1,00	5,00	1,00	2,00	2,00	3,00	2,00	5,00	3,00	6,00	5,00	5,00	2,00	5,00	4,00	4,00	3,00	5,00
TRU	5	3,70	4,00	3,00	2,00	5,00	3,00	5,00	3,00	4,00	1,00	6,00	2,00	5,00	3,00	6,00	1,00	5,00	3,00	6,00	1,00	6,00	4,00
TFG	1	3,15	1,00	5,00	1,00	4,00	2,00	4,00	4,00	3,00	6,00	1,00	3,00	4,00	2,00	4,00	3,00	4,00	4,00	2,00	2,00	4,00	6,00
WHL	4	3,60	5,00	6,00	6,00	6,00	1,00	3,00	6,00	1,00	5,00	4,00	4,00	6,00	5,00	1,00	2,00	3,00	1,00	3,00	3,00	1,00	1,00
MRP	3	3,50	3,00	4,00	5,00	2,00	4,00	2,00	5,00	6,00	2,00	3,00	6,00	1,00	4,00	2,00	6,00	1,00	6,00	1,00	5,00	2,00	2,00

Source: own research

When computing the balance metric score, a negative score translates to loss in ground in SC in comparison to the starting year. The results presented in Table 11 indicate that all the companies posted positive scores. TFG pole position in relation to the balance metric with an average of 3.15 followed by ZARA with 3.25. The increased performance by companies like TFG could be attributed to their purchase of strategic business units like Jet, which services a wider range of the South African population.

Resiliency

According to Ponomarov and Holcomb (2009), resiliency in SCs relates to the organisation's adaptive capability in the face of unexpected events, disruptions, and the capacity to keep operations ongoing at acceptable levels over time. Other scholas have viewed resilience as the capacity to proactively react to disruptions, survive, adapt, and grow in the face of change and uncertainty (Fakoor et al., 2013). The results obtained in relation to the resiliency metric are presented in Table 9 below, with resilience ranking in Table 10.

Table 9: Resiliency Metric Calculation

Square root [(OMn −ITn)^2+(OMn-1 −ITn-1)^2]	***S1 2020***	***S2 2019***	***S1 2019***	***S2 2018***	***S1 2018***	***S2 2017***	***S1 2017***	***S2 2016***	***S1 2016***	***S2 2015***	***S1 2015***	***S2 2014***	***S1 2014***	***S2 2013***	***S1 2013***	***S2 2012***	***S1 2012***	***S2 2011***	***S1 2011***	***S2 2010***	***S1 2010***
H&M	3.82	3.89	3.80	3.79	3.79	4.05	4.19	4.57	4.87	5.13	5.08	5.14	5.03	5.05	5.10	5.26	5.31	5.40	5.53	5.37	5.66
ZARA	6.31	5.71	5.62	5.65	5.54	5.53	5.51	5.60	5.57	5.49	5.48	5.41	5.71	5.92	5.78	5.80	5.84	5.94	5.89	5.92	5.90
TRU	5.72	5.74	5.70	5.77	5.60	5.20	5.62	5.40	5.95	7.18	7.44	7.62	7.76	7.88	8.25	8.27	8.69	8.83	8.73	8.63	8.47
TFG	2.82	2.89	2.91	2.92	2.92	2.94	3.15	3.25	3.41	3.49	3.63	3.76	3.76	3.90	4.40	4.69	4.91	4.97	4.87	4.76	4.67
WHL	7.53	7.40	7.76	7.75	7.42	7.65	7.78	7.97	8.90	9.47	9.83	10.81	11.41	11.48	11.85	12.22	12.50	12.79	12.69	12.68	12.81
MRP	6.71	6.90	7.05	7.29	7.33	7.31	7.60	7.91	8.11	8.61	8.84	9.05	9.34	9.13	9.08	9.09	9.24	9.33	9.08	8.62	8.08

Source: own research

Table 10: Rankings on the Resiliency Metric

Ranking		**AVE**	**S1 2020**	**S2 2019**	**S1 2019**	**S2 2018**	**S1 2018**	**S2 2017**	**S1 2017**	**S2 2016**	**S1 2016**	**S2 2015**	**S1 2015**	**S2 2014**	**S1 2014**	**S2 2013**	**S1 2013**	**S2 2012**	**S1 2012**	**S2 2011**	**S1 2011**	**S2 2010**	**S1 2010**
H&M	5	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00
ZARA	4	3,85	3,00	4,00	4,00	4,00	4,00	3,00	4,00	3,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
TRU	3	3,10	4,00	3,00	3,00	3,00	3,00	4,00	3,00	4,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	2,00	2,00
TFG	6	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00
WHL	1	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
MRP	2	2,05	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	3,00	3,00

Source: own research

Generally, a resilient SC is able to cope with unwanted disturbances, disruptions, and disasters (Sahu, Datta and Mahapatra, 2017). In modern day business environment, this has become one of the critical factors for organisational success. The results presented in Table 8 and Table 9 indicate that WHL showed significantly high levels of resiliency and had an average score over a ten-year period of 1.00. MRP, followed with an average of 2.05. TFG occupied the bottom position with an average of 6.00. It is interesting to note is that MRP maintained consistency in performance.

Overall ranking

According to Sahu, Datta, and Mahapatra (2017), globalisation, has placed businesses under immense pressure to pay particular attention to SC aspects, such as customer expectations, product quality, quick delivery, and best services. The results of the overall ranking of the SC index metrics are presented in Table 11.

Table 11: Overall Rankings

Ranking		***AVE***	***S1 2020***	***S2 2019***	***S1 2019***	***S2 2018***	***S1 2018***	***S2 2017***	***S1 2017***	***S2 2016***	***S1 2016***	***S2 2015***	***S1 2015***	***S2 2014***	***S1 2014***	***S2 2013***	***S1 2013***	***S2 2012***	***S1 2012***	***S2 2011***	***S1 2011***	***S2 2010***	***S1 2010***
H&M	5	5,05	6,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00
ZARA	4	3,67	3,00	2,00	3,00	3,00	4,00	3,00	4,00	3,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
TRU	3	3,10	4,00	3,00	2,00	4,00	3,00	4,00	3,00	4,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00	2,00
TFG	6	5,95	5,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00
WHL	1	1,33	1,00	4,00	4,00	2,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
MRP	2	1,90	2,00	1,00	1,00	1,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	3,00

Source: own research

An overall ranking of the firms based on a combination of the strength, balance, and resiliency metrics indicate that WHL has the highest ranking in terms of the supply chain index. This was followed by MRP, which consistently maintained second position, and at the bottom was TFG.

5. Discussion and Conclusion

This study sought to rank companies' performance through the supply chain index in the current study. The index assumes that its three components—balance, strength, and resiliency—are all equally important. Balance measures the rate of improvement in growth and return on invested capital, whereas strength and resiliency are determined by profitability and inventory turns. The study showed that when these three factors are combined, they provide an effective tool for measuring supply chain performance and improvement over time. These results corroborate with the findings of Datta and Diffee (2020), who studied the industry framework to index green supply chains From the literature review and the analysis of data, it can be noted that most managerial problems are common in supplier management, product forecasting, inventory management, timely distribution, and customer satisfaction domains. SCM becomes the centre for managing inefficiencies and solving the problems throughout the supply chain, from suppliers to final customers. As such, companies must develop the right strategies to ensue strength, balance, and resilience in the supply chain to achieve long-term growth and competitiveness. The study also provided some form of framework for managing supply chain in the retail industry in South Africa. Supply chain has remained a rather complex notion as it involves more than finding the materials needed at a reasonable price. They are highly related to the company strategy and competitive advantage. The study's objective is to focus on the retail clothing business—the new competitive landscape forces organisations to identify new opportunities to gain a competitive advantage. Apparel companies should be beginning to find more fashionable items in response to diversified consumer demands as the industry becomes global. These market changes require more product variety for the retail clothing business, generating demand uncertainty and supplier.

The analysis of the data collected in this study, gave birth to a supply chain index for the retail clothing business in South Africa. According to the resultant index, the most efficient supply chain is ranked number one and the worst-performing number six. Over the past five years, growth has slowed for The Foschini Group's general clothing and merchandise and its supply chain has been out of balance, with lack of focus on inventory turns. This has negatively impacted carrying costs compared to others in the peer group. Mr Price has consistently ranked number one or two for the past few years but struggled to maintain this rating in 2015 and 2019. Seemingly, this resulted from procurement issues which have since been resolved. Truworths like H&M has been out of balance for the last few years. This can be attributed to back-dated fashion reflecting the group's inventory turns. It is worth noting that the Index values are group numbers, thus inclusive of all divisions, including homeware- a division with relatively longer inventory day compared to the fast fashion Zara flagship stores, thus weighing down the overall index results.

Managers need to ensure that they maintain excess inventory levels. Excess inventory leads to high carrying costs and obsolescence of product while low inventory levels will compromise customer satisfaction. As it is important that to strike the balance metric, firms need to work through the employ of modern technology and inventory management systems, to stabilise inventory levels. To ensure that there is a general growth in the strength of the supply chain, there is a need for organisations in the retail industry to find ways of ensuring that there is a significant transformation in their inventory management. According to Toktay, Wein and Zenios, (2000), the primary objective is to ensure the crafting and adoption of an appropriate ordering policy that minimises the total expected procurement, inventory holding, and lost sales cost to the organisation. With a supply of inventory, it becomes easier for the firm to manage any disruptions to the supply chain effectively and the result is a significantly strong supply chain index.

Generally, when a firm experiences excessively long days of payables, this usually leads to a weaker supplier health. Superior inventory management advocates for a system where there is a significant reduction in the number of days that the customer pays for the inventory collected. This is because, the shorter the number of days, the higher the likelihood that the firm will roll over its inventory several times to achieve more profits. It is largely accepted that the fundamental financial purpose within a firm is to maximize value and as such the inventory management system must contribute to realisation of this objective. While traditional inventory methodologies have focused on managing risk through replenishment strategies, it is important that modern management strategies be adopted that maximise expected total profit.

As part of the corporate strategy to improve the strength of the supply chain, firms must work towards sustained improvement on operating margin. As the world continue to experience an increase in the use of Information and Communication Technology (ICT) and industry competition continues to intensify, there has been a significant pressure on operating margin. In supply chain management, production planning is an essential component that businesses must master to attain acceptable levels of sustainable production. This is

because mastering production planning helps improve delivery times, reduces the risk of stock shortages while maximizing on the effective use of human and material resources. The act of developing a guide for the design and production of a given product or service is known as production planning. Production planning assists organizations in making their manufacturing processes as efficient as possible. This is a process that helps in the manage resources such as time, operational capacity and unexpected changes that may arise. In the retail industry in South Africa, this can be achieved through the procurement of specialised tools and equipment that will allow for automated production management and planning.

The study's scope was limited to six JSE-listed clothing retailers. By limiting the study to clothing retailers, avenues for further research are left open. It is therefore recommended that more companies from various sectors, such as logistics, food retailers, tobacco companies, and so on, be included in the suggested supply chain index for performance measurement in order for managers and scholars to have a more absolute view of the improvements in their value chain. It is also recommended for motivational reasons that companies in various sectors conduct additional research to determine the extent to which the identified key matrix for assessing supply chain performance is applicable to their businesses.

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