Supply Chain Management Strategies of the Private Residential Construction Sector in South Africa

G. Khoza[1], K. K. Govender[2]

Abstract: The aim of the study was to critically evaluate the supply chain management (SCM) strategies and challenges in the private residential construction sector in South Africa. A quantitative approach was used to survey 320 private residential construction companies registered with the National Homebuilders Registration Council (NHBRC) within the Gauteng province. The data from 250 questionnaires returned were analysed using SPSS (Versions 23) and Smart PLS. It became evident that the SCM challenges included a lack of trust between the supplier and the organization; a lack of adoption of the SCM system; a lack of a sufficiently skilled SCM workforce; and poor implementation of contract management. It was ascertained that there is a significant positive relationship between the performance of the private residential construction sector in South Africa and the SCM strategies and processes. Strategies are proposed to enhance performance.

Keywords: supply chain management; private residential construction sector

1. Introduction

The construction industry is a significant contributor to the South African economy (Pillay & Mafini, 2017; Olarewaju, Chileshe, Babarinde & Sandanayake, 2020). Stats SA reports that the construction sector contributed 4% (R104 billion) to the gross domestic product (GDP) during the 2019/2020 financial year. Globally, the construction industry contributes between 6% and 9% to the GDP in the developing countries (Lopes, Oliveira & Abreu, 2017). According to Mosenogi (2014) cited in Pooe and Pillay (2019), the construction sector also plays an important role in capital accumulation and creating jobs and it employs more than 1.3 million people in South Africa (Zingoni, 2020). Several researchers (Cigolinia, Goslingb, Lyerc & Senicheva 2020) reported that the construction sector is currently facing SCM challenges such as lack of the understanding of the SCM concept; lack of trust between supplier and organization; lack of adoption of SCM system technologies; lack of a sufficiently skilled SCM workforce; and poor implementation of contract management.

Although there are several studies conducted on SCM in South Africa (Manyathi 2019 van Zoest, Volker & Hermans, 2019), there are few on SCM practices and strategies in the private residential construction sector. In light of challenges associated with SCM alluded to above, this study aims to analyse the SCM strategies in the private residential construction sector in South Africa and propose strategies to improve the performance in the sector.

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2. Literature Review

According to Habib (2011), SCM must have been viewed as a single entity and that strategic decision-making at the top levels was needed to manage the chain. Amande, Akpan, Ubani and Amaeshi (2016) argued that the key goal of SCM is to reduce inventory to the barest minimum and regulate supplier interaction along the production line more effectively. According to Mbhele (2014), SCM involves the planning, managing the activities in sourcing, procurement, conversion with also logistics. Russel and Taylor (2009) cited in Felea and Albăstroiu (2013), posit that SCM aims to manage the flow of information, products and service across a network of customers, enterprises and supply chain partners.

The private residential construction sector is the largest within the South African property sector (Centre for Affordable Housing Finance in Africa, 2020). During the 2019/2020 financial year, the South African national deeds Registry recorded over 6.6 million residential properties (Estate Agency Affairs Board, 2020). Although the construction industry is regulated is regulated by Construction Industry Development Board (CIDB**)**, the **r**esidential construction is regulated by National Home Builders Registration Council (NHBRC), (CIDB, 2020; NHBRC, 2020). Residential home contractors in South Africa are required by law to be registered with the NHBRC, before embarking on residential construction NHBRC (2020).

Supply chain management strategies are currently recognised as a new way of increasing business performance and assists in achieving long term goals (Rana, Haji, Osman, Bahari & Solaiman, 2015). According Sukatia, Hamida, Baharuna and Yusof (2012), business organizations need to adopt appropriate SCM strategies in order to be relevant in the market place. Supply chain management strategy is aimed at reducing the production costs (Ambe, 2010). Madhani (2020) asserts that the private residential construction sector can improve its performance by adopting supply chain strategies which include lean supply chain, agile supply chain and hybrid supply chain. Madhani (2020) further argues that supply chain strategies will assist the private residential construction sector to be competitive.

According to Lee (2021, p. 8), the supply chain strategy has a direct effect on the overall organization performance such as quality, cost, delivery, and flexibility, depending on the organization competencies. Supply chain strategies can improve performance of the private residential construction sector in SA by reducing costs, improving quality, delivery performance, and providing flexibility by maximizing each organizational competence. Based on these arguments, and to explore the relationship alluded to above, the following hypothesis is postulated:

H1 There is a positive and significant relationship between the supply chain management strategies and the performance of the private residential construction sector in South Africa.

The literature reports that supply chain management challenges that affect the performance of the private residential construction sector include lack of proper knowledge, skills and capacity (Mdadane 2018, p. 61), inappropriate selection criteria (Khoso, 2019, p. 5), and frequent changes in specification (Al-Werikat, 2017, p. 108). Understanding SCM challenges in the private residential construction sector in SA is significant topic of research, as the findings from studies like this will greatly assist the private residential construction sector in SA in developing a framework that can serve as better understand and manage these challenges, (Chigozie, Okafora, Ugochukwu & Ugwub 2020, p. 4). Saad (2018, p. 40) argued that SCM practitioners in the private residential construction sector need to understand characteristics of the construction project in order to minimise errors during the procuring stage, because those errors can contribute to poor performance of the sector. Pillay and Mafini (2017, p. 5) assert that awareness and implementation of construction supply chain management is very limited, which creates opportunities for further improvement for research in this area if the full potential of the industry is to be realized. Based on the above arguments, and in order to explore the relationships, it is populated that:

H2: There is a significant positive relationship between the supply chain management challenges and the performance of the private residential construction sector in SA.

The supply chain management process in the construction sector is described as a network of firms who together agreed that SCM is very useful and effective in the construction projects, in order to realise objectives relative to the construction projects (Pillay & Mafini 2017, p. 4). According to Gohari (2014) cited in Pillay and Mafini (2017, p. 5), the benefits of proper implementation of the SCM process in the private residential construction sector include improved relationships between supply chain partners, reduced operational costs, better quality outputs, enhanced customer satisfaction, higher profits for businesses and superior supplier performance. Ojo, Mbohwa and Akinlabi (2014, p. 147) assert that there is need to improve SCM in the construction sector in order to improve the profit margins of the private residential construction sector in SA. Performance is a significant element in all areas and activities in the private residential construction sector. Mundzedzi (2011) cited in Nguegan (2017, p. 67) argued that performance helps to communicate the company's vision and objectives that are set to ensure that the organization will make profits. Improvement of the SCM process in the private residential construction sector in SA can result in positive performance and client value at less cost (Ojo *et al.*, 2014, p. 148). The aforementioned study also argued that there is a relationship between supply chain management processes and the performance of private residential construction sector in SA. In order to explore this further, it is postulated that:

H3: There is a positive and significant relationship between supply chain management processes and the performance the private residential construction sector in SA.

Loury-Okoumba and Mafini (2021, p. 4) assert that supply chain performance increases responsiveness and awareness of perceived supply distortions in the market. Mahlatsi and Chinomona (2020, p. 4) argued that supply chain performance aims at enhancing product availability, productivity and profitability. According to some researchers (Mahlatsi & Chinomona, 2020), the benefits of supply chain performance include cost reduction, time and quality savings, which result in improved performance of the organization. In order to explore this further, it is postulated that:

H4: There is a positive and significant relationship between supply chain performance and the performance the private residential construction sector in SA.

Supply chain integration in the private residential construction sector involves communication among all supply chain partners, namely, the SCM practitioners and end users. According to Yuen and Thai (2017, p. 3), the performance of tasks and activities such as research and development, marketing, logistics and procurement is influenced by inputs from and collaboration with suppliers and customers. Uwamahoro (2018, p. 7) asserts that a close relationship between customers and the private residential construction sector offers opportunities for improving the accuracy of information on demand, which reduces supplier product design, production planning time and inventory obsolescence, thus allowing it to be more responsive to customer needs. Thus, supply chain integration can enhance performance by reducing costs, creating greater value and detecting demand changes more quickly. Several researchers (Madzimure, 2020; Zhao, Feng & Wang, 2015) confirmed the positive significant relationship between supply chain integration and the performance of the organization. In order to explore this further, it is postulated that:

H5: There is a positive and significant relationship between supply chain management integration and the performance of the private residential construction sector in SA.

3. Research Methodology

The researcher used both exploratory as well as descriptive research designs. A quantitative research approach was used and data was collected through a survey. Purposive sampling technique was chosen because the study required an in-depth understanding of SCM challenges and strategies in the private residential construction sector. The basic criteria used for choosing the respondents was, firstly, that the company should be registered with NHBRC, and secondly, the respondent occupied senior SCM position in that company. The respondents therefore included general managers, directors, chief financial officers and SCM specialists. The sample size for the study was 320, calculated using a sample calculator.

The Statistical Package for Social Sciences (SPSS) was used to analyse the data. To make judgments and determine observed differences between demographic groups, Multivariate Analysis of Variance (MANOVA) was used. In addition, Structural Equation Modeling and Path Modeling were conducted simultaneously using Smart PLS. Smart PLS was also used to test the model fit to the data as well as the hypothesized relationships in the conceptual model.

The reliability of the measurement instruments was assessed using both the Cronbach alpha and Composite Reliability coefficients. In terms of the validity of the scales, Factor Loadings and Average Variance Extracted (AVE) were used to test for convergent validity. Furnell and Lucker Criterion, Cross Loading Criterion and Hetero-Trait and Mono-Trait Ratio (MTMT) were also used to assess discriminant validity.

4. Research Findings

The majority (40.4%) of the participants were supply chain practitioners, followed by supply chain specialists (26.4%) and supply chain managers (19.2%). Figure 1 shows that the majority of the respondents were generally in agreement with the statements that were designed to determine the participant's perception of the SCM challenges. Almost 50% of the respondents agreed that a lack of capacity followed by an equivalent (47.2%) strongly agreed that SCM lacks practitioners with the right skills.

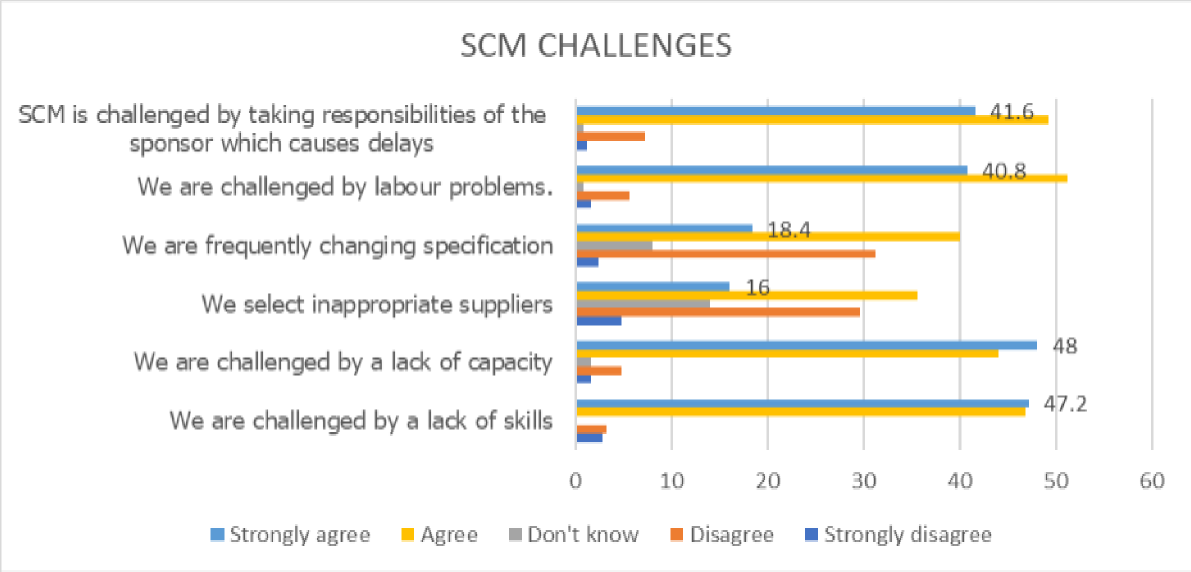

Figure 1. SCM Challenges

Source: Compiled from Primary Data

Figure 2 depicts that the vast majority (60.8%) of the respondents 'strongly agree' that the SCM department ensures quality in the SCM process, followed by 59.2 percent of respondents who 'strongly agree' that the SCM department is held accountable to suppliers that are performing poor. It was observed that the SCM departments maintain a risk register and they produce monthly reports indicating performance.

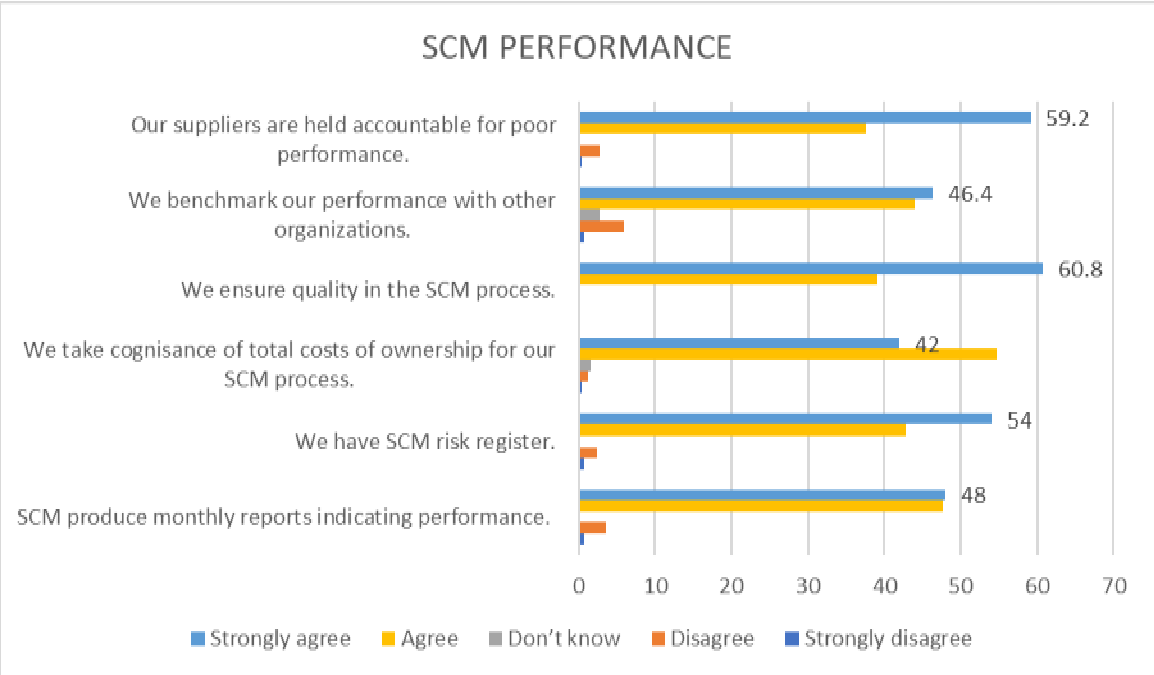

Figure 2. SCM Performance

Figure 3 depicts a summary of the opinions of the respondents on how they perceived the performance of the private residential construction sector. The results reveal an average performance of the private residential construction sector.

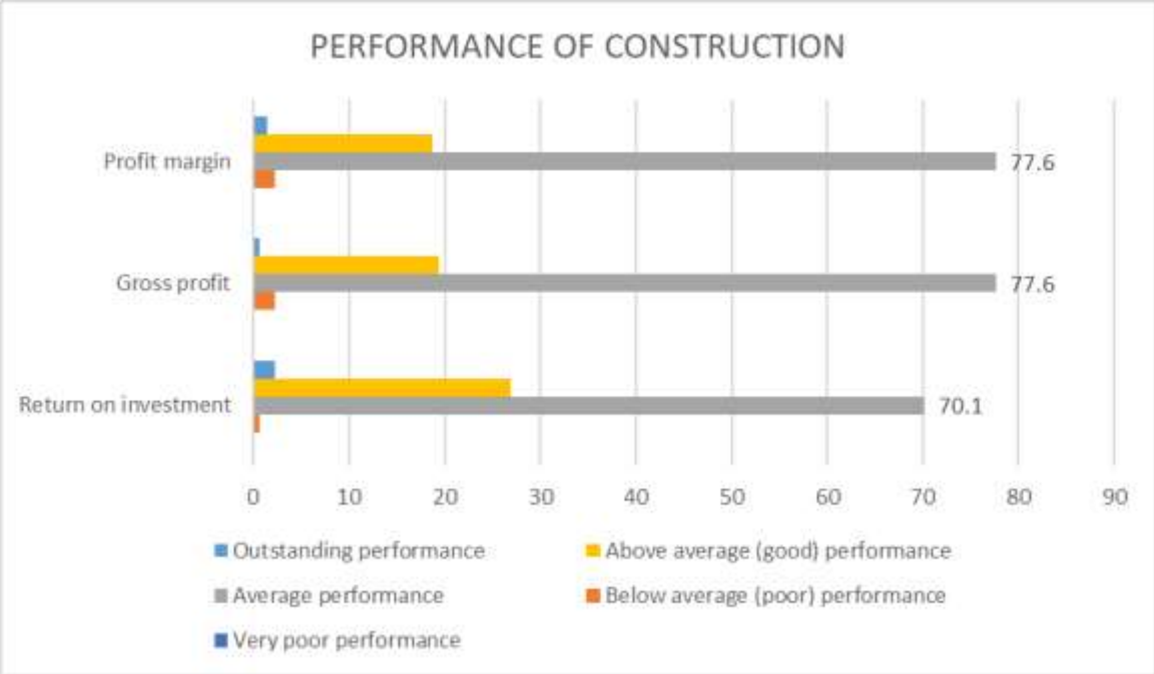

Figure 3. Performance of Construction
Source: Compiled from Primary Data

A Component Based Approach to Structural Equation Modelling as espoused in Smart PLS by Ringle, Wende, and Becker (2005), was used and confirmatory Factor Analysis (CFA) and structural modelling are performed simultaneously although the analysis and the interpretation follows the two-stage process. Firstly, confirmatory factor analysis (CFA) was conducted to determine the reliability and validity of the measurement model. As for validity, both the discriminant and convergent validity of each construct in the model were assessed. Finally, the model fit for the measurement model was checked to determine the fit between the data and research model. The second stage focused on path analysis to test the proposed hypotheses, and path coefficients generated, while the p-values for assessing the significance level of the proposed relationships were generated using the bootstrapping method.

Assessment of the measurement model mainly focused on three issues, namely, the measurement instruments' reliability and validity and the model fit. The initial proposed conceptual model was re-specified twice. The original model was re-specified since research variable was eliminated from the conceptual model after failing to satisfy the measurement model criteria. The second re-specified model was run statistically and some instruments for some variables measures that could not meet the acceptable loading threshold were deleted following the recommendations by Hair et al. (2010: 771). Lastly, the final model results were generated and interpreted.

It was then clear from Table 1 that the Cronbach alpha values of the measures in the final research model all exceeded the recommended threshold of 0.6, hence, authenticating that the measures used in the study were all reliable.

Table 1. Cronbach Alpha Coefficient (α)

Specified Original Model		**Respecified Final Model**	
Variable	***Cronbach Alpha Coefficients***	***Variable***	***Cronbach Alpha Coefficients***
PRCSC	0.799	**PRCSC**	0.799
SCI	0.726	**SCMC**	0.656
SCMC	0.534	**SCMP**	0.792
SCMP	0.554	**SCMPER**	0.527
SCMPER	0.506	**SCS**	0.282
SCS	0.343		

Source: Compiled from Primary Data

The Composite Reliability (CR) index was also used to check internal consistency of the measurement model and Urbach and Ahlemann (2010) posited that, values that are acceptable are normally between zero and one. According to Yang and Lai (2010) it is recommended that composite reliability values must exceed 0.7. The composite reliability test was calculated using the following formula:

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

Composite Reliability = (square of the summation of the factor loadings)/ {(square of the summation of the factor loadings) + (summation of error variances)}.

In the first model analysis, the lowest Composite Reliability Coefficient was 0.036 while the highest value was 0.882. In the final model, the lowest Composite Reliability Coefficient was 0.673 while the highest value was 0.875. It was then clear that the Composite Reliability coefficients of the final study model exceeded the recommended threshold of 0.7, hence, authenticating the measures that were used in the study. The outcome is presented in Table 2.

***Table 2.* Composite Reliability Coefficient (CR)**

Specified Original Model		**Re-specified Final Model**	
Variable	***Composite Reliability Coefficients***	***Variable***	***Composite Reliability Coefficients***
PRCSC	0.882	**PRCSC**	0.881
SCI	0.036	**SCMC**	0.811
SCMC	0.709	**SCMP**	0.875
SCMP	0.700	**SCMPER**	0.804
SCMPER	0.578	**SCS**	0.673
SCS	0.325		

Source: Compiled from Primary Data

Both convergent and discriminant validity were assessed. According to Hair et al. (2010: 771) convergent validity is “the extent at which indicators of a specific variable converge or share a high proportion of variance in common.” It simply explains the extent at which a scale correlates with other measures of the same construct to the same direction. According to Carlson and Herdman (2010) weaker convergent validity is evident using values deviating from one (1) while values closer to one (1) are normally accepted.

Table 3 reveals that the estimates of the factor loadings/standardized regression weights were all greater than 0.5, showing greater convergent validity. In the initial model analysis, the lowest loading or regression weight was 0.816 while the highest value was 0.-0.026. In the final model the lowest factor loading or regression weight was 0.521 while the highest factor loading was 0.884. It was then clear that, all the Factor Loadings of the final (revised) model reported in Table 3 exceeded the recommended threshold of 0.5, hence, authenticating that all the measures that were used in the study were valid. This result indicates that all the measurement instruments used in the final re-specified model explained at least 51% of what they are supposed to measure.

Table 3. Factor Loading / Standardised Regression Weights

		Specified Original Model	**Re-specified Final Model**		
Variable		***Factor Loadings***	***Variable***		***Factor Loadings***
	PRCSC1	0.862		**PRCSC1**	0.872
PRCSC	**PRCSC3**	0.856	**PRCSC**	**PRCSC3**	0.850
	PRCSC3	0.815		**PRCSC3**	0.809
	SCI	-0.322		**SCMC1**	0.861
SCI	**SCI2**	0.659	**SCMC**	**SCMC2**	0.830
	SCI3	-0.034		**SCMC5**	0.595
	SCMC1	0.800		**SCMP1**	0.882
	SCMC2	0.783		**SCMP2**	0.836
SCMC	**SCMC3**	0.363	**SCMP**	**SCMP3**	0.791
	SCMC4	0.460			
	SCMC5	0.511			
	SCMC6	0.241			
	SCMP1	0.823		SCMPER3	0.753
	SCMP2	0.746		SCMPER4	0.884
	SCMP3	0.749			
SCMP	**SCMP4**	0.166	**SCMPER**		
	SCMP5	0.300			
	SCMP6	0.291			
	SCMP7	0.308			
	SCMPER1	0.270		SCS2	0.742
	SCMPER2	-0.026		SCS3	0.521
SCMPER	**SCMPER3**	0.655	**SCS**	SCS4	0.642
	SCMPER4	0.769			
	SCMPER5	0.387			
	SCMPER6	0.445			
	SCS1	-0.273			
	SCS2	0.769			
SCS	**SCS3**	0.513			
	SCS4	0.562			
	SCS5	-0.237			

Source: Compiled from Primary Data

The average variance extracted reflects the total elements of variance in the indicators which are accounted for by a latent construct. Dillon and Goldstein (1984) suggested that an AVE value greater than 0.50 demonstrates that the convergent validity of the variable is good. According to Fraering and Minor (2006) an AVE value of 0.4 is seen as satisfactory. Hair et al. (2006) also observed that a threshold value of 0.30 qualifies to be used as a minimum threshold in social sciences, while in marketing an accepted threshold of 0.5 was comparatively acceptable. The AVE values were calculated using the formula below:

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

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

In the initial analysis, the lowest AVE value was 0.180 while the highest AVE value was 0.713. In the (revised) final model, the lowest AVE value was 0.412 while the highest AVE value was 0.713. It was then clear that, all the AVE values of the revised research study model exceeded the recommended threshold of 0.4 (Fraering & Minor, 2006; Hair et al., 2010). The AVE values greater than 0.5 further confirmed discriminant validity of the research constructs. Hence, this authenticates that the measures that were used in the study were all valid, as presented in Table 4.

Table 4. Average value extracted (AVE)

Specified Original Model		**Respecified Final Model**	
Variable	*Average Variance Extracted (AVE)*	*Variable*	*Average Variance Extracted (AVE)*
PRCSC	0.713	**PRCSC**	0.713
SCI	0.180	**SCMC**	0.595
SCMC	0.319	**SCMP**	0.701
SCMP	0.299	**SCMPER**	0.674
SCMPER	0.240	**SCS**	0.412
SCS	0.260		

Source: Compiled from Primary Data

Hetero-Trait and Mono-Trait (HTM) Ratio Criterion and Fornell and Larcker Criterion were also used to assess the discriminant validity in the current study. The discriminant validity of the study was examined through an examination of the correlation values of the research constructs. The correlation values range from 0-1 and a low correlation between the research constructs indicates that the research constructs are unique and distinct from one another, while the reverse indicates the absence discriminant validity. Theoretically, a correlation value less than 0.6 is deemed as an indicator of discriminant validity. However, practically, a correlation value that is less than 0.85 is still regarded marginally acceptable (Chinomona, 2011). In the original specified research model, as reflected in Table 5, the highest correlation value is 0.548, hence confirming the existence of discriminant validity of the research constructs used in the current study.

Table 5. Specified Original Model Correlation between the Constructs

RESEARCH CONSTRUCTS	PRCSC	SCI	SCMC	SCMP	SCMPER	SCS
PRCSC	**1.000**					
SCI	0.100**	**1.000**				
SCMC	0.516**	0.222**	**1.000**			
SCMP	0.174**	0.285**	0.386**	**1.000**		
SCMPER	0.206**	0.541**	0.430**	0.548**	**1.000**	
SCS	0.267**	0.222**	0.335**	0.357**	0.402**	**1.000**

***. Correlation is significant at the 0.01 level (2-tailed).*

Source: Compiled from Primary Data

Note: PRCSC= Private residential construction sector construction performance; SCI= Supply chain Integration; SCMC = Supply chain challenges; SCMP = Supply chain process; SCMPER = Supply chain performance; SCS = Supply chain strategies

In the re-specified (final) research model, as reflected in Table 5, the highest correlation value is 0.556, hence confirming the existence of discriminant validity of the research constructs used in the current study. The second approach to test the discriminant validity used in this study was the Fornell and Larcker Criterion, which is a comparison of the square root of AVE for a variable and the correlation values of each variable beneath in the correlation matrix. As suggested by Fornell and Larcker (1981:337), discriminant validity is achieved when a square root of an AVE for each research construct is found to be greater than the correlation with the other construct – showing that discriminant validity has been achieved. In the original specified research model, the square root of AVE value for each variable in the correlation matrix is greater than the correlation values with other constructs as reflected in Table 6. Hence, confirming the existence of discriminant validity of the research constructs used in the current study.

Table 6. Specified Original Model Correlation between the Constructs

RESEARCH CONSTRUCTS	PRCSC	SCI	SCMC	SCMP	SCMPER	SCS
PRCSC	**0.845**					
SCI	-0.082**	**0.424**				
SCMC	0.390**	-0.058**	**0.565**			
SCMP	0.130**	-0.016**	0.176**	**0.547**		
SCMPER	0.157**	0.090**	0.242**	0.084**	**0.490**	
SCS	0.250**	0.059**	0.130**	0.086**	0.101**	**0.510**

***. Correlation is significant at the 0.01 level (2-tailed).*

PRCSC= Private residential construction sector construction performance; SCI= Supply chain Integration; SCMC = Supply chain challenges; SCMP = Supply chain process; SCMPER = Supply chain performance; SCS = Supply chain strategies

In the re-specified final research model, as reflected in Table 7, the square root of the AVE value for each variable in the correlation matrix is greater than the correlation values with other constructs. Hence, this confirms the existence of discriminant validity of the research constructs used in the current study.

Table 7. Re-specified Final Model Correlation between the Constructs

RESEARCH CONSTRUCTS	PRCSC	SCMC	SCMP	SCMPER	SCS
PRCSC	**0.844**				
SCMC	0.357**	**0.771**			
SCMP	0.116**	0.173**	**0.537**		
SCMPER	0.121**	0.170**	0.004**	**0.821**	
SCS	0.246**	0.026**	0.037**	0.202**	**0.642**

***. Correlation is significant at the 0.01 level (2-tailed).*

PRCSC= Private residential construction sector construction performance; SCMC = Supply chain challenges; SCMP = Supply chain process; SCMPER = Supply chain performance; SCS = Supply chain strategies

Table 8 below provides a summary of the descriptive statistics and the measurement model assessment statistics. The mean values provided below indicate that the majority of the respondents agreed with the measures asked (>3-<5). The standard deviations were less than 2, therefore, indicating that the mean values are a correct reflection of the majority average perceptions. A detailed explanation of the measurement model statistics is provided under the reliability and validity assessment sections.

Table 8. Scale Accuracy Analysis

Research construct		Scale item Mean	SD	Cronbach's Alpha	CR	AVE	Factor Loadings
PRCSC	PRCSC 1	4.104	1.116	0.798	0.799	0.712	0.872
	PRCSC 2	4.088	1.008				0.850
	PRCSC 3	4.016	1.058				0.809
SCMC	SCMC1	4.324	0.864	0.656	0.811	0.595	0.861
	SCMC2	4.320	0.854				0.830
	SCMC5	4.240	0.852				0.595
SCMP	SCMP1	4.380	0.756	0.792	0.875	0.701	0.882
	SCMP2	4.312	0.747				0.836
	SCMP3	4.188	0.699				0.791
SCMPER	SCMPER3	4.368	0.620	0.527	0.804	0.674	0.753
	SCMPER4	4.608	0.488				0.884
SCS	SCS2	3.876	1.503	0.282	0.673	0.412	0.742
	SCS3	2.796	1.074				0.521
	SCS4	3.204	1.115				0.642

PRCSC= Private residential construction sector construction performance; SCMC = Supply chain challenges; SCMP = Supply chain process; SCMPER = Supply chain performance; SCS = Supply chain strategies

SD= Standard Deviation CR= Composite Reliability AVE= Average Variance Extracted

Since the model fit statistics are regarded to be still in the development stage – the current study also uses the Global Fit Statistic Approach proposed by Tenenhaus, Vinzi, Chatelin and Lauro (2005), to augment the model fit statistics generated by Smart PLS. The indices examined are: SMRM, the CMIN or the Chi-square $\chi2$ /df), and the Normed Fit Index (NFI).

The original specified model provided the following results: the SMRM was 0.114, which was above the required 0.10 recommended by Hu and Buntler (1999). Furthermore, the Normed Fit Index (NFI) was 0.238 which is below the recommended threshold of 0.900 endorsed by (Bentler and Bonett, 1980). Overall, these results (Table 9) indicate that the model fit indices did not meet the acceptable thresholds recommended in the extant literature.

Table 9. Model Fit of the Original Specified Model

Model Fit Indices	Acceptable Threshold	Current Study Threshold	Decision: Acceptable/Unacceptable
SRMR	> 0.900	0.114	Acceptable
Normed Fit Index (NFI)	> 0.900	0.238	Acceptable

Source: Compiled from Primary Data

In the re-specified final model, the Standardized Root Square Residual (SMRM) is 0.091, which is less than 0.10 threshold recommended by Hu and Bentler, (1999), hence confirming a good model fit. Furthermore, the Normed Fit Index (NFI) is 0.522, which is also less than the threshold of 0.900 suggested by Bentler and Bonett, (1980). Overall, these results indicate that by and large, the model fit indices (Table 10) can be deemed to marginally meet the acceptable thresholds recommended in the extant literature.

Table 10. Model Fit of the Re-specified Final Model

Model Fit Indices	Acceptable Threshold	Current Study Threshold	Decision: Acceptable/Unacceptable
SRMR	> 0.10	0.091	Acceptable
Normed Fit Index (NFI)	> 0.900	0.522	Unacceptable

Source: Compiled from Primary Data

Figure 4 is a depiction of the structural model also known as the path model which depicts the results of the tested hypotheses. In the structural model, the performance of the pprivate residential construction sector are depicted to have direct effects on supply chain challenges, the supply chain process, supply chain performance and supply chain strategies. Furthermore, the challenges of the private residential construction sector are noted to have an influence on supply chain challenges, the supply chain process, supply chain performance and supply chain strategies.

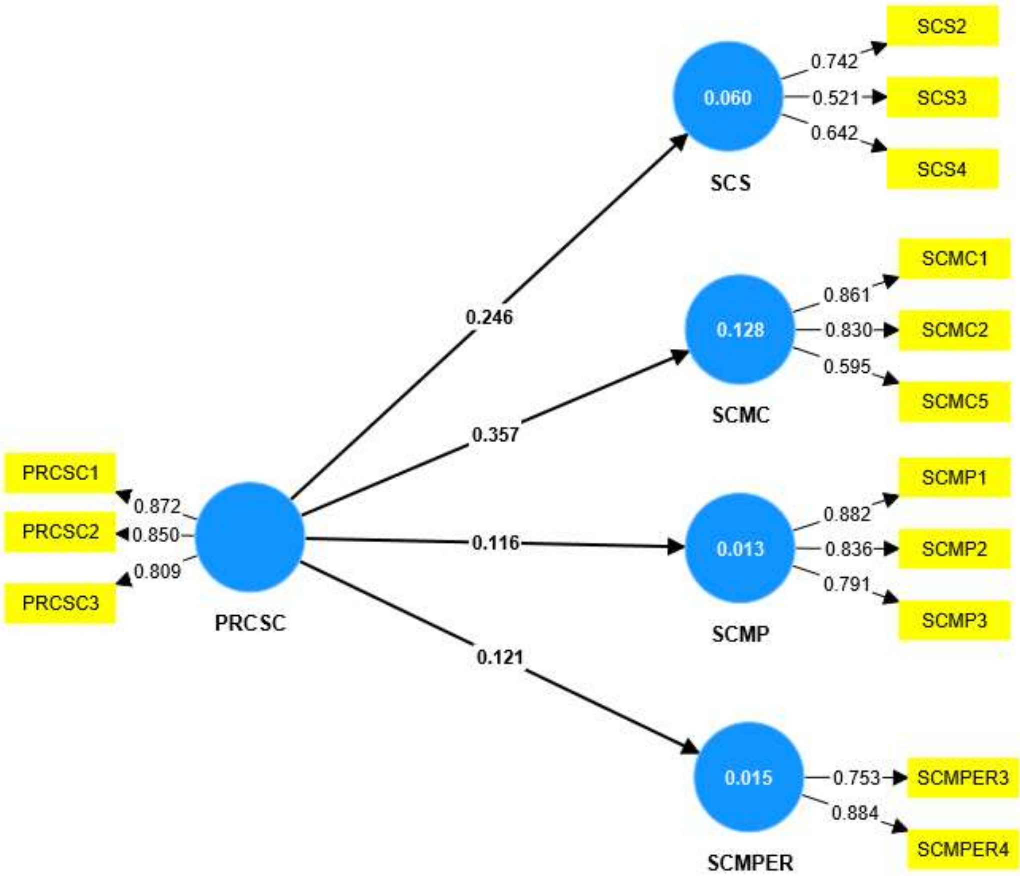

Figure 4. Structural Model

Source: Compiled from Primary Data

PRCSC= Private residential construction sector construction performance; SCMC = Supply chain challenges; SCMP = Supply chain process; SCMPER = Supply chain performance; SCS = Supply chain strategies

Four hypotheses were tested, and the path coefficients provided in Figure 1. The significant levels were assessed using p-values and t-statistics. The hypotheses are viewed as significant at a 95% or higher level of significance (≥ 95%), that is to say that p-value is ≤ 0.05 (Hair et al. 2010). The t-statistics are expected to be greater than 1.96 for the proposed relationship to be deemed acceptable. The proposed hypotheses and path coefficients are provided first and followed by t-statistics and p-values which indicate the significance level of the proposed relationship. Finally, the last column provides the decision taken by the researcher on whether to accept or reject the proposed hypotheses, given the research findings. The path coefficients demonstrate the strength of the relationships between the dependent and the independent variables (Hsu, 2008). Upon assessing the probability value also referred to as the p - value, it was demonstrated that three out of the four hypotheses postulated were significant at $p<0.05$, except H3 ($p=0.218$) which is insignificant.

Table 11 which provides the results of the four hypotheses tested reveals that the proposed positive relationship have been confirmed. However, H3 was found to be insignificant since the p-value is greater than 0.05 (0.218).

Table 11. Path Analysis Results

Hypothesized Relationship	Hypotheses	Path Co-efficient	T-Statistics	P-value	OUTCOME
PRCSC→SCS	H1	0.246	4.036	0.000	Significant & supported
PRCSC→SCMC	H2	0.357	4.833	0.000	Significant & supported
PRCSC→SCMP	H3	0.116	1.405	0.160	Supported but Insignificant
PRCSC→SCMPER	H4	0.121	2.104	0.035	Significant & supported

PRCSC= Private residential construction sector construction performance; SCMC = Supply chain challenges; SCMP = Supply chain process; SCMPER = Supply chain performance; SCS = Supply chain strategies

5. Discussion of the Findings

The findings reveal that supply chain strategies are positively significantly related with the performance of the private residential construction sector in SA. The findings are consistent with those reported by other researchers such as Lalmia, Fernandesb and Souad (2021:1), Hassani, Ceausu, and Iordache (2020:851) and Falks (2018). The findings of the study indicate that the private residential construction sector in S.A value cost and service providers are selected based lowest quote submitted. The results were tempered by the views of Windapo and Cattell, (2012:5) who argued that substantial growth in the construction sector depends on the price stability of building materials. Alabi and Fapohunda (2021:3) assert that inflation of the cost of materials results in low profitability, which renders the industrial performance areas inadequate, such as construction innovation, construction methods, and market research. Managing costs during the construction process is very crucial in ensuring the success of a project, (Alabi & Fapohunda, 2021, p. 7).

According to Cunningham, (2017) cost control is a procedure that has to be sustained through the construction time to make sure that the cost of the building is held in reserve in the agreed cost limits. Construction cost management is the entire procedure, which makes sure that the contract amount falls within the cost limits of the customer's approved budget, (Shadrach, 2017). Pillay (2016) argued that cost is a financial valuation of effort, resources, material time as well as risks incurred, utilities consumed, and opportunity sacrificed in production as well as delivery of a service or good. A crucial deliberation in selecting a supplier might be affordability. If an organization wants quality as well as reliability from a supplier, it will have to decide how much they are keen to pay for the supplies. It is significant to strike a balance between reliability, cost, quality as well as service (Cunningham, 2017).

The findings reveal that supply chain management challenges are positively and significantly related with the performance of the private residential construction sector in SA. The results are similar to that reported by Mdadane (2018, p. 61), Sibiya (2015, p. 49), Al-Werikat (2017, p. 107), and Nguyen (2018, p. 77). The challenges that affect the quality of services and products rendered by the private residential construction sector in SA include conflict of interest, inconsistent processes, quotation of wrong amounts, suppliers delivering poor quality materials, poor communication and corruption.

Conflict of interest occurs when a worker has an indirect or direct individual interest that can be seen to have the potential to affect their objectivity in executing their responsibilities or judgment in the best interests of the other party. Whereas episodes of bribery remain the most common method of supply chain corruption, workers having conflicting interests in business is a continuing challenge (Manyathi, 2019). The most common circumstances of conflict of interest happen when making consulting activities, procurement decisions as well as the use of business resources in addition to services (Pillay, 2017).

The results show that inconsistent processes are the other challenge facing supply chain management. Previous literature supports this by stating that changing a supply chain management system takes time, financial investment as well as human resources. If not executed correctly, there will be service redundancy, wasted labour as well as missed deadlines that result in substantial costs (Gustafsson and Lofstrom, 2018). Quoting wrong amounts is another challenge faced in supply chain management and poor pricing may slow down the supply chain. When a businesses' pricing becomes too low or high for the marketplace, a demand change will be obvious (Pillay, 2016). Irrespective of whether this disparity is negative or positive, the business will be required to adjust what is happening at every phase of the supply chain (Cunningham, 2017).

The cost of poor quality includes not only the subsequent costs resulting from product defects, but also business practices, processes or functions that cause errors as well as defects (Cunningham, 2017). Poor quality can damage reputation, weaken customer relationships, add main operational as well as financial costs. The operational associated consequences of poor quality can result in wasted resources, lost time, as well as decreased productivity. These can cause increased costs of production as well as lead to a higher cost of repairs (Manyathi 2019). Poor communication can cause all types of problems in construction supply chain operations, like lost items, demurrage as well as storage costs, and extra chassis costs (Gustafsson & Lofstrom, 2018). It is vital to know the clients' needs. This is why construction industries focus on effective communication alongside supply chain management with suppliers as well as clients. Effective communication makes for transparency as well as trust, in addition to contributing to sustainable construction business (Pillay, 2017). Other common types of construction supply chain corruption are the use of non-approved suppliers, biased contracts as well as forged invoices. Corruption and bribery policy as well as compliance frequently needs that businesses do more than just avoid bribery at the stage one supplier level (DBSA, 2019).

The findings confirmed a positive and significant relationship between SCM performance and the performance of the private residential construction sector SA. These results are in line with findings of Kiromo, (2015), Behera, Mishra and Mishra (2016), and Wibowo, Handayani, Sholeh and Uzoma (2019). It was ascertained that SLAs are used to monitor and evaluate the performance of the contracts and a supply chain risk register is used to record and monitor supply chain risks within the private residential construction sector in SA. Setino (2018, p. 140) asserts that measuring SCM performance can facilitate a greater understanding of the supply chain and improve its performance. Service providers and organization set these performance standards in the context of anticipated workloads and the service levels may need to vary in the light of changes to these workloads during the course of the contract. A supply chain risk register is used in the private residential construction sector in SA as a process to collectively identify, analyse and solve risks, before they become problems.

The findings also revealed that there is a positive (albeit insignificant) relationship between the supply chain management process and the performance of the private residential construction sector in SA. These findings are different from that reported by other researchers such as Al-Werikat 2017), Gor and Pitroda (2018), Nugroho, Setiawan, Sutopo and Wibowo (2021) and Aneesa, Gupta and Desai (2015), who reported a positive and significant relationship. The study findings reveal that the SCM department enters into a service level agreement with the suppliers. The SCM department also has a trusting relationship with suppliers in the sector and long-term relationships with strategic suppliers.

Baumann and Genoulaz (2014) in Loury-Okoumba and Mafini (2020) reported that supply chain management practices are effective in providing core value to an organisation's strategic direction in terms of adhering to performance objectives. Amedofu, Asamoeh and Agyei-Owusu (2019) assert that entering into strategic partnerships with suppliers allows both organization and supplier to collaborate and work toward reducing stock-outs, minimizing waste, reducing costs and meeting delivery schedules.

6. Conclusions

The findings reveal that supply chain management process has to some extent a direct effect on the performance of the private residential construction sector in S.A. However, the influence is not significant, compared to that of supply chain management challenges, supply chain management strategies and supply chain management performance. The adoption of supply chain management processes in the private residential construction sector in S.A. can improve its performance. It emerged that supply chain management strategies have a positive and strong positive influence on the performance of private residential construction sector in SA. The findings show that supply chain management performance has a positive and strong influence on the performance of the private residential construction sector in SA. Therefore, it can be concluded that supply chain management performance is applicable to the performance of the private residential construction sector in S.A.

It was also ascertained that supply chain management challenges have positive and strong effect on the performance of private residential construction sector in S.A. It is clear that supply chain management challenges have much effect on the performance of private residential construction sector in S.A. Improving supply chain management strategies is a great opportunity for the private residential construction sector to reduce cost and time, thus improve profitability. It is recommended that the private residential construction sector in SA. adopts a hybrid strategy which are a combination of cost leadership and differentiation strategy. The hybrid strategy will assist the private residential construction sector in SA to increase the efficiency and effectiveness of construction projects. Adopting the hybrid strategy will help the sector to collaborate with suppliers in order to get quality-building materials at a lower cost and it can benefit the sector by receiving building materials in a short time. This hybrid strategy will ensure that the private residential construction sector in SA achieves continuous improvement in value for money, based on cost and quality, and to improve the competitiveness of suppliers through the development of world-class professional SCM practices.

The private residential construction companies must implement internal and external performance benchmarking. They must identify and assess risk on a case-by-case basis and continue to utilise the risk register as a tool for managing risks and exercise risk management in a proactive manner. SCM managers must share information concerning changes in the industry and organisation to employees in order to avoid misunderstanding and to enhance the effectiveness of the supply chain. The is encouraged to develop strategic supplier relationships in order to have a stable supply of products.

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