Efficient material management strategies for enhancing the performance of SMEs in the South African construction industry

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ABSTRACT

In an effort to promote inclusive and sustainable industries to achieve Sustainable Development Goal (SDG) 9, SMEs are confronted with inadequate project management practices and, as a result, struggle to effectively complete construction projects. This study examines the efficient material management strategies adopted by SME construction firms to achieve sustainable business performance. The study adopts a sequential explanatory mixed method design to achieve the aim of the research project. Self-administered questionnaires were distributed to purposively selected management personnel representing SME contractors listed in Grade 1-4 of the cidb Register of Contractors and based in the Eastern Cape Province of South Africa. Following that, semi-structured interviews with contractors who participated in the survey were conducted at random. To analyze the quantitative data, descriptive and inferential statistics were used, while content analysis was used to analyze the qualitative data. The findings from this study based on the mean ranking technique revealed that strict adherence to specifications for materials in delivering construction projects, effective utilisation of construction materials, and effective material inventory strategy were adjudged to be the most significant material management practices. The results from the qualitative study showed that SMEs adopted effective monitoring and controlling of material and effective material procurement strategies as the most efficient material management practices. Additionally, the taxonomy of efficient material management practices was achieved through the use of exploratory factor analysis. The underlying grouped strategies were "efficient material procurement and storage practices", "effective inventory of material", "sustainable procurement system", and "adequate scheduling and utilisation of materials". The study focused on SME contractors registered under cidb Grade 1-4 in South Africa. However, the results of this study may be valuable for SMEs in developing nations seeking a competitive advantage over other enterprises.

KEYWORDS: Material management, Project delivery, SMEs, South Africa, Sustainable success rate

INTRODUCTION

Small and medium-sized enterprises (SMEs) are significant drivers in the growth of economies, as well as the development of the construction sector (Ogbu & Olatunde, 2019; Sogaxa, Simpeh, & Ndihokubwayo, 2021). Because of their labour-intensive nature, SMEs are crucial to the global growth of construction activities and a suitable source of employment (Ogbu & Olatunde, 2019). Offei, Kissi, and Nani (2019) reveal that in developing countries like Ghana, SME contractors are the backbone of the economic development. However, SME contractors have several challenges that hinder the success and sustainability of their construction projects. According to Yap and Lock (2017), SMEs are confronted by a lack of working knowledge, inadequate management techniques adopted by SME contractors and ineffective human resource management. Furthermore Bouazza, Ardjouman, and Abada (2015) stated that the success of

SME contractors' construction projects is hampered by a lack of consideration from financial institutions, low enterprise capacities, a lack of managerial capabilities to effectively manage production initiatives, and a lack of leadership abilities in the construction industry. Empirical data also revealed that SMEs are confronted by the challenges of sustainability, globalization, and technology (Prasanna et al., 2019). Other researchers like, Journeault, Perron, and Vallières (2021) identified lack of awareness in respect to the impact and benefits linked to business sustainability, inadequate time management, poor managerial skills and expertise. Musa and Chinniah (2016) also revealed that in other developing countries like Malaysian, SME contractors are challenged by lack of attention regarding workforce skills and knowledge training, and hesitant to take advantage of training programmes sponsored by the government. In support, Bhorat et al. (2018) posited that for SME contractors to enhance sustainable business, they significantly require certain skills that is achievable through effective education and training programmes. Matt, Modrák, and Zsifkovits (2020) share different sentiments by noting that SMEs are more proactive in improving their business operations, which gives them an edge over well established firms in terms of business innovation. In an effort to improve SMEs inadequate management techniques, this study focuses on SMEs material management practices. This effort will ensure SMEs continual survival in the industry. Donyavi and Flanagan (2009) revealed that construction material contributes between 30% and 70% of the project value. However, material if not effectively managed can be the major cause of the construction project delays (Gulghane & Khandve, 2015). Therefore, material management practices require adequate planning and controlling the quality and quantity of the material, punctual equipment placement, good price and the right quantity as required (Madhavi, Methew, & Sasidharan, 2019). Also, Sogaxa, Simpeh, and Ndihokubwayo (2021) opined that adequate material management practices largely contribute to the quality, time, and socio-economic development in construction projects delivery. Notwithstanding, SMEs' inadequate material management practices result in high waste, inadequate logistics, poor material handling on site, misuse of the materials, lack of activity planning, wrong materials delivery and excessive paperwork all adversely affect materials management (Kasim, Anumba, & Dainty, 2005; Kasim & Ern, 2010). Other researchers identified challenges confronting SMEs during construction project delivery, like, Mehr and Omran (2013) who mentioned that SMEs are confronted by shortage of materials, ineffective communication between the site and head office, poor purchasing planning and material within the firm. As a result, the survival of SME contractors depends heavily on the effectiveness of material management practices (Owusu-Manu et al., 2015). It is evident from the existing literature that SMEs inadequate material management practices hinder the sustainability of the business.

In light of this, the extent of effective material management procedures employed by construction SMEs to improve long-term company success has received little attention. Against this backdrop, the research aims to analyze and categorise the most significant efficient material management strategies that might enhance the performance of SMEs in construction project delivery. Consequently, the research questions investigated in this study are stated as follows: (a) What are the important efficient material management practices for enhancing SMEs performance in construction projects delivery? (b) How can the significant efficient material management factors be analysed and classified to enhance SMEs survival rate in the construction industry? This is accomplished through effective assessments of both quantitative and qualitative data from management team members of chosen SMEs in the general building category listed in Grade 1-4 of the cidb Register of Contractors. In summary, the paper's format reveals a brief discussion of relevant overview of literature pertaining to SMEs material management techniques. The methodology used in the study, as well as the data presentation and discussion, are then presented and discussed. The study's conclusions and recommendations are presented in the last section.

REVIEW OF LITERATURE

Efficient material management practices

In the context of South Africa, SME contractors play a significant role towards economic development and there have been an important call for sustainability initiative to assist SME contractors in an effective and efficient way to enhance competitive advantage and improve project delivery (Trufil & Hunter, 2006). A review by Vatsal and Pitroda (2017) indicates that the significance of efficient material management practices within the SME sector minimises material wastage during construction and the contractor can avoid the loss of potential profits. Sogaxa, Simpeh, and Fapohunda (2021) divulge that a 0% waste culture is the element in enabling SME contractors for enabling emerging contractors' sustainability and growth. Kulkarni et al. (2017) noted the following factors as the key benefits of efficient material management practices, namely effective use of the working capital, increase in inventory turnover and ensuring the cooperation of all departments. Thus, efficient material management practices ensure that the required quality and quantity of material is purchased, delivered to the correct location, and handled correctly upon arrival (Edike, 2021).

Challenges of material management

Isnin, Ahmad, and Yahya (2012) noted that the current material management strategies used by SME contractors is inadequate. As key personal attributes affecting project success, the majority of SME contractors' success is hampered by decision-making skills, problem-solving skills, the ability to recognize opportunities, and change management (Hwang & Ng, 2013). Whilst, the general problem confronting SMEs material management practices is associated with improper material handling on the construction site, lack of effective material procurement planning, poor relationship with suppliers and all these factors result in poor quality and construction project delay and subsequently result in contractor's project failure (Alabi & Fapohunda, 2021). Vilasini et al. (2012) concurred that SMEs material management practices is affected by poor planning, material shortages, SMEs financial problems, payment delays by the client, lack of management experience and inadequate site management.

SMEs material management practices

According to Kasim et al. (2005), material management comprises clear planning strategies and quantifying material, adjudication of subcontractors or suppliers and selection, buying of material, expenditure, transportation, material receiving, storing and material recording, and material distribution. Fapohunda (2014) and Blaževska-Stoilkovska, Hanák, and Žileska-Pančovska (2015) reveal that inadequate material management practices adopted during the construction stage of the project result in project material cost increase and affect the expected profit. However, Gulghane and Khandve (2015) were of the opinion that SMEs need to have effective procurement planning, ordering and scheduling in place. On the other hand, Fapohunda (2014) added that for construction SMEs to effectively manage materials at project level, there is a need to prioritize clear material scheduling and monitoring. Thus, additional cost incurred during construction stage are the result of delays which may be inevitable when a poor material procurement strategy is adopted. For SMEs to enhance sustainable delivery of construction project, they must prioritize the management of materials at the project level to promote effective flow and administration on a project.

Material procurement practices

According to Tunji-Olayeni et al. (2017), materials procurement is the primary objective of the construction firm to minimise cost and waste and improve productivity which subsequently enhance construction project performance. A study by Tunji-Olayeni et al. (2017) and Sawan, Low, and Schiffauerova (2018) reveal that material management components comprise price, quality, quantity, the capability of subcontractor/supplier, supplier reputation, and waiting time. These factors if not given attention can be the reason for SME contractors failure. Many studies have focused on factors hindering material procurement practices, however, there have been limited research studies in respect of the most efficient material procurement strategies for SMEs contractors to enhance sustainable project success. In addition, material procurement management practices as a modality to mitigate material waste during construction project delivery and the necessity of effective material procurement to improve productivity (Daoud et al., 2018). It is worthy to note that selecting unsuitable material procurement practice for a construction project can result in unsatisfactory SMEs business sustainability. Regardless, in consideration of all the above research done regarding material procurement strategies problems, ineffective information flow significantly contributes to contractor's challenges regarding material procurement, decision making and including a sustainable delivery of construction project. Furthermore, Thomas, Riley, and Messner (2005) noted that the reason behind the challenges in respect to material information flow during the procurement stage of a construction project delivery result in production and profit decrease. In addition, the development of material information flow is significant to SME contractor's project management team and the subcontractors tendering through the use catalogues.

Capabilities of material supplier

In the construction industry, material suppliers are considered as significant source of knowledge and innovation regarding alternative materials, as a result, the main contractor must be aware of the capabilities of the suppliers and make good use of them (Kim et al., 2016). Furthermore, Pun and Heese (2014) believe that suppliers include several dimensions such as financial management and suppliers' level of knowledge. In addition, Das Nair, Chisoro, and Ziba (2018) add that material suppliers need to invest in capabilities in order to achieve sustainable competitive advantages. This article focuses on the capabilities of SME contractors' material suppliers in terms of ensuring material delivery on time.

Construction material scheduling

Material scheduling is significant to mitigate project delays and estimate the delivery timing of resource (Ghiyasinasab et al., 2021). SME contractors during construction project delivery mostly adopt critical path method (CPM) for material scheduling (Ashby & Johnson, 2013; Farhikhteh et al., 2020). Moreover, Frankovič and Budinská (2000) reveal the following advantages of material scheduling: distributed control; robustness in terms of details; stability efficiency, and integrated control. Whilst, Hu et al. (2019) claim that material schedule is developed based on available logistics, accurate quantities and effective planning. Sogaxa, Simpeh, and Ndihokubwayo (2021) contend that SME material routing is still significantly reliant on the construction site manager's level of experience. As a result, SMEs must design sustainable material scheduling for building projects (Sogaxa, Simpeh, & Fapohunda, 2021).

Monitoring and control of materials

Material monitoring and control is referred to as techniques for construction management practices, where three main categories of object detection, object tracking, and action recognition (Kazemian et al., 2019). The monitoring and controlling of material entails material tracking, reviewing and progress reporting strategy to meet project goals and objectives (Tom & Paul, 2013). Material monitoring in the construction industry promotes progress monitoring of construction sites, quality control of fabrication and on-site assembly, energy performance assessment, and structural integrity evaluation of material available onsite (Dimitrov & Golparvar-Fard, 2014).

RESEARCH METHODOLOGY

A mixed research method that includes quantitative and qualitative research approaches was used in this study. Sunindijo, Zou, and Dainty (2017) reveal that mixed mode research approach increases the chances for the researcher to obtain validity and reliability of the results. A sequential explanatory research design was adopted in this study. Creswell and Creswell (2018) stated that in explanatory design, the research commences with quantitative data followed by qualitative data at the later stage. Therefore, a sequential mixed method was adopted with questionnaires survey developed to gain an insight regarding SMEs effective material management practices. Thereof, after analysing the data statistically, convenient sampling of participants who were part of the main survey guided the selection of the respondents for the semi-structured interviews. Interviews were conducted to gain the personal views and experiences of the participants regarding effective material management practices (Leavy, 2017).

Due to time constraints to complete this study and the schedule of the construction management team, this study considered SME contractors who previously completed a construction project or are currently busy with a project. As a result, the sample frame for this study includes SME contractors listed in Grade1 to 4 of the general building (GB) category of the cidb Register of contractors in the Eastern Cape Province. Nonetheless, this research focusses on the quality of information provided by the participants, based on their experience and qualification. The survey participants used in this study include construction managers, site agent, quantity surveyors and other site management personnel. It is important to note that purposive sampling approach was adopted to select the respondents for the questionnaire survey.

The following metropoles in the Eastern Cape Province were selected: East London; Port Elizabeth; Mthatha, and Butterworth. The Metropoles were grouped into clusters of thirty-two (32), with a total of one hundred and twenty-eight (128) SME firms. 59 of the 128 survey instruments distributed were completed and returned, representing a 46% response rate. The quantitative data was collected using closed-ended questions designed to elicit information from all participants. The questionnaire was created based on a thorough review of the literature on effective material management practices. The survey instrument was divided into two sections, the first of which collected demographic information regarding the participants, and the second of which collected information regarding the effective material management procedures used by SME contractors. To assess respondents' opinions concerning the most efficient material management procedures used by construction SMEs, a 5-point Likert scale where SD = Strongly disagree, D = Disagree, N = Neutral, A = Agree, and SA = Strongly agree was used. To validate the survey instrument, pretesting was conducted. Creswell (2014) recommended that the researcher use potential respondent(s) for pre-testing. For the purpose of this study five (5)

respondents were selected from COAGA, Department of Public Works (DPW) and Eastern Cape Business Chamber (ECBC). The piloting and reviews of the survey instrument by the respondents from COAGA, DPW and ECBC refined the tool and increased the content validity. After analysing the quantitative data gathered, interview questions were formulated based on the quantitative results. Four respondents were randomly selected from respondents who participated in the survey study. In terms of qualitative data collection, semi-structured interviews were conducted to gain more insight on the efficiency of material management practices adopted by construction SMEs at the project level. The survey questions were analysed using the Statistical Package for the Social Sciences (SPSS) version 25. Using both descriptive and inferential statistical techniques, the SPSS software was used to summarize, organize, and reduce large numbers. The quantitative data from the survey was analyzed using descriptive statistics such as mean, percentage, and standard deviation. The research variables are given mean values and are rated in a hierarchical order. An exploratory factor analysis (EFA) was used to categorize the underlying structure of efficient material management practices. In addition, a content analysis was used to analyse the qualitative results.

Reliability Testing

In this study, Cronbach's alpha coefficient was used to assess the questions' reliability. To test the reliability of the Likert scale questions, SPSS was used. Table 1 presents the results of the Cronbach's alpha co-efficient tests, which were judged to be good in terms of the reliability test criteria as suggested by Maree (2007).

Table 1: Reliability analysis

Heading	No. of items	Cronbach's alpha	Rank
Effective material management practices	14	0.84	Moderate

PRESENTATION OF FINDINGS

Profile of the respondents

The age group of the respondents

Figure 1 shows that 54.2% of the survey participants were in the age group between 26 and 39, 23.7% were aged between 40 and 49, with only 11.9% between the age of 50 and 59 years. At the same time, 10.2% were in the age group between 18 and 25. The dominant age was between 26 to 39, indicating that most graduates are working for SME contractors.

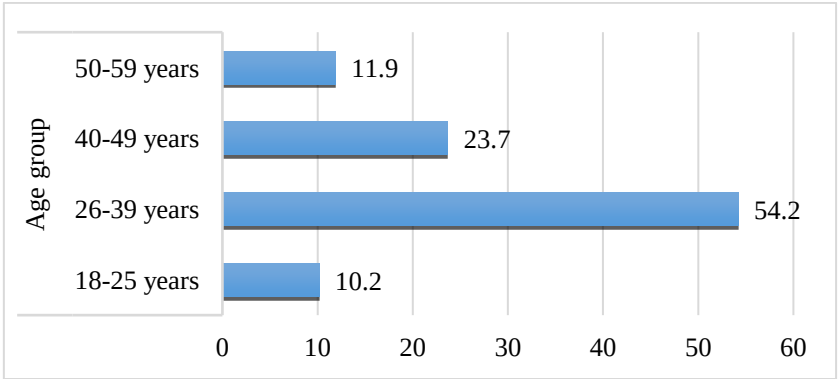

Figure 1: Age group of respondents

Experience of the respondents in the construction industry

In terms of relevant industry experience, Figure 2 indicates that 37.3% of the respondents had between 1 to 5 years of experience, whereas the remaining 62.7% had more than 5 years of industry experience.

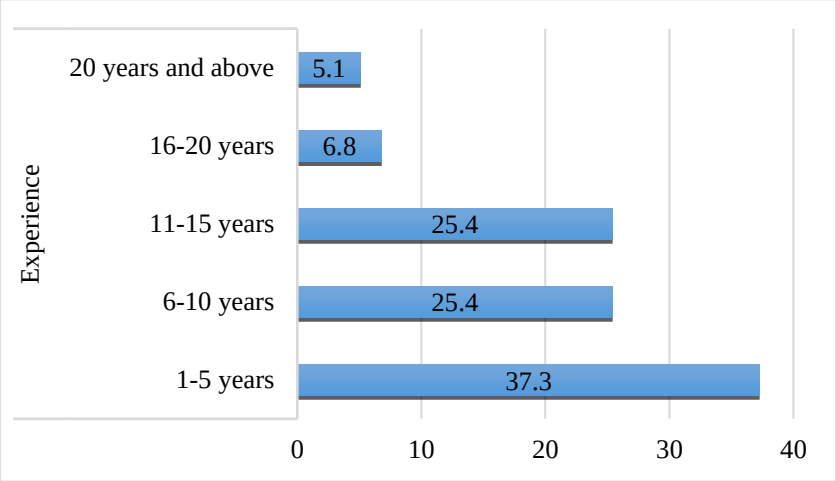

Figure 2: Experience of respondents

Educational qualification of the respondents

Pertaining to educational qualification, it is evident in Figure 3 that 47.5% of the survey participants had a National Diploma qualification, followed by respondents with bachelor's degree qualification (25.4%) and others (13.6%).

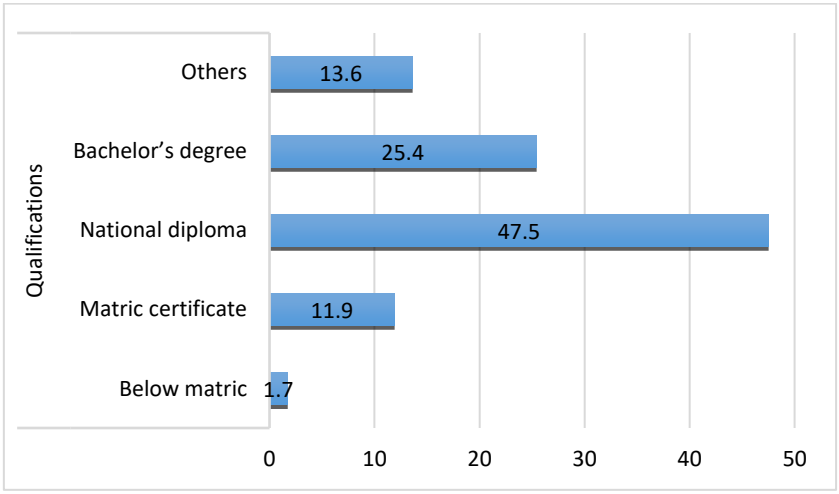

Figure 3: Qualification of respondents

The role of the respondents

In terms of respondents' roles, 37.3% were site agents, while 20.3% were project managers. Furthermore, 32.2% of the survey participants were employed in other occupations, with 10.2% working as Quantity Surveyors. Thus, Figure 4 shows that most participants were in the construction management role.

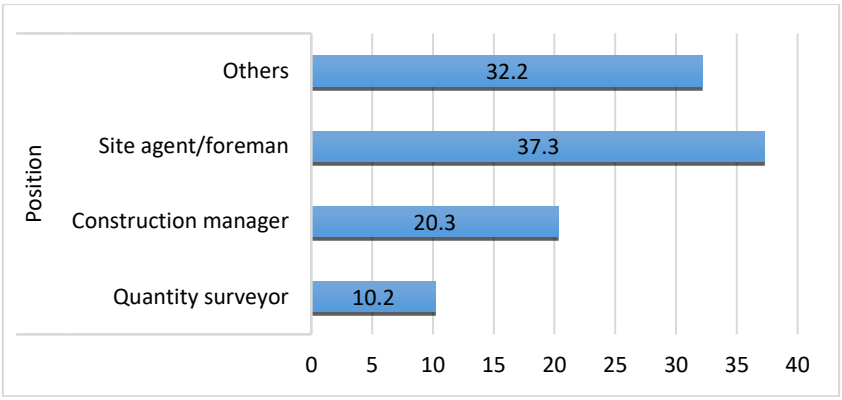

Figure 4: Role of respondents

Gender

Figure 5 shows that both genders took part in the study. It was discovered that 62.7% and 37.3% of respondents were male and female, respectively.

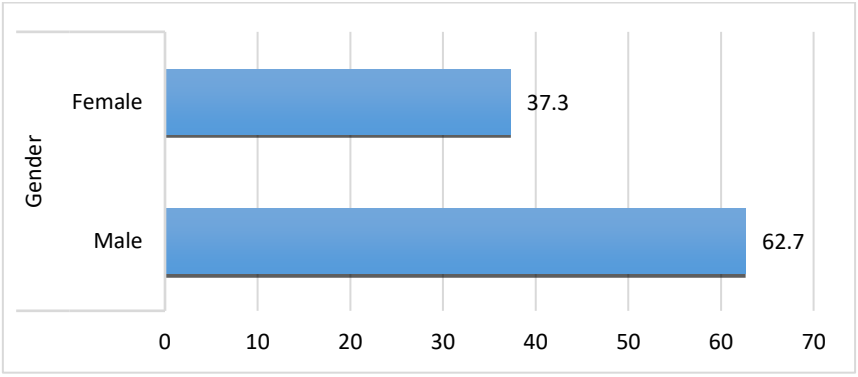

Figure 5: Gender of respondents

cidb grade of the firms

Figure 6 depicts the cidb grading of the selected SME contractors. Obviously, 35.6% of SME contractors are categorized as grade 3, whereas 32.2% of the contractors are categorized as grade 4. While 22.0% of the enterprises are classified as grade 2, just 10.2% are classified as grade 1.

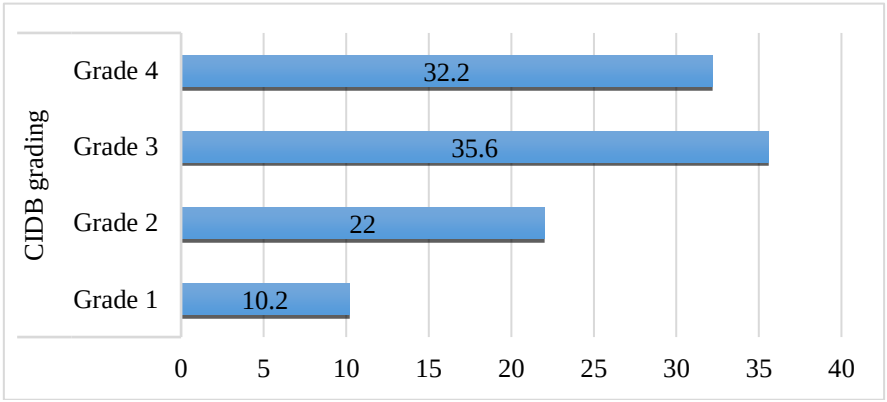

Figure 6: cidb Grading

Effective material management practices

Table 2 presents the efficient material management strategies used by construction SMEs to improve long-term project performance. The survey participants were asked to evaluate each SMEs' management practices on a 5-point scale ranging between SD to SA.

According to Table 2, the usage of specified materials for a construction project is evaluated highly, with an MS=4.25. This material management method is generally used by construction SMEs to improve the long-term success of their projects. This is closely followed by managing material through effective utilisation of construction material ranked second with a MS of 4.19. Adopting an effective material recording approach, which was ranked third with a MS of 4.12, is another recognized material management technique used by SME contractors. Furthermore, worker awareness of budgeted material against available material is the least recognized management technique among construction SMEs, with a MS of 3.48. Nonetheless, with an average mean score of 3.97, all the material management strategies are considered to be important for construction SMEs to improve construction project delivery.

Table 2: Efficient material management practices

Factors	No	Mean Score	Std. Dev.	Rank
Adherence to specifications for materials for construction project	59	4.25	.68464	1
Effective utilisation of construction materials	59	4.19	.60099	2
Effective material recording strategy	59	4.12	.64553	3
Adequate scheduling of construction materials	59	4.10	.66163	4
Availability of materials	59	4.10	.75874	4
Integrated material management approach among the team on site	59	4.03	.76488	5
Effective leadership on-site to avoid material wastage	59	4.02	.88066	6
Materials stored in safe areas	59	3.98	.84060	7
Effective management of materials by the use of requisitions	59	3.97	.76488	8
Building relationship with construction material suppliers	59	3.92	.79412	9
Sustainable procurement system	59	3.83	.79117	10
Effective processes for purchasing material from external suppliers	59	3.78	.85234	11
Material is ordered and delivered on time	59	3.75	1.25387	12
Worker awareness of budgeted material against available material	59	3.48	.95332	13
Average MS (composite score)		**3.97**		

Taxonomy of the underlying structure of efficient material management practices

The subsequent section presents the analytical taxonomy of the most significant material management practices that construction SMEs can implement to improve project delivery success rates. To this end, 14 variables were examined as effective material management practices with a positive or negative influence on the performance of construction SMEs. The analytic method began with the use of the SPSS version 25's principal component analysis (PCA) analysis tool. According to Pallant (2011), there are overarching requirements that must be met in order to deem the data satisfactory for EFA, including the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. As a result, the KMO sampling adequacy measure and the Bartlett's test of sphericity were applied to the variables related to effective material management techniques.

It is instructive to note that the value of the KMO should vary between 0 and 1, with 0.60 indicated as the minimal value for good factor analysis (Tabachnick, Fidell, & Ullman, 2012).

For EFA to be judged appropriate, the threshold of significance in the Bartlett test should be $p < 0.05$ (Field, 2013). As shown in Table 3, the KMO test result was 0.680, which is above the minimum acceptable level proposed by Tabachnick et al. (2012), while Bartlett's Sphericity value $p = 0.000$ (i.e. $p < 0.05$). Following the determination of the appropriateness and acceptability of the study data, the data was subjected to principal component analysis. To extract the variables that load on each discernible component, the "Kaiser's criteria utilizing eigenvalues" was utilized, and varimax rotation was applied. The use of PCA revealed four components in this category with eigenvalues larger than one. Table 4 shows the outcome of this factor structure. The retrieved components' eigenvalues are 4.842, 1.948, 1.404, and 1.326. A comprehensive examination of Table 4 establishes that component one can explain 34.584% of the variation, component two can explain 13.912% of the variance, component three can explain 10.031% of the variance, and component four can explain 9.469% of the variance. As shown in Table 4, these components account for 67.997% of the total variance of the 14 factors. In addition, the varimax rotation was used to aid in the elucidation of the four components, with results indicating that the first four components have a number of loadings greater than 0.4 on the rotated component matrix. The explanation of these findings in relation to the loading pattern of the efficient material management practices reveals that "efficient material procurement and storage practices" is the factor that congregates at Component 1, while others such as "effective inventory of material" converge at Component 2, "sustainable procurement system" converge at Component 3, and adequate scheduling and utilization of materials converge at Component 4.

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.680
Bartlett's Test of Sphericity	Approx. Chi-Square	372.212
	df	91
	Sig.	0.000

Table 4: Rotated Component Matrix for efficient material management practices

	Component			
	1	2	3	4
Component 1: Efficient material procurement and storage practices				
Material is ordered and delivered on time	0.863			
Effective leadership on site to avoid material wastage	0.862			
Building relationship with construction material suppliers	0.742			
Effective processes for purchasing material from external suppliers	0.674			
Materials stored in safe areas	0.669			
The use of specified material for construction project	0.639			
Component 2: Effective inventory of material				
Integrated material management approach among the team on site		0.879		
Effective material recording strategy		0.769		
Effective management of materials by the use of requisitions		0.682		
Component 3: Sustainable procurement system				
Sustainable procurement system			0.914	
Workers awareness on budgeted material against available material			0.860	
Component 4: Adequate scheduling and utilisation of materials				
Adequate scheduling of construction materials				0.801
Availability of materials				0.742
Effective utilisation of construction materials				0.456
Eigenvalue	4.842	1.948	1.404	1.326
Variance (%)	34.584	13.912	10.031	9.469
Cumulative variance (%)	34.584	48.496	58.528	67.997

Qualitative interviews

Justification for the interviews

In this study semi-structured interviews were conducted to validate the quantitative data to mitigate the biasness of the results. The interviews were conducted amongst four of the participants who took part in the survey. In the interview, attention was paid to the most efficient material management practices adopted by SME contractors to enhance sustainable project success. During the interviews, the quantitative findings were used as the guide for developing interviews questions.

Profile of respondents

The first interview was performed on September 5, 2019 at King William's Town, a district within East London in the Eastern Cape Province, with the firm's director (referred to as Participant 1 in this study). The second interview was performed with the business's director (referred to as Participant 2 in this study) on September 6, 2019 in the conference room of the SME contractor during office hours in the Southernwood area of East London. The third interview (referred to as Participant 3 in this study) was conducted with the director of the firm, who was the firm's sole management executive. The final interview was conducted on September 23, 2019 in Mthatha at the site office with the contract's manager (referred to as Participant 4 in this study), who handled all of the firm's construction sites. The interview lasted around 76 minutes.

Efficient material management practices

The following are verbatim comments emanating from the interview with regard to efficient material management practices adopted by construction SMEs:

Participant P1 stated that the appropriate manner in terms of managing and handling materials on site was achieved through adequate record keeping of materials delivered to site and issued on site. According to the interviewee, construction SMEs have a purchasing unit in their organizational structure that is in charge of managing what is needed on site. The interviewee also suggested that the project manager performs the material reconciliation task after recording the content.

Participant P2 claimed that a storekeeper will monitor the material recording on-site at the start of each project, but the director quantifies the material to order. The storekeeper kept track of what was available. For safety considerations, the material was ordered based on the quantities obtained from the drawings rather than the Bill of Quantities (BoQ), and it was housed in a safe area as well as a locked section for small items (e.g. ironmongery). The interviewee further stated that the storekeeper was solely responsible for the storeroom and record keeping of the materials.

Participant P3 stated that a zero percent waste campaign was promulgated on building sites to lower the cost of materials, which accounted for the lion's share of project expenditures. The interviewee suggested that materials be handled on construction sites through adequate site security and that orders, including material ordering, be monitored and controlled by the site manager.

Participant P4 revealed that the company carried out planning to procure the material, as well as planning to effectively utilise the material available.

DISCUSSION OF FINDINGS

Component 1: Efficient material procurement and storage practices

This principal factor explained the most variance and was defined by six variables: material ordered and delivered on time (0.863); effective leadership on site to avoid material wastage (0.862); building relationships with construction material suppliers (0.742); effective processes for purchasing material from external suppliers (0.674); materials stored in safe areas (0.669), and the use of specified material for construction project (0.639). Notably, each variable's appropriate factor loading has been contained in parenthesis. Material ordered and delivered on time has the highest factor loading among the 'material procurement and storage practices.' This was followed by effective leadership on site to avoid material wastage and building relationships with construction material suppliers. The four practices in this category deal with concerns linked to effective procurement practices, while the remaining two deal with storage practices. The quantitative findings align with the qualitative data. In respect of storage practices, Respondent P2 mentioned that the ordering of materials is based on the quantities extracted from the construction drawing, not from the BOQ, and that the materials were stored in a lockable area for small materials (e.g. ironmongery) to prevent pilfering. According to Arbulu and Ballard (2004) and Tabrizi (2018), material procurement in construction projects comprises identifying, acquiring, distributing, and disposing of materials. According to Alumbugu, Shakantu, and Tsado (2020), materials procurement is the primary objective of the construction firm to minimise cost and waste and improve productivity which subsequently enhance construction project performance. For instance, Lam et al. (2011) justify the use of specified materials for construction projects, noting the importance of material specification and promoting the effective use of project specifications by SMEs.

Component 2: Effective inventory of material

The second component includes three features, namely integrated material management approach among the team on site, effective material recording strategy, and effective management of materials by the use of requisitions (Table 4). This component is capable of explaining 13.912% of the variance. Integrated material management approach among the team on site recorded the highest factor loading of 0.879 followed by effective material recording strategy with a factor loading of 0.769 and effective management of materials by the use of requisitions (0.682). The findings are in consonant with the qualitative data. For instance, interviewee P1 concurred by indicating that materials were managed through adequate record keeping of materials delivered to site and issued on site. Participant P2 expressed similar feelings, noting that a storekeeper would monitor the material recording on-site and keep records of the available material at the start of each project. Furthermore, Respondent C proposed that materials be handled on construction sites through efficient site security and that orders, including material ordering, be monitored and controlled by the site manager. These findings are in harmony with the normative literature and reinforced by Li et al. (2015), who argue that the majority of material management systems use material recording approaches.

Component 3: Sustainable procurement system

The 'Sustainable procurement system' component explains 10.031% of the total variance and comprises two factors, namely, sustainable procurement system and workers' awareness on budgeted material against available material (Table 4). The most important factor in this

category is the sustainable procurement system, which has a factor loading of 0.914, while the least important factor is workers' awareness of budgeted material versus available material, which has a factor loading of 0.860. It is instructive to note that sustainable procurement system should benefit the firm, society, and economy while reducing environmental impact and providing value for money throughout the project's life cycle (Sustainable Procurement Task Force, 2006). According to Ruparathna and Hewage (2015), the primary benefit of implementing sustainable procurement is long-term cost savings. As a result, SMEs adopting a sustainable procurement system would improve project delivery performance, potentially helping to secure the industry's long-term viability.

Component 4: Adequate scheduling and utilisation of materials

The fourth component consists of three strategies, namely, adequate scheduling of construction materials, availability of materials, and effective utilisation of construction materials (Table 4). This underlying group is capable of explaining 9.469% of the total variance. From the qualitative findings, Respondent D, indicated that SMEs should carry out planning to effectively utilise the materials available. The findings are akin to the normative literature. For instance, Fapohunda (2014) stated that for construction SMEs to effectively manage material at project level, there is a need to prioritise clear material scheduling and monitoring. This is corroborated by Ghiyasinasab et al. (2021) who opine that material scheduling is significant in mitigating project delays and estimate the delivery timing of resource. In terms of utilization of materials, Spillane and Oyedele (2017) revealed that effective utilisation of available material result in cost reduction, budget management and maximise contractors profit. It is important to mention that SME contractors that use building materials effectively in their projects reduce project costs and enhance output (Ahmadi & Al-Khaja, 2001; Md & Mohd, 2010).

CONCLUSIONS

In an effort to improve SMEs inadequate management techniques, the extent of effective material management procedures employed by construction SMEs to improve long-term company success has received little attention. In SMEs sector, material management practices play a crucial role, nonetheless, many scholars are concerned about management practices adopted by SME contractors to improve sustainable construction project delivery. The research aimed to determine a suitable taxonomy system for efficient material management practices that are considered useful for construction SMEs at project level to enhance sustainable delivery of construction projects in developing countries. Based on the findings, it can be concluded that the main effective material management practices include: strict adherence to specifications for materials in delivering construction projects, effective utilisation of construction materials, and effective material inventory strategy

In addition, the PCA was utilized to extract four components based on fourteen variables, which were then used to classify the significant efficient material management strategies. The four components are “efficient material procurement and storage practices", "effective inventory of material”, "sustainable procurement system", and adequate scheduling and utilization of materials. Furthermore, in South Africa there is high demand for sustaining SME business success, especially in the construction industry to promote economic development. Construction industry is ultimately more complex and with more activities that require the use of materials, there is a need for academics and industry practitioners to develop effective material management practices for enabling sustainable business success especially in the SMEs sector.

RECOMMENDATIONS

This study recommends that, to ensure the success rate and sustainability of SMEs, SMEs should adopt an effective procurement strategy that encompasses the use of specified material, utilisation of the available material effectively and effective recording of material to avoid material wastage. Although, the purpose of this study attempt to respond to crucial questions based on the literature related to material management practices to gain ground knowledge. However, the suggestive material management practices cannot be always adopted by construction SMEs. For future trends, this study suggests a collaborative framework for SMEs material management practices which includes: collaborative planning, employees training concerning material management and SMEs to develop a supply data set for construction materials. This study is confined to South Africa's Eastern Cape Province and focuses on SME construction firms registered in Grades 1 to 4 of the cidb Register of Contractors. As a result, the importance of this study should be expanded to the national level and other developing nations to establish whether an agreement can be reached on the study's conclusions.

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APPENDIX 1: QUESTIONNAIRE SURVEY

Efficient material management strategies for enhancing the performance of SMEs in the South African construction industry

Section A: Biographical information

Please complete all the sections by indicating with an X in the appropriate box and fill in the blanks when necessary.

1. Please indicate your age group.

18 –25		26 –39		40 – 49		50 - 59		60 & above	

2. Please indicate your years of experience in your current position

1-5 years		6-10 years		11-15 years		16-20 years		20 & above	

3. Please indicate your highest formal qualification

Below Matric		Matric		Diploma		Degree		Other	

If 'other', please specify.....

4. Please indicate your role in the organisation

Quantity Surveyor		Project Manager		Site Agent/ Forman		Other	

If 'other', please specify…..……

5. Please indicate your gender

Male		Female	

6. Please indicate your CIDB grading

CIDB grades	Less than or equal to	Tick one box
1	R 200 000	
2	R 650 000	
3	R2 000 000	
4	R4 000 000	

Section B: Efficient material management strategies for enhancing construction Project delivery

1. The following are material management practices that can be implemented by SMEs to enhance construction project delivery in South Africa. Please indicate your level of agreement using the following 5-point scale: **Strongly Disagree = (SD); Disagree = (D); Neutral = (N); Agree = (A), and Strongly Agree = (SA)**

	Effective construction resource management practices					
No	**Material management practices**	**SD**	**D**	**N**	**A**	**SA**
1	Adequate scheduling of construction materials					
2	Availability of materials					
3	Effective utilisation of construction materials					
4	Adherence to specifications for materials for construction project					
5	Effective material recording strategy					
6	Integrated material management approach among the team on site					
7	Effective management of materials by the use of requisitions					
8	Workers awareness on budgeted material against available material					
9	Sustainable procurement system					
10	Effective processes for purchasing material from external suppliers					
11	Materials stored in safe areas					
12	Building relationship with construction material suppliers					
13	Material is ordered and delivered on time					
14	Effective leadership on site to avoid material wastage					

Thank you for your kind cooperation.

APPENDIX 2: INTERVIEW QUESTIONS

Efficient material management strategies for enhancing the performance of SMEs in the South African construction industry

Section A: Background information of interviewee

1. What is your current role or position in the firm?
2. How long have you worked in the construction industry?
3. What is your highest educational qualification?
4. What is your company's CIDB grade?
5. What type of projects does your firm undertake?

Section B: SMEs material management practices

1. What are the material management practices employed by SMEs to effectively manage and monitor the construction project?