

Effective Material Management Practices Adopted by SMEs to Achieve Project Success: A Perspective of Construction Industry in the Eastern Cape Province

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Abstract:

This study investigates the effectiveness of material management practices adopted by construction SME firms at the project level to achieve sustainable construction project success. A mixed-method research approach that involved a questionnaire survey was distributed to purposively selected management personnel of SMEs construction companies listed in Grade 1 – 4 of the cidb Register of Contractors and based in the Eastern Cape Province of South Africa. Also, semi-structured interviews of purposively selected contractors who took part in the survey were undertaken. The quantitative data were analysed using descriptive statistics, and content analysis was used to analyse qualitative data. This paper discovered effective material management practices to promote SMEs sustainable success using specified material for construction project, effective utilisation of construction materials, and effective material recording strategy. The qualitative findings revealed effective material management practices and effective monitoring and control of material and effective material procurement practices. The study focuses on emerging contractors registered under CIDB grade 1 and 4 in the Eastern Cape province. However, the findings have practical significance to big firms and the construction industry because projects will be successful when materials are effectively monitored, controlled and procured. This study focuses on SMEs effective material management strategies and provides more comprehensive effective material management practices for enhancing sustainable project implementation.

Keyword: Material management, project delivery, SMEs, sustainable construction

1 Introduction

Material management during the construction of a project has been viewed as the effective practices which result in the success of Small Medium Enterprises (SMEs). Smit and Watkins (2012:6325) referred to SMEs as a business based on yearly turnover and the number of workers or employees. The South African development and the country's economic growth within the lower grades of CIDB are significant to build the capacity required to produce high-quality infrastructure (Yokwana, Ndiokubwayo & Windapo, 2016). Among SMEs project success, Ofori-Kuragu, Baiden and Badu (2016) and Chan and Chan (2004) argue that SMEs project success is measured based on project performance and adoption of profitable and competitive business. Ulubeyli, Kazaz and Sahin (2018:655) and Labuschagne and Brent (2005; 159) indicate that SME businesses constitute one of the pillars of the country's economy and that SMEs have the responsibility to

prioritise the significance of sustainability in the construction industry. Hence, construction growth mostly relies on home-based sustainable growth, brought through effective performance by the firm in the industry. Islam, Keawchana and Yusuf (2011) note factors that SMEs can adopt concerning sustainable business, namely management and know-how. For instance, Khyomesh and Vyas (2011) note that construction material management is influenced by numerous factors, including inadequate material handling and material management during construction project delivery. It can be concluded that contractor's effective material management practices contribute to quality, time, and a socio-economic transformation of sustainable construction. Also, construction material contributes largely to construction project cost; hence, SMEs need to invest in effective material planning and control to minimise wastage which invariably affects the organisation's performance (Gulghane & Khandve, 2015).

Nonetheless, Kasim, Anumba and Dainty (2006) suggested that the sustainability performance of a construction contractor on projects is mostly influenced by the strategies adopted by contractors regarding material management, which then affects the delivery time of construction project at large. According to Adedeji, Afolabi, Ojelabi and Ayim (2017), contractors need to understand the logistics related to procurement, transportation, handling, storing and efficient use of materials on site. Based on the above literature, the problem to be investigated is stated as follows: it is not evident to what extent effective adoption of material management practices during construction project delivery enhances SMEs' business performance in the Eastern Cape province. Therefore, the study aims to investigate and determine the most effective material management practices that can be adopted by construction SMEs at the project level to achieve sustainable construction project success. The purpose of the study is pursued by analysing both quantitative and qualitative data from selected SMEs' management team in the general building category listed in Grade 1 – 4 of the cidb Register of Contractors.

2 Literature Review

2.1 SMEs Material Management Practices

Management of material in construction is the main element, as it is applied to construct the structure of the building. When materials are not effectively managed, they add to the cost of the project from the contractor's perspective (Gulghane & Khandve, 2015:60). Kasim, Anumba, and Dainty (2006:794) point out that materials management is the process that includes planning and quantifying construction material, supplier evaluation and selection, effective purchasing of construction material, expenditure, transportation, material receiving, storing and material recording, and material distribution. Also, Kasim (2011:48) points out that when the material is not properly managed during a construction project, this will have a negative impact on the project performance. Furthermore, Kasim (2011:48) points out that materials make up the bulk of the costs on a construction project between 30% and 80%. During construction project delivery, poor materials management leads to largely unavoidable variation costs that the contractor must consider (Fapohunda, 2014:25). Thus, inappropriate materials management will result in construction project failure. There is a need for emerging contractors to develop an effective material procurement system. The impact of procurement includes planning, ordering and scheduling (Gulghane & Khandve, 2015:60).

Stoilkovska, Hanak and Pancovska (2015:723) reveal that the lack of materials management is the leading factor in increased cost and time overruns. Donya and Flanagan (2009:12) argue that for a contractor to achieve cost reduction, special attention is required on the management of materials, which include the following: effective procurement strategy, shop fabrication, effective material logistics, effective resource management, production on-site, and effective field servicing, which promotes cost reduction. To properly manage production times in construction projects, SME contractors have to ensure proper scheduling of material delivery (Fapohunda, 2014:25). Opoku, Cruickshank and Ahmed (2013) believe that sustainable construction practices are achieved through effective contractor's leadership skills to encourage and influence sustainable practices. Moreover, Korkmaz, Riley and Horman (2011) argue that sustainable construction project delivery is not only the contractor's responsibility but also includes the client's decision making. The sustainable management of project material is the key factor in achieving sustainable construction project delivery. Solanke and Fapohunda (2016:497) opine that sustainable material management requires an integrated approach concerning reducing material wastage during construction projects, thus increasing the company's profit and environmental protection. Hence, extra costs on construction sites are caused by delays which may be unavoidable where there is an inadequate material ordering system within the company. It is necessary for the growth and sustainable use of available materials that construction managers ensure a proper flow in the administration of materials on a project.

2.2 Material Procurement Practices

Kasim, Anumba and Dainty (2005:795) and Tunji-Olayeni, Afolabi, Ojelabi and Ayim (2017) refer to procurement as the term that includes a wide range of activities such as procurement and management of materials, manpower and services required for construction project delivery. According to Patel and Vyas (2011), materials procurement is the primary objective of materials management in any project management system used in a construction project. Similarly, according to Kasim (2011:32), material procurement is the process of purchasing materials from external suppliers to support the project operations. The current interest of construction firms mainly focuses on the resource acquisition relationship concerning SME contractor and material suppliers and construction subcontractors. In most construction organisations, material procurement activities are the responsibility of the buying department or estimating department. Practically, procurement officers or buyers perform vital functions to ensure that the materials required for a project are provided (Hadded, 2006). Consequently, the material procurement strategy scheduled for a construction project as large as an industrial plant requires a complex and integrated management system, which could be determined by considering the above-mentioned selection factors. It is worth noting that selecting an unsuitable material procurement strategy for a project could result in unsatisfactory project outcomes in terms of quality and cost.

2.3 Construction Material Scheduling

The management personnel decisions are mainly based on programmes and schedules developed during the planning stage of a project, but there is still a lack of material scheduling that needs to be done, among many scenarios that could be considered at the project level (Ashby & Johnson, 2013). Although most SMEs use CPM (Critical Path Method) to do scheduling of materials, this technique has been used since the 1950's and benefited most SMEs in many areas of construction projects, such as the planning and controlling of materials, communicating plans, and training management (Ashby & Johnson, 2013; Farhikhteh, Kazemi, Shahin & Shafiee, 2020). Hence,

Risku and Karkkainen (2004:4) conclude that materials can be managed effectively by focusing on two factors; namely, the planner needs to have access to effective, comprehensive information regarding materials required on the project, and the materials should be reliable in terms of the required quality, without excessive record build-up at the project site. Consequently, SME material routing is still heavily dependent on the level of experience of the construction site manager. Hence there is a need for SMEs to develop sustainable material scheduling for construction projects. Cost, quality, time, client, supply chain and project size are drivers of strategic material procurement selection, which is usually also influenced by the legislation of any country (Baloi, 2002).

2.4 Selection of Sustainable Building Material

According to Haddara and Elragal (2014), most construction activities worldwide use billions of tons of raw materials in a single year, contributing to more than 40% of the global use. Thus, Ljungberg (2007) opines that the objectives of sustainable construction can be enhanced through effective consideration of environmental impact, economic impact, client's requirements and the demand within the market. Nevertheless, Abeysundara, Babel and Gheewala (2009) divulge that contractors can select material based on the fundamentals of sustainable construction practices for contractors to achieve economic benefits. Thus, ineffective material selection affects the contractors' desire to achieve sustainable project goals. Moreover, Abeysundara *et al.* (2009) conclude that an appropriate approach adopted from the design to the construction of the sustainable project is fundamental in the sustainable construction project delivery.

3 Research Methodology

This study adopts a mixed-method research approach consisting of both quantitative and qualitative research approach was adopted in this study. Zou, Sunindijo and Dainty (2014:317) argue that a mixed-method enhances the validity and reliability of the study outcome. The sample frame for the study is from emerging SME contractors listed in Grade 1 to 4 of the general building (GB) category of the cidb Register of the Contractors. It is important to highlight that the population comprises construction managers, site agent, and quantity surveyors. The purposive techniques were adopted to select participants for a questionnaire survey.

Construction SMEs situated in East London, Port Elizabeth, Mthatha and Butterworth in the Eastern Cape Province were grouped into clusters of thirty-two (32) in which participants were selected using a purposive sampling approach with a total of one hundred and twenty-eight (128) firms. Out of the 128 questionnaires administered to the respondents, 59 were duly completed and returned, representing a 46% response rate. Closed-ended questions were formulated to obtain data from all the participants. The survey instrument adopted in collecting the quantitative data was divided into two sections. The first section solicited information regarding the participants' demographic details, whereas the second section collected information about the effective material management practices adopted by construction SMEs. A 5-point Likert scale where SD = Strongly disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly agree was adopted to evaluate respondents' perceptions regarding the most effective material management practices adopted by construction SMEs. Concerning qualitative data gathering, semi-structured interviews aided the data collection to understand effective material management practices at the project level. Statistical Package for the Social Sciences (SPSS) version 25 was used to analyse the quantitative

data. SPSS was adopted to summarise, organise, and reduce large numbers in the research study using descriptive statistics. Whereas qualitative data was analysed using content analysis.

3.1 Reliability Testing

The scaled questions used were tested on Cronbach's alpha coefficient to check the reliability of questions. Statistic Package for Social Sciences Software (SPSS) was used to examine the reliability of the Likert scale questions. According to Maree (2007:216), the Cronbach's alpha test is interpreted as follows: values that are lower than 0.6 are considered as unacceptable; values with a coefficient of 0.70 are considered as having low reliability; while values with a coefficient of 0.80 are considered as moderate, and values hovering around 0.90 are considered as possessing high reliability. The results of the Cronbach's alpha co-efficient tests presented in Table 1 were found satisfactory in terms of the reliability test requirements.

Table 1 Reliability Testing

Question No.	Headings	No. of items	Cronbach's alpha coefficient value	Rank
12	Effective material management practices	14	0.84	Moderate
Sum	All questions combined	14	0.84	Moderate

4 Analysis of Results

4.1 The Profile of Respondents

A total of 59 respondents from different SME firms. 54.2% of respondents fell 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. 89.8% of the respondents were aged between 26 to 59, which suggests respondents had sufficient maturity. Regarding the relevant experience of the respondents in the industry, it is evident that 37.3% had experience ranging between 1 to 5 years, 25.4% of respondents had worked in the industry between 6 to 10, while 25.4% had 11 to 15 years of industry experience. Furthermore, 6.8% of respondents had worked in the industry between 16 and 20 years, and only 5.1% had worked in the industry ranging for more than 20 years. Concerning the educational qualification of the respondents, 47.5% held a National Diploma qualification, followed by respondents with degree qualification 25.4% and others with 13.6%. It can be deduced from the findings that an overwhelming 72.9% have obtained tertiary qualification. Regarding the role of respondents, 37.3% of the respondents were site agent, and 20.3% of respondents were project managers. Also, 32.2% of respondents have other roles, 10.2% are Quantity Surveyors. Concerning the gender of the respondent, it was found that 62.7% and 37.3% of the respondents were male and female, respectively. This implies that both genders participated in the study.

4.2 Effective Material Management Practices

Table 2 presents the findings related to effective SME material management practices adopted by construction SMEs to achieve sustainable construction project delivery in the Eastern Cape province. Table 2 indicates that the use of specified material for a construction project is ranked peak, with MV=4.25. This is reinforced by the fact that 90% of the respondents agreed that using

specified material for a construction project is significant for SMEs to achieve sustainable construction projects. 8.5% of the respondents were neutral, and 1.6% of the respondents disagreed. Managing material through effective utilisation of construction material is ranked second, with MV=4.19. 89.9% of the respondents agreed that the effective utilisation of construction material is an effective material management modality for construction SMEs to achieve sustainable project success. However, 10.2% of the respondents were neutral, and Table 2 indicates that none disagreed. Notably, 84.5% of the respondents agreed on adopting an effective material strategy, which ranked third with a mean value of 4.12. 15.3% of the respondents were neutral on this factor, and none of them disagreed. In addition, the least recognised factor by construction SMEs is worker awareness of budgeted material against available material, with a mean value of 3.48. Nonetheless, it can be noted that these modalities proved to be significant for construction SMEs to achieve sustainable construction project success, with an average mean value of 3.97.

Table 2: Effective Material Management Practices

Statements	No	SD %	D %	N %	A %	SA %	Mean	Std.	Rank
The use of specified material for construction project	59	1.7	0.0	8.5	52.5	37.3	4.25	.68464	1
Effective utilisation of construction materials	59	0.0	0.0	10.2	61.0	28.8	4.19	.60099	2
Effective material recording strategy	59	0.0	0.0	15.3	57.6	27.1	4.12	.64553	3
Adequate scheduling of construction materials	59	0.0	0.0	16.9	55.9	27.1	4.10	.66163	4
Availability of materials	59	1.7	0.0	13.6	55.9	28.8	4.10	.75874	4
Integrated material management approach among the team on site	59	0.0	0.0	27.1	42.4	30.5	4.03	.76488	5
Effective leadership on-site to avoid material wastage	59	0.0	3.4	27.1	33.9	35.6	4.02	.88066	6
Materials stored in safe areas	59	0.0	1.7	30.5	35.6	32.2	3.98	.84060	7
Effective management of materials by the use of requisitions	59	1.7	0.0	20.3	55.9	22.0	3.97	.76488	8
Building relationship with construction material suppliers	59	0.0	1.7	30.5	42.4	25.4	3.92	.79412	9
Sustainable procurement system	59	1.7	1.7	25.4	54.2	16.9	3.83	.79117	10
Effective processes for purchasing material from external suppliers	59	1.7	3.4	28.8	47.5	18.6	3.78	.85234	11
Material is ordered and delivered on time	59	13.6	0.0	11.9	47.5	27.1	3.75	1.25387	12
Worker awareness of budgeted material against available material	59	1.7	15.3	28.8	42.4	11.9	3.48	.95332	13
Average	59						3.97		

4.3 Qualitative Interviews

4.3.1 Profile of Respondents

The first interview (*with respondent A*) was conducted with the firm's director on 05 September 2019 in King William's Town, a suburb of East London in the Eastern Cape Province. The second interview (*with respondent B*) was conducted with the firm's director on 06 September 2019 in the Southernwood suburb of East London at 14:45 in the meeting room of the SME contractor during office hours. The third interview (*with respondent C*) was conducted with a firm's director, who was the sole management executive of the firm.

Respondent A declared that material was managed through material recording of the material coming in and material going out. The respondent also suggested that construction SMEs have a buying department in their organisational structure responsible for overseeing what is needed on site. The respondent also recommended that after recording the material, the project manager does the material reconciliation. *Respondent B* stated that at the beginning of each project, a storeman would oversee the material recording on-site, although the director quantifies the material to order. The storeman kept the record of the available material. The material was ordered based on the quantities taken from the drawing, not from the BOQ, and the material was stored in the safe area and a lockable area for small materials (door locks) for safety reasons. The respondent also indicated that the storeman was strictly responsible for the storeroom and kept the material's record. The storeman was to check the delivery notes of the material to ensure that the correct material was delivered on-site, and the storeman was given the necessary training to read the delivery notes. Lastly, *Respondent C* opined that a 0% waste initiative was implemented on construction sites to reduce the cost of materials, which made up the lion's share of costs on a project. The respondent recommended that material be managed through effective site security on construction sites and that orders be managed and controlled by the site manager, including ordering materials.

5 Discussion of Findings

Among the effective resource management practices, the effective use of materials for the construction project contributes to sustainable material management. As presented in Table 2, the quantitative findings indicate that the use of specified construction material in construction projects is the most important material management practices adopted by SMEs in sustainable construction projects, with $MV=4.25$. The specification on the construction project forms the basis of the contract, which the SME has to comply with. This finding is justified by Lam, Chau, Chau and Poon (2011), who note the significant material specification and promote the effective use of project specification by SMEs, as this forms the basis of contractual documents concerning achieving project goals. The effective utilisation of materials during construction project delivery is the second important effective material management practice. It is significant to note that SME contractors who adopt effective utilisation of construction material in construction projects minimise project cost and increase production (Safiuddin, Jumaat, Salam, Islam & Hashim, 2010; Ahmadi & Al-Khaja, 2001). Effective material recording strategy ranked third, with $MV=4.12$, and is a notable material management practices adopted by SMEs. Mikulakova, Konig, Tausche and Beucke (2010) support this finding, arguing that most material management system utilises material recording techniques.

Quantitative analysis suggested that SMEs adopt material recording, safe storage of material, and monitor and control material and material procurement strategies to achieve sustainable construction project success. As indicated in quantitative analysis, material recording is significant for SME contractors' effective material management strategy, indicated in Table 2 with MV=4.12. Qualitative findings also revealed effective monitoring and controlling of materials as a tool used by SME contractors to manage material. This result aligns with the findings of previous research by Omar, Mahdjoubi and Keder (2018). They point out that monitoring and controlling systems assist construction managers in seeing the project's progress, identifying potential delays, and taking corrective action to prevent risks. The qualitative findings in Table 2 indicate effective material procurement as the effective strategy adopted by SMEs. Arbulu, Ballard and Harper (2003) and Tabrizi (2018) reveal that material procurement includes identifying, acquiring, distributing, and disposing materials on construction projects.

6 Conclusion and Recommendations

Based on the quantitative analysis, the most effective material management practices adopted by construction SMEs to achieve a sustainable success rate include the effective use of specified material for a construction project (MV=4.25), effective utilisation of construction material (MV=4.19) and effective material recording (MV=4.12). Qualitative findings were consistent with the quantitative analysis, as the respondents revealed that effective material management practices adopted by construction SMEs include effective material recording, as discussed in quantitative findings, and reconciliation of the material. Also, the qualitative findings revealed that construction SMEs could adopt materials stored in safe areas, material ordering as per issued construction drawings, adequate site security, monitoring and controlling construction material, effective material procurement and effective utilisation of material to achieve sustainable construction project success. The study provides information on effective material management practices to enhance sustainable construction project delivery by SMEs. It is recommended that SMEs should ensure that they utilise the available material effectively and avoid waste on construction sites. Also, SMEs need to keep a record of available material on-site to minimise waste. Construction SMEs should adopt an effective procurement strategy to order material according to the specification and ensure that the ordered material is as per drawings. This study is limited to the Eastern Cape Province of South Africa and focuses on Small to Medium Enterprise (SME) contractors listed in Grade 1 to 4 of the cidb Register of Contractors. However, the findings have practical significance to big firms and the construction industry because projects will be successful when materials are effectively monitored, controlled and procured.

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