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INFLUENCE OF LOW-COST BUILDING MATERIALS ON HOUSING PROJECT IN REDUCTION OF HOUSING DEFICIT IN NAIROBI CITY COUNTY, KENYA

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Abstract

Purpose: The purpose of the study was to explore the influence of low cost building materials on reduction of housing deficit in Nairobi County, Kenya.

Methodology: The study adopted four theories: open innovations theory, the value theory, transformational leadership theory, and institutional theory. Methodologically, the study adopted a descriptive research design, while the population of this study was all the real estate firms registered by Kenya Property Developers Association (KPDA). Census technique was employed to collect data from all 69 real estate firms using questionnaires. Questionnaires were applied to collect primary data, where the researcher trained research assistants to aid the data collection procedure. A pilot-test was conducted as an approach to establishing both the reliability and validity assessments of the questionnaire. Statistical packages for social sciences (SPSS) was used to undertake both descriptive and inferential statistical computations.

Results: The findings of the study established that the use of technology enhances the capability and capacity of construction firms to use an array of building materials. The study found that use of modern technology defined skilled labour because most organizations are leveraging technology as a basis of realizing competitive advantage. It also established that real estate firms utilize competent based human resource management firms to hire qualified personnel. In addition, it was evident that personality traits influenced adoption of new technology in the construction of low cost housing, whereas knowledge and attitudes, and skills were significantly attributed to adoption of new technology.

Unique contribution to theory, practice and policy: In light of the research findings, the study recommends that organizations should leverage modern technology as a basis of realizing efficiency, effectiveness, and sustainability of projects. The study likewise recommends that organizations should build capacities to enhance labour productivity. In addition, the study recommends that organizations should adopt transformational leadership approaches as a basis of enhancing performance. The study recommends the need to revise the legal framework with a view to ensure that it reflects the changing needs of the project requirements.

Keywords: *Low cost building materials, housing deficit.*

1.0 INTRODUCTION

Implementation of construction projects should be based on the premise of ensuring the projects are capable of meeting housing demand of a population. The best way to ensure the houses are available and affordable is using quality and low-cost building materials (Olaya, Vasquez, & Muller, 2017). These materials will help to boost the number of housing units in Nairobi County and by extension in the whole country. Use of low cost building materials will cut down the cost of construction and, therefore, make more housing units affordable. Sourcing of construction materials from different areas and suppliers is one of the reasons for the high costs of building construction and deficit of the housing units (Watson, 2014). In South Africa, the building construction industry has incessantly considered and embraced the inception of new technologies, which increase construction speed, reduce the cost of construction, make buildings stronger, and observe the environmental requirements (Afrane *et al.*, 2016). However, there is dearth of literature on the interplay between building technology using low cost building materials and cutting housing deficit.

Wesangula (2016) reported that Kenya is experiencing an annual housing deficit in quantity of over 200,000 units. Arguably, the shortage is an instigating factor for finding new technologies to increase the number of housing units and reduce house shortages in Nairobi County. The housing projects, real estates, and housing industry in Kenya have experienced challenges, such as high cost of building materials that have led to inadequate housing units for the population (National Housing Corporation, 2013). In Kenya, the building industry's desire and embrace for innovative construction materials have positive reception since building clients and companies are seeking and adopting innovative building technologies that are time and cost effective. These materials will help to boost the number of housing units in Kenya and reduce the housing deficit. Demand for housing in Nairobi County overwhelms the supply capacity, and this increases the housing shortage on annual basis. The demand is more than supply because existing construction and building projects are labour demanding, costly, and takes too long to complete; however, most of the construction firms still rely on these conventional traditional building materials.

Ringera (2015) explains that many construction projects are not completed in the time leading to cost overruns and occasionally desertion. This problem is attributed to many reasons but the time taken to complete buildings is one reason. The cost of construction sometimes changes during the project, especially projects that take longer to complete. Therefore, the EPS panels' and aluminium formwork's efficiency and economic benefits make them the ideal alternatives to reduce the gap between demand and supply of houses in Kenya. Innovative technologies are needed to reduce the housing costs and bridge the housing shortages in Nairobi. Fortunately, the technologies advocated for in this study are available. However, there is little research about them so many Nairobi building companies are seeking information; thus, this study will provide them with needed information. Completing research gap and providing sufficient information to consumers, constructors, and building owners who are seeking innovative construction materials will be one of success criteria of this study.

1.2 Statement of the Problem

Currently, the Kenyan housing industry experiences a deficit of over 200,000 housing units annually (Wesangula, 2016). Housing professionals believe this shortage is likely to destabilize

the real estate industry in the near future because of many reasons, but the main reason is the high cost of construction and high prices of houses. The research problem revolves around establishing suitability of the identified technologies to adequately address the research topic. Achieving sustainable accommodation projects require a balance of ecological, economic and public matters with technical considerations (Liyanage, 2018; Ibsen, 2014). Survey results depict that up to 60% of the overall construction cost of a low-income building project is attributed to construction materials and engineering design. In addition, walls represent 50% of the total cost of requirements and approximately 45% of the entire project schedule. Material sources, manufacturing techniques and labour demands all have a key contribution to the collection of walls building stuff. Therefore, since the two technologies are accessible, can be tailored to suit the buildings, and are less bulky; they will considerably reduce the cost of wall construction and total cost.

Construction of affordable housing using low cost building materials requires a set of inputs, processes, and resources as a basis of successful implementation. One of the key inputs of using low cost building materials is skilled labour because technological innovation as a process requires individuals with expertise (Alhaji, 2016). In addition, there is need to have capable project leaders/managers to utilize the skills and expertise and ensure the entire outcomes of the projects conform to the construction regulations and statutory requirements (Archer, Verster, & Zulch, 2010).

For the current study, independent variables are (1) use of innovative building technologies and how they relate with the critical success factors of the building construction industry in Kenya. (2) Skilled labour capability to utilize low cost building materials to achieve the capacity required to facilitate construction of number of units required in a timely manner without compromising on the quality of houses. (3) Influence of project managers' leadership capabilities on the use of low cost building materials in reduction of housing deficit. The influence of statutory and regulatory factors in the use of low cost building materials to reduce the housing deficit. To this end, this study seeks to establish contextual, conceptual, and empirical gaps on the factors influencing successful building project implementation of low cost building materials in reduction of housing deficit in Nairobi, Kenya.

1.3 Objectives of the Study

The main objective of the study was to explore the influence of low-cost building materials on reduction of housing deficit in Nairobi County, Kenya.

1.3.1 Specific Objectives

i. To examine the influence of technological innovation on use of low cost building materials to reduce of housing deficit in Nairobi County
ii. To assess the effect of skilled labor on use of low cost building materials to reduce housing deficit in Nairobi County
iii. To determine the influence of project managers leadership capability on use of low cost building materials to reduce housing deficit
iv. To establish the effect of statutory and regulatory factors on use of low cost building materials on reduction of housing deficit

2.0 LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Open Innovations Theory

Henry Chesbrough proposed the theory of open innovation in 2006 (Chresbrough, 2014), where the author defined open innovations as framework that assumes organizations are free to enhance their internal operations by integrating external and internal ideas. In fact, Chresbrough (2006) argues that external and internal paths are key enablers of organizational competitiveness. In today's modern world, there is need for project managers to formulate sound approaches as a means to meeting housing shortage, where one of the critical steps is through open innovations. Through innovative processes, project managers are able to deliver quality and competitive housing projects. Open innovations approach offers significant insights on how project managers through fusion technological innovation could leverage critical thinking as a means to using low cost building materials in the construction of affordable housing projects (Merschbrock & Munkvold, 2015). The relevance of the open innovation theory to this study hinges on the context that the theory provides an in-depth explanation on how project managers could leverage complex innovations through knowledge and technological exchange with external firms. Furthermore, the theory of innovation hinges on the integration of factors, such as regulatory and statutory requirement by the government coupled with leadership capabilities to enhance innovations because technological innovations do not occur in a vacuum.

2.1.2 The Theory of Value

The theory of value was proposed by Dahrendorf (1968). According to the value theory, the economic worth of a product hinges on the amount of productive and/or skilled labour required to produce the product. In fact, Dahrendorf (1968) contends that skilled labour is required to design and create a product is more critical than the utility derived by end users (demand) or by the supply side of the product (scarcity). Baker and Ball (2018) argues that skilled labour market faces plethora of challenges, such as treatment of skilled labour. The theory of value is applicable to this study because it explains how project managers can get labour from the market and how they are supposed to develop the labour with a view to attaining of the relevant skills. The theory of labor toes the line of the difference between unskilled and skilled labour by arguing that the labour of skilled workers represents the value of the product they produce.

2.1.3 Transformational Leadership Theory

Burns (1978) proposed the theory of transformational leadership. According to Burns (1978), transformational leadership takes place when individuals embrace interactions that lead to collective growth of all individuals in a manner that followers and leaders all gain. According to Burns (1978), transformational leadership takes place when followers and leaders engage in actions that lead to increased levels of morality and motivation. Simply put, transformative leaders are those individuals that raise their followers from lower levels to higher levels. According to Matzler, Bauer and Mooradian (2015), transformational leaders apply charisma as an approach to gaining respect of their followers and stakeholders by communicating a common mission and vision, which are critical elements of transformation. Moreover, transformational leaders are inspirational in their action and this encompasses communicating to their followers in simple and

clear manner on the essential of teamwork (Gregory, 2004). Transformational theory is relevant to this study since it describes how leadership capabilities of managers determine the realization of project goals through inspiring and motivating employees to be resourceful and innovative when faced with difficulties in their tasks, such as use of new technology that require skilled labour.

2.1.4 Institutional Theory

Darnall (2003) while presenting the institutional theory argued that organizations are constrained by external forces to adopt or formulate given policies as an approach to complying with existing rules in the market. For instance, the use of low cost building materials could only be possible when construction companies and project managers conform to external forces, such as from industry regulators, who put pressure on firms to achieve and operate under quality standards. There is distress among organizations because of the consequences of not adopting the required quality standards and as such, companies have zero choice but to adhere to the rules. Further, pressure from regulators ensures that firms are environmentally responsive in their settings. As argued by Keohane and Martin (2014), due to the formal industry rules, firms voluntary strive to adhere to the regulations as a means to realizing rapport with the industry regulators. Darnall (2003) observed that corporate policies have been instrumental in ensuring that companies strive for certification even in their endeavor to adopt low cost choices, such as low-cost building materials, as this is the surest approaches that project managers can indicate to the regulators that they are committed to adhering to quality practices.

2.2 Empirical Review

2.2.1 Technological Innovation

Merschbrock and Munkvold (2015) examined incorporation of technology in a hospital construction project and contended the construction and engineering sector needs digital innovations as a means to realizing increased productivity, tighter integration, and transparency; however, the authors suggested that project teams have not been efficient in terms of using modern technology. Accordingly, the authors recommended integration of information sharing systems that supports collaborative design and changing of institutionalized and traditional work routines and practices. Based on diffusion of innovations theory, Merschbrock and Munkvold (2015) suggested critical factors that enhance digital collaboration, which included building modeling (BIM) contracts, a cloud-computing infrastructure, new responsibilities and roles, change agents, and creating BIM learning environment.

2.2.2 Skilled Labour

Alhaji (2016) investigated how project managers should improve the performance of skilled workers in Nigeria's construction projects, and argued that performance of skilled workers is a critical component of productivity of labor that project managers should leverage as a basis of enhancing the performance of construction projects. In fact, inefficient and low productivity in the construction industry continues to blame low performance of skilled workers. The study collected data from 150 respondents, such as site supervisors and project engineers, and project managers. The analysis of the collected data established that low performance of skilled workers hinged on poor compensation schemes, inadequate acquisition of skills, and low wages for skilled workers. The author recommended that for Nigeria's construction industry to flourish, it was critical to have

a good remuneration for skilled workers, proper supervision, and acquisition of appropriate equipment and plants.

2.2.3 Project Leadership Capabilities

Al Kazaz (2016) examined the effects of leadership skills possessed by construction project managers on performance in Dubai and argued that Dubai has undergone qualitative changes to include modern requirements, such as expected levels of production and job requirements. The author contended that the construction industry is now looking for individuals with professional experience on management and leadership skills compared to experience in the technical areas. In fact, the author argued that Dubai's construction industry had undergone growth was in need of effective skills. The argument according to the author was that proper leadership skills was key precursor in the recovery of shortages in technical skills. Simply put, leadership affects the quality of relations and thus the need to deepen the leader-follower relations.

2.2.4 Statutory and Regulatory Factors

Ndumia (2015) examined factors that influence regulatory framework within construction sites in Kenya's Capital, Nairobi and established that Quantity Surveyors and Architects played critical roles in terms of advising their clients on the essentials of complying with the regulatory framework, which defines the construction projects. The author contended that Nairobi County had a regulatory framework that regulated the construction of buildings in Nairobi and this included a compulsory stakeholder and public participation in the process of policy formulation. The City County government of Nairobi involved other industry regulators, such as NCA and NEMA, where the latter regulated environmental policies, while the former certified and registered constructors. In addition, NCA stipulates the building code in the construction industry. The author recommended that a regulatory framework is essential in the improvement of construction projects, while it is important for a regulatory framework that has a legal capacity to regulate property developers.

3.0 METHODOLOGY

The study adopted four theories: open innovations theory, the value theory, transformational leadership theory, and institutional theory. Methodologically, the study adopted a descriptive research design, while the population of this study was all the real estate firms registered by Kenya Property Developers Association (KPDA). The real estate developers registered by KPDA are 69 in number (KPDA, 2018). Census technique was employed to collect data from all 69 real estate firms using questionnaires. Questionnaires were applied to collect primary data, where the researcher trained research assistants to aid the data collection procedure. A pilot-test was conducted as an approach to establishing both the reliability and validity assessments of the questionnaire. Statistical packages for social sciences (SPSS) was used to undertake both descriptive and inferential statistical computations.

4.0 FINDINGS AND DISCUSSIONS

4.1 Descriptive Analysis

4.1.1 Technological Innovation on Low-Cost Building Materials

The study sought to determine the relationship between adoption of technological innovation and use of low-cost building materials. Respondents were provided with statement and were required to select the extent to which they agreed with the statements (Where 1 is "strongly disagree", 2 is "disagree", 3 is "moderate", 4 is "Agree", 5 is "Strongly agree"). Analysis of the collected data was analyzed in Table 1.

Table 1: Technological Innovation on Low-Cost Building Materials

Statements	N	Mean	Std. Deviation
Adoption of technology influences overall cost of construction	63	4.10	.88
Use of technological innovation in use of low-cost building materials is environmentally friendly	63	4.00	.90
Use of technological innovation in use of low-cost building materials is environmental friendly	63	4.10	.91
Application of technological innovation improves alternative construction technologies	63	4.30	.65
Average		**4.10**	**0.84**

As detailed in Table 1, majority of the respondents strongly agreed that Application of technological innovation improves alternative construction technologies as supported by a mean of 4.3 and a standard deviation of .6476. In addition, respondents strongly agreed that use of technological innovation in use of low cost building materials is environmental friendly as indicated with a mean of 4.1 and a standard deviation of .9133. Similarly, respondents strongly agreed that adoption of technology influences overall cost of construction as evidenced by a mean of 4.1 and a standard deviation of .8877.

In light of this finding, it can be concluded that technological innovation influences use of low cost building materials with a view to reduce housing deficit as supported by a computed mean of 4.1. This finding is in tandem with a study done by Yamazaki (2004) who argued that construction industry should leverage knowledge and technological innovation as it will definitely define the future of construction projects. On the same breadth, Gambatese and Hallowell (2011) agrees with the finding in this section by asserting that enormous resources are required for effective progress, implementation, and diffusion of an innovative product.

4.1.2 Skilled Labor in Property Development

The study sought to determine the relationship between skilled labour and use of low cost building materials. Respondents were provided with statement and were required to select the extent to which they agreed with the statements (Where 1 is "strongly disagree", 2 is "disagree", 3 is "moderate", 4 is "Agree", 5 is "Strongly agree"). Analysis of the collected data was analyzed in Table 2

Table 21: Skilled Labor in Property Development

Statements	N	Mean	Std. Deviation
Skilled labour fast-tracks delivery of low-cost housing	63	3.90	0.87
Use of skilled labour has an influence on the overall construction	63	3.90	1.06
Skilled labourers are ready to learn new technologies and machinery operation	63	3.90	1.13
Labour productivity requires proper attention for effective projects delivery in the construction industry	63	4.20	0.66
Average		**4.00**	**0.93**

As presented in Table 2, respondents strongly agreed that labour productivity requires proper attention for effective projects delivery in the construction industry as supported by the highest mean score of 4.2 and a standard deviation of .6609. In addition, respondents strongly agreed that skilled labour fast-tracks delivery of low cost housing as evidenced by a mean of 3.9 and a standard deviation of .8746. Similarly, respondents agreed that use of skilled labour has an influence on the overall construction with a mean of 3.9 and a standard deviation of 1.0642. A similar mean score of 3.9 and a standard deviation of 1.1341 supported the statement on skilled labourers' readiness to learn new technologies and machinery operation. To this end, it is note-worth to state that skilled labour influences project outcomes that seek to use low cost building materials as supported by a computed mean of 4.0.

The finding in this section agrees with a study with a study done by Griffith and Macartney (2014) who suggested that the contemporary world has undergone a number of technological innovations, which require individuals with skills, such as computer competence. On the same breadth, Lill (2008) contended that inadequate skilled labor is a critical factor, which undermines the development of construction industry. Notably, Qudus (2016) suggested the need for constriction firms to invest in skilled labor by ensuring that there is coordination during construction as a basis of reducing omissions and errors.

4.1.3 Leadership Capability

The researcher sought to establish the influence of project managers' leadership capability on use of low cost building materials to reduce housing deficit. Respondents to the study were provided with various statements in relation to project leadership capabilities and were expected to indicate the extent to which they agreed or disagreed with them (Where 1 is "Strongly disagree", 2 is "Disagree", 3 is "Moderate", 4 is "Agree", 5 is "Strongly agree"). The results of this sub-section are presented in the Table 3 below.

Table 3: Project Managers' Leadership Capability

Statements	N	Mean	Std. Deviation
Project manager capability influences performance of construction projects	63	4.01	0.81
Project management culture has a substantial effect performance of construction projects	63	3.81	1.11
Overall organizational culture determines performance of a project	63	4.00	1.08
Past experience of construction managers influences project performance	63	4.24	0.67
Training substantially influences project performance	63	4.43	0.84
Average		**4.10**	**0.90**

Based on the findings presented in the table above, it is evident that majority of the respondents were of the view that project manager capability influences performance of construction projects with a mean of 4.0159 and a standard deviation of .81304. Statement on project management culture has a substantial effect on performance of construction projects had a mean of 3.8095 with a standard deviation of 1.10508, overall organizational culture determines performance of a project had a mean of 4.0000 and a standard deviation of 1.07763. Moreover, the statement on experience of construction managers, influences project performance had a mean of 4.2381 and a standard deviation of .66513, while the statement on training substantially influences project performance had a mean of 4.4286 and a standard deviation of 0.83694.

Overall, the average mean of the responses from the statements was 4.09842, implying that the majority of the respondents were agreeing with most of the statements considered in this particular study; however, responses from the respondents were varied as demonstrated by a standard deviation of 0.899564.

The findings in this study agrees with a research sanctioned by Bhangale and Devalkar (2013) who suggested that Project managers ought to formulate ways of positively persuading project teams to accomplish the set goals within the set timelines. In fact, leadership goes beyond managing people or projects to include the art of persuading behavioral tendencies of team members to enhance their performance.

4.1.4 Statutory and Regulatory Factors

The researcher sought to establish the influence of statutory and regulatory factors on use of low cost building materials to reduce housing deficit. Respondents to the study were provided with various statements in relation to statutory and regulatory factors, and were expected to indicate the extent to which they agreed or disagreed with them (Where 1 is "Strongly disagree", 2 is "Disagree", 3 is "Moderate", 4 is "Agree", 5 is "Strongly agree"). The results of this sub-section are presented in the Table 4 below.

4: Statutory and Regulatory Factors

Statements	N	Mean	Std. Deviation
Compliance to regulations and statutes enhances project quality	63	4.08	0.79
Involvement of stakeholders improves OSHR compliance	63	OSHR 3.81	1.19
compliance mitigates against negative impacts of building construction projects	63	4.03	1.05
Implementation of OSHR is ineffective	63	4.29	0.68
Regulatory framework governing the construction industry does not have legal capacity to prosecute errant developers	63	4.51	0.69
Average		**4.14**	**0.88**

Based on the findings presented above, majority of the respondents agreed to the statement that compliance to regulations and statutes enhances project quality with a mean of 4.0794 and standard deviation of 0.78907. The statement on involvement of stakeholders improves OSHR compliance had a mean of 3.8095 and a standard a deviation 1.18943, whereas the statement on OSHR compliance mitigates against negative impacts of building construction projects was supported by a mean of 4.0317 and a standard deviation of 1.04678. Moreover, implementation of OSHR is ineffective had a mean of 4.2857 with a standard deviation of 0.68223, while the statement on regulatory framework governing the construction industry does not have legal capacity to prosecute errant developers was strongly supported by a mean of 4.5079 and a standard deviation of 0.69266.

Overall, majority of the respondents agreed that statutory and regulatory factors affected the use of low cost building materials with a mean of 4.14284. The standard deviation of 0.880034, suggesting that responses were varied. This finding agrees with a study sanctioned by Ismail *et al.* (2012) who suggested that personal awareness and communication are critical aspects of safety measures, while Grosso *et al.* (2008) contended that procurement practices have a critical consideration in the construction sector. Similarly, findings in this subsection agrees with a study conducted by Ndumia (2015) who suggested that regulatory framework is essential in the improvement of construction projects, while it is important for a regulatory framework that has a legal capacity to regulate property developers.

4.2 Correlation Analysis

After the descriptive analysis, the study conducted Pearson correlation analysis to indicate a linear association between the predicted and explanatory variables or among the latter. It thus helped in determining the strengths of association in the model, that is, which variable best explained the use of low cost building materials in reduction of housing deficit in Nairobi City County, Kenya.

Table 5: Correlation Analysis

Statement		Technological innovation	Skilled Labour	Employee Training	Statutory factors	Reduction of housing deficit
Technological innovation	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	63				
Skilled Labour	Pearson Correlation	.090	1			
	Sig. (2-tailed)	.483				
	N	63	63			
Employee Training	Pearson Correlation	-.063	-.010	1		
	Sig. (2-tailed)	.622	.938			
	N	63	63	63		
Statutory factors	Pearson Correlation	.075	.022	.013	1	
	Sig. (2-tailed)	.557	.864	.917		
	N	63	63	63	63	
Reduction of housing deficit	Pearson Correlation	.552**	.580**	.432**	.494**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	63	63	63	63	63

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

The study used correlation analysis to establish the influence of technological innovation, skilled labour, employee training, and statutory factors on use of low cost building materials in reduction of housing deficit. Two-tailed Pearson correlation (R) was used to establish the same at 95% confidence level. From the results, there is a moderate positive, significant, and linear relationship between technological innovation and use of low cost building materials as indicated by Pearson correlation value of 0.552. Skilled labour had a correlation value of 0.580 with use of low cost building materials in reduction of housing deficit. This depicts a moderate positive, significant, and linear relationship between skilled labour and use of low cost building materials in reduction of housing deficit. Similarly, noted was that employee training had a correlation value of 0.432, which indicated a moderate positive, significant, and linear association between employee training and use of low cost building materials. Statutory factors had a correlation value of 0.494, which means existence of a moderate positive, significant linear association between statutory factors and use of low cost building materials in reduction of housing deficit.

4.3 Regression Analysis

This section presents a discussion of the results of inferential statistics. The researcher conducted a multiple linear regression analysis to determine the relative importance of each of the variables with respect use of low cost building materials to enhance housing affordability in Nairobi County. Statistical package for social science (SPSS) to enter and compute the measurements of the linear regressions for the study. Findings are presented in the following tables.

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.237a	0.056	-0.009	0.4514

a. Predictors: (Constant), Regulatory factors, leadership, skilled labour, technology
b. Dependent Variable**:** Use of low cost building materials to reduce housing deficit.

Coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (Use of low cost building materials to reduce housing deficit) that is explained by all the 4 independent variables (technological innovation, skilled labour, project leadership capability, and statutory and regulatory factors).

The four independent variables that were studied, explain 5.6% of variance in use of low-cost building materials to reduce housing deficit in Nairobi County as represented by the R^2. This therefore means that other factors not studied in this research contribute 13.2% of variance in the dependent variable.

Table 7: ANOVA (Analysis of Variance)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0.705	4	0.176	0.865	.0090b
	Residual	11.818	58	0.204		
	Total	12.523	62			

a. Dependent Variable: Low cost materials
b. Predictors: (Constant), Regulatory factors, leadership, skilled labour, technology

The P value was 0.001, which was less than 0.05 thus showing a correlation between the predictor's variables (technological innovation, skilled labour, project leadership capability, and statutory and regulatory factors) and response variable (Use of low cost building materials to reduce housing deficit). If the probability value was larger than 0.05 then the independent variables would not explain the variation in the dependent variable.

Table 8: Multiple Regression Analysis

Variable	β	Std. Error	t	Sig.
(Constant)	4.624	1.162	3.978	0.000
Technology	-0.238	0.141	-1.690	0.096
Skilled labour	0.049	0.132	0.369	0.514
Leadership	-0.068	0.151	-0.449	0.655
Regulatory factors	0.125	0.160	0.785	0.536

a. Predictors: (Constant), technological innovation, skilled labour, project leadership capability, and statutory and regulatory factors
b. Dependent Variable: Use of low cost building materials to reduce housing deficit

From the regression findings, the substitution of the equation ($\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4}$) becomes:

$Y = 4.624 - 0.238X_1 + 0.049X_2 - 0.068X_3 + 0.125X_4$

Where Y is the dependent variable (Use of low cost building materials to reduce housing deficit) X_1 is I technological innovation, X_2 is skilled labour, X_3 is leadership capability and X_4 is the statutory and regulatory factors. According to the equation, taking all factors; (technological innovation, skilled labour, project leadership capability, and statutory and regulatory factors) constant at zero, use of low cost building materials to reduce housing deficit will be 4.624.

The data findings also showed that a unit increase in technological innovation variable would lead to a 0.0238 decrease in housing deficit in Nairobi County. A unit increase in skilled labour would lead to a 0.049 increase in use of low-cost building materials to reduce housing deficit, while a unit increase in project leadership capability would lead to a 0.068 increase use of low cost building materials to reduce housing deficit. A unit increase in statutory and regulatory factors would lead to a 0.125 increase in the use of low-cost building materials to reduce housing deficit.

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

Analysis of the collected data under the first objective of the study, which sought data on the influence of technological innovation in the use of low cost building materials to reduce housing deficit in Nairobi County established that that infusion of technology in the use of low cost building materials led to the overall reduction of construction cost. Moreover, analyzed data revealed that use of technology enhances the capability and capacity of construction firms to use an array of building materials.

Analysis of the collected data under the second objective of the study, which sought data on the influence of skilled labour in the use of low cost building materials to reduce housing deficit in Nairobi County established that skilled labor translates into quality projects, leads to reduction of construction materials wastages and timely delivery of projects. Evidently, the study found that use of modern technology defined skilled labour because most organizations are leveraging technology as a basis of realizing competitive advantage. Importantly, the study established that math and reading skills were crucial as they enable individuals to undertake estimation and measurements, which ultimately reduces wastages, while computer literacy is an important component of skilled labor.

Analysis of the collected data under the third objective of the study, which sought data on the influence of project leadership capability in the use of low cost building materials to reduce housing deficit in Nairobi County established that real estate firms utilize competent based human resource management firms to hire qualified personnel. In addition, it was evident from the analyzed data that personality traits influenced adoption of new technology in the construction of

low cost housing, whereas knowledge and attitudes, and skills were significantly attributed to adoption of new technology.

5.2 Conclusions

The study revealed that technological innovation augments the use of low cost building materials. The study concludes that technological innovation significantly influences use of low cost building materials in the reduction of housing deficit. The study established that skilled labour predicates the use of low cost building materials in reducing housing deficit. The study concludes that skilled labour is positively correlated with use of low cost building materials with a view to reduce housing deficit by increasing affordability.

The study reveals that use of low cost building materials is predicated on project leadership capabilities. The study concludes that project leadership capabilities influences success implementation of the use of low cost building materials as a basis reducing housing deficit. The study exposes that statutory and regulatory factors predicates use of low cost building materials. The study concludes that statutory and regulatory factors, such as building code, influences use of low cost building materials in the reduction of housing deficit.

5.3 Recommendations

In light of the research findings, the study recommends that organizations should leverage modern technology as a basis of realizing efficiency, effectiveness, and sustainability of projects. The study likewise recommends that organizations should build capacities to enhance labour productivity. In addition, the study recommends that organizations should adopt transformational leadership approaches as a basis of enhancing performance. The study recommends the need to revise the legal framework with a view to ensure that it reflects the changing needs of the project requirements.

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