FACTORS INFLUENCING USE OF INTERLOCKING RED BRICKS TECHNOLOGY IN HOUSING PROJECTS: A CASE OF ISIOLO COUNTY, KENYA

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International Academic Journal of Information Sciences and Project Management (IAJISPM) | ISSN 2519-7711

Received: 30th July 2018

Accepted: 7th August 2018

Full Length Research

Available Online at:

http://www.iajournals.org/articles/iajispm_v3_i2_272_290.pdf

Citation: Ombiro, R. O. & Mbugua, J. (2018). Factors influencing use of interlocking red bricks technology in housing projects: A case of Isiolo County, Kenya. *International Academic Journal of Information Sciences and Project Management, 3*(2), 272-290

ABSTRACT

The failure of interlocking red bricks technology in Isiolo County construction project is mostly related to the problems attributed to technical data of ISSB technology is still insufficient, leading to skepticism of the technology amongst construction industry professionals. Unfortunately, some projects provide new accommodation that is unaffordable to many low-income households and thus failing its true cause. The purpose of the study was to establish the factors affecting the use of interlocking red brick technology in housing project in Isiolo County. The study was guided by the following objectives; to determine the effect of availability of technology, construction cost, access to equipment by CBOs and individuals, perception of the quality of building blocks and training on use of interlocking red bricks technology in housing project in Isiolo County. The study was grounded on the adoption and diffusion theory. The target population for this study composed of the county representatives, contractors and project management committee members. A sample size of 156 for the study with the population of 262 was obtained using Morgan and Krejcie (1970) model. The study was significant in disseminating interlocking red brick technology information and making the stakeholders aware of the availability of this technology. Primary data was obtained using self-administered questionnaires. The drop and pick method were preferred for questionnaire administration so as to give respondents enough time to give well thought out responses. Data was analyzed using Statistical Package for Social Sciences (SPSS Version 25.0). All the questionnaires received were referenced and items in the questionnaire were coded to facilitate data entry. After data cleaning which entailed checking for errors in entry, descriptive statistics such as frequencies, percentages, mean score and standard deviation was estimated for all the quantitative variables and information presented inform of tables. Inferential data analysis was done using multiple regression analysis. The study found that in Isiolo County the use of interlocking red bricks in housing projects is positively and significantly affected by availability of construction technology, cost of construction, access to construction equipment by individuals and quality of building blocks and training. The study concluded that availability of construction technology had the greatest effect on the use of interlocking red brick technology in house construction in Isiolo County, followed by access to equipment by CBOs and individuals then perception of the quality of building blocks then construction cost while training had the least effect to the use of ISSB construction technology in Isiolo County. The study recommends that National Government in conjunction with the County Government should ensure that the numbers of machines for supporting the use of interlocking red bricks technology are sufficient. That there is a need to harmonize the construction cost so as to promote the interlocking red bricks technology, that the County Government need to sensitize the residents to adopt use of the ISSBs in houses construction since they offer better internal climatic conditions than other modern

materials and that training on ISSBs should be done since it forms an integral part of ensuring improved houses and imparting important skills, which the trained can use in income generating activities.

Key Words: *interlocking red bricks technology, housing projects, Isiolo County, Kenya*

INTRODUCTION

Meeting the need for adequate housing of the world's population requires sustained investment and continued innovation, particularly in appropriate technologies that lower the cost of construction and the cost of materials. Technology is an aspect of the environment that should be considered in developing strategic plans. The appropriate construction technology can be measured by the availability of locally made plant and equipment, skilled manpower resources, extent of local material resources and the degree of utilization of such local construction resources. With a growing number of organizations using the technology there is a need to improve communication and knowledge-sharing, to quantify and verify the benefits, and to develop efficient approaches for its promotion and adoption (Kibert, 2016).

The lack of technological know-how and the shortage of managerial manpower are considered to be one of the major problems and constraints facing the nation. The situation is aggravated by acute shortage of managerial manpower. As at today, the country still remains a net importer of technical manpower, virtually most spare parts are imported and most investment in research and development are made abroad, except those sponsored by the government in public owned institutions (Akanni, Oke&Akpomiemie, 2013).

The concept of construction project development may be impaired without a good knowledge and successful management of the impact of environmental factors influencing the performance of such projects. Industries producing red ceramic, are mostly classified as small and medium-sized companies, using antique technologies and equipment in both production process (extraction and preparation of raw materials, shaping, drying and burning), and relation to machinery and automation level. In this way the process generates a great amount of wastes from bricks, tiles and ceramic blocks incorrectly stored and broken or defective, which passed the full cycle of production and were discarded by presenting cracks, warping, low mechanical strength, deformation or any other defect that prevents its use by applicable standards and by quality required from market (Megha&Rajiv, 2013).

Deboucha and Hashim (2011) observed that although the stabilized earth blocks have been an area of interest, its potential as a commercial construction material and the ability to fulfill several functions such as structural integrity, thermal transmittance and durability, makes the material an excellent walling material when compared to other masonry materials used in construction today and this has brought about the resurgence of renewed research interest in

recent years. Joseph (2010) observed that using compressed earth blocks, in place of conventional fired bricks, will to a large extent reduce the energy usage and carbon emissions.

Building construction follows the principle of dry stacking. In dry stacking construction, the interlocking blocks are laid without mortar thereby leading to considerable savings in cost associated with mortar. This method of construction has existed in for thousands of years. Pave and Uzoegbo (2010) observed that ancient dry-stack masonry consisted of robust construction and huge structural elements which were both material and time-consuming construction process. At the time, attention shifted from dry-stack construction to research on new materials and applying new methods of construction. Moreover, building with ISSB reduces the use of industrial products like cement and depends on local resources. It is considered to an environmental friendly technology, because it consumes less production energy, reduces deforestation, reduces the use of non-renewable resources and produce less waste from construction process than the main walling alternatives like (fired bricks, cement-sand blocks)

Global Perspective

Worldwide, the use of earth for construction is as old as mans' existence, further improvements have been done to give immense benefits and optimum end user satisfaction through its usage. Deboucha and Hashim (2011) observed that although the stabilized earth blocks have been an area of interest for researchers in the past, its potential as a commercial construction material and the ability to fulfill several functions such as structural integrity, thermal transmittance and durability, makes the material an excellent walling material when compared to other masonry materials used in construction today and this has brought about the resurgence of renewed research interest in recent years. Using compressed earth blocks, in place of conventional fired bricks, will to a large extent reduce the energy usage and emissions.

In addition, with latest technology available in Saudi Arabian construction industry, the growth of this particular sector is inevitable. With the availability of such technology, Saudi Arabia was able to attract several investors who are particularly interested in the growth of the construction industry in the forthcoming years (Ventures, 2011). According to Harris (2012), the construction costs in Saudi Arabia are the cheapest compared to other countries in the Middle East. On the other hand, it was also observed that Bahrain's construction costs are the highest compared to any country in Middle East. It was indicated in the research that the difference in the construction cost between Saudi Arabia and Bahrain is almost half.

However, the potential impact of innovative technologies and construction methods on a step-wise (rather than gradual) reduction of overall construction times cannot be disregarded. However, the usual increased cost of new technology has to be balanced with the need to achieve reduced times. The right to adequate housing is a universal right, recognized at the international level and in more than one hundred national constitutions throughout the world. It is a right recognized as valid for every individual person. The universal Declaration of Human Rights of

1948 recognizes the rights to adequate housing as an important component of the right to adequate standard of living (Ouda 2009).

Regional Perspective

Many African countries have experienced a large increase of urban population during the last 50 years. The proportion of people living in informal settlements is in some cities as high as 60% (Muraguri 2011), which clearly demonstrates how the demand for low cost housing has been urgent for a very long time. The construction industry problems in developing economies can be classified into three layers as; problems of shortages or inadequacies in industry infrastructure (mainly supply of resources), problems caused by clients and consultants and caused by contractor incompetence inadequacies. The construction industry can be seen as a pathway through which societal goals of urban and rural development can be achieved while construction works carried out in the industry cover site acquisition, design, contract, site operations and management. Lemougna, Melo, Kamseu, and Tchamba (2011) observed that due to the permeability of stabilized earth blocks to water vapour, earth walls remarkably regulate the humidity of indoor air.

Other researchers like Zulo (2014) in South Africa states that as a result of innovations in construction, industries need to accept the changes in order to manage their resources effectively. But, the adoption of green technology in construction sector is not in effect like other industries due to its unique features such as resistance to change, low level of technology awareness and training, one-off projects, and industry fragmentation (Betts,1999). Also, Kasim and Ern (2010) revealed that with the innovation in this technology to facilitate the management of construction site, resistance toward green construction adoption exist in the world of construction. As a result, the construction industry is blocked from progressing (Ang, 2009). Isikdag (2009) states that currently in most industrially developing countries like South Africa, organizations are aware of the competitive advantage presented by technology adoption but are still not willing to invest in it as expected. Equally, due to economic and social changes, construction environment is becoming more complex and sophisticated, needing advanced technology to meet organizational and operational demands (Ozumba&Shakantu, 2008).

The Nigeria construction industry is a wide range of loosely integrated organizations that collectively construct, alter and repair a wide range of different buildings and civil engineering projects. However, the construction industry in Nigeria following the oil boom in 1970/71 was characterized by the development projects which required the construction technology and resources of developed countries. Since then, Nigeria's economic growth over the last decade according to Isa, Jimoh and Achuenu (2013) has been high and the contribution of construction sector has risen steadily leading to sustainability.

The construction industry in Egypt is one of the main supports of Egyptian economy. The rapid growth of the Egyptian Construction Projects together with the unrest of the Egyptian society

due to political and economic variables in the period that followed the 25th January Revolution calls for massive development in risk management techniques. These variables bring opportunities to researchers in the field of project management to develop effective risk management techniques to cope with risks associated with construction activities and to implement the projects in accordance with project objectives including time, cost, quality and safety. Another factor that adds additional risks to construction projects in Egypt is the participation of foreign partners with the local stakeholders (Khodeir& Mohamed,2015)

The construction industry plays a significant role in the economy of South Africa; as major construction activities account for about 80 % of total capital assets and 15 % of the Gross domestic products, in addition this industry provide high employment opportunities. Despite the significant contribution of this industry to the South African economy and its role in the country's development, the quality performance of the industry still remains low. Many construction projects in developing countries encounter considerable time and cost overruns and fail to realize their intended benefit as a result quality suffers and these projects will be totally terminated and abandoned before or after their completion (Nyangwara&Datche, 2015).Adedeji and Fasakin (2008) also established that when interlocking earth blocks are used for construction, it has unparallel advantages such as shorter period of construction, lesser gang of labour and reduced cost of construction (Mwakipesile,2015)

Interlocking Stabilized Soil Block (ISSB) technology is one such technology that is gaining growing recognition, notably in East Africa. Compared with alternatives such as fired brick, it offers lower construction costs at comparable quality, is suitable for a wide range of environments, and dramatically reduces the impact on the environment. The technology has not yet been standardized in Uganda. The Good Earth Trust is coordinating with the Uganda National Bureau of Standards to produce standards for ISSB technology. In order to ease the integration of ISSB technology into more densely-populated urban areas, there is a need to produce more technical data including quality tests and appropriate building codes and standards.

Local Perspective

Kenya housing construction industry is facing enormous challenges in quality assurance from cases of collapsing buildings, unfinished and substandard constructed and uninspected houses. Cases of overruns in cost, schedule, technical quality and safety have also been rampant. Under the Vision 2030, the Kenyan government has committed to provide adequate, affordable and quality housing for all citizens, particularly the low-income groups. The Kenyan government has therefore incentivized developers to move down market by offering, among other things, tax breaks for housing units that cost less than KES 1.6 million (Githenya& Ngugi,2014). In 2007 Government of Kenya identified a set of incentives to encourage developers to enter the affordable/low-income housing sector but Developers say this has had little impact. It is widely believed that there is a dearth of low-cost appropriate technology in Kenya (Ayieko, 2012).

There is a need to promote awareness of appropriate construction technologies in civil society and the private sector. Appropriate technologies refer to materials, methods and/or practices which help protect the natural environment, take inspiration from the cultural values and practices in the area, make use of local resources, and contribute to local economic development. The construction industry is making the transition to technology and building practices, but progress is slow. Recent market data shows that environmentally certified buildings represent 5.4 percent of the commercial office stock, and diffusion of such building practices is even more limited in other sectors, such as retail space and industrial warehouses. The World Bank representative flagged that KISIP (particularly component 4) as suitable to accommodate further initiatives on affordable housing related efforts. With general elections looming in late 2012 or early 2013 the political and institutional landscaping may change in the near future (Osiani, 2015). This can bring considerable opportunity. Affordable green housing is an issue for more than 80% of the population in Kenya and carries substantial democratic weight considering the rapid rise in the costs of utilities (Wainaina, 2015).

Even though construction is gaining market share, new construction and building refurbishment are still mostly conventional. This raises questions about the marginal costs and benefits of environmentally certified, green construction perhaps these market trends simply reflect economic rationality (Mwandeu, 2013). The economic literature on more efficient, green building has thus far solely focused on the measurement of outputs, and generally documents rental, occupancy and value premiums for green commercial buildings (Narncy, 2014). These marginal financial benefits reflect cost savings and risk perception, but perhaps also the higher input costs required to construct more efficient buildings (Wanjau & Mueni, 2011).

Oluoch (2010) noted that the Kenyan construction industry has in the past five years experienced a tremendous growth in terms of production so much that it defied a global economic recession to post a 6% growth in the year 2009 according to Kenya National Bureau of Statistics and 5% in 2010 according to World Bank Global Economic Prospects. The cost of any building design is determined primarily by the costs of labor and materials involved in erection. The rising cost of construction will impact both supply and demand, with the rise in cost, the cost of the building will rise.

STATEMENT OF THE PROBLEM

In many developing countries, technologies adopted compose the main part of the total cost in construction projects. Housing construction projects has been poorly performing in Kenya evidenced by failure to meet the housing demand that continues to widen in the country with an estimation of housing demand in urban areas is approximately 150,000 units per year yet the current supply is about 30,000 units (HASS, 2013). According to KNBS (2013), the sector recorded a growth of 4.8 per cent in 2012 while cement consumption rose by 1.7 per cent (from 3,870.9 thousand tones in 2011 to 3,937.3 thousand tones in 2012). In order to meet the accelerating demand of low cost housing, and to improve the living conditions in informal

settlements, various organizations are involved in slum upgrading projects. Some are small-scale, community initiatives carried out with support from NGOs, while others are large-scale, governmental programmes. The use of interlocking red bricks technology in Isiolo County construction project is mostly related to availability of technology information which is still insufficient, leading to skepticism of the technology amongst construction industry professionals. Unfortunately, some projects provide new accommodation that is unaffordable to many low-income households and thus failing its true cause. Similarly, durability properties of stabilized earth blocks do not look at the implementation of the stabilized soil blocks but looks at advantages and disadvantages of using the stabilized soil blocks giving examples where they have been used, their strength testing and quality control and how to improve on their durability. Adoption of the right technology is challenge to the running of the entire project. Isiolo County also suffers project failure which the County Integrated Development Plan (CIDP) (2014) attributes to poor management. If this continues, then Isiolo County will still remain underdeveloped. This indicates wastage of millions of shilling lost in the construction project failure. Several studies have been carried out on construction projects such as; Aghimien (2015) Assessment of the Use of Compressed Stabilized Interlocking Earth Block for Building Construction in Nigeria, Githenya and Ngugi (2014) assessment of the determinants of implementation of housing projects in Kenya, Charagu (2013) who concluded that it is due to deficiency of the designs in construction sector. Mohamed (2012) did a study on green built technology and climate change management in Kajiado county and found out that in some areas of the county where this technology was applied, there is low level of environmental degradation and that the land remained fertile for agricultural activities and finally Ong'ong'o (2014) carried out a study on factors affecting adoption of green technology by firms in central Kenya. However, none of the studies reviewed focused on the factors influencing the use of new construction technology in housing project in interlocked red bricks in Isiolo County creating a gap that this study sought to bridge.

PURPOSE OF STUDY

The study sought to establish the factors affecting the use of interlocking red bricks technology in housing project in Isiolo County.

OBJECTIVES OF THE STUDY

1. To determine how availability of construction technology influence use of interlocking red bricks in housing projects Isiolo County.
2. To establish how construction cost influence use of interlocking red bricks in housing projects Isiolo County.
3. To assess how access to construction equipment by individuals influence use of interlocking red bricks in housing projects Isiolo County.
4. To evaluate how quality of building blocks influence use of interlocking red bricks in housing projects Isiolo County.

5. To examine how training influence use of interlocking red bricks in housing projects Isiolo County.

THEORETICAL ORIENTATION

The study will be grounded on the adoption and diffusion theory. According to Rogers (2003), adoption is the process in which an innovation is communicated thorough certain channels over time among the members of a social system and it involves three stages which are knowledge, persuasion, and decision. This definition also indicates that innovation, communication channels, time, and social system are the four key components of the diffusion of innovations (Robinson & John, 2004). This model suggests that adoption is not a single act but a process that occur over time with potential adopters going through when interacting with innovation. The Knowledge stage has the potential adopters finding out about innovation and gaining basic understanding of what it is and how it works (Jenkins & Willis, 2008). The second stage which is persuasion and the adopters form positive or negative impression of the innovation and it is only in the third stage that innovation is adopted or rejected (Abukwe, 2015. The adoption and diffusion theory relate well with use of new technology hence it can be used to determine the level of training which is available to make the use of new technology a reality.

An innovation may have been invented a long time ago, but if individuals perceive it as new, then it may still be an innovation for them (Anderson, Varnhagen, & Campbell, 1998). The newness characteristic of an adoption is more related to the three steps (knowledge, persuasion, and decision) of the innovation decision process. In addition, Rogers (2003) claimed there is a lack of diffusion research on technology clusters. A technology cluster consists of one or more distinguishable elements of technology that are perceived as being closely interrelated (Bennett & Bennett, 2003). Uncertainty is an important obstacle to the adoption of innovations. An innovation's consequences may create uncertainty; consequences are the changes that occur in an individual or a social system as a result of the adoption or rejection of an innovation (Carter, 1998). To reduce the uncertainty of adopting the innovation, individuals should be informed about its advantages and disadvantages to make them aware of all its consequences. Therefore, adoption and diffusion theory is relevant to this study in relation to availability of technology and use of new construction technology in housing project.

RESEARCH METHODOLOGY

Research Design

The study adopted a descriptive research design. A descriptive analysis attempts to describe characteristics of subjects or phenomena, opinions, attitudes, preferences and perceptions of persons of interest to the researcher (Creswell, 2012). Thus, this approach is suitable for this study, since the study intends to collect comprehensive information through descriptions which was helpful for identifying variables. Singleton (2009) describes a descriptive research design as

a comprehensive design that enables large and diverse amounts of data to be collected within a short time frame and analyzed quantitatively, giving a credible presentation of results.

Target Population

According to Sekaran and Bougie (2010), a population is the total collection of elements about which we wish to make inferences. The target population for this study composed the county representatives, contractors and project management committee members in Isiolo County as shown in Table 3.1.

Sample size and Sampling Procedures

Sampling is a deliberate choice of a number of people who are to provide the data from which a study drew conclusions about some larger group whom these people represent. The section focused on the sampling size and sampling procedures. Sample size can be defined as the number of observations used for calculating estimates of a given population (Smith, 2009). Basing the determination of sample size with Morgan and Krejcie (1970) model, a sample size of 156 respondents were targeted. This was done according to the Krejcie Model. According to Krejcie Model:

$$n = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)}$$

Where: n = desired sample size; N = Target population **(262);** P = Population proportion **(0.5);** d = degree of accuracy expressed as a proportion **(0.05);** X^2 = 3.841 at 95% confidence level

Therefore; $n = \frac{3.841 \times 401 \times 0.5(0.5)}{0.05^2 (262) + 3.841 \times 0.5 \times 0.5}$

$n = 156.7$

For convenience, the researcher rounded off the sample size ***'n'*** to 156 which was guided by Mugenda & Mugenda (2003) that 30% of the population can be used to determine a representative sample size of the whole population. The study selected the respondents using stratified proportionate random sampling technique. Stratified random sampling is unbiased sampling method of grouping heterogeneous population into homogenous subsets then making a selection within the individual subset to ensure representativeness. The study used simple random sampling to pick the respondents in each stratum.

Research Instruments

For the purpose of this study, the researcher used a semi structured questionnaire as the primary data collection tool. The questionnaire was structured to include both closed, open-ended and

matrix questions to allow variety. The structured questions were normally close ended with alternatives from which the respondent is expected to choose the most appropriate answer (Creswell & Creswell, 2017). Unstructured questions were open-ended and present the respondent with the opportunity to provide their own answers. Matrix questions were also utilized. This type of questions presents the respondent with a range of questions against which they are expected to respond based on a predetermined rating scale. The most commonly used was the Likert scale. These types of scales are used to measure perceptions, attitudes, values and behavior (Wang, 2015). These types of questions are popular with the respondents and researchers as they are easy to fill in, economical and provide easy comparability. The Likert type of questions enabled the respondents to answer the survey easily and for ease in data interpretation. The survey questionnaire was appropriate since it allows data from the sampled groups to be collected in a quick and efficient manner.

Data Collection Procedures

The research data was collected using semi-structured questionnaires. In order to ensure uniformity in response and to encourage participation, the questionnaires were kept short and structured with mostly multiple-choice selections in a Likert scale. The questionnaires were preferred in this study because respondents of the study are literate and quite able to answer questions asked adequately. According to Creswell and Creswell (2017), questionnaires are commonly used to obtain important information about a population under study. The researcher obtained an introductory letter from the University to collect data. The researcher personally administered the questionnaires to the respondents, allow the respondents to fill them and then collect them later: the drop and pick later method.

Data Analysis Techniques

The completed questionnaires were edited for completeness and consistency. The data was then analyzed using descriptive statistics and inferential statistics. The descriptive statistical tool (SPSS V.25.0) helped the researcher in the analysis of the data. This generated quantitative reports through tabulations, percentages, and measure of central tendency. The findings were presented using tables and graphs for further analysis and to facilitate comparison. A multiple regression model was applied to determine the relative importance of each of the independent variables with respect to the use of interlocking red brick construction technology. The linear regression analysis is chosen as the approach to analyze the data. The regression model was as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Where: Y= Use of New Construction Technology; β_0=constant; β_1, β_2, β_3, $\beta_4$andβ_5= regression coefficients; X_1= Availability of technology; X_2= Construction cost; X_3= Access to equipment by CBOs and individuals; X_4= Perception of the quality of building blocks; X_5= Training; ε=Error Term

INFERENTIAL STATISTICS

The study conducted multicollinearity that arises when at least two highly correlated predictors are assessed simultaneously in a regression model. Further researcher conducted regression analysis was used to establish the relations between the independent and dependent variables while correlation was conducted to assess the degrees of association between the variables. The findings were as shown in the subsections that follow.

Test for Multicollinearity

Multicollinearity occurs when several independent variables correlate at high levels with one another, or when one independent variable is a near linear combination of other independent variables (Keith, 2006). The study utilized Collinearity Statistics to find out whether the independent variables are adequately correlated to show a substantial causal correlation. The results for multicollinearity test were presented in Table 1.

Table 1: Collinearity Statistics

Model		Collinearity Statistics	
		Tolerance	VIF
1	Availability of construction technology	0.127	7.875
	Construction cost	0.166	6.008
	Access to equipment by CBOs and individuals	0.103	9.749
	Perception of the quality of building blocks	0.183	8.762
	Training	0.138	7.226

Based on the coefficients output, availability of construction technology had a VIF value of 7.875, construction cost had a VIF value of 6.008, access to equipment by CBOs and individuals had a VIF value of 9.749, Perception of the quality of building blockshad a VIF value of 8.762 and traininghad a VIF value of 7.226. The VIF values for all the variables were less than 10 implying that there were no Multicollinearity symptoms.

Multiple Regression Analysis

This was applied to determine the relative importance of availability of construction technology, construction cost, and access to equipment by CBOS and individuals, perception of the quality of building blocks and training with respect to the use of ISSB construction technology. The findings were presented in Table 2, 3 and 4.

Table 2: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.827	0.684	0.669	2.288

The outcome of table 4.19 found that adjusted R-Square value (coefficient of determination) is 0.669, which indicates that the independent variables (availability of construction technology, construction cost, access to equipment by CBOS and individuals, perception of the quality of building blocks and training) explain 66.9% of the variation in the dependent variable (use of ISSB construction technology). This implies that there are other factors that affect the use of ISSB construction technology attributed to 33.1% unexplained.

Table 3: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1268.88	5	253.776	46.745	.000
	Residual	586.33	108	5.429		
	Total	1855.21	113			

The results shown in Table 3 revealed that p-value was 0.000 and F calculated was 58.972. Since the p-value was less than 0.05 and F-calculated was greater than F-critical (2.2984), then the overall model was statistically significant.

Model coefficients provide un-standardized and standardized coefficients to explain the direction of the regression model and to establish the level of significance of the study variables. The results are captured in Table 4.

Table 4: Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.951	0.217		4.382	.000
Availability of construction technology	0.882	0.352	0.913	2.506	.014
Construction cost	0.633	0.281	0.717	2.253	.026
Access to equipment by CBOs and individuals	0.799	0.196	0.834	4.077	.000
Perception of the quality of building blocks	0.713	0.233	0.738	3.060	.003
Training	0.576	0.204	0.659	2.824	.006

As per the SPSS generated table above, the equation ($\mathbf{Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 ++ \beta_5X_5\ \varepsilon}$) becomes:

$$Y= 0.951+ 0.882\mathbf{X_1}+ 0.633\mathbf{X_2}+ 0.799\mathbf{X_3}+ 0.713\mathbf{X_4}+ 0.576\mathbf{X_5}$$

The findings showed that if all factors (Availability of construction technology, Construction cost, Access to equipment by CBOs and individuals, Perception of the quality of building blocks

and training) were held constant at zero use of ISSB construction technology will be 0.951. The findings presented also show that taking all other independent variables at zero, a unit increase in the availability of construction technology would lead to a 0.882 increase in the scores of Uses of ISSB Construction Technology. This variable was significant since the p-value 0.014 was less than 0.05.

The findings also show that a unit increase in the score of construction cost would lead to a 0.633 increase in the score of use of ISSB construction technology. This variable was significant since 0.025<0.05. Further, the findings show that a unit increases in the scores of access to equipment by CBOs and individuals would lead to a 0.799 significant increase in the score of use of ISSB construction technology since p-value (0.000) was less than 0.05.

The study also found that a unit increase in the score of perception of the quality of building blocks would significantly lead to a 0.713 increase in the score of use of ISSB construction technology since p-value (0.003) was less than 0.05. Moreover, the study revealed that a unit change in training would significantly change the use of ISSB construction technology by 0.576 since the p-value (0.006) was less than 0.05.

Overall, it was established that availability of construction technology had the greatest effect on the use of ISSB construction technology in Isiolo County, followed by access to equipment by CBOs and individuals then perception of the quality of building blocks then construction cost while training had the least effect to the use of ISSB construction technology in Isiolo County.

CONCLUSIONS

The study concluded that in Isiolo County the use of interlocking red bricks in housing projects is positively and significantly affected by availability of construction technology. The use of interlocking red bricks technology in Isiolo County was revealed to be greatly affected by number of machines in the area, advancement of red bricks compressor as well as sophistication of the technology. Also, the technology perception and instructional level were established to moderately affect the use of interlocking red bricks technology.

Further the study concluded that cost of construction affects the use of interlocking red bricks in housing projects Isiolo County significantly. The cost of construction was in form of installation costs, material types and its reusability as well as transport costs which were established to have affected the interlocking red bricks technology use greatly. Labor cost however was revealed to lowly affect the use of interlocking red bricks technology in Isiolo County.

Moreover, the study concluded that in Isiolo County, the use of interlocking red bricks in housing projects was affected by access to construction equipment by individuals. Tools availability, community awareness and level of expertise were revealed to have a great effect on the extent to which the interlocking red bricks technology is used in Isiolo County although the funds availability was revealed to lowly affect it.

The study also concluded that quality of building blocks greatly and significantly affects the use of interlocking red bricks in housing projects Isiolo County. In Isiolo County, the use of interlocking red bricks technology was found to be greatly affected by environmental condition resistance, durability concerns and taste and preference as well as social cultural practices. Also, it was clear affect the use of interlocking red bricks technology was moderately affected by maintenance concern while previous experience had a low influence on how the interlocking red bricks technology is used in Isiolo County.

The study further concluded that in Isiolo County, use of interlocking red bricks technology in Isiolo County greatly was greatly affected by workshops, brochures, posters and signs as well as seminars. Moreover, the study revealed that demonstrations lowly affect the use of interlocking red bricks technology in Isiolo County. Finally, the study concluded that availability of construction technology had the greatest effect on the use of new construction technology in Isiolo County, followed by access to equipment by CBOs and individuals then perception of the quality of building blocks then construction cost while training had the least effect to the use of new construction technology in Isiolo County.

RECOMMENDATIONS

The study recommends that the National Government in conjunction with the county government should ensure that the number of machines for supporting the use of interlocking red bricks technology is sufficient. This will ensure that all the county residents have an access to the machines hence promoting the interlocking red bricks technology in the county which in turn creates jobs for the jobless youths.

The study also recommends that there is a need to harmonize the construction cost so as to promote the interlocking red bricks technology. This can be done by subsidizing the cost of the transport, labor and the installation costs where the Government reviews from time to time the taxation levels on building materials so as to reduce the cost construction for housing arising from the building materials.

The study recommends that the county Government need to sensitize the residents to adopt use of the ISSBs in houses construction since they offer better internal climatic conditions than other modern materials. Also use of ISSBs generates more direct and indirect employment opportunities within the local populace than would be in the case with other materials.

The study also recommends that training on ISSBs should be done since it forms an integral part of ensuring improved houses and imparting important skills, which the trained can use in income generating activities. It also disseminates the ISSBs technology to the public and to those who need better housing at reasonable costs and increases the production and utilization of these technologies and materials with a view to improve houses and provide a means of earning a living.

The study recommends that more efforts should be made to promote intensified training in requisite skills and construction technologies through Youth Polytechnics, Women and Youth Groups, Community-Based Organizations and Appropriate Technology Building Centers.

The study recommends that there should be allocation of funds to research institutions to facilitate research on building materials and technologies, and also consider imposing a research levy on the building construction industry. The Government should establish a National Research Coordination Secretariat within the ministry concerned with housing to coordinate and disseminate research findings.

The public, private and voluntary sectors should be encouraged to utilize the research materials in their housing and other development programs while large scale builders and constructors should be sensitized on this technology. All research actors should harness and document existing locally available building materials and technologies as well as disseminate this information to the users as appropriate.

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