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AN ANALYSIS OF THE INFLUENCE OF SOME STRUCTURAL PROPERTIES ON THE PRODUCTION AND SALES OF 225MM HOLLOW SANDCRETE BLOCK IN MINNA.

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ABSTRACT

This is a research work on the influences of structural properties on the sales and production of 225mm hollow sandcrete block in Minna Metropolis. A test was conducted to examine whether or not there are statistical relationships between some structural properties such as bearing load, crushing load, strength and marketing efficiency of the block. Employing both simple and multiple regression analysis and testing at 95% confidence level it was discovered that structural properties have no significant relationship with marketing efficiency (that is, sales and production). The research showed R-square of 1.87, 0.67and 0.90% respectively for strength versus marketing efficiency; strength versus bearing load; and crushing load versus marketing efficiency respectively. However, there is a statistical relationship between sales and production. In addition, the result showed R-square of 63.50% with probability value less than 0.05% confidence limit. It was concluded that sales of 225mm hollow sandcrete block is largely influenced by rate of production and that marketing efficiency has no relationship with the compressive strength, crushing and bearing loads of the hollow blocks studied.

INTRODUCTION

The construction industry is one of the most important sectors of the economy and it is the major index of assessing the growth of any economy. The industry is an essential contributor to the process of development, which includes the construction of roads, dams, irrigation works, schools, houses, hospitals, and factories to mention a few. The products of construction works forms the basis on which development effort and improved living standards are re-established. The significance of blocks in housing and construction in general cannot be over emphasized, as it is the most accepted walling unit by the public because of its peculiar resistance to fluctuating weather condition. (Ezetah, 1999)

The use of sandcrete blocks for construction purposes came into being about eighty years ago in Nigeria without adequate standards. In recent times, designers and builders have been faced with the decision of apparent'simplicity, which are deeply rooted in very complex consideration of structural and mechanical effectiveness coupled with appearance, durability and cost implication. The economic situation in the country coupled with the above conditions make it necessary to appraise the technical and marketing efficiency of commercial production of hollow sandcrete blocks. (Okawu, 2003).

THE PRODUCTION OF HOLLOW SANDERETE BLOCK

Production in economics is any activity that results in the creation of goods and services that have utility value. A given process can be simultaneously physical, human and economic and it is designed to transform a given set of input elements. In addition, production is the art or process of making something naturally.

Hollow Sandcrete blocks production is made from Portland cement, fine aggregate and water. Crushed stone, plaster and other stabilising agents are sometimes. According to Rosacometta (1975), the nature of the mix for the blocks considerably affects the vibration time required for a good filling of the mould and very fine aggregate requiring a rather long vibration time. The cement and fine aggregate used in the manufacture of block is usually thoroughly blended during the mixing. The mix used for blocks is not richer than one part by volume of cement to six parts of combined fine and coarse aggregate (1:6). However, the proportions of cement to mixed aggregates may be increased to 1:4:5 i.e. one part of water where the thickness of the web ranging from one part by volume of cement to between six and eight parts (1:6 to 1:8) of sand with a water/cement ratio ranging from (0.6 0.9) depending upon the workability and the strength required.

The production of sandcrete blocks may be carried out mechanically or manually. Typical manufacturing process of the blocks, firstly involves, batching of material, which is the measuring of the constituent materials in specific proportion to be used in the production of blocks, which could be measured by volume or weight. Blocks for load bearing walls should have a mix of one part of cement to six parts of clean sand. Secondly, mixing of batched material, which is the process of turning the fine aggregate, cement and water together to obtain a consistent mix. This could be achieved either by mechanical or manual methods. Thirdly, moulding, this could be done mechanically or manually. It involves pouring the already mixed materials in its plastic state into a receptacle usually of steel or wood, which is of the same form as the desired final shape of the block. The machine vibrates and compacts the mixed material for about twenty-five to thirty seconds. Thereafter the moulded block on pallet is removed and taken to an open place, where it is allowed to harden. The fourth stage is curing, which is the process of preserving or maintaining the mixture content of sandcrete block by wetting it with water for a particular period of time ranging from 3-7days. This is to achieve maximum compressive strength required. The last stage in the process of production is storage, which involves the stacking of the already cured block on a dry land or raised platform far away from where they are likely to be damaged by activities on site. The rule in block stacking is that, the height of stacking should be moderate (about five courses) to avoid the damage of the blocks at the bottom layers. (Obande, 1990; Seeley, 1992).

STRUCTURAL PROPERTIES OF HOLLOW SANDCRETE BLOCKS

The BS2028 of 1968 specifies that block for general use in building of dense aggregate. The compressive strength should be 3.5N/mm^2 for buildings with designed wall strength of 7.0N/mm^2 and above. The block should however have a minimum compressive strength of 2.8N/mm^2 for building of designed wall strength of 5.6N/mm^2 and above. The Nigerian industrial standard specifies a minimum compressive strength of 3.45N/mm^2 for 225mm vibrated sandcrete block and a minimum compressive strength of 2.5N/mm^2 for 150mm vibrate sandcrete block. (NIS, 1987).

Strength is of prime importance when it comes to properties of hollow sandcrete block. The compressive strength is dependent on the mix proportion, degree of compaction, fine aggregate, water content and the curing conditions. Analyses from previous studies showed that compressive strength of sandcrete blocks increase appreciably with increase in cement content and compaction effort of up to 8MN/m^2 However, the tensile strength of sandcrete blocks appears to be independent of the sizes of the blocks. (Okawu, 2003).

Banuso (1993), revealed that the average compressive strength of blocks taking a sample of two hundred and fifty was found to be 0.53N/mm^2, which is lower than the British standard specification of 3.5N/mm^2 and NIS specification of 3.45N/mm^2 which thus increases the volume of wastage or breakage of blocks during transportation and subsequently on site during construction. Also the moisture movement of the blocks studied was 0.075%, which exceeded the 0.05% specified by the British standard.

MARKETING EFFICIENCY AND SALES OF SANDCRETE BLOCK

According to Lazo (1962), marketing is the sum of all business activities, which deal with the movement of goods and services from producer to ultimate user. The focus on the consumer has uncovered a far greater task for efficient marketing. Marketers of today are aware that marketing deals with customer values, convenience, peace of mind, pride of ownership, satisfaction and ease of use, storage and re-order. All these factors deal with the ability and willingness of the consumer to maintain and increase demand. This can be created through sales promotion.

In their contribution, Bovee and Arens (1986) explained that promotion, supplements, advertising and personal selling stimulate sales of any product. They further explained that sales promotion would enhance speed of selling process, bring about direct inducement and maximize sales volume. Marketing efficiency, which is total sales over total production expressed as a percentage, has the potential to increase where promotion strategies are employed. Therefore marketing efficiency increases as sales increase. Lazo (1962) adduced that industrial sales must have basis on which to compete. This could be on quality, service, price or promotional activity. However, it is worth nothing quality could mean different things to different people, although standard for quality is set by professional organization.

Etuka (1989) stated that apart from availability and cheapness of building materials, quality of such materials are measured in line with durability, size, shape, thermal conductivity and strength. The question that must be asked here is "do sandcrete block producers consider quality as a structural property to be reckoned with in attaining high marketing efficiency?" This research work is aimed at providing an answer to this question.

RESEARCH METHODOLOGY

This study was limited to the production and sales of 225mm hollow sandcrete block for a period of one year (i.e. 2004), in Minna Metropolis. It entails generating primary data from samples of randomly selected block moulding factories for five different experiments, and for each, the block samples were collected after proper curing for seven days, and were subjected to crushing test. The results from the test were analysed statistically.

RESEARCH FINDINGS

Table 1, shows the values of production, sales and marketing efficiency of 225mm hollow sandcrete block from the selected block factories in Minna. Table 2, shows the figures for some structural properties of 225mm hollow sandcrete block. The properties examined included, the average weight, crushing strength, bearing and crushing loads of the block, which have the following mean values; 23.37kg. 0.358N/mm^2, 201.56N and 36.27N respectively.

Table 1: Values of Production, Sales and Marketing Efficiency of 225mm Hollow Blocks from Selected Block Industries in Minna

S/No	Name of Block Industry	Production per day	Sales per day	Production per year	Sales per year	Marketing Efficiency (S/P)
1	Haske	1700	1000	323,594	190,320	58.80
2	Mutunci	900	400	171,288	140,717	82.10
3	Yarzuku	1500	600	285,480	114,192	40.00
4	Sunny	600	300	114,192	57,096	50.00
5	Arewa	720	500	137,031	95,660	69.80
6	Atucluka	700	500	133,224	95,660	71.80
7	Dzuwa	570	500	108,581	95,660	88.10
8	Sanaco	460	250	107,372	48,210	44.90
9	Jossy Royal	1500	800	285,480	152,256	53.30
10	Suhabib	700	500	285,766	95,160	33.30
11	A.C	480	200	49,210	38,064	41.60
12	Unik	750	600	91,354	57,096	62.90
13	Zuma	850	500	142,908	114,184	79.90
14	Hauwa	860	500	161,837	95,160	58.80
15	Banjamia	540	350	95,433	66,612	69.80

Source: Author's field data 2005.

Table 2: Structural properties of 225mm Hollow Sandcrete Block from Selected Block Moulding Industries in Minna

S/No	Block Factory	Average Weight (kg)	Bearing Load (N)	Crushing Load (N)	Strength (N/mm^2)
1	Haske	23.67	228.70	30.33	0.299
2	Mutunci	23.44	226.50	125.33	1.235
3	Yarzuku	23.99	231.80	40.33	0.299
4	Sunny	24.42	235.90	50.67	0.500
5	Arewa	24.71	239.30	28.67	0.283
6	Abuduka	22.51	217.50	20.67	0.204
7	Dzuwa	25.07	242.20	28.00	0.277
8	Sanaco	20.79	200.80	38.33	0.379
9	Jossy Royal	22.40	156.50	26.30	0.259
10	Suhabib	22.77	220.00	41.00	0.405
11	A.C	22.70	161.40	0.70	0.106
12	Unik	23.00	168.10	18.70	0.185
13	Zuma	22.90	157.50	9.70	0.095
14	Hauwa	25.50	171.00	69.30	0.684
15	Banjamia	22.60	166.20	16.00	0.158
16	Mean Value	23.37	201.56	36.27	0.358

Table 3, gives the summary of regression analysis. In the first experiment carried out, it showed that there were strong significant linear and non-linear relationship between total sales and total production of 225mm blocks with R-square values of 63.56%, 60.56%, 63.61%, and 63.65% for linear, logarithmic, quadratic and cubic relationships. The average probability value for both the linear and non-linear models is 0.012, which is less than the 0.05 level of significance adopted in the study. Therefore, it can be inferred from the positive linearity equation that as total production of blocks increases, the total sales also increases. The result further revealed that correlation between the variables was high with 'F' values calculated higher than the 'F' values tabulated. This indicates strong significant relationship between the variables tested.

The second experiment conducted shows a mixed result for the variable investigated. The linear regression analysis showed that there is no significant relationship between the strength of block and marketing efficiency. The R-square value is 1.87% for linear model which shows that only approximately 2% of variation in marketing efficiency is explained by strength. The probability value is 0.62, which is higher than the 0.05 confidence limit adopted. Also correlation between the variables was low with 'F' values calculated lower than the 'F' values tabulated. This further reveals that there is no significant linear relationship between the variables analysed. Other data transformation showed some level of significance. The quadratic model showed strength of relationship with R-square of 49.73% and 'F' calculated lower than the 'F' tabulated which indicates that there is no significant relationship between the variables. Further transformation of data using cubic model revealed a strong significant relationship between the variables. It gave R-square value of 50.21%. The probability (P) value is 0.04, which is less than 0.05 level of significance which shows high correlation. The 'F' value calculated is higher than the 'F' value tabulated which shows that there is a strong significant cubic relation between the variables tested. From this transformation it means that for strength to show appreciable variation in marketing efficiency it must be raised to the third power. This is expressed in the regression equation. $ME = 127.27 - 317.81STR + 306.37(STR)^2 - 64.73(STR)^3$

Experiments three and four showed very weak correlation between the variables analysed. In experiment three, there were no significant linear and non-linear relationships between strength of block and bearing load of blocks. The R-square values for linear and non-linear regression are 0.67%, 2.07%, 5.645 and 20.07% for linear, logarithm, quadratic and cubic models respectively. The probability values range from 0.04 to 0.77, which are higher than 0.05 level of significance adopted, which confirms that correlation was low between the variables. The positive linearity in the equation model shows that as the strength of block increases, the bearing load also appreciates.

The result in experiment four is not different from that in experiment two. There were no significant linear and non-linear relationship between bearing load and crushing load of 225mm block. The R-square values for both linear and non-linear regression are, 0.09%, 2.67%, 7.38% and 19.88% for linear, logarithm, quadratic and cubic models respectively. The probability values average 0.597, which is higher than 0.05 level of significance used in the study, which means correlation, was low.

In experiment five, it was observed that, there is positive correlation among the variables tested with a multiple linear regression between bearing and crushing loads, and marketing efficiency. The R-square value is 1.9%, which shows that only about 2% of variation in marketing efficiency is explained by bearing and crushing loads. The 'F' value calculated is lower than 'F' value tabulated and the P-value exceeds 0.05level of significance.

Table 3: Summary of Regression Analysis

Exp. No	Variables X	Variables Y	Type of model	Results of experiment: Regression equation	R^2 %	F_{cal}	F_{tab}	P_{value}	Inference: Strength of Relationship	Inference: Remark
1.01	T_{sale}	T_{prod}	Linear	TP = 3071.04+1.72Ts	63.56	22.67	4.66	0.004	Strong	S.S
1.02			Logarithm	TP=-1613082.17+115593 4.23logTS	60.56	19.93	4.66	0.0006	Strong	S.S
1.03.			Quadratic	TP=13231.85+193TS-9.97 $(TS)^2$	63.61	10.49	3.88	0.002	Strong	S.S
1.04			Cubic	TP=38087.31+2.79TS-9.53 $(TS)^2$ +2.52$(TS)^3$	63.65	6.42	3.58	0.009	Strong	S.S
2.01	STR	MKE	Linear	MKE = 56.94 +7.17 STR	1.87	0.24	4.66	0.62	Very weak	N.S
2.02			Logarithm	ME=59.36-0.59log STR	0.03	0.004	4.66	0.94	Very weak	N.S
2.03			Quadratic	ME=117.38-251.72STR + 180.83$(STR)^2$	49.73	5.93	3.88	0.16	Strong	N.S
2.04			Cubic	ME=127.27-317.81STR + 306.37$(STR)^2$ - 64.73$(STR)^3$	50.21	3.69	3.58	0.04	Strong	S.S
3.01	STR	B_{load}	Linear	B_{load} =197.87 +8.80 STR	0.67	0.08	4.66	0.77	Very weak	N.S
3.02			Logarithm	BL=210.93+9.01log STR	2.07	0.27	4.66	0.60	Very weak	N.S
3.03			Quadratic	BL=158.41+179.24STR -119.35$(STR)^2$	5.64	0.35	3.88	0.70	Very weak	N.S
3.04			Cubic	BL=46.26=931.525STR – 1549.12$(STR)^2$+737.21($STR)^3$	20.07	0.92	3.88	0.46	Very weak	N.S
4.01	C_{load}	B_{load}	Linear	B_{load} =197.14+0.01 C_{load}	0.90	0.11	4.66	0.736	Very weak	N.S
4.02			Logarithm	B_L=164.27+1034log C_L	2.67	0.35	4.66	0.56	Very weak	N.S
4.03			Quadratic	B_L=152.77+1.95C_L - 0.14 $(C_L)^2$	7.38	0.47	3.88	0.63	Very weak	N.S
4.04			Cubic	B_L=51.39+8.70C_L -0.14 $(C_L)^2$ + 0.0006$(C_L)^3$	19.88	0.90	3.58	0.46	Very weak	N.S
5.01	C_{load}' and B_{load}	MKE	Multiple	MKE=49.3144.15E-02 B_{load}+5.28E -02 C_{load}	1.90	0.12	3.88	0.90	Very weak	N.S

Source: Researcher's analysis results (2005).

KEY:
S.S = Statistically Significant;
N.S = Not Significant;
T_{sale} = Total sales;
T_{prod} = To tal Production;
B_{load} = Bearing load
C_{load} = Crushing load;
STR = Strength;
MKE = Marketing Efficiency.

CONCLUSION AND RECOMMENDATIONS

This study established that production of 225mm hollow sandcrete block is influenced by sales. The regression equation model showed a positive linearity which means that an increase in production brings about an increase in the sales of the blocks.

The marketing efficiency is not influenced by strength on the premise of bearing and crushing loads. Although the regression equation showed that increase in strength based on crushing and bearing loads leads to an increase in marketing efficiency. Most variation in marketing efficiency of 225mm hollow sandcrete block are due to factors other than crushing load and bearing load.

It was also established that the mean strength of block produced in Minna is 0.358N/mm^2, which is far lower than 3.45N/mm^2 recommended by the Nigeria Industrial standard. The blocks being produced now have strength of about 11% of the required standard strength. From the foregoing, the following recommendations are made:

- Improving the structural properties of the block would increase sales of the same block. Since the regression equation MKE = 56.94 + 7.17STR shows some positive linearity
- The strength of 225mm hollow sandcrete block could be increased by improving the bearin load capacity as indicated in linearity of the regression equation which is Bload = 197.14 + 0.01Cload. This can be achieved if block producers will adequately compact and cure their blocks.

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