A Study on the Sources of Residential Satisfaction Among Households in Kumasi city in Ghana

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1. Introduction

The promotion of safe and congenial living environments has been the major thrust of most national housing development plans over the years. In the formulation and execution of these plans, targets are usually set and evaluated periodically to ascertain among other things, how these targets are being achieved.

In most developed countries, as part of the general framework for assessing the impacts of such plans for the redefinition of future goals and policies and in recent years for re-investment programs, residential or housing satisfaction studies have been conducted and used quite often [15]. Thus, literature on this subject abounds for comparative and other forms of analyses. One important finding that has come out of these studies is the fact that adequate housing supply in terms of housing numbers alone does not necessarily represent housing or residential satisfaction. In contrast, other factors like small size of house, inadequate interior space and facilities and unsafe neighborhoods have accounted for a greater proportion of the sources of residential or housing dissatisfaction among residents in most of these places. This knowledge, may have equipped housing policy makers with additional clues for formulating policies towards the improvement of residential satisfaction in these areas.

In developing countries, particularly those of sub-Saharan Africa, where housing problems seem to occur largely as a result of low rates of increase in housing stock (as against an ever-increasing housing need resulting from high rates of population growth and rapid rural to urban migration), housing dissatisfaction has been viewed largely in terms of the problems created by inadequate increases in the housing stock vis-a-vis the ever-increasing housing need levels.

Empirical studies have rarely been conducted in these areas to judge the validity of this assumption as well as to seek further understanding of the role of other potential sources of residential satisfaction. The lack of adequate knowledge on this important subject matter may have contributed in no small way to compounding urban housing problems in these areas as policies for rectifying them may have been formulated based on intuition rather than empirical evidence.

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The present study is primarily aimed at deriving the salient factors that could help explain residential satisfaction among households in Kumasi city, Ghana. An in-depth knowledge on this subject matter, it is hoped, could offer some useful clues to housing policy makers so that housing decisions go a long way to satisfy the aspirations of the people. In addition, it is hoped that this study would help enrich the literature on urban housing research in Ghana and other urban areas in sub-Saharan Africa as urban environmental conditions do not vary much between these areas. Another potential use could be for comparative analysis over both space and time with other areas where literature on the subject abounds.

In a small way, this research could help diffuse some of the criticisms on the lack of empirical models for explaining housing market operations in sub-Saharan Africa [9].

2. Previous Research

There already exists substantial amount of literature on households residential satisfaction in the advanced countries as a result of numerous studies. Factors explaining this subject matter can be grouped under three major categories—physical housing characteristics, locational characteristics and individual or household characteristics [24], [6]. Some physical housing characteristics that have been found to have greatly influenced residential satisfaction in these areas include size of housing [21], interior space and tenure status [21], [4] and size of households [13]. Locational characteristics affecting households residential satisfaction and preferences have included accessibility to the CBD (downtown) and other public facilities [7], [16], social relation in the neighborhood [16] neighborhood quality and image [15], life cycle stage [16], [20].

Researchers like [24] and many others employing econometric models have variously utilized rent and other price—based variables as one of the major categories for the analysis. Despite these analytical differences, the residential or housing satisfaction concept remains essentially the same. A previous study on urban housing satisfaction in a transitional society [6], was very remarkable in several ways as it served as one of the pioneering works in this research area in a city in a developing country. In this study, the writer found out that the length of time that a migrant had stayed in his current destination greatly influenced his residential satisfaction levels. This study invariably took into account the high rate of rural-urban migration in most third world cities. But as the writer rightly pointed out in the study, Taiwan is a transitional society about to 'graduate' into the realms of the advanced economic nations and therefore it is doubtful if the sources of residential satisfaction in Taiwan would be applicable to urban areas in say, sub-Saharan Africa. This is also one of the tasks of this study.

In the present study, additional variables that are likely to have considerable influence on households residential satisfaction have been included. They are variables that reflect the present-day realities of the conditions existing in the residential areas of these countries and which might not be accorded the same response in the previous researches on the subject. For example, three forms of household wealth indicators have been introduced to

ascertain their importance in explaining household residential satisfaction in the city. These forms of wealth indicators are household nominal income, household permanent income which is represented here by household consumption levels and finally, household non-monetary but movable wealth or property. The last variable refers to household possessions like vehicles and other durable items like television, refrigerator, air conditioners and many others.

In addition, the relative importance of home-based industries (commonly called informal industrial activities) in contributing to residential satisfaction is yet to be assessed. Strassmann [23] has stressed that in cities of developing countries, from a tenth to a quarter of dwellings have an enterprise on the premises. Such home-based industries he further emphasized, are likely to proliferate and their productivity in the future would be dependant on neighborhood traits like cost of space, density of settlement and access—some of the factors that affect residential satisfaction. Their importance in developing policies meant for residential satisfaction in these areas can therefore not be overlooked.

3. Study Methodology

Kumasi city is Ghana's second largest city with a population of 759,109 (inclusive of all areas constituting the present metropolitan area) in 1984 [11]. Over the last three decades, rapid population growth rates averaging over 3.25 percent per year have been experienced. Similarly, large increases were recorded in the growth rates in the number of households in the city over the same duration. The average rate of increase in the number of households over the period stood at 3.76 percent, thus even surpassing the equivalent figure for the growth in the total population [3]. The recent expansion in the city's area of jurisdiction to encompass the hitherto outlying towns and villages has outstretched the city's limited resources for the provision of adequate facilities. The result is that the quality of the residential environment has worsened calling for appropriate remedies to overcome them.

The data used in this study is from a household housing survey conducted in Kumasi city, Ghana, from September to October, 1989. The sample consists of 401 households who were selected using multi-stage random sampling techniques. The interviewees were heads of households. The characteristics as well as the viewpoints of household heads were taken to reflect that of the entire household.

To assess the potential problems that may be encountered in the main survey task, a pilot survey was conducted in some preselected sites for twenty households. The outcome of this pilot survey served as a useful guide in the development and execution of the main survey. The interview was conducted by final year university students majoring in Urban Planning and Architecture after the purpose of the survey had been clearly explained to them.

3.1 Definition of Response Variables

The major task this study sets out to accomplish is the measurement of households

attitude towards their present housing. Two conceptually distinct dimensions of residential satisfaction were employed—satisfaction with space and satisfaction with location [6]. Satisfaction with space as employed here represents the households attitude towards his present residential space. It is taken to represent (a) his perception of his internal housing conditions (b) some variables representing the characteristics of the household head and which it is thought to have significant influences on his residential space decisions.

The question posed and the responses provided in view of this concept is as follows:

Q1. How do you assess your current housing condition?.

1. very satisfied
2. satisfied
3. neither satisfied nor dissatisfied
4. not satisfied
5. very dissatisfied

On the second concept, satisfaction with location, the emphasis is on the household perception of his housing facility relative to the general surroundings or neighbourhood. Included also are some of the household characteristics that may influence his residential location decisions. In view of this concept, the question posed and the response given is as shown below.

Q2. With regard to this house what is your level of satisfaction with your location?

1. very satisfied
2. satisfied
3. dissatisfied

From the above questions, each respondent, that is a household head, was asked to rate his/her response towards the two concepts in 5 and 3 ordinal categories. The unequal number of categories employed above was arrived at after a thorough examination of the results that emanated from the pilot survey in which the redefinition of the responses as in the second concept resulted in a negligible impact on the overall results despite helping to save space and question time.

In the first question (satisfaction with space), the responses, "very satisfied" and "satisfied", were viewed as coming from households who were satisfied with their residential space while the remaining households—those who said otherwise, were described as those dissatisfied with their residential space as defined above.

For the second question, the responses, "very satisfied" and "satisfied", were respective-

Table 1. % Distribution of responses under the two concepts.

	Satisfied	Dissatisfied
Satisfaction with space	31	69
Satisfaction with location	67.2	32.8
Total (base)	100 (401)	100 (401)

ly viewed as coming from households who were satisfied with their location while those who gave dissimilar responses constituted those taken to be dissatisfied with their residential location. The table below (Table 1) gives a summary in percentages for the response categories under the two concepts.

3.2. Definition of explanatory variables for satisfaction with space analysis

Based on the literature review in section 2 above, the following explanatory variables were selected.

i. Educational level

Educational level of a person is a strong indicator of his social status and this is thought to influence his housing consumption and probably his satisfaction with space as used above. In this analysis, this variable was categorized into two, one for those with formal education (literate) and those without (illiterate). Literates accounted for 73.7 percent of the responses while illiterates constituted 26.3 percent.

ii. Household size

Households with five or less members were labeled as small households while those with over five members were classified as large or big households. On the basis of this criterion, 71.2 percent of the households constituted small households while 28.8 percent were large households.

iii. Permanent income

Permanent income represented by household consumption has been found to be a good predictor of household housing consumption income [11]. In the present research, the city's average per capita permanent income was used as the yardstick to distinguish between households with either high or low per capita permanent income. Those whose per capita permanent incomes exceeded that of the mean value for the city were defined as high income earners and high consumers of housing space. The others constituted the low income and low consumers of housing space. The former had a representation of 50.1 percent as against 49.9 percent by the latter.

iv. Home-based industries

Home-based industries were perceived as limiting the space available in a house for easy manoeuvrability and therefore households' access to space. Thus for houses without home-based industries and therefore little constraints on free movements within them, it was hypothesized that the residents would be much more satisfied with their housing space than their counterparts who are bordered by the presence of these small-scale industries. Those who were satisfied under this criterion accounted for 45.2 percent as against 54.8 for the dissatisfied households.

v. Occupancy rate

A measure of 2.5 persons per room as a benchmark was used [2]. Households whose

occupancy rates exceeded this limit were defined to be lacking adequate space while those below this limit were taken to be enjoying adequate space. The former group (low occupancy rates) accounted for 44.4 percent as against 55.6 percent for the latter (high occupancy rates).

vi. Other factors

In addition to the above variables, other factors that were considered but have been de-emphasized here and in the subsequent analysis because of their low levels of association with the response variables include :

a. level of interior quality—this factor deals with the exclusive use, shared use and non—availability of the following facilities and services—kitchen, bathroom, toilet, water supply, electricity, balcony/veranda. Based on the responses obtained, a rating procedure was adopted for the subsequent classification. Households with exclusive use to all of the facilities were labeled as those satisfied with their space while the rest constituted those dissatisfied with their space.

In addition, variables like (b) tenure status, that is whether a household head is a landlord or otherwise. Landlords were deemed to be more likely to be satisfied with space than the other household heads who were not landlords. (c) the type of residential area that a household inhabited was also taken to be influential in determining his levels of satisfaction with space. Residents of high class residential areas were rated as being satisfied with their housing space as against the others [1].

Other factors include recent migrants as against long-term residents [6], monthly incomes greater or smaller than the mean value for the city and finally, households who possess more than half the non-monetary wealth as previously defined were classified as rich households as against poor households with fewer possessions.

3.3 Definition of explanatory factors for satisfaction with location

i. Social relations

Social relations as used here refer to the relationship between the household and the other households either in the house or in the immediate neighborhood. Household heads were asked to respond to a question as to whether they were satisfied with the existing social relations either in the house or in the neighborhood. Those who responded that they were satisfied with the social relations accounted for 88.8 percent of the total number of respondents while those who said they were dissatisfied represented 11.2 percent of the responses.

ii. Access to facilities

This index was derived from the composite of the responses on the ease of access to the following important facilities and locations—CBD, market, workplace, bus/tro-tro (a local wooden passenger vehicle) station. The question posed was that, “with regards to your residence, what is your level of satisfaction with access to the following locations and facilities”. An index was constructed for ranking these responses and those who had good

access accounted for 84.6 percent of all the respondents. Those who said that they were inaccessible to these facilities and locations represented 15.4 percent of the total number of respondents.

iii. Recreational facilities

Recreational facilities as used here refer to drinking bars, drama/concert halls and sports facilities. Households who said that they were satisfied with the availability and access to these facilities accounted for 44.4 percent of all the respondents while those who were dissatisfied represented 55.6 percent.

iv. Neighborhood image

This variable was defined in terms of the following indices-(a) safety with respect to crimes and drug addicts (b) frequency of refuse removal (c) nature of neighborhood roads. Household heads who said that they were satisfied with the image of their neighborhoods totalled 81.1 percent while those who were dissatisfied stood at 18.9 percent.

v. Other variables

In addition to the above variables, some of the variables used in Section 3 above were employed here as they were thought to be relevant for explaining satisfaction with location in the city. These include (a) residential quality (b) length of stay in the city as well as all the income and wealth indicators like (c) per capita permanent income (d) monthly income and (e) non-monetary wealth.

4. Data Analysis

The variables explained above were analysed using (a) Cross tabulation and (b) Log-linear modeling technique.

4.1 Cross tabulation analysis

Cross tabulation analysis was undertaken with the objective of obtaining an initial understanding of the relations between the variables and to delineate the most relevant factors affecting each dimension of residential satisfaction, that is, satisfaction with space and satisfaction with location in the city.

Due to the conceptual differences between the two dimensions of residential satisfaction employed in this study, different variables were expected to be important in explaining each dimension. From the literature, it was postulated that greater satisfaction with space would be related positively to housing and households characterized by (a) household heads who have formal education (b) Home-ownership and (c) long-time residents of the city.

Satisfaction with location was expected to be influenced largely by (a) good neighborhood image (b) good access to facilities and (c) good social relations.

In addition all the income and wealth variables were expected to have positive relationships with these two dimensions of residential satisfaction. The results showing

the relationship between satisfaction with space and satisfaction with location and the independent variables are as shown in Tables 2 and 3 below. In addition the percentage scores for each category of the independent variables (discussed in the previous sections) have also been given.

The analysis was conducted employing Somer's D [18] and chi square's degree of freedom statistics to establish the relationships between the response and the explanatory variables.

$$\text{Somer's D } (dy) = \frac{P - Q}{P + Q + Ty} \quad (1)$$

dy = proportionate excess of concordant pairs over discordant pairs among pairs not tied on the independent variables.

P = concordant pairs i.e when values for both variables for one case are higher (or lower) than for the corresponding values for the other case.

Q = discordant pairs i.e if the value of one variable for a case is larger than the corresponding of one variable for the other case and the direction is reversed for the second variable.

Ty = number of pairs tied on y but not on x , where y is the dependent variable and

Table 2 Statistical association between satisfaction with space and explanatory variables.

Variables	Proportion in each category	Association level (Somer's) #
a) Household size		
i. five or more	71.2%	
ii. more than 5	28.8%	+0.218***
b) Occupancy rates		
i. under 2.5	44.4%	
ii. 2.5 or more	55.4%	+0.210***
c) Permanent income per head		
i. city's average and above	50.1%	
ii. below city's average	49.9%	+0.186***
d) Level of education		
i. literate	73.7%	
ii. illiterate	26.3%	+0.096*
e) Home-based industry		
i. absent	45.2%	
ii. present	54.8%	+0.086*

= the strength of association is measured by Somer's D (assymetric) which ranges from -1.0 for a perfect negative association, through 0.0 where there is no association to +1.0 where there is perfect association.

(a) * = 0.05 means association expected by chance five times in one hundred

(b) ** = 0.01 means association expected by chance one time in one hundred.

(c) *** = 0.001 means association expected by chance one in a thousand.

x the independent.

Tied pairs represent two cases with identical values on one or both variables.

In the analysis on satisfaction with residential space and the selected explanatory variables, strong positive relationship existed between the response variable and some of the explanatory variables. Table 2 gives an account of these relationships. Variables with weak positive as well as negative relationships have been excluded from the table.

Strong positive relationships existed between the response and the household size variable ($d=0.218$), occupancy rates ($d=0.21$), permanent income per head ($d=0.186$).

Moderately strong relationships were recorded for educational background of household head ($d=0.096$) and the presence of home based industries ($d=0.086$).

Low positive relationships existed between the response variable and non-monetary wealth ($d=0.079$), monthly income ($d=0.036$) and interior quality ($d=0.034$). On the other hand negative relationships were recorded between the response variable and tenure status ($d=-0.274$), length of stay in city ($d=-0.131$), and residential area ($d=-0.026$).

With the exception of the variable, level of education, (which had a moderately strong

Table 3 Statistical association between satisfaction with location and explanatory variables.

Variables	Proortion in each category	Association level (Somer's) #
a) Social relations		
i. good	88.8%	
ii. bad	11.2%	+0.432***
b) Neighborhood image		
i. good	81.1%	
ii. bad	18.9%	+0.472***
c) Access to facilities		
i. good	84.6%	
ii. poor	15.4%	+0.433***
d) Recreational facilities		
i. good supply	44.4%	
ii. poor supply	55.6%	+0.378***
e) Non-monetary wealth		
i. rich	12.4%	
ii. poor	87.6%	+0.146**
f) Residential area		
i. high class	29.8%	
ii. Low class	70.2%	+0.110**

#=the strength of association is measured by Somer's D (assymetric) which ranges from -1.0 for a perfect negative association, through 0.0 where there is no association to +1.0 where there is perfect association.

(a) *=0.05 means association expected by change five times in one hundred

(b) **=0.01 means association expected by chance one time in one hundred

(c) ***=0.001 means association expected by chance one in a thousand.

position relationship with the response variable) our initial hypothesis that home-ownership and long-time residents of the city would play a strong role in determining residential space satisfaction in the city proved to be exaggerated. Instead, factors such as size of households, occupancy rates, per capita permanent income and presence of home-based industries played prominent roles in explaining the concept of residential space satisfaction (a lower arbitrary limit of $d=0.085$ was used to delimit variables to explain the concept). The only income and wealth factor that provided important relationship with the response variable was the per capita permanent income ($d=0.186$).

In a more explicit note, we can say that households in the city that are satisfied with their residential space bear some of the following characteristics-(a) have household size of five or less (b) occupancy rates are below 2.5 persons per room (c) per capita income exceeds the city's average (d) household head is literate or has formal education and finally (e) live in homes that do not have home-based industries.

The relationships between satisfaction with location and the independent variables described in section 2 of this paper are as shown in table 3 below.

Strong positive relationships existed for social relations ($d=0.482$), neighborhood image ($d=0.472$), access to facilities ($d=0.433$) and recreational facilities ($d=0.378$). Moderately strong relationships were recorded for non-monetary wealth ($d=0.146$), residential area ($d=0.11$). Relationships ranging from low positive to negative were recorded for the remaining variables.

Comparing the above results with the already hypothesized situation, it becomes clear that apart from the income and wealth variables, which did not have particularly strong relationships with the response variable, all the other factors displayed strong positive relationships. Thus it is clear from here that households who are satisfied with their residential location are those who have (a) good social relations (b) good neighborhood image (c) good access to facilities (d) good recreational facilities (e) live in high class residential areas and finally (f) possess considerable non-monetary wealth.

In crude terms, it can be stated from the above results that households in the city seem to be more satisfied with their residential location in comparison with their residential space. This may be inferred from the magnitude of the test statistics showing the relationships between the two conceptual frameworks and their respective independent variables.

While the above results may not be unique as compared with existing literature, they nonetheless offer some useful insights and ideas that may hitherto not have been seriously considered. A case in point is the importance of home-based industries in explaining the concept of satisfaction with residential space.

4.2 Log-linear Analysis

The above analysis based on cross tabulation was carried out to obtain an initial understanding of the relations between the variables and to delineate the most relevant factors affecting each dimension of residential satisfaction, that is satisfaction with space

and satisfaction with location. However, since a series of two-way tables did not permit the simultaneous effects of the several independent variables on residential satisfaction, alternative methods of analyses based on Log-linear modeling framework (the abbreviated stepwise selection method and logit extensions of it) were introduced for more detailed analysis.

Since we are concentrating on the effects of independent variables on dichotomized response variables (that is whether a household is satisfied or dissatisfied with his residential space or location), rather than on the relations among the variables and the exact degree of residential satisfaction, the analysis correspond to the logit model [10], [25].

In short, therefore, our goal here is to find a simple, parsimonious model—one that fits the data with the fewest number of parameters for each of the two dimensions of residential satisfaction.

i. The Abbreviated Stepwise Selection (ASSM)

The variables with strong positive relationships with the two response variables in the preceding analysis were examined simultaneously in terms of their effects on these response variables. The method of analysis employed here is the abbreviated stepwise selection method proposed by Goodman [8]. It consists of two main analytical steps [25].

First, standardized values (equation 2 below) are computed for the parameter estimates of a fitted saturated log-linear model of these selected variables. For a sufficiently large sample, the test of the null hypothesis that the lambda (λ) is zero (0) can be based on the standardized value. For example as shown in equation 2 below, if we denote any particular parameter estimator $\hat{\lambda}^z$ and its asymptotic variance estimator as $\text{Var}(\hat{\lambda}^z)$ then the the standardized value of $\hat{\lambda}^z$ can be estimated as:

$$\hat{\lambda}^z / \sqrt{\text{Var}(\hat{\lambda}^z)} \quad (2)$$

If the computed standardized value is greater than +1.96 or less than -1.96, then we

Table 4. Results for Satisfaction with space variables

Variable*	Standardized value	Parameter estimate
D	5.686	0.535
C	-2.179	-0.205
B	5.164	0.486
A	-4.725	-0.444
E*F	2.29	0.216
D*E	3.414	0.321
C*E	4.155	0.391
A*D*E	-2.011	-0.189

Variable Names: A=Satisfaction with space, B=Level of Education, C=Occupancy rates, D=Household size, E=Permanent income per head, F=Home-based industry location.

* All variables listed exceed the absolute value of 1.96

Table 5. Results for Satisfaction with Location variables.

Variables	Standardized values	Parameter estimate
G	3.225	0.338
P	-4.352	-0.455
R	-2.199	-0.230
N	2.412	0.252
S	4.059	0.425
S*G	2.149	0.225
P*I	2.043	0.214
S*N	2.539	0.266
L*R	1.974	0.202
L*L	1.962	0.199

Variable Names: L=satisfaction with location, S=social relations, N=neighborhood image, R=recreational facilities, P=non-monetary wealth, G=access to facilities, I=residential area.

NB/all variables exceed the absolute value of 1.96

can reject the null hypothesis that lambda (λ) is zero. These standardized values can be used to guide the selection of a base model when the value falls outside this range [25].

In this study, variables from Tables 2 and 3 (from the previous contingency analysis) were employed for the first part of the ASSM analysis—the estimation of standardized values and Tables 4 and 5 show the results for the two concepts of residential satisfaction—satisfaction with space and satisfaction with location. Because of the enormity of the data output, only those with important significance for the next analysis are reported here—i.e. those exceeding the absolute value of 1.96.

The second or last part of the ASSM analysis involves a variable selection method using backward elimination procedures. Under this procedure, the parameters selected under the previous standardized value analysis are fitted as a saturated model suggested by

Table 6. Satisfaction with housing space-Backward Elimination Procedures

$$\text{ORIGINAL MODEL} = \lambda + \lambda_1^A + \lambda^B + \lambda^C + \lambda^D + \lambda^E + \lambda^F \\ + \lambda^{AD} + \lambda^{EF} + \lambda^{CE} + \lambda^{DE} + \lambda^{ADE}$$

Model specification	G ₂	df	Conditional G ²	df
Model (2)-A.D.E	313.1	9	313.1-299.2=13.9	1*
Model (2)-E.F	323.3	9	323.3-299.2=24.1	1*
Model (2)-C.E	369.5	9	369.5-299.2=70.3	1*

* Conditional G squared significant at the conventional 5% level

$$\text{FINAL MODEL} \rightarrow \lambda + \lambda_1^A + \lambda^B + \lambda^C + \lambda^D + \lambda^E + \lambda^F \\ + \lambda^{AD} + \lambda^{EF} + \lambda^{CE} + \lambda^{DE} + \lambda^{ADE} \quad (3)$$

Table 7. Backward elimination procedures for satisfaction with location.

$$\text{ORIGINAL MODEL} = \lambda + \lambda_1^L + \lambda^S + \lambda^N + \lambda^R + \lambda^P + \lambda^G \\ + \lambda^{SP} + \lambda^{PI} + \lambda^I + \lambda^{LN} + \lambda^{LR} + \lambda^{SN} + \lambda^{SG}$$

Model specification	G ²	df	Conditional G ²	df
Model (3)-L.N	626.89	13	626.89-602.25=24.64	1*
Model (3)-L.R	634.60	13	634.89-602.25=32.35	1*
Model (3)-S.P	602.48	13	602.48-602.25=0.23	1
Model (3)-S.N	623.37	13	623.37-602.25=21.12	1*
Model (3)-P.I	603.22	13	603.22-602.25=0.97	1
Model (3)-S.G	636.37	13	636.37-602.25=34.12	1*

* Conditional G squared significant at the 5% level

$$\text{FINAL MODEL} = \lambda + \lambda_1^L + \lambda^S + \lambda^N + \lambda^R + \lambda^P + \lambda^G \\ + \lambda^{SP} + \lambda^{PI} + \lambda^I + \lambda^{LN} + \lambda^{LR} + \lambda^{SN} + \lambda^{SG} \quad (4)$$

Wringley [25] and it involves main effects and interaction effects.

The likelihood ratio chi-squared statistic (G^2) is employed to provide a measure of the goodness of fit of the model. This statistic follows a chi-squared distribution. To test the null hypothesis that any given model could have generated the observed frequencies, the G^2 value is compared with the tabulated value for the appropriate degrees of freedom. If G^2 is greater than the tabulated chi-squared value, then the null hypothesis must be rejected. The model has a hierarchical structure such that only the interactions whose component factors have been included may be tested. The reduction in deviance achieved by the introduction of an interaction term can be tested by comparing the difference in G^2 with the tabulated chi-squared statistic for the equivalent difference in degrees of freedom. This use of the chi-squared statistic is equivalent to its use for comparison of observed cell frequency values with expected values generated from a priori model [5].

The results of fitting the log-linear model and of introducing the various interaction effects by means of the backward elimination method for the two concepts are as shown in Tables 6 and 7 below.

ii. Logit extensions of Residential Satisfaction model

When one variable is thought to depend on others, special class of log-linear models called logit models can be employed to examine the relations between the dichotomous dependant variable and one or more independent variables. Logit models, which comprise examples of discrete or qualitative choice models [14], [25] developed out of the difficulty encountered in applying regression models to categorical data. Essentially, the rationale of logit models rest on the derivation of choice probabilities based on utility theory [25].

The model takes the form :

$$\log \frac{\text{Probability (satisfaction)}}{1 - \text{Probability (satisfaction)}} = a + bXi \quad (5)$$

where ;

Probability (satisfaction) is the probability that the household is satisfied with his form of residence—here, either his residential space or residential location.

The left hand side of the equation states that the log-odds of a household choosing the first alternative or category in the response variable is dependant on a set of characteristics X_i which are observed up to a parameter b and a constant a . [18]. The left hand side of equation (5) is interpreted as a ratio of two log-linear models.

Using the previous analysis as a guide, the household is involved in a binary choice, he is either satisfied or dissatisfied with his residential space or location. Thus his decision on, for example, his residential space (A) becomes a response variable with two alternatives—satisfaction or dissatisfaction. The explanatory variables then become level of education (B), Occupancy rate (C), household size (D), per capita permanent income (E), and the presence of home-based activities (F). The log-odds for residential satisfaction then becomes :

$$\ln \frac{M_{1jklmn}}{M_{2jklmn}} = \ln M_{1jklmn} - \ln M_{2jklmn} \quad (6)$$

Where the subscripts refer to the dimensions of the table. A is the response variable with two dimensions and the independent variables of B, C, D, E and F are of the dimensions j, k, l, m and n respectively. From the results of our log-linear model equation (3) and suppressing the subscripts other than those for the response model for simplicity, we can rewrite equation (6) as follows :

$$\begin{aligned} \ln M_{1jklmn} = & \lambda + \lambda_{1A} + \lambda_B + \lambda_C + \lambda_D + \lambda_E + \lambda_F + \lambda_{EF} \\ & + \lambda_{1AD} + \lambda_{1AE} + \lambda_{1ADE} + \lambda_{CE} + \lambda_{DE} \end{aligned} \quad (7)$$

$$\begin{aligned} \ln M_{2jklmn} = & \lambda + \lambda_{2A} + \lambda_B + \lambda_C + \lambda_D + \lambda_E + \lambda_F + \lambda_{EF} \\ & + \lambda_{2AD} + \lambda_{2AE} + \lambda_{2ADE} + \lambda_{CE} + \lambda_{DE} \end{aligned} \quad (8)$$

and by subtracting equation (8) from equation (7), we get

$$\begin{aligned} \ln M_{1jklmn} - \ln M_{2jklmn} = & \lambda_{1A} - \lambda_{2A} + \lambda_{1AD} - \lambda_{2AD} + \lambda_{1ADE} \\ & - \lambda_{2ADE} + \lambda_{1AE} - \lambda_{2AE} \end{aligned} \quad (9)$$

Employing centered effect coding [25] i.e. $\lambda_{1A} = -\lambda_{2A}$;

$$\lambda_{1AD} = -\lambda_{2AD} ; \lambda_{1AE} = -\lambda_{2AE} ; \lambda_{1ADE} = -\lambda_{2ADE}$$

Thus

$$\begin{aligned} \lambda_{1A} - \lambda_{2A} &= 2\lambda_{1A} ; \lambda_{1AD} - \lambda_{2AD} = 2\lambda_{1AD}, \\ \lambda_{1AE} - \lambda_{2AE} &= 2\lambda_{1AE} ; \lambda_{1ADE} - \lambda_{2ADE} = 2\lambda_{1ADE} \end{aligned} \quad (10)$$

Therefore

$$\ln \frac{M_{1jklmn}}{M_{2jklmn}} = 2\lambda_{1A} + 2\lambda_{1AD} + 2\lambda_{1AE} + 2\lambda_{1ADE} \quad (11)$$

Conventionally, we define

$$W = 2\lambda_{1A}, \quad WD = 2\lambda_{1AD}, \quad WE = 2\lambda_{1AE},$$

$$WDE = 2\lambda_{1ADE} \quad (12)$$

Therefore

$$\ln \frac{M_{1jklmn}}{M_{2jklmn}} = W_1 + W_{1D} + W_{1E} + W_{1DE} \quad (13)$$

Expression (13) is called the linear logit model and the W terms are referred to as logit terms.

This model then means that the main factors that determine households residential space satisfaction in Kumasi city are the size of households (W_{1D}), per capita permanent incomes (W_{1E}), the interaction of these two factors (W_{1DE}) and finally the interaction of all the five explanatory factors (W_1).

Utilizing (3) and going through the same procedure for the logit analysis on satisfaction with residential location, it was revealed that neighborhood image and the presence of recreational facilities are the main factors that determine residential location satisfaction among households in the city.

A further analysis was conducted to assess the relative importance of the factors identified under the above logit model analysis in explaining the two concepts of residential satisfaction under study [19].

This analysis was carried out to test the null hypothesis that the response and the (factor) explanatory variables are independent. The test is significant and therefore the hypothesis of independence is rejected.

As illustrated in Table 8 for the satisfaction with space model, AD , AE , and ADE

Table 8. Contributions of factors in the Satisfaction with space model.

Source	Marginals fitted	G ² component	df
Null	BCDEF/A	177.9	8
due to per capita permanent income	BCDEF/AD	69.0 (38.8)	1*
due to household size	BCDEF/AE	24.7 (13.8)	1*
due to household wealth (D and E)	BCDEF/AD	43.4 (24.4)	1*
RESIDUAL		65.5 (3.68)	5*

* significant at the 5% level

NB-shown in parenthesis are the values for the corresponding percentages

Table 9. Contributions of factors in the Satisfaction with space model.

Source	Marginals fitted	G ² component	df
Null	SNRPGI/L	603.85	10
due to neighborhood image	SNRPGI/LN	217.38 (31.33)	1*
due to recreational facilities	SNRPGI/LR	53.98 (7.8)	1*
RESIDUAL		332.49 (55.07)	8*

* significant at the 5% level

NB-shown in parentheses are the values for the corresponding percentages

Table 10. Comparison of the results from the Contingency and log-linear analyses-Satisfaction with space.

Contingency	Log-linear
1. Household size	1. Household size
2. Occupancy rate	2. Permanent income per head
3. Permanent income per head	
4. Level of Education	
5. Home-based industry	

Table 11. Comparison of the results from Contingency and log-linear analyses-Satisfaction with Location.

Contingency	Log-linear
1. Social relations	1. Neighborhood image
2. Neighborhood image	2. Recreational facilities
3. Access to facilities	
4. Recreational facilities	
5. Non-monetary wealth	
6. Residential quality	

when fitted accounted for 38.8 percent, 13.8 percent, and 24.4 percent respectively of the total G^2 , leaving a residual value of 36.8 percent which can be attributed to the interaction term of the independent variables.

Similarly, Table 9 shows that when the model is fitted for the satisfaction with location model, LN and LR accounted for 31.38 percent and 7.8 percent respectively of the total G^2 value leaving a residual of 55.07 percent which can be attributed to the role of the interaction term of the factors or independent variables.

4.4 Comparison of the results from the Contingency analysis and Log-linear model.

Tables 10 and 11 give a summary of the comparison of the results from the two main analytical techniques employed in the study.

From Table 10, it can be seen that the role of household size in explaining residential space satisfaction in the city is undisputable. The reason for this may be as follows:

Kumasi city, as stated previously, is experiencing high rates of population increase against a background of stagnant or slowly increasing housing stock. This imposes severe restrictions on the access to housing (assuming we negate all the other factors determining access to housing). Thus, households with fewer members are more probable to be satisfied with their residential space as compared to those with larger sizes. This fact also corroborates the already existing notion that residential satisfaction in such areas may be attributed to housing stock deficiencies. Although occupancy rate appeared second under the contingency analysis, its importance under the log-linear analysis was unnoticeable and therefore unclear. We may therefore speculate that its relationship with the response

variable may be the inverse type [6]. Further analysis is needed to clarify the exact nature of this relationship. The importance of permanent income in explaining housing decision making has also been validated here.

While the results from Table 11 depicting a similar analysis for satisfaction with location model seem a little unclear as compared with the analysis under the residential space model, it nevertheless brings into the fore the relative importance of neighborhood image and good supply of recreational facilities in accounting for satisfaction with residential location.

5. Conclusion

The research was initiated with the aim of developing a better understanding of the sources of residential satisfaction in a city in sub-Saharan Africa. Its anticipated use is to aid policy makers in the formulation of better policies for resolving problems within the urban residential environment.

In the first part of the work, we explored the strength of association existing between the two concepts of residential satisfaction employed for the study and a number of independent variables. The test statistics were the Somer's d and chi squared degrees of freedom.

In the first part of this analysis, one of the concepts—satisfaction with space displayed strong positive relationships with the following independent variables—household size, per capita permanent income, level of education, occupancy rates and the presence of home-based industries among others. In the second part, the second concept—satisfaction with location, was found to have strong positive association with social relations, neighborhood image, access to facilities, recreational facilities, household non-monetary wealth and residential area type.

In the follow-up analysis, log-linear and logit model techniques were employed to further assess the relationships between the response variables and the independent variables that were selected from the contingency analysis. From this analysis, we see that household size and permanent income per head and their interactions accounted for over 77 percent of the sources of residential satisfaction in the city. Probably, this large figure may be attributed to the importance of population and income-related variables in the sphere of housing decision making in the city.

From the residential location analysis, neighborhood image and recreational facilities explained 39.1 percent of the sources of satisfaction with residential location among households in the city. The low level of explanatory power for the variables under this concept may be due to the relative unimportance of this concept of residential satisfaction to the households. This assertion may further re-confirm the previously stated fact that households may be more sensitive to their residential space than to their residential location even though this assertion may not be justified by any available empirical evidence.

An ancillary aim of this research has been to compare the results of this study with

those undertaken in other areas. While factors associated with population size, financial status and the level of housing stock seem to sum up for the important determinants of residential space satisfaction in this research, results available from the advanced nations and Taiwan seem to portray a different picture. In these areas, the major determinants of residential space satisfaction have been with factors associated with further improvements in the already existing residential facilities and services. The often-quoted sources of residential dissatisfaction have been small size of dwelling unit and poor interior quality. In the present study, however, it can be inferred from the strong explanatory powers of some of the variables to justify the claim the sources of that dissatisfaction can be interpreted in terms of non-existence or at best, inadequacy of basic housing needs.

In the satisfaction with location analysis, the differences may be a little blurred. However, one exception can be emphasized. While household characteristics, for instance, educational level of the respondent, have been very prominent in explaining satisfaction with residential location in previous studies, this factor seems to be down-played in this analysis. Perhaps the two categories employed to define educational level in this study may have been too broad to capture the expected differences.

In conclusion, it can be emphasized that while the results obtained under this study may not be very different from those available from existing studies, it has undoubtedly helped better our understanding of some of the present-day realities associated with the urban housing sector in a city in an under-developed country.

Our future research intentions are two-fold; first, it is our intention to do further exploratory research in this area to help clarify some of the ambiguities that came along in the course of this study. Secondly, we hope to employ and test other methods available for model selection under log-linear analysis as expounded in [25] as a basis for comparative analysis on the methodological framework.

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