Original Article

Post-occupancy evaluation and residents' satisfaction with public housing in Lagos, Nigeria

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ABSTRACT   This study evaluates the residential environments of five low-income and three medium-income public housing estates in Lagos, Nigeria. The specific objectives were: to appraise the physical characteristics of residential buildings in the estates; to examine the socio-economic characteristics of the residents; to determine the relative levels of residents' satisfaction; and to analyse the relationship between the physical characteristics and residents' satisfaction. The methodology involves an expert rating appraisal conducted by four evaluators and a survey of residents' satisfaction. Ten performance criteria were developed and used in assessing the characteristics of the residential environments. Data relating to residents' satisfaction were obtained by means of structured questionnaire administered on a systematic sample of 806 household heads, from a sampling frame of 8060 housing units. The quantitative data were analysed using descriptive and inferential statistics. The study revealed a gap in quality between the medium- and low-income estates. The results also showed that 62 per cent of the physical characteristics of the residences are highly correlated with residents' satisfaction ($r = 0.62$). This buttresses the significance of the physical characteristics of residences in determining the level of residents' satisfaction. Such information will enhance the skills of architects and housing administrators to ascertain specific actions that can maximize more satisfactory housing provisions and minimize dissatisfaction as much as possible.
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INTRODUCTION

Architects seldom receive useful feedback about the performance of completed buildings, except from the satisfied or dissatisfied clients or users. Evaluation by the actual users of a building is therefore important for improving design quality. This is as vital in the

context of public housing as it is in private housing. In one, the motive is social service welfare; in the other, customer satisfaction geared towards profit-maximization. The focus of the reported research is on public housing: it evaluates the residential environments of five low-income and three medium-income public housing estates of the Lagos State Development and Property Corporation (LSDPC), Lagos, Nigeria.

Public housing – housing provided by the state for households who lack the necessary resources to obtain it for themselves – has been the object of many evaluation studies (Husock, 2000; Rigatti, 2000). Designing buildings for public housing presents a unique challenge to the architect, because these structures are intended for people who, generally speaking, have a different socio-cultural status from that of the architect. This study reports a post-occupancy evaluation (POE) involving, first, an expert rating appraisal conducted by four evaluators, and, second, an analysis of residents' satisfaction.

Completed residential buildings should not only be fit for the purpose of the users, but also be able to perform their functions in such ways as to ensure relative residents' satisfaction (Liu, 1999). This is, however, without prejudice to the need for routine maintenance to ensure that buildings function well at all times (Ikpo, 2009). POE is a structured approach to evaluating the performance of buildings when fully operational, that is, after they have been occupied. The main purpose of this study is therefore to appraise how certain quality and performance characteristics of the residential environment contribute to creating conditions congruent with residents' satisfaction.

RESEARCH PROBLEM

The LSDPC was established in 1972 primarily for the provision of public housing (Fadahunsi, 1985). The LSDPC is therefore the dominant provider of public housing in Lagos, Nigeria. In more than three decades of existence, the Corporation has developed residential estates in various locations in the state, and for varied categories of clients. As the implementation agency of the mass-housing programme of the first civilian administration (1979–1983), the LSDPC embarked on massive construction of low-cost housing estates. Between 1981 and 1990 about 20 000 housing units – representing 20 low-income, 9 medium-income, and 5 upper-medium-income housing estates – were provided on owner-occupier basis. It is from the low-income and medium-income categories that the population for the survey in this study was derived.

The research problem is, therefore, to evaluate the products of LSDPC public housing from the conceptual perspective of residential satisfaction. Evaluation is particularly suited to research in the context of public housing, given that public housing involves the employment of public expenditure, as well as the delivery and distribution of public good, and therefore demands a high degree of accountability. The notion of 'public' may suggest a tendency towards the average, rather than optimal provision. Moreover, lessons learnt from the evaluations of existing projects can serve as input into ongoing or future projects.

Public housing as a product of the direct state intervention in housing has generated much criticism globally. There appears to be an underlying stigma attached to public housing schemes, and the public perception of the quality of such housing does not seem very flattering (Husock, 2003; Varady, 2004). Despite this general stigmatization, however, attempts to conduct empirical research to ascertain the validity of these criticisms and to evaluate the extent to which they apply to the public housing schemes in Lagos, Nigeria, are negligible. There is little factual evidence to ascertain the key problems and the specific factors of 'inadequacy' or 'non-satisfaction' in existing public housing estates.

It is essential that empirical research findings support criticisms, if they are to serve as valid constructs for objective decision making and policy formulation. In essence, this study contributes to knowledge in the field of public housing, in terms of POE and residential satisfaction. It builds on studies such as Onibokun (1974), which focused on satisfaction with public housing in Canada; Olojede (1997), which examined management problems in the implementation of housing policies and programmes in Lagos, and Boston (2005), which examined how revitalization affects public housing residents of the Atlanta Housing Authority.

RESEARCH OBJECTIVES

The aim of the research was to appraise how quality and performance characteristics of the residential environment contribute to creating conditions congruent with residents' satisfaction in selected public housing estates of the LSDPC. The specific objectives of the study were to

- appraise the physical characteristics of residential buildings in the selected estates;
- examine the socio-economic characteristics of the residents in the selected estates;
- determine the relative levels of residents' satisfaction;
- analyse the relationship between the physical characteristics of the buildings and residents' satisfaction.

LITERATURE REVIEW

The terms *building appraisal*, *building evaluation, building diagnosis, post-occupancy evaluation* and *buildings in use* describe studies that focus on completed building projects. Preiser and Schramm (1998) attempted to widen the scope in the direction of *building performance evaluation*, to integrate user and aesthetic factors with technical and economic factors. Watt (2007) uses the term 'Building pathology' to describe that aspect of building appraisal that is concerned principally with defects and associated remedial action. Although Duffy (2008) suggests the existence of a terminological dilemma, all of these concepts aim at discovering how the completed building performs; determining possible misfits, mistakes or omissions; and accumulating information for future programming and design efforts. Preiser and Vischer (2004), however, consider POE to be the most commonly used term for the activity of evaluating buildings in use.

POE is about procedures for determining whether or not design decisions made by the architect are delivering the performance needed by those who use the building. By using occupants as a benchmark in evaluation, POE provides enormous potential for improving the performance of a building. POE evolved to fill the gap in the conventional building process, which consists of planning, programming, design, construction and occupancy of a building. It represents the vital diagnostic step needed to feed the prescriptive tools of planning and programming (Voordt and Wegen, 2005).

POE is a systematic manner of evaluating buildings after they have been built and occupied for duration of time (Preiser, 1995, 2002). The gap between the actual performance of buildings and explicitly stated performance criteria constitute the evaluation (Preiser *et al*, 1988). One of the applications of POE is the comparison between the use that the designer intended for an environment and that to which its users put it. Watson (2003) defined POE as a systematic evaluation of opinions about buildings in use, from the perspective of users. It is essential to elicit the perceptions of the residents and correlate these with the performance level of housing as determined by POE.

The benefits of POE are diverse. First, it ensures the sustenance of building performance, particularly of public buildings and facilities. Vischer (2002) suggests that POE is used in determining building defects, formulating design and construction criteria, supporting performance measures for asset and facility management, lowering facility life cycle costs by identifying design errors that could lead to increased maintenance and operating costs, and clarifying design objectives. Second, POE provides a mechanism for understanding the mutual interaction between buildings and users' aspirations and for proposing ways of improving the environment necessary to accommodate these aspirations. In addition, POE serves as a multifaceted tool to account for building quality through the identification of successful design features, redundant or unnecessary building features, problems to mitigate, and defects to rectify (Watson, 2003). It thereby helps to empower users to negotiate building issues and reduce maintenance works and cost (Bordas and Leaman, 2001; Vischer, 2002; Hewitt *et al*, 2005).

Post-occupancy evaluation and public housing

Historically, building performance was evaluated in an informal manner, and the lessons learned were applied in subsequent building cycles of similar building types (Preiser, 2002). Although informal, subjective evaluations of the built environment have been conducted throughout history, systematic evaluations, employing explicitly stated performance criteria with which performance measures of buildings are compared, is of more recent origin.

POE evolved from the architectural programming techniques of the late 1950s and early 1960s. Early significant evaluative efforts were in response to severe problems faced in institutions such as mental hospitals and prisons, some of which were attributable to the built environment. The 1960s saw the growth of research that focused on the relationship between human behaviour and building design, leading to the creation of the new field of environmental design research and the formation of interdisciplinary professional associations, such as the Environmental Design Research Association in 1968.

The 1970s witnessed significant increase in the scope, number, complexity and magnitude of evaluation studies and publications, with developments such as: the use of multiple buildings for data collection and comparative analysis; the use of multi-method approaches to building evaluation; the investigation of a comprehensive set of environmental factors, not as isolated variables, but to access their relative importance to the users of the facilities; and the addition of technical and functional factors to the scope of evaluation studies, compared with the earlier emphasis on strictly behavioural research. The final decades of the century was the era of applied evaluation in which POEs became routinely used (Preiser, 2002).

From the early 1970s, the tools of POE became more relevant to public housing in the developed countries of the world. Some evaluation projects relating to housing for the elderly and public housing were conducted. The work by Newman (1973) – which examined data from 100 housing projects, and linked the incidence of crime to housing form and disposition, site design and circulation – stands out in terms of scope and influence. Though provocative, Newman's work was well publicized and effectively influential on housing policy on the national level, stimulating the renovation of existing public housing projects. Researchers at the University of Illinois also conducted an important evaluation study that significantly influenced policy of the United States Department of Housing and Urban Development (Francescato *et al*, 1979). This effort included project management as part of the study and demonstrated its importance to the

residents' satisfaction. It tested the nature and relative importance of various factors that contribute to residents' satisfaction.

Evaluation research in architecture and housing fall into three environmental dimensions: the physical, the social and the socio-physical environments. In all cases, the assumption is that residents judge the adequacy or habitability of their environments based on predefined standards of quality. Some studies evaluate cognitive responses to the physical environment, focusing on issues such as the perceived quality of buildings and environmental quality (Kane *et al*, 2000; Fornara *et al*, 2006; Cold (1993), 2000 views the experience of 'quality', not as a static, objective, rational concept, but as originating in the interaction between the individual and the object, building or place. Voordt and Wegen (2005) describe quality as the extent to which a product fulfils the requirements set for it; and 'architectonic quality' as an umbrella term, covering various aspects of quality, such as aesthetic, functional (building efficiency), symbolic and cultural value. Other studies attend to the evaluation of the quality of the built environment in terms of affective responses, using user assessment of the environments (Al-Momani, 2003). Satisfaction, attitudes and preferences are three types of criterion normally used. Though these affective responses are not mutually exclusive, satisfaction as an affective criterion has been more widely investigated (Lawrence, 1987; Varady, 2004). Many of these studies have been in the context of public housing projects with the aim of evaluating policies (Amole, 1989).

Three levels of effort in typical POE work have been identified, namely: (1) indicative, (2) investigative and (3) diagnostic (Preiser and Vischer, 2004). 'Effort' refers to the amount of time, resources and personnel, the depth and breadth of investigation, and the implicit cost involved in conducting a POE. Indicative POEs give an indication of major strengths and weaknesses of a particular building's performance. Investigative POEs go into more depth whereby objective evaluation criteria are explicitly stated. Diagnostic POEs require considerable effort and expense and utilize sophisticated measurement techniques.

This review of literature confirms the relevance of POE in public housing evaluation. However, despite the preponderance of research in the context of building performance, POE as a systematic method of collecting data on buildings in use has not found wide usage for public housing in Nigeria, hence the need for this study.

THE EVALUATION PROCESS

The study is an investigative POE (following Preiser, 2002), using some defined criteria. It involves an expert rating by four evaluators and a survey of residents' satisfaction. For the expert rating, 10 performance criteria were developed and used in assessing the quality of the residential environments, based on a systematic sample (every tenth block of particular typologies) of 225 housing blocks containing 760 housing units: 140 blocks of 6 units (two-storey) and 85 of 8 units (three-storey) of two-bedroom and three-bedroom apartments. The first five estates are for low-income respondents; the last three are for the medium-income.

The process of evaluation involved five steps (adapted from Voordt and Wegen, 2005). The initial step involved collecting and examining layout plans and architectural drawings of the housing estates, blocks and units. The second step was to determine the factors to be assessed (from literature and related studies). Owing to the wide scope of the survey and peculiar issues of privacy and local security, detailed criteria related to the evaluation of interiors of housing units were excluded. The third step was to prepare the measurement instruments and the evaluators (four postgraduate students of architecture) on their use. The actual evaluation was carried out through researcher observation and photographic

Table 1: Assessment of the physical characteristics of the selected estates

	Est type	VQ	MQ	StQ	DQ	Qsv	Qrd	QLs	Qos	Qen	QLc	TPQ
Anikantamo	LI	1	3	1	1	1	1	0	1	1	1	11
Ijaiye-LI	LI	3	1	3	3	3	3	1	1	3	3	24
Iponri	LI	1	3	1	3	1	5	1	1	1	5	22
Isolo	LI	3	3	3	3	3	3	1	3	3	3	28
Ojokoro	LI	3	5	5	5	3	5	3	5	5	3	42
Alapere	MI	5	3	5	5	3	5	3	3	5	5	42
Ebute-Meta	MI	3	5	5	5	5	3	3	3	5	3	40
Ijaiye-MI	MI	3	5	5	3	5	3	3	3	3	3	36

Abbreviations: VQ = External visual quality; MQ = Maintenance quality; StQ = Structural quality; DQ = Detailing quality; Qsv = Quality of services; Qrd = Quality of estate roads; QLs = Quality of Landscape; Qos = Quality of open spaces; Qen = Quality of environments layout; QLc = Quality of the location; TPQ = Total physical quality.
Source: Author's fieldwork.

records, defects noted, relevant variables measured and the outcomes evaluated by assigning values to each of the criteria. Uniform weights were assigned to each of the factors because the evaluation was more interested in the comparable values of the assessment.

Table 1 summarizes the appraisal of the characteristics of the residential buildings and neighbourhoods of selected estates. The use of multiple evaluators was to reduce the subjectivity of the evaluation process. The evaluators operated independently, but within similar time frames. However, the nature of data collected by the evaluators favoured the employment of the modal values (as average) of the evaluators' ratings for each of the 10 performance criteria. The Table represents the modal average of the four evaluators' ratings. In virtually all the estates, three or all of the evaluators returned similar values. In such a situation, using the mode rather than mean values of the ratings was considered more appropriate. This evaluation process is therefore deemed replicable.

The 10 performance criteria developed and used in this appraisal are, namely:

1. External visual quality of buildings (ViQ): the evidence of, and general state of the external finishing, such as renderings and painting.
2. Maintenance quality of buildings (MtQ): the evidence and extent of renovations and improvement of buildings/apartments by the residents.
3. Structural quality of buildings (StQ): evidence of durability, stability and long-term integrity in terms of structure, fabrics and materials.
4. Detailing quality of buildings (DQ): the detailing and performance of the operational elements, such as doors, windows, ceilings, roofing members and fascia boards.
5. Quality of building services and (QSv): availability and quality of amenities and conveniences, such as sanitary, water supply, refuse and sewage disposal.
6. Quality of estate roads (Qrd): whether or not they were tarred, condition of surface, kerbs and drainage; and efficiency of vehicular circulation.
7. Quality of landscaping (QLs): evidence of designed landscape and their condition.
8. Quality of semi-public open spaces (Qos): existence, condition, layout, and efficiency of open spaces between blocks of housing units for recreation and socialization; and indoor-outdoor spatial relationships.
9. Quality of environmental layout (Qen): an overall image of neatness, orderliness, layout efficiency, pedestrian circulation and street quality.
10. Quality of the location (QLc): describes how the estate relates with the surrounding neighbourhoods (Is it isolated, integrated or dominated?).

The first five criteria relate to the residential blocks, while the next five deal with their neighbourhoods. They cover aesthetic, functional and technical quality. These performance mandates were scored in terms of whether they were evidenced in good state (5 points), in fair state (3 points), in poor state (1 point), or not evidenced (0 point). The summation gave the value of Total Physical Quality (TPQ) for each estate. The maximum possible TPQ for any of the estates is therefore 50 (5 points for the 10 criteria).

Measurement of residents' satisfaction

The study conceives residents' satisfaction as a multidimensional concept, a measure of people's attitudes towards certain aspects of their residential environment (Francescato, 2002). The concept is operationalized here as a multi-item index, which is more likely than a single item to constitute a robust criterion variable in multivariate analysis. The index consists of five inter-correlated items to which respondents were required to indicate their degree of agreement or disagreement on a 5-point Likert scale, namely:

1. You are generally satisfied with living in this estate.
2. You are satisfied with living in this apartment.
3. You want to live here for a long time.
4. If you were to move, you will like to live in another place like this.
5. You will recommend this place to a friend if they were looking for a place to live.

Responses to these five items were summed up to produce aggregate scores. However, relative rather than absolute values of residential satisfaction are more useful as performance criterion. Hence, the responses were further categorized into three classes, namely: satisfied, neutral and dissatisfied. In addition, these summative values were correlated with values of residents' satisfaction derived from more detailed responses in the structured questionnaire.

The questionnaire contained open- and close-ended questions, covering all aspects of the research objectives. These included items on the respondents' socio-economic characteristics; functional issues of housing type, accessibility, car parking provision, efficiency, flexibility, building density, landscape and children play spaces; aesthetic issues of visual quality, spatial configuration and order; technical issues of facilities, structural soundness, security and safety; and behavioural issues of housing fit, territoriality, privacy and sense of community. The levels of satisfaction were related to housing units, blocks and the estate in general. Residents were required to respond to items (on a 5-item Likert scale), with regard to their perception of the degree, adequacy or otherwise of the listed measures.

The questionnaire was validated in order to ensure that it measured what it was designed for. Although some of the variables considered, particularly the personal characteristics such as age, sex and household size, had obvious face validity, content validity was carried out through the use of judges. Experts in the fields of housing and planning assisted in vetting the measuring instrument objectively, in order to examine and determine the appropriateness of the items and indices for the variables. The instrument satisfied content validity in terms of adequate coverage of the scope of the survey. It was also tested for reliability, referring to its precision, dependability and predictability (Bernard, 2000). This was determined by means of a test-re-test method; it was used to collect information from a neighbourhood within a public housing estate not included in the final sample. This was to simulate the similar socio-economic and contextual characteristics. Results obtained in the first and second tests for all the variables were

subjected to Spearman's Rank correlation to determine the reliability of the instrument. The coefficient of correlation obtained was 0.785, higher than the empirically acceptable coefficient of 0.70 for reliabilities in basic research (Cournoyer and Klein, 2000).

Sampling procedure

The population of study consists of all household heads in the housing units of the identified estates. At the level of the estates, a purposive sample of 8 estates (5 low-income and 3 medium-income) out of a total of 28 estates (20 low-income and 8 medium-income), which represents those estates that capture the greatest number of housing typologies, was selected. Questionnaires were administered to one respondent per floor of selected blocks within the estates, representing a systematic sample of 806 household heads, from a sampling frame of 8060 housing units. From this sample size, 760 questionnaires were retrieved, the responses from which form the basis of analysis, findings and discussion.

The effective sample therefore comprised 760 respondents as summarized in Table 2, which describes the demographic and socio-economic characteristics of the respondents in the selected public housing estates. These include the estate type, gender, age, marital status, employment, socio-economic status, education and housing tenure status.

The survey shows the predominance of married, self-employed, male household heads; less than one in six of the respondents were female. The modal age range of respondents is 40–54 years (middle-age), constituting about 34 per cent, although the middle-income estates had a preponderance of younger, middle-aged household heads than the low-income estates. More than half of the respondents are the original purchasers of the housing units, while about one-fifth have sold the units to new residents; a lesser proportion is occupied on rental basis. In addition, more than half have attained a minimum of post-secondary school education. Although the data show that majority of the respondents resided in the low-income estates, ironically the data reveal the pronounced presence of respondents who indicated belonging to the medium-income socio-economic status, even in the low-income estates. Cross-tabulation shows that: a larger proportion of the low-income estates were occupied by respondents who considered they were medium-income in terms of economic status. This demonstrates the phenomenon of goals displacement, as the low-income estates were intended for people in the low-income economic category.

FINDINGS

The evaluation of public housing reveals a number of building defects, and aspects of housing in which maintenance interventions, repairs and renovations are urgent. These include: weathered exterior wall finishes; paint decay, dilapidating wall and floor finishes, including ceiling collapse; broken doors and windows fixtures; leaking roofs; broken and leaking plumbing fixtures; deteriorating timbers; and residents' disorderly attempts to improve their housing environments (see Figures A1–A12 in the Appendix for illustrations).

Findings (see Table 1) indicate that the values of TPQ for the medium-income estates (42, 40 and 36) are significantly greater than for the low-income estates (11, 24, 22 and 28). A slight variation might have been attributed to some degree of subjectivity in the rating process, but the wide gap indicates that the physical characteristics of the medium-income estates were distinctly of better quality than those of the low-income estates. Among the low-income estates, however, Ojokoro appears to be an exception (rated 42), perhaps owing to its younger age, and the fact that it is not among the nucleus of the original mass

Table 2: Respondents' demographic characteristics

Demographic variables	Sub-categories	Frequency	Percentage
Estate type	Low income	620	81.6
	Medium income	140	18.4
Gender	Male	643	84.6
	Female	117	15.4
Age of respondents	18–25 years	16	2.1
	26–39 years	206	27.1
	40–54 years	259	34.1
	55–69 years	252	33.2
	70+ years	27	3.6
Marital status	Married	596	78.4
	Separated	17	2.2
	Divorced	14	1.8
	Widowed	54	7.1
	Single	27	10.4
Employment	Public servant	102	13.4
	Private employee	203	26.7
	Self-employed	332	43.7
	Student/unemployed	15	2.0
	Retiree	108	14.2
Socio-economic status	Low-income	178	23.4
	Lower medium-income	373	49.1
	Upper medium-income	179	23.6
	High-income	30	3.9
Education	Illiterate	0	0
	Completed primary	22	2.9
	Secondary	272	35.9
	Post-secondary	352	46.3
	Postgraduate	113	14.9
Tenure status	Original purchasers	414	54.5
	Transferred ownership	143	18.8
	Inheritance	49	6.4
	Tenancy	124	16.3
	Government allottee	30	3.9
Total		760	100

Source: Author's Fieldwork.

Table 3: Levels of satisfaction with physical characteristics of residences

Estate type	1 – Dissatisfied		2 – Neutral		3 – Satisfied		Total
	Frequency	%	Frequency	%	Frequency	%	
Satisfaction with physical environment (PHYSAT)							
Low-income	259	41.8	122	19.7	239	38.5	620
Med-income	29	20.7	28	20.0	83	59.3	140
Sub-total	288	37.9	150	19.7	322	42.4	760

Source: Author's fieldwork.

housing schemes. The main reasons that can be adduced for the much higher quality of the medium-income estates are further discussed below.

In terms of residents' satisfaction, Table 3 shows significant difference in the levels of satisfaction between residents of the low-income and those of the medium-income estates. Slightly more respondents were dissatisfied with the physical environment of the

Table 4: Indices of residential satisfaction

Estate type	1 – Dissatisfied		2 – Neutral		3 – Satisfied		Total
	Frequency	%	Frequency	%	Frequency	%	
Satisfaction with estate (ESTSAT)							
Low-income	157	25.3	130	21.0	333	53.7	620
Med-income	18	12.9	18	12.9	104	74.3	140
Sub-total	175	23.0	148	19.5	437	57.5	760
Satisfaction with apartment (UNITSAT)							
Low-income	184	29.7	87	14.0	349	56.3	620
Med-income	7	5.0	13	9.3	120	85.7	140
Sub-total	191	25.1	100	13.2	469	61.7	760

Source: Author's fieldwork.

Table 5: Summary of chi-square and symmetric measure tests

Dimensions of satisfaction	Chi-square test			Symmetric measure
	Pearson chi-square	df	Asymp. sig. (two-sided)	Approx. sig.
With estate	19.975	2	0.000	0.000
With apartment	45.654	2	0.000	0.000
With neighborhood	24.966	2	0.000	0.000

Source: Computed from Author's field studies.

low-income estates (41.8 per cent) than those who were satisfied (38.5 per cent), compared with those of the medium-income estates (20.7 per cent) and (59.3 per cent), respectively. This reinforces earlier findings of the less-than-satisfactory physical characteristics of the low-income estates and their correlation with residents' satisfaction. Table 4 shows that about 57 per cent of respondents were satisfied with the estate, and a little over 60 per cent with their apartments. In general, the medium-income residents indicated more favourable responses. That only 5 per cent of respondents in the medium-income estates were dissatisfied with their apartments speaks favourably of these estate types, notwithstanding other contributory variables.

There are large disparities in responses between the two types of estates in respect of satisfaction with the apartment (85.7 per cent compared to 56.3 per cent) and satisfaction with the estate in general (74.3 per cent compared to 53.7 per cent).

The chi-square statistics summarized in Table 5 also shows that the Pearson chi-square value is significant for both 'satisfaction with estate' (ESTSAT) and 'satisfaction with apartment' (UNITSAT), meaning that there is significant difference in these dimensions of satisfaction, between residents of the low-income estates and those of the medium-income estates of LSDPC public housing.

Furthermore, correlation analysis showed that **62** per cent of the physical characteristics of the residences are highly correlated with residents' satisfaction ($r = $ **0.62**). Finally, multiple regression analysis shows that satisfaction with the physical environment of their residences (PHYSAT) with a Beta value of 0.368 (indicating its predictive strength) is the most powerful of residential satisfaction (RSAT).

DISCUSSION

Francescato (2002) noted that the criterion of residential satisfaction is not without its limitations, which must be kept in mind when interpreting the results of satisfaction

research, but do not invalidate the utility of the criterion. This refers mainly to the limitation of absolute satisfaction scores in measuring the performance of public housing, and therefore the need to emphasize analysis of variance among scores obtained across a number of environments and populations, in establishing differential performance levels. This we have done between the low-income and medium-income estates of LSDPC public housing.

The findings support Francescato *et al* (1989) that certain residential contexts generally elicit less satisfaction. Respondents in the medium-income estates were generally more satisfied than those in low-income estates. Differences were most pronounced in respect of satisfaction with the physical aspects of the residential environment. In both kinds of estates, residents' dissatisfaction was also more pronounced in respect of the physical environment.

Two main reasons can be adduced for the much higher quality of the medium-income estates, and the relatively lower quality of the low-income estates. The first explanation relates to their initial conception and construction. The second explanation relates to the predominant socio-economic characteristics of the residents. Qualitative data suggest that: during the mass housing era, when most of these schemes were conceived, government was more concerned about quantity than quality of housing in the case of the low-income schemes. With bold, but blind political will in many instances, government pushed on with an ambition that met the urgent and immediate needs of some of the low-income citizens, but in doing so, sacrificed quality for quantity. The disparity in quality was further widened by the fact that many of the residents in the medium-income estates were more economically empowered to maintain and improve their environment. In contrast, many of the low-income original purchasers became indebted to friends and relatives, before they could become owners of houses. Some had to borrow even more, in order to bring the units to minimally habitable conditions, as they received partly completed houses. Others simply adapted to the less than habitable state of their accommodations. The route of the average medium-income owner was less intimidating. Quite often, he was backed up with a more stable employment, and opportunity to obtain long-term loans or mortgage facilities, which minimized the tension, and allowed some surplus to improve his or her housing environment.

Further to these explanations, it is not unlikely that the categorization of certain estates as low-income and others as medium-income schemes has had the tendency of residualizing the former, and thereby increasing the 'quality gap'.

CONCLUSIONS

This study appraised the essential characteristics that contribute to residential satisfaction. The very important role of the quality of the physical environment as a dominant predictor of satisfaction is emphasized. Equally significant is the role of residents' perception in mediating between these objective physical characteristics of the environment and residential satisfaction. This article has presented the analysis of residents' perceptions and levels of satisfaction with their housing. Through the review of relevant literature and few statistical tests, the study reveals the subsisting relationships between user responses and the physical characteristics of the residential buildings and estates. The study also reveals a gap in quality between the medium- and low-income estate, as well as a relatively high correlation between the physical characteristics of the residences and residents' satisfaction. In addition, multiple regression analysis shows satisfaction with the physical environment of residences as the most powerful predictor of residential satisfaction. The thrust of all these findings is that the physical characteristics of residences are significant

in determining the levels of residents' satisfaction in the LSDPC public housing estates. Through the analyses, we are able to ascertain specific actions that can maximize more satisfactory housing provisions and minimize dissatisfaction as much as possible.

An important point that this study has stressed is the vital role of the ultimate users of the housing product – the residents – in the housing delivery process. Policymakers need to recognize that participation by the public and private sectors are only two components in a system, which cannot operate effectively without the third component – the people. This study has added to empirical evidence that residents' perception of residential environment cannot be discountenanced at policy, planning, design and implementation levels.

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APPENDIX
See Figures A1–A12.

Figure A1: Blocks of flats showing weathered façade and broken fascia boards.

Figure A2: Block of flats showing weathered exterior finishes and paint decay.

Figure A3: Disorderly effects of residents' attempts to add to their housing environment.

Figure A4:   Effects of residents' transformation strategies to provide shading devices.

Figure A5:   Broken and leaking waste pipes with growth around.

Figure A6:   Weathered and broken timber roofing fascia board.

Figure A7: Weathered underside of exterior wall and paint decay.

Figure A8: Broken window hood with exposed reinforcement.

Figure A9: View showing broken ceiling boards.

Figure A10: Exposed suspended floor reinforcement over balcony space.

Figure A11: Leaking roof and broken fascia boards.

Figure A12: Exposed drains owing to inadequate provision of drainage system.