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Peter A. Makachia

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Design strategy and informal transformations in urban housing

A study of the contribution of design strategy to dweller-initiated transformations using comparative case study analyses of Buru-Buru and Kaloleni housing estates in Nairobi, Kenya

Peter A. Makachia

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Abstract Dweller-initiated transformations are mostly chided for their apparent locational spontaneity that is often at variance with functional and aesthetic objectives in formal housing design. This presumes speculator-driven motives as sole reasons for the phenomenon, and yet others, including the social and physical functional objectives also underlie the processes. The paper uses empirical findings from Nairobi housing estates—Buru-Buru; a middle-income estate and Kaloleni; a Council rental estate—to illustrate physical qualities in informal transformations of formal housing. Using measurements and illustrative material, the results show a (sub)-conscious rationale that generates tenements while also retaining the desired socio-spatial qualities of the middle-income neighbourhood. It is posited that a design strategy that is responsive to the varied objectives of economy, social and physical spatial demands of housing should inform concepts in housing design. This is aimed at enhancing environmental qualities of formal housing that emerge when faced with unilateral transformations.

Keywords Design strategy · Estates · Housing · Kenya · Nairobi · Transformations

1 Introduction

The context is formal housing estates in the Kenyan capital city of Nairobi (Fig. 1) whose genesis was the production strategies of public institutions. This paper investigates the unsanctioned production of housing in light of the dwellers' own initiatives, which are evident in the informal transformations that occur within the formal housing estates. Referred to as dweller-initiated transformations (DITs), they provide dwellings that aid in bridging the deficit in housing stocks. Kenya has served as a laboratory for a variety of these housing strategies throughout her life as a nation state (Syagga 1979, 2003; Makachia 1995, 2010). The results of those strategies hardly match the demand for decent housing of

P. A. Makachia (✉)
Department of Architecture and Building Science, University of Nairobi, P.O. Box 30197-00100,
Nairobi, Kenya
e-mail: pamakachia@gmail.com
URL: www.uonbi.ac.ke

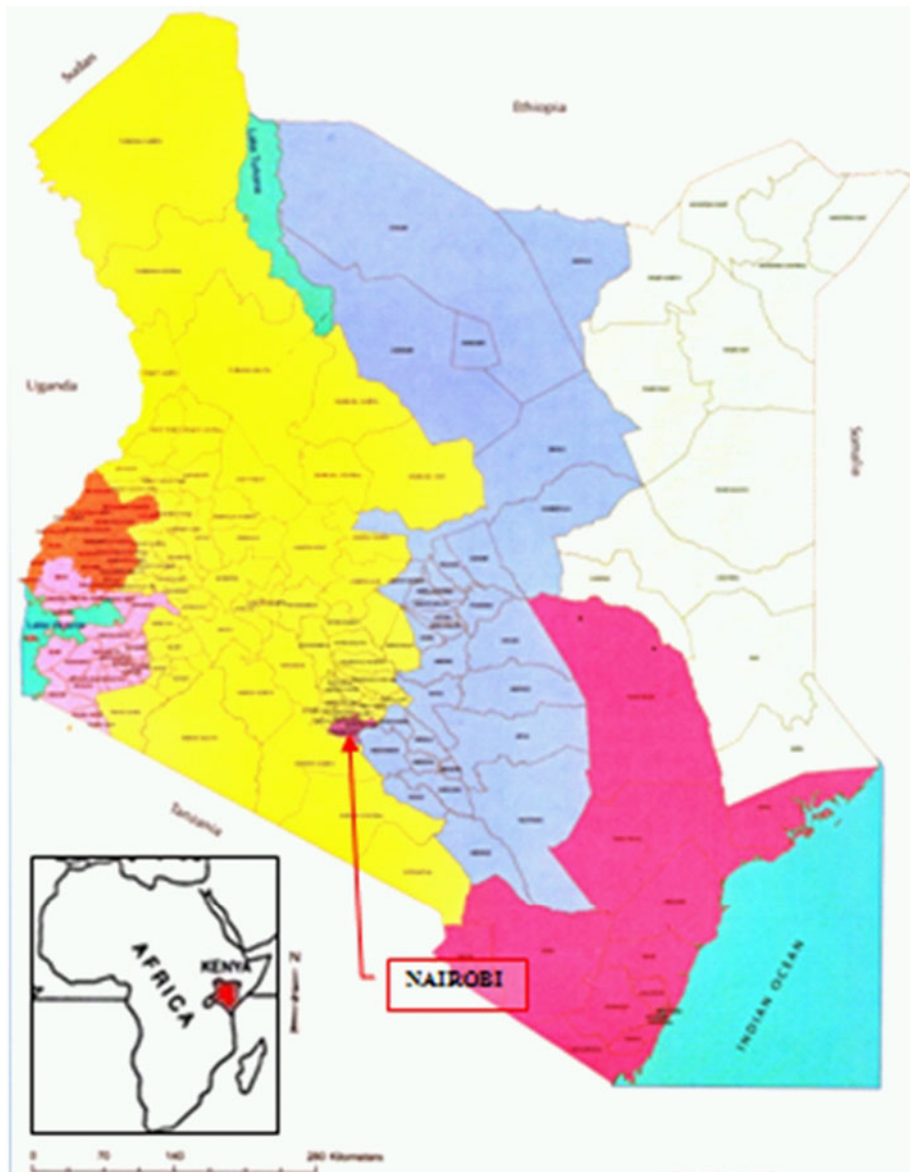


Fig. 1 Kenya in Africa map

her ever-growing urban population. The common denominator of these strategies is their origination from the centre, which has mostly downplayed the grassroots' positions of the occupants.

The problems of shortage and quality in the housing stock are a direct consequence of the increasing urban population density. Thus, 150,000 housing units are required annually, and yet only 35,000 (23.5 %) are produced (Republic of Kenya 2008). Further, this production favours the more affluent against the poorest, with under-investment in low- and lower-middle income housing. Thus, only 6,000 (about 20 %) of the houses produced

target the low-income class, and yet the shortage disproportionately affects the group who require 48 % more dwellings (Republic of Kenya 2008, p. 115).

The problem investigated in the present work is how design strategies in housing have influenced and contributed to the dwellers' actions evident in DITs. The self-propelled transformation is laudable for the attempt to bridge the housing gap but is also condemned for the emergent deficits in the physical environment. The phenomenon has induced an unforeseen neighbourhood functional mix and a breakdown of land-use zoning objectives.

Strategy in design is defined here as measures taken at the point of design conceptualisation to realise affordability for a target group; such measures include the physical form and socio-economic models. A design strategy for housing sets quantitative and qualitative goals and proposes spatial methods of attaining them. Indeed architectural design as an activity is aptly defined as a 'purposeful, goal-oriented search' (Markus 1972, p. 13) for physical and spatial solutions to spatial problems.

Transformations, manifest as spontaneous physical additions and modifications, are thus also functional where the dwelling unit (DU) assumes unenvisioned functions. In Nairobi, transformations have been criticised for the resulting compromised aesthetic, congestion, and environments devoid of the desired level of comfort and privacy. The scenario in DITs is often dire: they are ill-lit, poorly ventilated, acoustically and environmentally polluted neighbourhoods (Ndung'u 2008). They also are devoid of basic environmental amenities like solid waste and sewage disposal (Huchzermeyer 2006). Socially, the reduced level of privacy and recreational space are some of the functional anomalies that now prevail. Further, with regard to urban design, DITs emerge on spaces reserved for community use like open spaces on or outside the plot, which is compromising to the physical environment. From an investment perspective, one consequence is the lowered economic value of the houses, as evidenced in middle-income housing like Buru-Buru (Gitau 1999) and Koma Rock Estate (Ochieng 2001).

The architectural strategy avails space and opportunity, which invites the dwellers to physically transform the dwellings that had been provided and the projections that had been made for the living environments. The basic problem clearly is that the strategies do not envisage the transformation and that culminates in dysfunctional neighbourhoods.

Using the case of Kaloleni and Buru-Buru estates, the study is an exploration and comparison of the physical strategies adopted in the design of formal housing and the contribution to the nature of DITs in Nairobi's estates. The cases reflected differing strategies in design form, ownership and occupancy, besides their implementation in various epochs of housing in Kenyan towns.

The investigation of how architectural design strategy guided the resulting DITs in formal housing was focused on the extent, use and form of the added space. Consequently, guidance was formulated on how the architectural strategies could accommodate the dwellers' spatial transformation initiatives in formal housing. This focus on strategy was intended to support the design process, its methodology and housing policy.

2 The cases

The case estates contrast in scale, historical background, and age, as well as in the underlying strategies. Two things they have in common are their Eastlands location and the fact that they both evolved from formal public-sector interventions. The housing provision paradigm adopted in the Kaloleni and Buru-Buru cases was the 'providers' approach (Hamdi 1991).

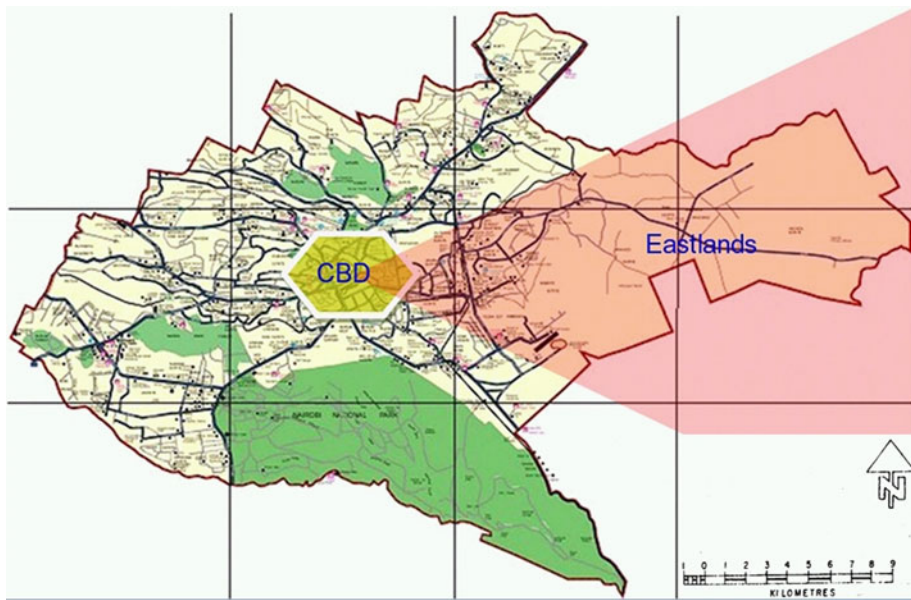


Fig. 2 Map of Nairobi—Eastlands



Fig. 3 Aerial photo of part of Eastlands showing location of case estates (*source*: adapted from Makachia 2010)

Thus, the estates were developed on the basis of the notion that the state could ‘produce houses’.

The tenure and housing access model also varied. Ownership in Buru-Buru was on the basis of mortgage; thus, the model targetted middle-income residents. Kaloleni was a City Council of Nairobi (CCN) estate and was established as a social rental estate.

The Eastlands district (Figs. 2, 3) in which both schemes fall has a history of social housing developments. As part of the housing strategies initiated after the 2nd World War,

Table 1 The case estate

	Kaloleni	Buru-Buru
Development year	1945	1973–1983
No. of units	884	4,715
Target population	3,000	35,000
Tenure and housing access system	Rental	Owned/mortgage
Typology	Bungalow/walk-up flats	Bungalow/maisonettes
Target income group	Low-income	Middle-income

Source: Makachia (2010)

the colonial government identified the district east of the current CBD as ‘the African location’ (Hake 1977; Nevanlinna 1996). The fact has been reiterated by independent Kenyan governments by situating more housing estates here. Table 1 summarises the basic characteristics of the case estates.

2.1 Kaloleni rental estate

2.1.1 Characteristics and design strategies in Kaloleni

Kaloleni falls within the rental strategy which was favoured by the colonial government when it was no longer sustainable to control the inward migration of the native African population from the hinterland. Between 1926 and 1961 up to 14,157 rental housing units were erected. The vast majority of these were for low-income households; further, these were almost exclusively sited in the Eastlands zone. The typologies were often largely bungalows with one or two rooms.

Kaloleni is located about 2 km from the CBD (Fig. 3). Now an inner-city residential neighbourhood because of rapid urban expansion, it was originally on the city’s periphery. Constructed between 1945 and 1948 (Hake 1977, p. 56; Nevanlinna 1996, p. 171; Anderson 2002; Oglivie 1946) through colonial grants, it is now a CCN rental housing scheme. Bordering the estate to the west is the City Stadium; to the east, Makongeni estate; to the north, Jogoo Highway; and to the south is the Industrial Area, a manufacturing district. Kaloleni has been described as a ‘model neighbourhood unit’ (Hake 1977, p. 56). It was developed to house the native Kenyans following the recommendations by C. E. Mortimer who chaired the African Housing Committee (Mortimer 1946; Oglivie 1946) that was given the task to address African urban housing needs.

In character with the description as ‘model neighbourhood unit’ (Hake 1977; Nevanlinna 1996), the abundance of green space and organic layout of the dwelling units are the best attributes of Kaloleni. Indeed, it borrows heavily from the Neighbourhood Unit Concept (NUC) proposed in the 1948 Nairobi Master Plan (Thornton-White et al. 1948), one of the key planning concepts that have guided Nairobi’s growth over her century-long history.

However, unlike the linear, street-based clusters that featured in the proposed NUC Model, the clusters were arranged around vast courtyards. Further, apartment blocks linearly aligned within open spaces and a radial street network dominate the Kaloleni estate layout. At the global scale, the estate possessed two levels in the hierarchy of open spaces: a central open space serving the entire estate and a smaller court serving the clusters.

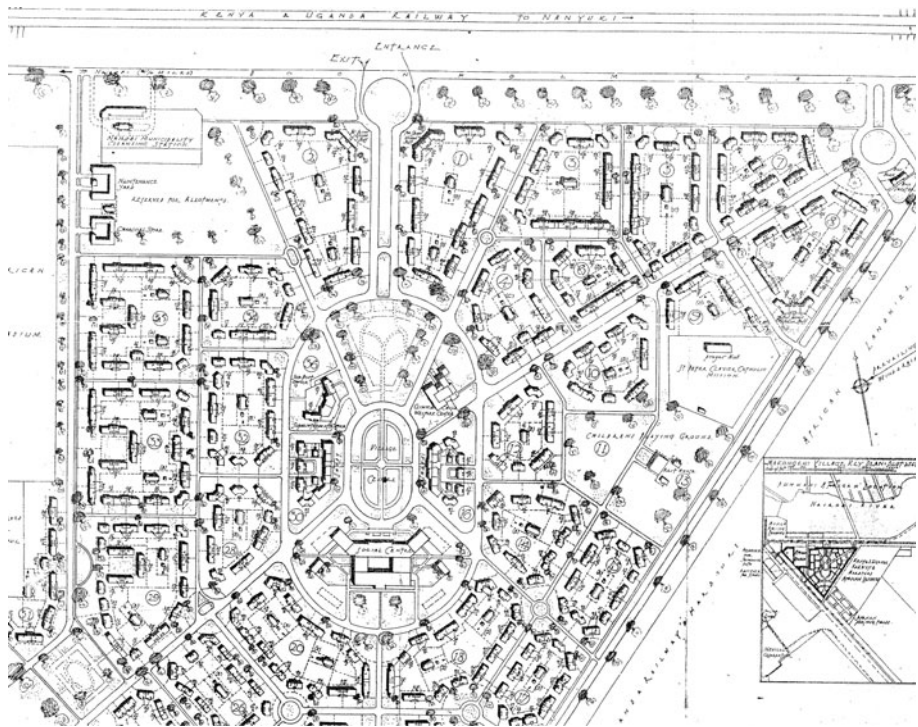


Fig. 4 Original layout of Kaloleni estate (source: Oglivie 1946)

The circulation paths are of two types: the concentric rings originating from the central court and continuing up to the edges; and radial linkages between them that are also focussed on the centre. This was in line with Oglivie (1946) description of the planning strategies of the estate (Figs. 4, 5).

A central open space, referred to as the ‘village green’ (Oglivie 1946, p. 18), was surrounded by communal nature and common-function buildings that housed social, commercial and administrative functions. Together, this was the central visual and functional focus in the physical layout of the estate. The commercial facilities (referred to as ‘African shops’ in the early discussions) include a shopping centre that housed formal commercial activities, including grocery shops, bars, butcheries, carpentry shops, salons, and barber shops.

The recreational facilities included the social hall, an open ground used as a handball pitch and the nearby city stadium, which hosts city-wide events. Currently, administrative functions included the chief’s office and an administrative police post and camp. Initially there was only a housing superintendent’s office. In these early proposals the social functions included ‘a small welfare clinic and a social centre, in which provision is made for reading, writing, recreation and games, feeding, and facilities for occasional cinema shows.’

Other facilities included in the early layout and designs were children’s playgrounds and shelters, schools, playing fields, allotment gardens, and a bus shelter (Oglivie 1946, pp. 18–19). The elliptical open space at the centre of the green zone is a recreational space,

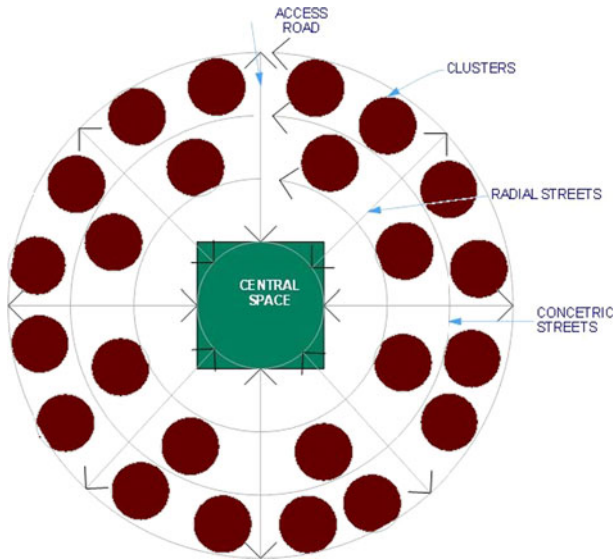


Fig. 5 Kaloleni schematic street layout (source: Makachia 2010)

although large parts of it are now used as a dump for solid waste. Part of the green space is now a chief's camp, used by the administration.

According to the estate layout depicted in Fig. 4, these buildings faced the 'village green' and an oval vehicular road separated them from the dwelling units. The houses had entrances from the radial roads and paths. The central traffic roads were initially made of tarmac while the secondary roads and paths were made of murram.

In the projections, the streets (and communal buildings) had street lighting provided. The dwelling units were later to have individual unit connections. Street and path borders, as well as courtyards, had landscaping with trees, shrubs and manicured grass, and a Housing Authority was to maintain these features. The estate covered nearly 37 ha. It was composed of 26 courtyard clusters, each with 16–34 bungalow-type semi-detached units, totalling 618 units. In Oglivie (1946) early reports, he referred to the unit groupings as 'Plots that vary in size from those housing 65 persons to those housing 120 persons'.

Besides the bungalow clusters, there were apartment blocks composed of 224 DUs that were arranged in two linear clusters, all located on the edge fronting the railway and the city stadium. The courtyards in clusters were largely organic, with no pure geometry, and they were porous on the edges. Nevertheless, they defined a centrally focussed nucleic organisation oriented towards the ablution block (s). The maximum length of the provided courts was 115 m, while the width varied from about 20–50 m; these distances could vary within one cluster. This physical form hardly promoted neighbourly and territorial control, a factor that contributed to the nature of the resulting DITs.

Within the estate, interlinked estate roads and footpaths defined the circulation. Concrete footbridges over the wide, 1½–2 m wide, open storm water drains linked the clusters to these circulation networks. These wide drainage gullies were also useful as elements defining the edges of the clusters in some parts of the estate. Intra-estate circulation was mainly pedestrian, but many residents used other modes of transport for goods and water.

2.1.2 Nature of transformations in Kaloleni

Estate-wide, three physical parameters were significant: (1) the centrally located common commercial, social, community, and recreational spaces; (2) the radial estate street organisation with ring roads; and (3) the unit grouping and clustering morphology. These parameters are illustrated in the schematic layout shown in Fig. 4. The first two elements did not seem to catalyse transformations overtly. However, the third one, the clustering of the units, was at the core of all transformations observed.

Some transformations occurred in direct contradiction to these physical principles. For instance, certain transformations promoted the conduct of informal trade away from the centrally located NUC shopping centre. This fact nullified any possible gravitation to the centre and instead decentralised trade. Trade activity was thus informally spread across the scheme that emerged along the circulation arteries and spontaneous nodes. The non-hierarchical radial street pattern seemed conducive to the locational spontaneity of these commercial activities. These concentrations were thus a negation of the strategy of focussing trade at the centre in the NUC frame. The central formal market in the estate therefore remained dormant and with low activity, as opposed to the thriving spontaneous informality in the streets and on the edges at the periphery.

The clusters were the main focus of dweller-initiated transformations, albeit again in direct contradiction to the provided types. The formation of 'mini-clusters' using the provided unit as the locus created appropriately scaled clusters that also established individual territorial control. They thus established a 'plot' formation that was otherwise absent in the initial concept (Figs. 6, 7, 8, 9 and 10). This effect was dampened by the illegality of the act in the rental ownership strategy, which forced the dwellers to define these spaces using temporary technology and materials. This lower quality was a result of

Fig. 6 Transformation in a typical Kaloleni cluster (source: Makachia 2010)





Fig. 7 External view of DU G3 (source: Makachia 2010)

Fig. 8 Plan of Unit G3 after transformation (source: Makachia 2010)



the lack of tenure security, but the phenomenon of informal construction confirms the inevitability of the need and urge to extend the units.

The availability of physical space occasioned by the open cluster planning in the 'plot-less' formation was seen as the catalyst of transformation. Repeated throughout the estate clusters, the literal replication of the DITs was a re-affirmation of the hypothetical position that physical space determined the DITs' type. Thus, the thesis here is that availability of ground space (a 'site') adjacent to the provided DU or UDE was the impetus for DITs formation (Figs. 11, 12).



Fig. 9 CAD projection of G3 (source: Makachia 2010)

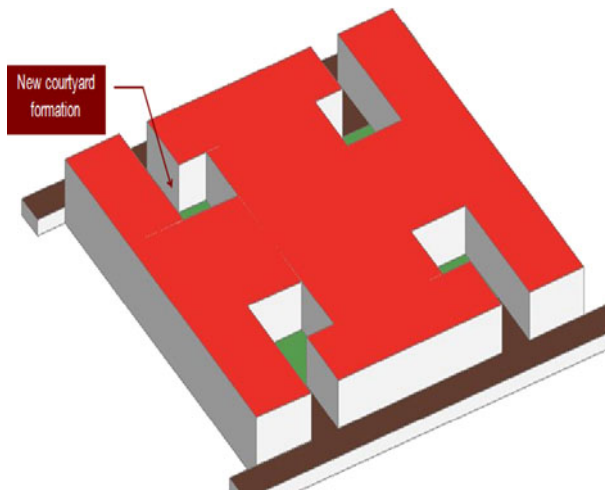


Fig. 10 Generic cluster formation in Kaloleni (source: Makachia 2010)

This physical stance position was reiterated in the opposite theoretical replication in the apartment typology, where minimal transformation activity was carried out because of the vertically grouped UDE typology. The vertical grouping denied access to the ‘site’, which denied the dwellers an opportunity for transformation. Thus, physical space promoted or deterred DITs, and there was less influence of the social and economic dimensions.

At the DU scale, the lack of significant variety in the unit characteristics meant that transformations occurred regardless of the unit types. Thus although the physical nature of the units did not seem to promote or deter transformations, it was precisely the limited variety compared to the household requirements that provides further re-affirmation of the proposition. The conclusion was that regardless of any social or economic inclination of the strategy, the physical strategy was the most important factor of transformations.

Fig. 11 Aerial photograph of Buru-Buru estate (*source: Makachia 2010*)



2.2 Buru-Buru mortgage estate

2.2.1 Design strategies and characteristics

In Buru-Buru Estate, the dwellers own the units through mortgage loans. The estate came into existence in the 1970s. At that time, not only was the ownership model in vogue but there was also a morphological disposition towards the singular but terraced, semi-detached or detached unit. Commencing in 1973, the five phases took 10 years to implement; people moved into the last few units in 1983. The Commonwealth Development Corporation (CDC) funded it in collaboration with the government and CCN. The initiators of Buru-Buru estate envisaged a population of 25,000. A few authors (Anyamba 2006; Nevanlinna 1996; Hirst and Lamba 1994) trace the origins of Buru-Buru to the 1962

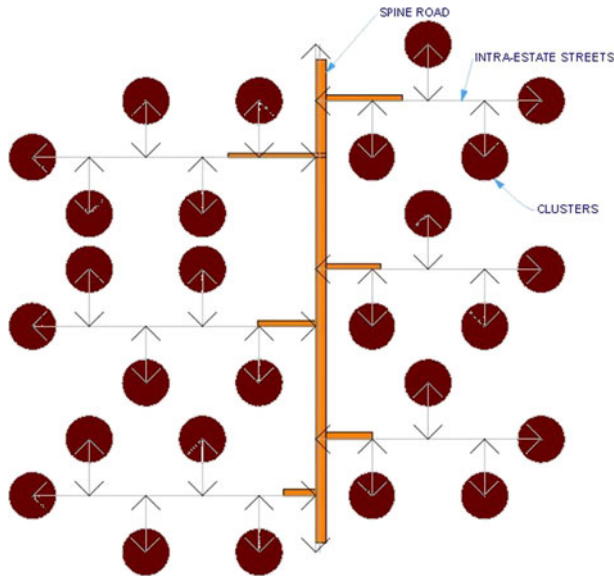


Fig. 12 Buru-Buru—schematic circulation network (source: Makachia 2010)

Regional Boundaries Commission that advocated the eastward expansion of Nairobi for housing development.

The action incorporated the former Donholm Sisal Farm into the city as a residential zone. It is now a major residential district. In addition, the Nairobi Urban Study Group in the 1973 Metropolitan Growth Strategy, (NUSG 1973), averred and further advocated eastward expansion of the city's boundaries for the same purpose (Emig and Ismail 1980). Figure 7 is an aerial photograph showing the location of the phases and the districts adjacent to Buru-Buru estate.

Earmarked for the then emerging middle-income groups, Buru-Buru adopted the mortgage housing financing delivery strategy. This marked a departure from the Rental and the Tenant Purchase housing finance models, hitherto popular in urban housing delivery. Over time, these earlier approaches, heavily laced with state subsidies, had proved economically unsustainable and less amenable to the liberal market development orthodoxy since preferred.

In this then new direction, the government only offered guarantees for offshore funding (Anyamba 2006, p. 168), leaving the bulk of housing development to the private sector through mortgage loans that were to be paid over 15–25 years. This was unlike the rental model used in Kaloleni estate (Oglivie 1946), where repayment was to last up to 40 years.

In Buru-Buru, the joint main institutional actors were the City Council of Nairobi (CCN) (implementers), the central government (financial guarantees) and the CDC (off-shore finance). The design and planning consultants were private firms. In the early phases (I and II) these were Colin Buchanan and Partners, a UK-based firm. Mutiso Menezes International, a locally incorporated planning and architectural consultancy, was charged with the bulk of the later phases (III, IV and part of V). Paviz Agepour, another Nairobi firm, worked on a final part of the last phase, Phase V Extension (Sector SG).

The two key planning and design morphology determinants that defined Buru-Buru estate are the physical constraints and the timing defined in the phases of the scheme.

The physical dimension used the plots' clustering system, the plot-based planning that accommodated the units, and the circulation networks. Unlike Kaloleni, Buru-Buru was laid out on individually demarcated plots. The sequential planning was through the phases from Phase I to V.

The plots vary from 6 to 10.5 m wide and 20–24 m in length. This ratio of 1:3.3 to 1:4 falls within the recommendations in the *Urbanization Primer* (Caminos and Goethert 1969) for efficient services utilisation in plot sub-divisions. However, as it was organically planned around unit clusters that surround courtyards, overall, the estate is devoid of any rigid geometrical planning. The courtyards vary in dimension, surface area and number of constituent units. The cluster was the main Urban Design Element (UDE) used for physical and social grouping in the estate.

The time-based grouping element was influenced by the phasing of the implementation. Each phase houses an average of 943 dwelling units that vary in scale from two to four bedrooms.

They also vary in form from the detached, bungalow-type, semi-detached, maisonette and terraced articulation. There was a design evolution over the five phases, though vestigial, with increased sizing of the units from two- or three-bedroomed up to four-bedroomed units. In addition, a new typology of a 'corner shop' was an option. The former evolution increased the space and reflected a revision of the targeted household size. It also reflected the added spatial needs as well as the increased affordability to the newer residents.

The latter was a functional change and illustrated the need for a functional mix; as such it was a precursor to some of the emergent typologies witnessed in the DITs. The development control conditions that guided the planning design aimed for a density of 32 (or 260 persons) plots per hectare, a plot ratio of 0.75 and plot coverage of 35 %. Car parking requirements allowed a car per plot and a single car provision for two plots outside the plots, meant to accommodate visitors and extra cars. Another restriction was vertical, whereby no more than two-storeyed (ground-plus-one) dwellings were developed.

The major circulation paths that define the edges of the estate and separate it from neighbouring districts include the railway line to the south and east and Jogoo Highway to the west. These two corridors defined the wide expanse of open space to the south that ultimately fronted the Industrial Area. Rabai Road forms a loop on the eastern and northern sides.

A low-income estate, Umoja Phase 1, was located to the east of Buru-Buru. The railway line and outer ring road that ran parallel to each other separated the two estates. A natural edge, the Nairobi River, defines part of the extreme northern edge. A spine road, Mumias South Road, which traversed the scheme and connected the various phases, was used mainly for vehicular transport, and it accommodated common commercial and social amenities. It was a 30-m-wide road reserve with a tarmac carriageway.

2.2.2 Nature of transformations in Buru-Buru

2.2.2.1 Estate-level DITs characteristics

At the estate level, the key factor influencing the transformations was the circulation arteries. Hierarchically arranged, they guided the transformation, both in its nature and its scale (Fig. 13). The estate was framed around a circulation network that focussed on the spine, Mumias South Road. These transformations were primarily carried out for the economic purposes and objectives of the dwellers. The scale of the street and the nature of the frontage, however, gave shape to this economic drive. The transformations represented a common response that was guided by the socio-economic background of the estate dwellers.



Fig. 13 Aerial photo of transformed typical in Buru-Buru (source: Makachia 2010)

The hierarchical scaling of the circulation elements from the spine road down to the feeder roads and cluster roads elicited diverse transformation responses. The spine road was perceived as a public forum suited largely for non-residential development. Thus, the major functions were common-use activities suitable for commercial and social spaces. This was at the expense of dwellings.

Residential DITs were located within the estate but mainly away from the spine road. Thus, these were evident along estate roads, the inter-cluster feeder roads and sometimes close to the cluster courts. Another distinction also emerged here, with residential DITs fronting these feeder roads and lying away from the inner courtyard spaces. This courtyard was a private space amenable to the owner-occupiers' usage.

These physical manifestations evoked social concerns, namely about inclusion of the owner-occupiers and exclusion of the tenants accommodated in the DITs. Household-use residential DITs were accessed from the inner courts, ostensibly to distinguish the socially accommodated owner from the alien tenant, who accessed their units mainly from the more public feeder roads.

A dimension of the locational aspect of the transformations was their form and magnitude. Court-focussed DITs were often smaller in scale with fewer storeys, presumably not to deface and dehumanise the human-scaled courts. The multi-storeyed types were outward in orientation.

At this estate level, the technology guided the dwellers' attitudes to the actions they took in engaging in the DITs' activity. This attitude was locational but was it couched in

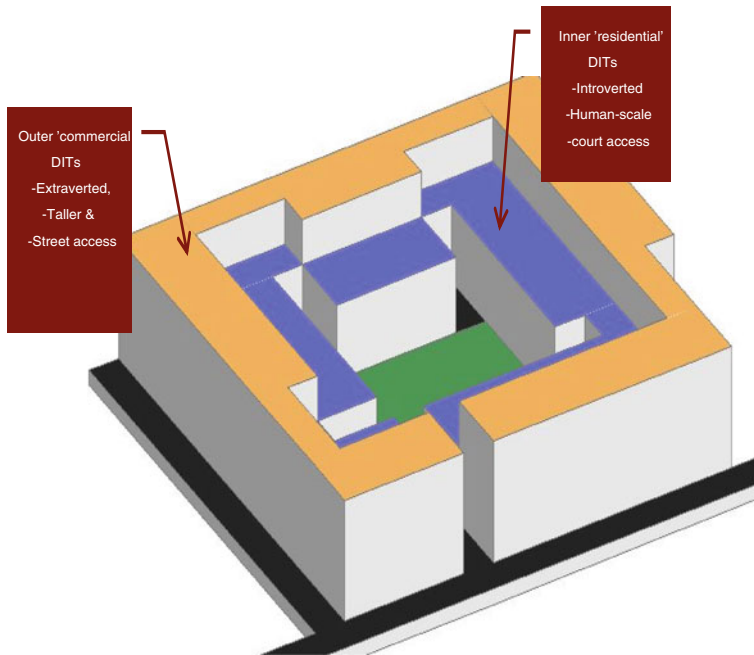


Fig. 14 The physical, social and economic order in the Buru-Buru cluster (source: Makachia 2010)

the legality of the activity accommodated. Secondly, the ownership of the land it was based on also guided the technology in the DITs. Rarely did DITs develop on common-use land. But when this did happen, it was exclusively on the basis of 'temporary' technology and non-durable materials. This reflected encroachment; hence the inherent illegality of such acts.

Other than the illegal encroachments into these spaces and the ancillary spaces, most of the transformers used durable materials that reflected the higher-income status of the dwellership. It also made a statement about attracting a higher-income tenancy, presumably in a similar middle-income bracket as the original owner-occupiers.

2.2.2.2 The UDE: cluster-level DITs characteristics The only UDE was the cluster (Figs. 13, 14). Its morphology was also transformed by the dwellers to fulfil both their social and physical objectives. For instance, the original design of the cluster preferred interconnected clusters through footpaths. The transformation result was the sealing of these paths and their substitution by 'gated' cluster formations (Figs. 15, 16). This fulfilled the social objectives of the owner-occupiers who wished to exclude outsiders. The stance was also physical as it restricted accessibility to the 'gated' cluster communities by anti-social elements.

The social grouping was for a middle-income community that encouraged the 'owners' of the units at the exclusion of the 'others', among whom the rental dwellers. It was manifest in the form and orientation of the added units, as broached at the estate level. The minimal development within the court-fronting spaces and the extroverted orientation of the extensions offer further proof of the approach.

Fig. 15 Typical DU transformations in Buru-Buru—ground floor plans (source: Makachia 2010)



2.2.2.3 Dwelling unit-level DITs characteristics From the findings and analysis, it appears that the DU was the focus of most transformation activities in a variety of ways (Figs. 15, 16). These include the plot formation, the dwelling type, and the space type. However, the most significant physical factor was the use of the plot as a defining element and as the catalyst for the type, magnitude and use of the DITs. The unit typology, its size and number of storeys contributed minimally to the transformations. The same could be said of the space types as contributors to extensions.

The underlying explanation was that the provided DU sufficed for the household's needs. Thus, its scale and organisation and the physical disposition of the major spatial elements were adequate. They met the middle-income objectives of the targeted socio-economic grouping in Buru-Buru estate. The conclusion was that the transformations enhanced the position of this socio-economic class.

The drive for extensions was to serve economic objectives only. This stance, however, came at a social price. The economic-driven extensions entailed compromises on the social objectives. Central to these social objectives was territorial exclusivity and privacy for the owner-occupier dweller.

The plot, though physical, circumscribed the range of social control over a territory owned by an individual resident. The individual dweller's control over the plot explained its utilisation as the appropriate avenue for transformations. This plot was thus physically

Fig. 16 Unit no. 104 extension photograph and CAD projection (source: Makachia 2010)



amenable to functional transformations to express a resident's individuality. The economic uses in the extensions, including sub-tenancy rents and commercial activities, required physical articulation, as demonstrated in the findings.

The primary control regime for the extension transformations was the physical articulation. This included boundary markers and unit-enclosing elements that accorded increased security for the dweller. Other aspects were the internal modifications and the 'skin'-based internal finishes that were aimed at retaining the social status of the middle-income dwellership. However, the major added spaces hardly served the householders, ostensibly because the provided units suited the basic physical needs of a nuclear family, reflecting those of the vast majority of the dweller-householders.

Another dimension of the extensions added was the durable technology of the 'permanent' units (Fig. 16). This signified the confidence—the minimised fear of demolition and eviction—that the residents had in these 'owned' dwellings. The 'permanent' technology implied reliance on the builders or contractors. Again, this reflected the up-scale professional and business-class dwellership. Hiring reliable contractors had added cost implications, which were acceptable to the middle class.

This trend was irrespective of the house typology, and it was typical of middle-class housing. The open space on the plot was the first major driver for extensions; the location in relation to major circulation arteries was the other. The dictum that emerges here was that for dweller-initiated extensions, 'form follows location'. This contradicts long-held notions in conventional architecture that the 'form follows function'.

The second dictum, that for dweller-initiated extensions 'function follows location', is also valid. This position is justified as the functions in the extensions, which ranged from 'owner-dweller' to 'tenant-dweller' and 'commercial-dweller' use, were locationally

determined within the plot. For instance, the DIT for the owner-dweller was located within the court frontage and was accessed from there. This was contradictory to the spatial stance for the tenant dwellers, as they were inclined towards the inter-cluster streets. Their physical and functional detachment, and thus the independent articulation, was an added supportive qualification. Regarding legality—legitimacy or otherwise—it should be noted that most major transformations contravened planning conditions, including plot coverage, plot ratio and the building line. Despite this reality, the dwellers felt unremorseful about this due partly to the breakdown of formal control over building development, but more fundamentally due to the legitimacy of the extensions. The legitimacy was the fulfilment of the functional needs that the provided DUs did not bridge.

3 Conclusions and recommendations

The most overt type of DITs, the extensions, had various dimensions that could ultimately guide policies and the management of residential neighbourhoods. These include the technology, encroachment on common ground, typology/morphology, cluster definition, and locational articulation.

The first lesson on extensions was typological. The linear typologies in Kaloleni encouraged extensions that created enclosure through mini-court formations. In Buru-Buru, the trend was to create structurally and functionally independent additions, away from the properly enclosed and articulated clusters and dwellings. This lesson was a verdict on the physical strategy and hence the need to encourage containment in the typology.

The second lesson on extensions emanated from their use for defining the edges of clusters. This defined the territorial extent and control of the space. The tendency to add spaces for non-residential functions and for tenant households on the edges was one such indicator. The aim was to physically define the insider/outsider roles of the dwellership in neighbourhoods. This was clear in Buru-Buru clusters, while in Kaloleni the new introverted mini-courts confirmed the same tendency. A likely recommendation for the design of clusters is thus to develop core unit on the inner layer fronting the cluster courtyard, while leaving room for future income-based extensions on the edges.

A third lesson also pertains to the definition of the edges and relates to the circulation paths. These paths formed the avenue for income-oriented DITs and afforded room for unique developments that included the mixed-use vertical typology. The emerging multi-use typology located the commercial use space at ground level, whereas residential-use spaces were found on the upper levels.

3.1 Recommendations

3.1.1 Policy

At the policy level, it is recommended to mainstream and hence provide incentives for transformations as an accepted mode of housing delivery. Thus, design of housing should accommodate transformations as an inevitable and necessary eventuality. The same policy should allow the necessary legal framework to deter vindictive and undue demolitions. This would open avenues for access to individual or community micro-finance loans for development of DITs. It would also open avenues for legalisation of the existing extensions and access to finance by dwellers for more additions.

3.1.2 Development control

The inevitability of transformations, as supported by the cases, should form a strong basis for mainstreaming the phenomenon within development control regimes. The recommendation begs for Building and Planning Codes that accommodate transformations. Thus, based on physical factors like location and unit size design, proposals should envisage growth initiated by the dwellers. Architects will provide alternative expansion channels that the unit was amenable to, and channels that the dweller may adhere to. This will take cognisance of the likely infrastructure expansion demands for the likely population. The planning and building codes will thus permit this flexibility.

3.1.3 Transformation manuals

At the dwellers level, a guide for transformations is envisaged and hence the architects would produce Transformation Manuals, envisaging a self-managed extension process. This would be preceded or accompanied by individual dweller and/or communities' civic education which would avail a 'do-it-yourself' software strategy for the future. This strategy does not eliminate the architects in the transformation process, but it does allow the inevitable DITs to be of an informed standard and spatial quality.

The recommendation is to guide the possible growth patterns and hence the framework for its use in formal housing. The physical proposal assumes that the legal and social frameworks that will provide the enabling environment are operational and that they rely on covenants that facilitate the administration of common and boundary areas. The technical framework thus defines the extents through the cadastral and topographical authorities of individual and shared spaces and service lines. The physical model would be operationalised at the scale levels of the DU, the UDE and the estate.

Central to the physical framework proposed are the following points. One: the incremental nature of the designed unit, allowing for progressive dweller-initiated transformation is at both spatial as well as structural level using a reinforced concrete structural frame. Two: flexibility in the incremental options is through a definition of the structural frame that permits partitions (as the 'structure-and-infill' model) using demountable technology and materials. And three: the DITs allow a functional mix between commercial, residential, and other uses as evidenced by the case findings. To reduce functional and land-use conflicts, the recommended models create layers of privacy and public interfaces. The technology to be used anticipates progressive upgrading, moving sequentially from temporary to more durable materials within the provided structural frame.

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