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HOUSING CLUSTERS AND TYPOLOGIES IN THE SLUMS: A Case of Korogocho Slum in Nairobi, Kenya

Belinda O. Tuju & Robert W. Rukwaro
School of the Built Environment,
University of Nairobi, Nairobi, Kenya

ABSTRACT

Kenya is fast urbanizing, just like most African countries, and the high task of provision of affordable housing to its citizen has been a daunting task. Despite the high urban population growth rate of 6-7% per annum, the production of affordable housing by the government does not match the population growth rate thus leading to housing deficit. Since the launching of slum upgrading programme in Kenya by Cities Alliance in 1999, there has been negligible success in the projects despite the heavy investment by the Government, Non-Governmental Organizations (NGOs), Faith Based Organizations (FBOs) and Community Based Organizations (CBOs). Proper response to low cost housing should consider understanding the context of existing livelihood of slum dwellers, the social organization and space economy. Lack of in-depth understanding of the socio-economic factors and space economy by the Kenyan Slum Upgrading Program (KENSUP) has led to construction of housing typologies which are largely gentrified within few months of occupation. This paper therefore seeks to document space planning, use and design as well as the existing housing typologies in Korogocho slum. The relationship between the housing unit and the resultant settlement and their modifying factors has also been delved into. 59 households in Korogocho slum were selected and qualitative data was collected using interviews, survey questionnaires and observations. The information collected was analyzed using qualitative analysis techniques. The study revealed that land and tenure security influenced the location and type of informal settlements. The multi-functionality of spaces, the importance of the housing unit as an organizing principle and the vitality of the outdoor space for household chores extension influenced typology. The study, finally, recommends in-situ upgrading with set minimum standards for space utilization.

Keywords: *Slum dweller, typologies, housing clusters.*

INTRODUCTION

A clear understanding of the slum dwellers' space planning, design and use will contribute greatly to development of a slum upgrading proposal that is integrative, economically viable and socially accepted. This proposal will not only tap into the existing socio-economic fabric but also borrow from the existing primitive planning and design concepts of the slums.

Urbanization and industrialization is responsible for population growth due to migration and in-migration. Globally, it is estimated that by 2025, almost 60 percent of the population will live in towns and cities; with African countries having the fastest urbanizing cities since they gained their formal independence. Like most African countries, the urban population growth rate in Kenya is 6-7 percent per annum and the production of affordable housing by the government does not match the population growth rate thus leading to housing deficit. Thus the vast majority of the population is being accommodated by private developers in informal settlements and slums. In effect, efforts to upgrade the Kenyan slums were launched in December 1999 by Cities Alliance. Since then other initiatives have been launched by the National and County Governments, and bodies such as Non-governmental organizations (NGOs), Community-based organizations (CBOs), Faith-based organizations (FBOs), Kenya Slum Upgrading Programme (KENSUP), Sustainable Neighbourhood Programme (SNP) and Swedish International Development Agency (SIDA), for example, are some of the institutions that have joined efforts in the slum upgrading projects in the country.

Problem

It is posited that proper response to low cost housing must entail understanding the context of existing livelihood of slum dwellers, the social organization and space economy. The Kenyan Slum Upgrading Program (KENSUP) however, is not fully responsive to these issues of low cost housing and is totally oblivious of the socio-economic structure of the slum dwellers. This is manifested by not having integrative housing development that considers socio-economic, social organization and space economy. Lack of proper inventory on informal settlements, failure of upgrading initiatives to deliver adequate housing prototypes in terms of affordability, design and livelihoods, and finally failure by designers to tap into the already efficient multiple and innovative use of space that already exist within the slums are some of the reasons brought forward by National Slum Upgrading and Prevention Policy explaining the failures of the past slum upgrading initiatives (Government of Kenya (GoK), 2013). In addition to that, some other reasons according to the UN-Habitat are that the initiatives tend to focus on large scale projects instead of zooming into a particular group, thus failing to understand the needs of many different groups within the slums, the projects have always been designed and implemented in isolation due to lack of good governance structure to ensure sustainability and replication. Finally, lack of well-designed demonstration projects, as most are cosmetic, resulting to later abandonment. This lack of difference in housing between the existing high-income earner and the renewals of the low income neighbourhoods has led to the problem of gentrification. *Therefore this study seeks to investigate existing socio-spatial organization, livelihood and environmental dynamics direct influence on the use of space of the slum dweller.*

THEORY

A review on the characteristics of slum built environment is presented below.

Land and security tenure

Most slums and informal settlements tend to be on squatter lands in Kenya. For example, Kibera slum grew mainly as Nubian housing for soldiers of the demolished British East Africa in 1947 and expanded over the years (Ndukui, 2012). The land was initially owned by the government. The same scenario can be said about

Korogocho and Huruma (Kambi Moto) slums where the land was owned by the government. In addition, some informal settlements sprang out of privately owned land that were lying fallow; for example, Mukuru kwa Njenga slum in Nairobi Kenya and as was remotely the case in Baan Mankong Programme in Asia (Boonyabancha, 2012). The issue of land is very sensitive and important when it comes to upgrading projects as the land tenure system to be adopted becomes a complex phenomenon to handle and resolve between the different slum stakeholders (that is structure owners, slum lords and tenants). In most scenarios the slumlords do not upgrade as they see it leading to loss of their properties. For example, in Kibra Soweto East, slumlords who were government officials and politicians took a case seeking to stop the upgrading process to court but were dismissed (Ndukui, 2012). Consequently a similar scenario was witnessed in Mathare 4A project. However, some of the tenure solutions which has been applied in the upgrading processes have proved to be futile. For example, in Kibera the government through KENSUP took over the land, developed housing and are currently selling the houses to the dwellers at subsidized prices and this has led to high rate of gentrification. The other approach adopted by Mathare 4A project was that the land was bought from the government by the Executive Agency, beyond which the structures were obtained from the slumlords who were then compensated. The houses were then developed and solely managed by a central body (Executive Agency) in terms of rent collection. This scenario was again politicized and boycotted by the dwellers leading to failure of the whole project (Gitec Consult, 1995). On the contrary, cases such as Kambi Moto proved successful as even though the land was owned by Nairobi City Council, the dwellers were able to negotiate with the council to accommodate community enumeration, planning and construction process and a working lease for land tenure system. The same success scenario is witnessed in Baan Mankong where the land sharing schemes was used for squatters on private lands (Gupte et al., 2010)**.** In the land sharing scheme, the land is divided into two portions where the community leases one portion (normally the least economically attractive) and the land owner gets the most economically attractive portion. This method tries to find a win-win situation for both the dwellers and the land owner despite their conflicting interests.

Space planning, use and design

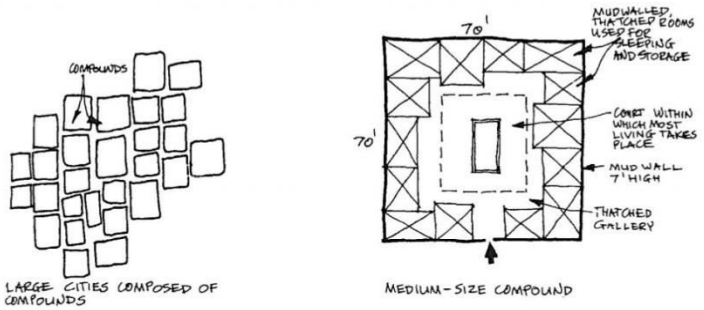
Slum settlement studies in Mumbai, indicated that each and every slum has its own unique way of building that is influenced by geography, materials availability, technology, among other factors (Gupte *et al.*, 2010) thus this is a summary of spatial issues that cuts across. And at any point, it is highly advised that the specifics of the slums be identified instead of generalization of the issues. However, after a survey of 8 different slums, there were issues that cut across that are identified to be relevant to the Nairobi, Kenya scenario. The survey results indicated that since most of the slums are characterized by low incomes and the kind of occupations available require day-long involvement, the dwellers tend to build their houses near their work places and by doing so, they use space efficiently. For example, in Kumbharwada in Dharavi, the built forms are typically the same, that is, each house is a long narrow space (normally single storied but occasionally double storied), with parts of the house used to store raw materials, intermediate products, finished products, and tools and implements. The houses facing the street have shop-fronts where the products are sold. It should be noted that, the informal settlements have undergone years of evolution to establish these enterprises, the efficiency and a culture that exists within it therefore it should never be taken for granted during the slum upgrading projects. The report further indicates that due to scarcity of space, the slum dwellers over time have developed innovative ways to use space. It further elaborates the failures of the government Slum Upgrading projects to take into account the dwellers social and economic needs. The same is reiterated in Mathare 4A feasibility report, where it stresses the fact that an upgrading project should maintain the multi-functional phenomenon of the settlement by having residential areas integrated with places of work and economic activities. Besides, Community Organization Development Issues(CODI, 2015), reveals the two and a half stories building typology being a successful upgrading in the urban set up as it allowed for

commercial activities on the ground floor and residential on both the first and mezzanine floors. Therefore the space planning of the informal dweller is a constant which is bound not to change despite the upgrading process thus should not be treated as a variable.

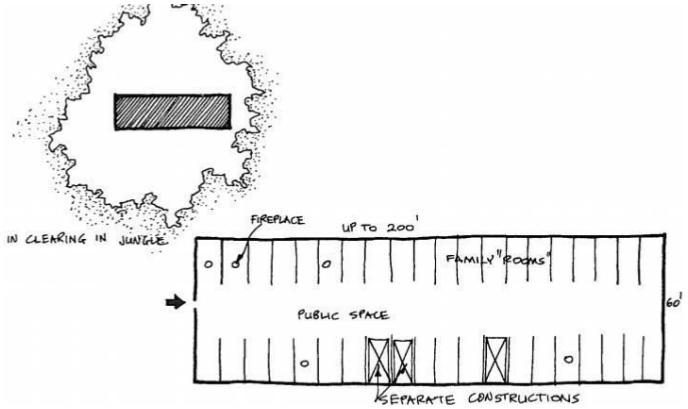
The Built Forms Typologies and Resultant Settlements

Living pattern always extend beyond the house to some extent, it is therefore necessary to see a house as part of total social system, and not in isolation, which helps in understanding the relation of man to his settlement and landscape. A house is only a small part of large settlement, and the way one uses the settlement affects the house form. Moreover, each of the settlements has its own customs, traditions, ideas, and different man – women relations. These differences can be seen in their houses, their forms and space allocation in them, even if direct casual relations cannot be traced. Perin (1977) shows that principal social order are translated into settlement patterns by the practices of everyday life, relating to physical proximity, social homogeneity, race relations, form of tenure, housing styles, income levels, privacy and community. The use of public spaces and buildings, interaction spaces for each gender, ceremonial spaces, and educational spaces forms the part of settlement and affect its surrounding and settlement in total. Thus, it is important to see house not only in relation to the basic dichotomy of settlement types as settings for life and in relation to their variants along the total space use scale, but also as part of the specific system to which it belongs. **Figure 1 (a, b & c)** shows how different types of housing are likely to inform the settlement patterns. **Figure 1 (a, b & c)** should be understood in its relation to the town, its monumental parts, non-domestic areas, and social meeting places, and the way they and the urban spaces are used. One should also consider the movement from the house, through the various transitions to the street, and then to the other parts of the settlements (Adopted from Rapoport, 1969).

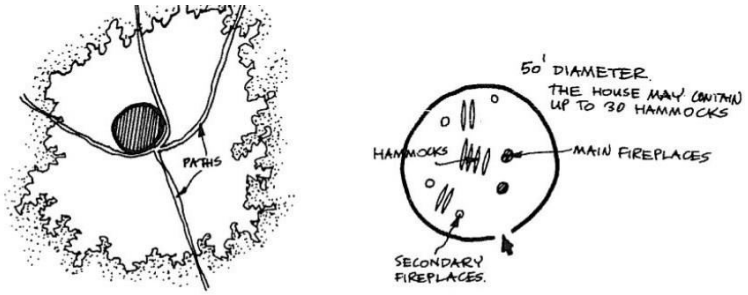
Consequently, as Gitec Consult (1995) notes, the upgrading projects should understand the relationship between the house and the settlement, the uses of indoor and outdoor spaces as this influences the final layout of the upgraded settlement. In addition to that slum upgrading projects such as Baan Mankong programme in upgrading Suan Phlu took into account the effect of different housing typologies on the settlement layout (Boonyabancha, 2009) The five stories housing typologies used for onsite reconstruction at Suan Phlu, Thailand gave rise to a defined settlement layout. It is therefore vital to study the existing layouts of the settlement to be upgraded and how the individual houses influence them so as to adopt the same in the upgrading project.



(a) Yoruba African settlements



(b) Jamadi South American house and settlement



(c) Piaroa South American House & Settlement

Figure 1 (a, b & c): Examples of relationship between housing and the settlement

Source: Adapted from Rapoport, 1969

Moreover, according to Gupte et al., 2010, slum forms and typologies are characterized with unclear layouts, narrow streets and dead ends which makes its maneuverability difficult for the outsiders. For example, the long narrow houses in Kumbharwada, Dharavi are stacked next to each other to form the entire settlements. The spaces between the two rows of houses, forms the streets and the open spaces and double up as work spaces and hold numerous kilns, storage spaces. Basically the activities from inside the house (since the houses are small 3metres by 3.5metres) tend to spill over into the streets thus adding into the character of these streets. In some cases temporary structures are built over the street as a house extension. This outside space is not only used for leisure but also for all kinds of work, such as household chores like washing of vessels and clothes. Though the physical form of the settlement is organic (growing as and when required), it pays special attention to detail to make efficient use of space and resource. As large numbers of people occupy small amounts of space, every millimeter of the space gets used efficiently**.** The housing units thus become the organizing principle around which the entire village and settlement is formed. Some slum upgrading projects such as onsite re-blocking by Community Organization Development Issues (CODI, 2015), were implemented to upgrade infrastructures while maintaining their layouts in Thailand.

Services

Most services in the slums are shared communally except for some remote cases where an individual household is self-contained. The slums are characterized by communal toilets and bathroom where they pay as little as Ksh.5 to use. Some are privately owned while others are government or NGO's initiatives e.g. the Biodigesters by Umande Trust in Kibera and Mukuru kwa Njenga etc. Despite that, some slums still use flying toilets or have open fields

for disposal of human waste, for example, Kibagare people, Ndumbuoni in Kenya and Behrampada, Bandra East residents in India (Gupte et al., 2010). The slum houses lack piped water thus there exists water collection points distributed in the settlements and which act as socializing areas as well. A number of slums lack proper drainage (waste or storm water) systems and the entire wastes freely flow in the open drains into the nearby rivers as the case in Kaptagat slums. While in the case that drainage systems exists, they are usually blocked due to lack of maintenance (Mitullah, 2003).

In terms of accesses and circulations, the study finds that most slums have major accessible main roads for example Mathare accessed from Juja road or Thika road, but the internal settlements circulation is characterized with weathered roads and narrow paths that cannot allow motorized movement and deep alleys. Garbage collections are generally not organized therefore dumping occurs throughout the slums blighting the areas and posing significant health risk.

Most slums have either one or two public hospitals (where they pay as little as Ksh.20 for treatment of common maladies) and school depending on its size. Since this is rarely adequately equipped to serve the entire population, they are always supplemented by private hospitals (which charge as high as Ksh.500 for treatment of common maladies) and private schools which are a little bit more expensive than the public schools (Muungano Support Trust (MuST) et al., 2012). The slums are also characterized with illegal and dangerous power connections as shown in (MuST et al., 2012).

Consequently, provision of services for a settlement can be a step towards upgrading an area. According to Mathare 4A socio-economic survey, infrastructure was prioritized such as sanitary and water reticulation (Gitec Consult, 1995). This forced the project manager to have a two tire project where it started with infrastructure improvement that was able to reach many people followed by housing. In addition to that, Favela Bairro in Brazil concentrated on bringing the basic services to the favelas without displacement of the dwellers. It included community development, sanitation, environmental education and regularization of the informal settlement (Mariana, 2013).

Factors Modifying Slum Built Forms' Typologies

These are forces that are secondary to influencing housing forms typologies, they act as modifying factors to the already decided form by a people and in most cases they are always constraints that affect the final form. They include:

Physical and climate constraints

Climate affects human comfort generally hence has a major effect on the final form decided upon. Besides, heat build-up in the houses affected by activities within the house such as cooking will also modify the internal environment of the house as a whole. Climatic influence is analyzed in terms of form orientation and plan influence. Besides, site physical constraints as well affects their building technology and materials used. In informal settlements how suitable are the sites for habitation? In most cases the dwellers settle on hazardous sites, on way-leaves and river riparian and this exposes them to danger as they carry on with their daily life. Site influences the general layout of the settlements but it does not by any chance influence the type of form decided upon by the people (Rudofsky, 1964).

Consequently, successful upgrading projects such as Favela Bairro (Brazil) and Baan Mankong(Thailand) invested in thorough site study to ascertain site which are harzardous and those which are suitable for resettling of the informal dwellers. Thus during these projects, the dwellers were relocated from disaster prone areas such as

river riparian and steep slopes that could not allow for any reasonable construction. Besides, the CURI report (2012) on Mukuru Kwa Njenga feasibility study demarcated suitable and unsuitable land for relocation. Therefore, physical and climatic constraints not only modified the informal dwellers' settling site selection but also influenced the feasibility of the upgrading projects.

Factors such as land ownership influences the types of slum settlements as most occur in squatter lands. Upgrading of the shelter should resolve the ownership status prior to the physical upgrading. From the literature, it can be deduced that every slum is unique to its inhabitants in terms of space planning, use and design. However, multi-functionality of the spaces and integration of work and living activities are some of the shared characteristics that cuts across most of the settlements. These constants should be observed and maintained during the physical upgrading. The housing unit is the organizing principle of the settlement in totality, with the built and unbuilt spaces resulting into clear or unclear layouts. Due to the high density of inhabitants per square kilometer, provision of communal services such as water points, sanitary facilities and hospitals among others is encouraged as it is cost effective. In addition, modifying factors such as physical location of the settlement and climate constraints affects the resultant forms of the slum built environment.

RESEARCH METHODS

This study was based on a cross-sectional survey carried out around June to August 2016 with the study area being the eight villages within Korogocho slum. This survey allowed for a comparative analysis of the eight villages in terms of their socio-economic organization as well as their physical characteristics and layouts. Apart from being the fourth largest slum in Kenya, Korogocho slum was chosen by the authors due to interaction with the dwellers on a daily basis thus strong social bonds with the inhabitants. The slum also portrayed inclusiveness of the variables being investigated.

Korogocho slum had a population of 42,000 inhabitants according to 2009 census with 18,386 households and a high population density of 47,895 people/km^2 (UN-Habitat, 2012). Korogocho slum was divided into 8 villages namely; Grogan A and B, Korogocho A and B, Highridge, Gitathuru, Kisumu Ndogo and Nyayo (**Figure 1**). Multi– cluster random sampling was used to establish the sampled homestead. The socio-economic organizations were studied as well as the physical characteristics and layout of each village. Multi-cluster random sampling was used to select a representative sample of 59 households from 8 Korogocho slum villages (**Table 1**). The chosen sample size was statistically adequate and manageable according to researchers' time and financial constraints. The authors worked closely with village elders to access the randomly sampled households. This was important to assure the researchers' security and recognition to structure owners and tenants as Korogocho slum was the fourth largest and most dangerous slum in Nairobi. The data collection techniques used for this study were interviews, observations and questionnaires. The data was analysed using qualitative techniques that included descriptive and graphical presentations.

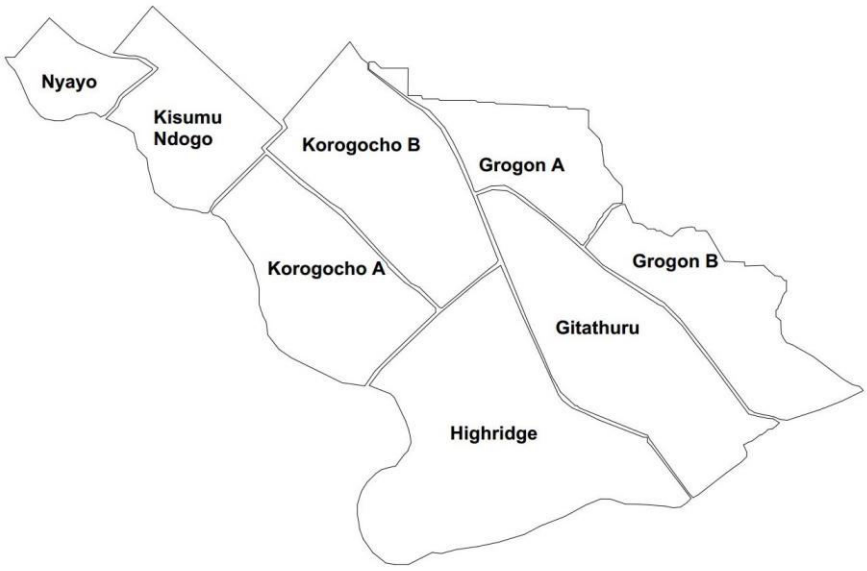


Figure 2: The eight villages in Korogocho

Source: Compiled from Korogocho streetscape UN-Habitat, 2012

Table 1: Calculating representative sample of households in Korogocho villages

Korogocho Villages	Population of Villages	Proportion Populations	Ratio of Population	Sample size per village (ratio x 3)
Grogon A	1,471	0.08	1.6	5
Grogon B	2,022	0.11	2.2	7
Korogocho A	2,574	0.14	2.8	8
Korogocho B	2,574	0.14	2.8	8
Gitathuru	2,758	0.15	3	9
Highridge	4,413	0.24	4.8	14
Kisumu Ndogo	1,655	0.09	1.8	5
Nyayo	919	0.05	1.0	3
Total	**18,386**	**1**		**59**

Source: Field survey, 2016

RESULTS AND DISCUSSION

Space Typology, Scale and Use

In the informal settlements there are two types of spaces, namely, the indoor and the outdoor. Based on the different users, these spaces carry different functions. Considering the scarcity of the indoor spaces (mostly 3metres X 3metres) most of the dwellers activities takes place in the outdoor spaces thus making them important spaces in Korogocho. This section focuses on the outdoor spaces while the next sub-title focuses on the indoor built forms. The resultant spaces to be discussed are streets, courtyards, service points, riparian areas, markets and building clusters.

The role and hierarchy of streets

The upgraded streets in Korogocho range from public commercial, semi– public to private residential streets.

Street as a public space

Social interactions that are witnessed in Korogocho makes the streets a public space. Just like any other slum in Kenya, there is lack of open spaces making the streets to be the major public space not owned by any particular individual but where both the public and private activities meet and a public space is formed. The streets are not only spaces for movement but also places to be in and spend some time in (**Figures 3 (a), (b) and (c)).** Most of the dwellers social life takes place in the streets due to lack of alternative options thus creating a vibrant street life in Korogocho. It is the dynamic quality of streets that creates successful urban spaces and in Korogocho the streets have mixed uses and support the making of public spaces. After the upgrading of the streets the dwellers moved and personalized the streets to fit their needs, wants and essentials. The streets in Korogocho have created both direct and non-direct spaces thus has become places for spontaneous meetings and social interactions thus creating places for people to reside in. For a successful upgrading project the streets ought to provide space for public actions as well as opportunity for people to perform private and civic roles.

(a) (b) (c)

Figures 3 (a), (b), (c): Kamunde commercial public street, Semi-private Street, and residential private street respectively

Source: Authors 2018

Street for democracy

Due to lack of open spaces in Korogocho, streets are the available public spaces and therefore convenient for democratic functions. They facilitate representation of organizations or individuals who want to influence or impact on the public (**Figures 4**). Organizations, such as Hope Raisers, who wish to transform their society mindset and reduce on the social evils have taken to the streets to convey their message to the entire settlement. They have done this through owning the streets by skating and also using graffiti. In addition, during the annual Koch Fest, there is a marked seven days of street democracy that involves masquerading, paintings, artists showcasing their talents such as music, poetry, acting, dancing etc. These kind of activities are the ones that personalize the streets and make it an important space in the settlement for the dwellers to express their likes, dislikes and aspirations.

Figure 4: Streets for public democracy and security surveillance

Source: Authors 2018

Street for safety and security

Slums are often seen by outsiders as well as the dwellers as unsafe and insecure due to lack of clear form and structure e.g. Gitathuru is perceived and is actually unsafe due to its unclear structures and dingy corners. The village does not give the basis of safety or security. On the other hand the upgraded streets in Korogocho B and Highridge provide residents with a sense of security. These streets provide sense of orientation, with clear origins and endings thereby tying the village together thus improving security for both dwellers and outsiders.

According UN-Habitat (2012), in the safety audit conducted in Korogocho before the street upgrading took place, many crime hotspots were located around street crossings and along thoroughfares. Adequate streetlights, streets and community facilities has shown to have a direct effect on the perceived safety and security. Streets with high level of activities, such as Kamunde road are perceived to be safer than the uninhabited streets, such as Community lane. The importance of security is that the perceived security (not the actual) related to public space; if people feel safe in the public space there are better opportunities for the area to improve, which in turn increases safety.

Street for economic prosperity

Streets are corridors for movement of good, vehicles and even people it supports the urban economy thus most livelihoods are dependent on the streets. The upgraded streets in Korogocho has increased access of the outsiders to the area has brought about better relationships with the surrounding economies' adjacent neighbourhoods, such as Kariobangi, Babadogo and Dandora and enhanced money circulation. Some of activities that takes place in and around the street include vending, hawking, services such as shoe mending, handicrafts, metalwork and also transportation. Besides, it also supports hidden economy of suppliers, money-lenders, landlords, importers and exporters. The street economy encompasses all the commercial and business activities that to some extent profits from the street and includes profitable enterprises, which can be a stepping-stone to secure work. In summary, for a street upgrading which has already commenced in Korogocho should not only be looked at in terms of its physical entity for ease of mobility and accessibility, but also as the public realm that articulates and promotes social, cultural and economic activities. The street should promote connectivity while respecting the urban fabric without disruption of the social networks and residents livelihood locations.

Courtyards

The arrangement of housing in Korogocho tends to lean towards courtyard systems in most cases. Scenarios such as in Korogocho A and B; and Highridge have courtyards which are rectangular in shape as shown in **Table 2.**

These types of courtyards serves as lighting source, enhances air circulation within the habitable rooms as well as serving as an outdoor spaces where light and air intensive activities such as washing and cooking occur. In some cases, storage of unused household belongings is found in the courtyard. In addition, to the rectangular courtyards, the I-shaped courts are mainly found in Kisumu Ndogo and Nyayo villages only. This type of court has one side exaggeratedly longer than the shorter side (**Table 2**). The rooms are arranged facing each other within the court. The width of the court is less than 2.5 metres thus allows for limited functions as much as they still serve the same function as the later, that is washing, cooking, storage and socializing. The last type of courtyard is found in Grogon and Gitathuru villages. They are small courts that acts buffer zones between their spontaneous single houses and the roads as shown in **Table 2**. They are used for lighting, air circulation, sometimes for socializing and mostly for urban agriculture.

Fields

These are open spaces found within the settlement and are not so many. The main one is Korogocho stadium found along Kamunde road (**Figure 5**). Bounded by Daniel Comboni Primary school and St. Claires Primary School, the field serves as a playground for the two schools and other several private schools within the settlement as well as playground for private football clubs within the area. Other open spaces within the settlements are unplanned and spontaneous especially in Grogon and Gitathuru. **Figure 6** shows an example of such fields. They are used by the youths and women for socializing, meetings and smoking areas. Other uses include holding village Kamkunjis (meetings) by the elders and women groups, and for resolving disputes arising from misunderstandings.

Figure 5: Korogocho stadium
Source: Authors 2018

Figure 6: Spontaneous field, Gitathuru
Source: Authors 2018

Service points

Service such as water points and public washrooms are places for congregation and socializing points in the settlement. **Figure 7** shows water collection point which acts as meeting points for women, girls and young boys while queuing for water. News, gossips are spread through these places. They are majorly found along the main roads. As for the public washrooms female users expressed the insecurity issue as inhibiting their usage by the gender.

Figure 7: Services points, water points
Source: Authors 2018

Figure 8: Nyayo open air market
Source: Authors 2018

Riparian areas

River riparian areas have not yet been fully personalized within the settlement as they are considered very insecure areas by the dwellers. This can be attributed to the fact that both the Nairobi and Mathare Rivers, passing through the settlements, are heavily polluted from elsewhere or within. The areas are unbuilt and polluted by the open sewers thus there is no conducive for any type of outdoor activities taking place. In some scenarios the riparian is used for farming activities. In Grogon B, the riparian is perceived by the dwellers as very insecure as thugs take advantage of the river and bridges to mug and throw the culprits into the river.

Markets

In Korogocho there is only one place designated as a market and that is in Nyayo village (**Figure 8**). This can be attributed to the fact that throughout the settlements economic activities takes place along the streets. Street vending is a common phenomenon in the settlement with merchandise displayed on both permanent structures along the streets as well as temporary structures extension of businesses along the street edge zones (businesses extend their spaces by appropriating the edge zones and building over the open sewers). In other scenarios, merchandise is directly laid on the ground along the street edge zones. The market at Nyayo is an informal market where there are sales of household consumables, second hand clothes, scrape metals, food vending, electrical, hardwares, hotels, general stores, animals (goats), among other things. The temporary stalls used for display of merchandise allows for portability of the goods in case of relocation or if it is a daily movement of goods for sale.

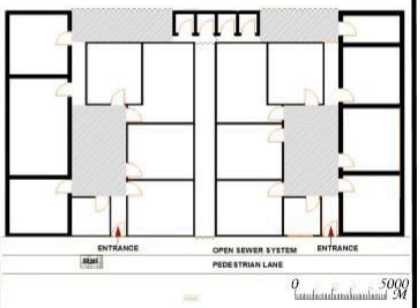
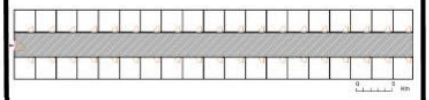
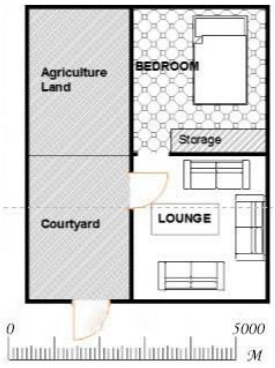
Housing Clusters

Buildings in Korogocho slum were clustered to form diverse layouts. These resultant patterns, form and layouts of different villages were attributed to the type of individual houses and how dwellings formation occurred, the income levels of the residents and formal planned layout and gradation of privacy. The clusters range from grid iron layouts to spontaneous layouts (**Figure 9**). A summary of the different housing clusters and typologies are presented in **Table 2**. Each of these housing typologies is discussed below.

Figure 9: Map showing different types of housing clusters in Korogocho

Source: UN-Habitat 2012

Table 2: Summary of the different housing clusters and typologies

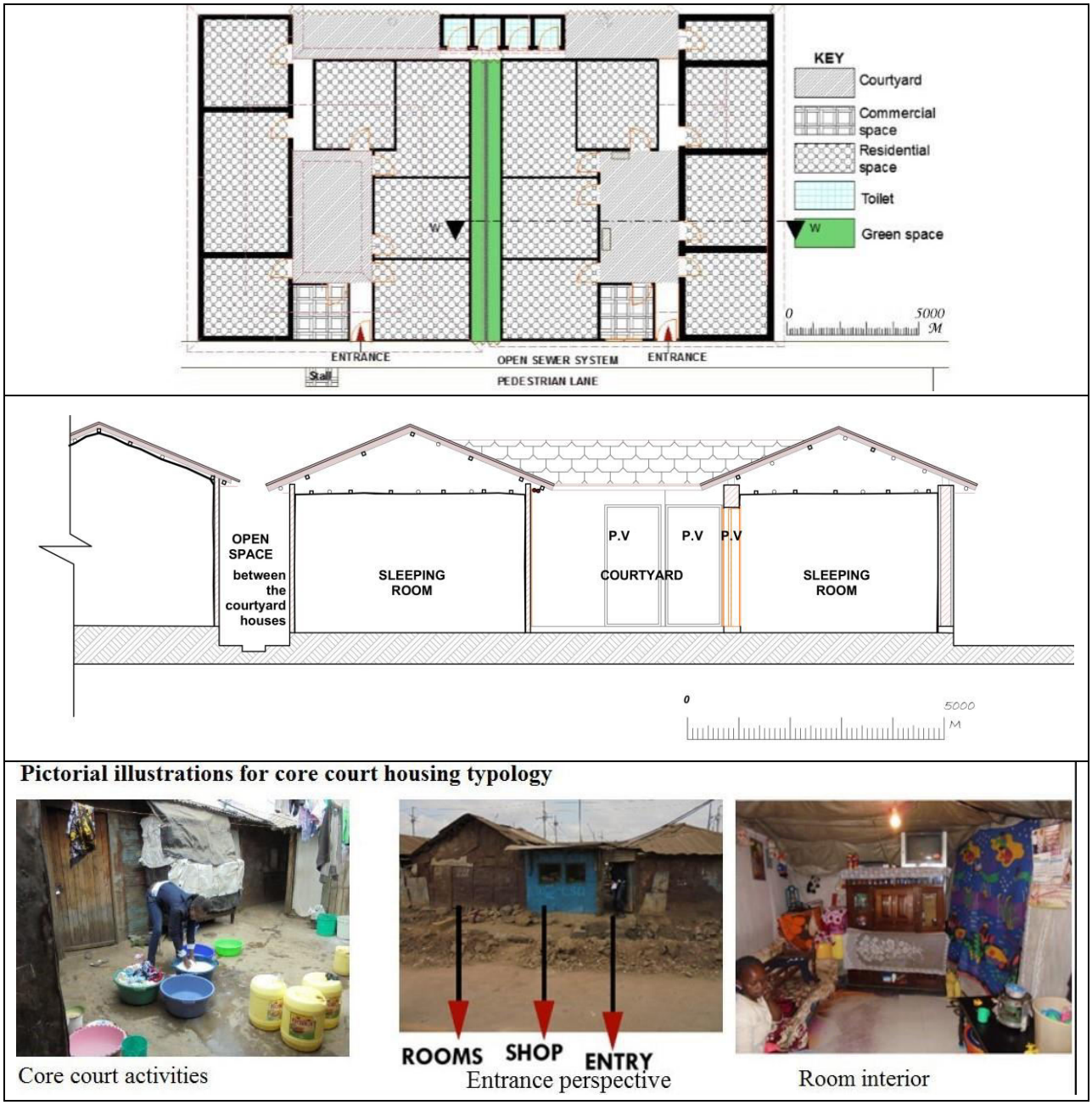
Housing cluster	Housing typology
Formal well planned layouts 	Core court housing typology 
Grid Iron layout 	I– Shaped courtyard housing typology 
Spontaneous unplanned layout 	Front court housing typology 

Source: Field survey, 2018

Core court housing typology

This core court housing design was mainly found in Korogocho B and Highridge settlements **(Table 3)**. This type of housing design was formal and had well planned layouts. It was characterized by well-planned roads and paths with clear sightlines. This typology was perceived as safer than other settlements in Korogocho. This perceived security encouraged economic investment in the village.

Table 3: Core court housing typology in Korogocho slum



Source: Field survey, 2018

Construction materials used in this housing typology were recycled materials such as poles, tins and scrape metal to make walls and roofs. This typology was more associated with relatively high income tenants. The zone had

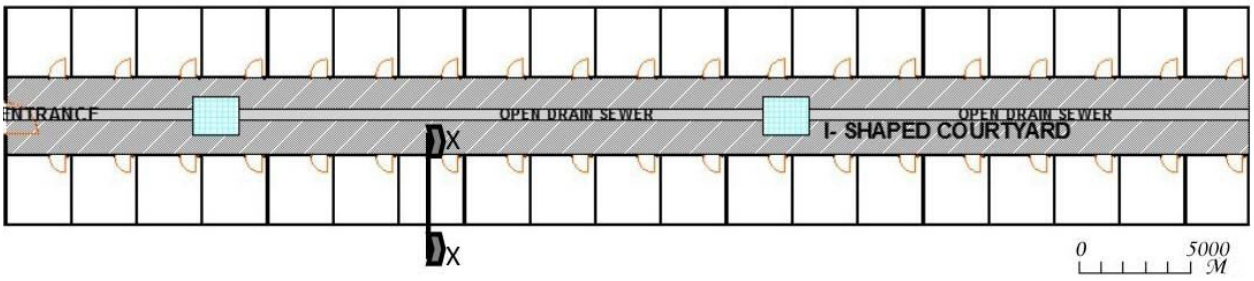
higher investment opportunity due to presence of high security. The hessian cloth was used to sieve out dust from penetrating into the houses since most of the residential dwellings had no windows (**Table 3**).

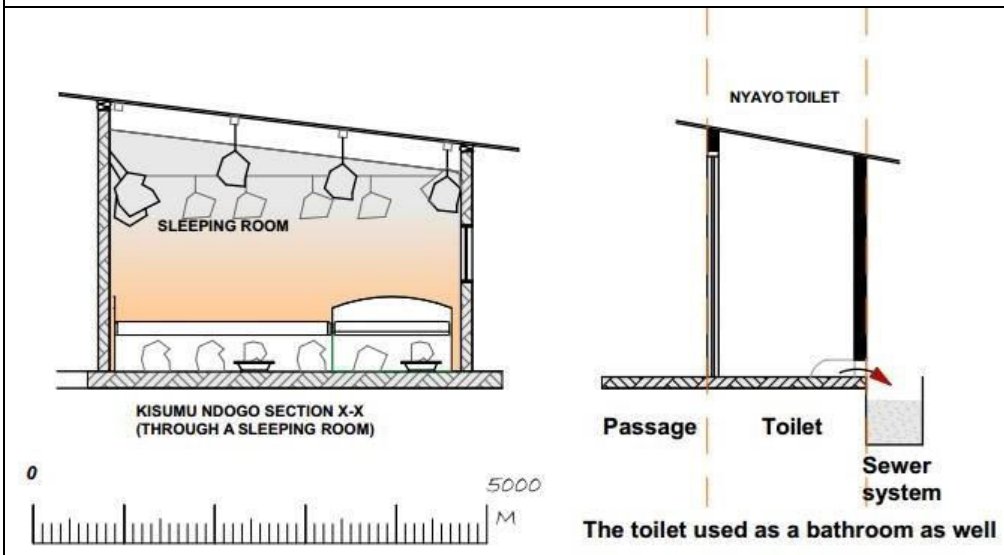
I-shaped courtyard housing and typology

I-shaped courtyards were found in Nyayo and Kisumu Ndogo villages. I-shaped courtyard housing design had grid iron layouts (**Table 4**). The roads and paths were not upgraded.

Table 4: I-shaped court housing typology in Korogocho slum

Housing layout





Pictorial illustrations for I - shaped courtyard housing typology

I– shaped courtyard

Interior view of a single

Nyayo 'flash me' toilet

Source: Field survey, 2018

The dominant houses were semi-permanent and were constructed using mixture of rammed earth, wattle and scrape materials. I-shaped courts were associated with middle income tenants and were perceived to be insecure. They had medium investment opportunity due to relatively low insecurity **(Table 4)**.

Front court housing and typology

Front court housing design had spontaneous unplanned layout. This type of settlement was associated with private small buffer courts **(Table 5).**

Front court housing typology had occurrence of unplanned random open spaces. This housing typology was characterized by unclear roads, dingy and meandering pathways with no clear sight lines and poorly lit at night. This led to severe insecurity in the villages. The lowest investment was witnessed in this type of settlements due to insecurity (**Table 5).**

Mixed Use Housing Typology

Figure 6 shows that no direct access was provided from main commercial street to the residential quarters. The residential spaces were accessed from feed road. This was for security and privacy purposes. The one storey house placed sleeping spaces in upper level while front court had welding and mechanic working places. The vertical separation of the house was good to achieve privacy gradation of functions.

The commercial use units found included: general stores, groceries and kiosks as they tend to improve the quality of business and accommodation. The study found out that light industry activities were separated from residential areas as they require more space and time and might be source of air and noise pollution.

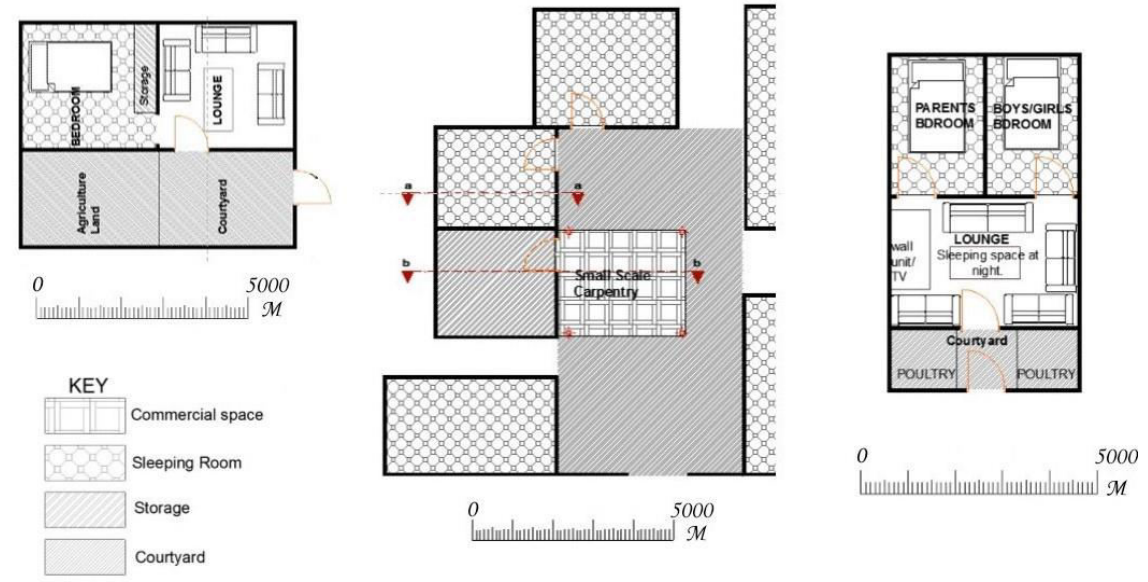
In the terms of housing typologies; mixed use housing typology seems to work with commercial and residential part clearly separated to avoid competition of interest between the two. There was a horizontal separation with a provision of a chimney to aid in ventilation of the spaces as shown in **Figure 10** or vertical separation as shown in **Table 6**.

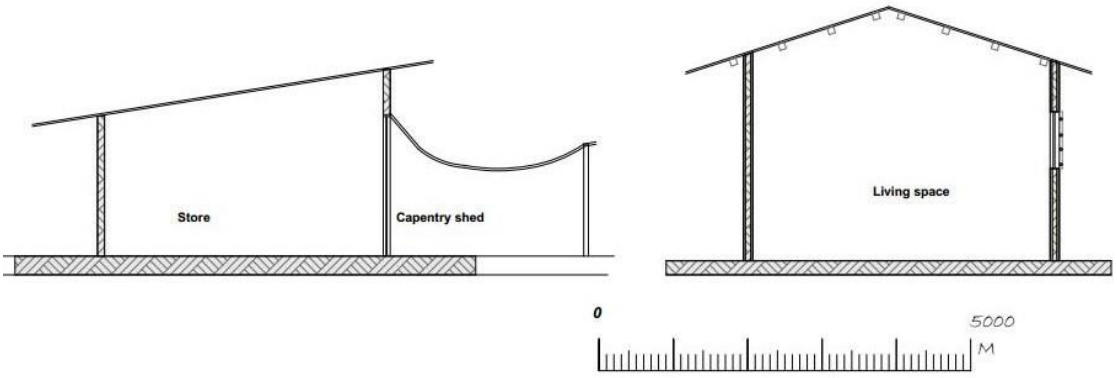
Different scales of housing typology found in the slum included; one storey, two storeys and three storeys. One storey building was found not to be economical on space use age, the built up areas plus services left minimal outdoor space for complementary services as well as was characterized with competition between economic and residential activities in the outdoor space. The two storeys building had a viable solution if the built up density was oriented towards minimum outdoor space requirement and was not allowed for design of complementary services.

The three storeys building was found to be the most advantageous as it allowed for minimum criteria of outdoor space and met most design principles as well as it had left room for considerable surplus outdoor spaces.

Table 5: Front court housing typology in Korogocho slum

Front court housing typology (Mixed use - Agricultural/Residential activities)





Pictorial illustrations for front court housing typology

Carpentry shed

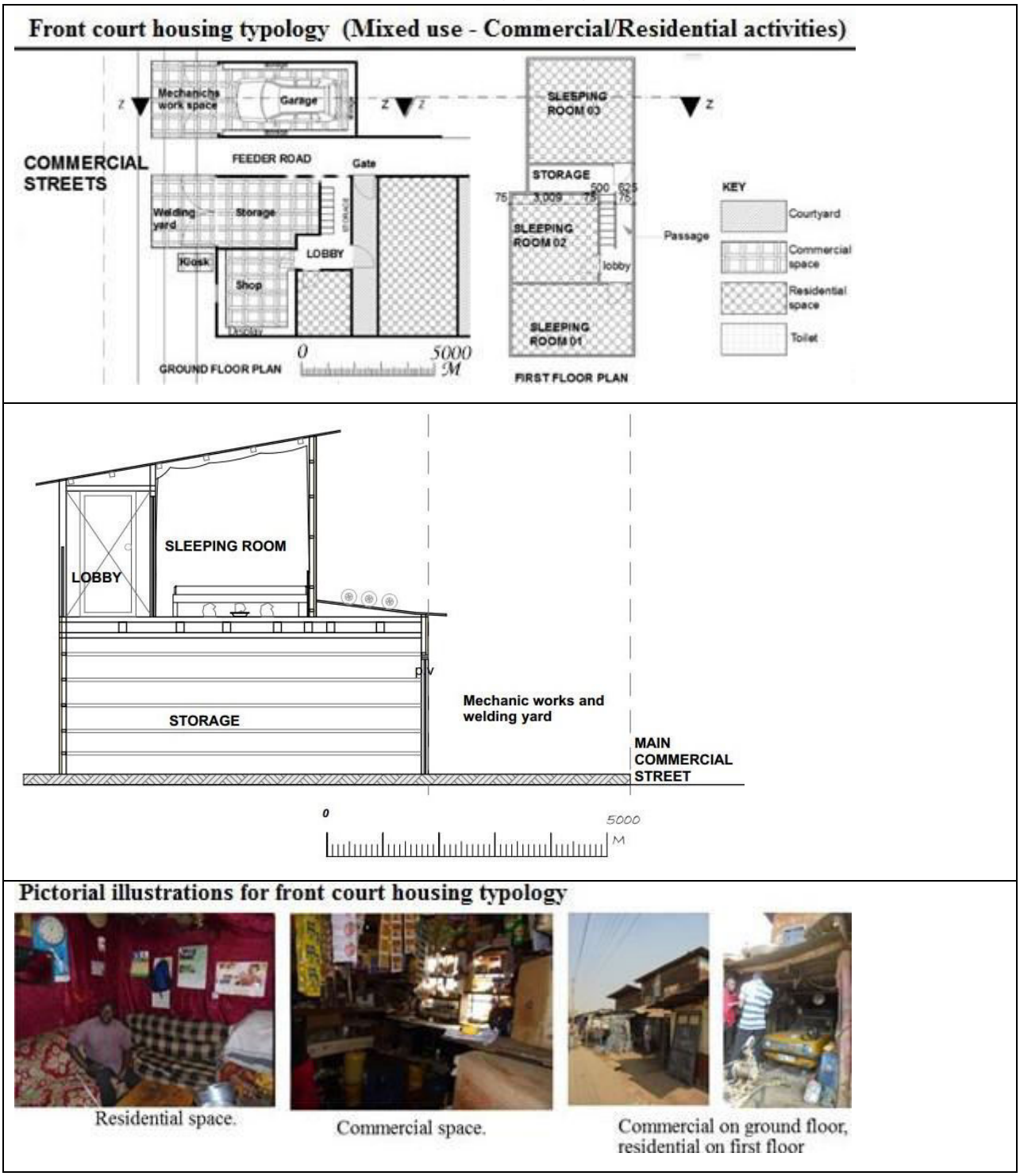
Poultry and vegetable farming

Recycling of hessian sac for construction occurring in the court

Source: Field survey, 2018

In terms of scale of the intended housing typology; a mixture of two and three stories was more economical and advantageous in terms of space use for both internal and external as shown in **Table 6**.

Table 6: Front court housing typology in Korogocho slum



Source: Field survey, 2018

The best housing typologies to be used were a combination of different stories as this offers a more flexible solution. A combination of one, two and three stories buildings allowed for diverse effect of low land efficiency of one stories to be encountered by higher land efficiency of the two and three stories options and all land requirements complementary facilities were met.

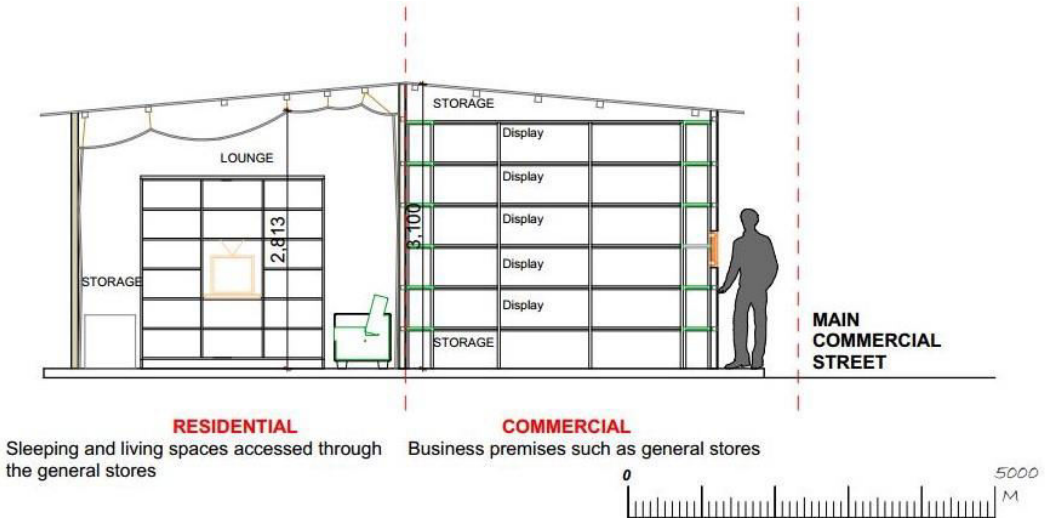


Figure 10: Horizontal separation of economic and residential spaces

Source: Authors 2018

In-situ upgrading of slum

The in-situ upgrading of slum was preferred in this study as the way of improving the slum because of the outlined reasons. In-situ upgrading does not disrupt economic and social fabric of the dwellers and cares for kinship ties and organizational network. The proximity of dwellers livelihood and support networks is maintained. It facilitates transformation of slums into integrated communities which promotes economic and political stability.

Further, in-situ upgrading involves improving the slums through legal and regulatory instruments and improving housing, public spaces, streets and basic services. It also involves improving employment, education opportunities, developing new community facilities, connecting slums into the wider urban fabric both spatially (roads and streets) and in terms of services (street lighting, sewer, refuse management, firefighting, and provision of security).

CONCLUSION

Korogocho slum was characterized with both indoor and outdoor spaces. Due to the scarcity of space in the slum, especially indoors, most of the dwellers activities took place in the outdoor spaces. This gave significance to spaces such as streets as house chores spilled over on to them besides them still being spaces for democracy, economic prosperity, social engagements, safety and security. Outdoor spaces such as courtyards, open fields, service points, riparian areas and markets were also spaces where different social and economic activities occurred.

Further, Korogocho slum has different building clusters exhibiting varied characteristics, qualities and perceptions in terms of security, social networks and economic prosperity. The building clusters range from formally well planned layouts, grid iron layout to spontaneous unplanned layouts. The housing typologies within the settlement

influenced the resultant form of the village. Besides, the phenomenon of house chores extending onto the streets, the strong social networks and status quo, ties the village together creating a strong sense of territoriality, while socialization points, nodes along major streets weaves the whole settlement into one whole village called Korogocho. Moreover, the buildings are also arranged to form a private or public street. Houses turning their back onto the streets make it a private street while along commercial streets, the structures open up to the streets to capture customers to the businesses. In-situ upgrading of the slum was the preferred method of upgrading because had flexibility and; encompassed physical, economic and social interventions. A summary of findings are given in the Table 7.

Table 7: Established cluster planning and typology design constants for slum housing

Housing Constants for Slum Dwellings	Architectural/Planning Constants
Communal living/groupings	Living in cluster with social stratification through ethnic lines or economic status.
Security of the dwellings	Organizing houses in courts, providing few openings for privacy gradient. Provision of public and private spaces.
Livelihood attainment Differentiation of functions	Space planning according to economic activities. Efficient and economical spatial definition
Priority of opportunity and identity	Provision of mixed use housing typologies with commercial and residential activities
Interactive place for living and work Minimizing the expense in lifestyle	Proximity of functions Neighbourhoods with walking distance to work and leisure.
Sense of belonging	Identity of the slum neighbourhoods

Source: Authors, 2018

RECOMMENDATIONS

The following are recommended for a successful integrative slum upgrading project:

i. **Land and security of tenure:**
   (a) Land use and urban structure planning should be well planned and oriented towards a pedestrianized population as is the existing case in Korogocho, provision of communal facilities (educational and civic buildings) and control of built up and open areas.
   (b) The land tenure option influences the site ownership of the upgrading project thus influencing the site services provisions, depending on whether it is individual owned lands or government owned. It also determines the character of built up and open areas.

ii. **Mixed use design:** Informal settlements are multi-functional environments therefore any attempt to upgrade them in a sustainable manner has to recognize and support their multi-functionality.

iii. **Social facilities:** Social facilities should be allocated adequately i.e. direct combination of residential and commercial use with units especially, general stores, groceries, kiosks as they tend to improve the quality of business and accommodation. On the contrary, light industrial activities should be separated from residential areas as they require more space and time and might be a source of air and noise pollution. Craft centers and informal sector (Jua Kali) should not be relocated far as they offer their services directly to the micro market.

iv. **Services**
   (a) If sanitary facilities are to be provided inside the building (one toilet and shower), they should be shared by not less than 3 to 5 households.
   (b) Shared kitchen facilities, minimum fitting, one water point, splash area for sullage, effective funnel for smoke and cooking odours to escape should be provided.
   (c) Adequate cross ventilation and light in rooms to be allowed to save on electricity bills and maintenance of the building e.g. in kitchen and bathrooms.

v. **Room dimension:** The small sized room of three by three metres is not a problem as a household to the dwellers as long as it is provided with an outdoor space for extension of activities.

vi. **Aesthetics:** The architectural appearance of the designs should not be dull and monotonous i.e. appearance should not be compromised e.g. staircase, roofing and windows detail should be aesthetically appealing without adding an extra cost.

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