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Building Densification as a Strategy for Urban Spatial Sustainability Analysis of Inner City Neighbourhoods of Dar Es Salaam, Tanzania

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Abstract- Building densification in developing countries is shaping the spatial patterns of the inner city neighbourhoods. The densification processes are fuelled by higher land values and real estate market dynamics. Due to increased land values, new building forms, uses and density are emerging. Although densification is considered as a strategy to achieving compact development and city spatial sustainability, the unguided nature of building redevelopment is increasingly posing threats in terms of diminishing spatial and liveability qualities in these neighbourhoods. This paper examines the building densification processes in two neighbourhoods of Dar es Salaam City and the resulting effects in terms of plot coverage, floor area ratio and overall spatial patterns. Observations, measurements, transect walks, interview with officials and map analysis were the key methods employed in gathering data. Results indicate that in one of the neighbourhoods, building densification was taking place without a redevelopment plan to guide the process. In Kariakoo, 89 percent of all buildings had higher plot coverage above the recommended standards. Land coverage at block level was noted to be 78 percent which was above the recommended coverage of 70 percent. In Sinza, 13 percent of all buildings also had plot coverage above the recommended ratio. These divergences were compounded by the weak development control mechanism and developers' desire to maximize use of land. This pattern of building densification was culminating into poor spatial and liveability qualities. There is therefore a need for preparing plans that will guide the redevelopment processes, instituting effective development control measures and revisiting the possibility of combining plots to facilitate flexibility in design and move towards urban spatial sustainability.

Keywords: building densification, plot coverage, floor area ratio, spatial quality, sustainability and dar es salaam.

I. Introduction

Although urban sprawl is a characteristic feature in most cities of the developing world, the pressure for increased building density towards compact city development is increasingly becoming imminent. It is common in these countries that the rapid city spatial expansion goes hand in hand with transformation of old low rise residential with high rise residential cum commercial neighbourhoods. Worldwide, densification has been recognized as one of the tools for achieving compact city forms and sustainable urban development. Densification that culminates into compact cities has the advantages of reducing vehicle movement, environmental pollution and energy consumption. Densification creates good premises for provision of public transport, effective usability of infrastructure, open space, public realm and business opportunities (Paez, 2012; Cereda, 2009). Paez (2012) further argues that compact nodes are helpful in controlling unplanned urban spatial growth in the cities. High-density areas promote walkability, discourage vehicular movement and also prevent urban sprawl (Long, McGrath and Kolder; 2011). In addition, urban densification promotes social interaction, social inclusions and cultural enrichment in the cities (Bahadure and Kotharkar, 2012). It sounds that all basic facilities such as schools, shopping, parks and playgrounds can be effectively allocated at walking distance. Therefore, people can get equal benefits from these facilities if optimal densities are achieved (ibid.). Aggregated together, these qualities culminate into liveable cities and sustainable urban development.

Literature indicate that the most compact and vibrant European city is Barcelona, which has an average density of 400 dwellings per hectare (The Urban Task Force, 1999; Lupala and Namangaya, 2010). Although increase in density is consistent with the idea of sustainable neighbourhoods, higher densities also carry the connotations of urban cramming (ibid.). From economic perspective, literature further indicate that land economy gains are being achieved from increasing densities from 20 to 25 dwellings per hectare to 35 to 40 dwellings per hectare (Barton in Breheny, 1992). Despite the fact that land use gains diminish above these levels, research confirms that higher densities allow greater number of public amenities and transport facilities to be provided (ibid.). As density levels increase to 40 to 60 dwellings per hectare, the land take diminishes rapidly. More people are close enough to communal facilities to walk, and efficient bus service can be made viable. Increased densities contribute to energy efficiency. If increased densities contribute to these urban qualities, it can therefore be argued that building densification can be deployed as a strategy towards liveability and sustainability of urban centres.

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The approach towards urban densification may include increase in Floor Area Ratio (FAR) and Land Coverage (LC). It implies that appropriate use of FAR by increasing more floors in building increases more space to accommodate more functions in one building. City spatial sustainability has been viewed as a useful economic approach because it can attract more capital investment and job opportunities in compactly built cities (Bhayo, 2014). To be able to analyse city spatial sustainability, land coverage (depicting the horizontal expansion of built environment) and Floor Area Ratio (how vertical development building are) becomes instrumental variables.

II. Density as a Concept

Density as a concept has been in academic currency for many years. Several authors have discussed density from varying perspectives. There has not been a consensus on the actual definition of density apparently because of the varying contexts, perceptions and values attached to this concept. It is from these variations that many authors have shied away from definitively arguing for what is high or low density. However, a number of authors have attempted to define density from physical, social, temporal and perceptual perspectives. Physical density is largely manifest in form of floor area ratio and land coverage and building heights (James, 1967; Rapoport, 1975, Correa, 1985; Newman and Kenworthy, 1989; Barton, 1992; Breheny, 1992; Jelinek, 1992; Alexander, 1993; Acioly and Davidson; 1996; Rådberg, 1996 and Arenas-Gomez, 2002). Physical density (sometimes referred to as objective density) has been examined as land use ratios (Lupala, 2002). In housing and urban design, density has been measured in terms of floor area ratios, plot coverage and dwelling units per specified area (Alexander, 1993; Rådberg, 1996). While Floor Area Ratio (FAR) is a unit of density referring to the floor space in relation to plot or land area, plot coverage refers to the proportion of built up areas to that of plot area expressed in percentage. Floor Area Ratio largely expresses the verticality of buildings while coverage expresses the horizontal coverage of built spaces. In common practice, density has often been referred to as a degree or intensity of development or of occupancy. The social cultural perspective of density focuses on such variable as levels of social interaction and feeling of control (Rapoport, 1975). Density can also be viewed from temporal aspects such as fast tempos and rhythms of activities and associational or symbolic relating to the presence or absence of, tall buildings or apartment buildings, absence of private gardens (ibid.). In this paper, emphasis is being put on physical density because it is more practical to objectively operationalize its variables. Some of the key questions that are worth examining are; what are prevailing plot coverage and floor area ratios in densifying neighbourhoods of Dar es Salaam? Is the type of densification notable contributing towards spatial sustainability of the city? What challenges and opportunities are being posed by the on-going densification processes?

III. Spatial Growth Trends in Dar Es Salaam City

Dar es Salaam city has a jurisdictional area of 147,557 hectares and its built up area is estimated to be 115,372 hectares. The built up area is equivalent to 71 percent of the jurisdictional area (TACINE, 2013). By 1892, the spatial extent of Dar es Salaam was limited to only 2 kilometre radius from the city centre. This coverage increased to 6 kilometres in 1963, 17 kilometres in 2002 and 30 Kilometres in 2012 (Bhayo, 2014). The four major arterial roads radiating from the centre are the key features structuring the spatial pattern of Dar es Salaam city. The city has grown up to 30 kilometres northwards along Bagamoyo Road, 28 kilometres westwards along Morogoro Road, some 32 kilometres southward westwards and south eastwards along Pugu and Somanga Roads (Figure 1). This has resulted into a finger-like city spatial structure and corridor development along these major roads. Density along these corridors is relatively high decreasing as one move away from the major roads. The fact that almost all employment is located at the city centre where major roads converge or radiate, the horizontal growth and mono-centric city spatial structure have resulted into severe traffic jams during peak hours and delays from home to work places. This pattern of growth has culminated into a number of issues that undermine city sustainability. For example, the increase in the number of vehicles has compounded traffic congestion problems in the city. The situation is made worse by the increase of motorcycles and tricycles in Dar es Salaam using the same city roads (Kiunsi, 2013). A study by Japanese International Cooperation Agency (JICA, 2008) indicates that vehicles often spend up to two hours to cover a 16-kilometre trip in the city, a distance which could have been covered in 15 minutes if there were more roads and intersections. From economic point of view, URT and Ukaid, (2011) estimated that traffic jams in Dar es Salaam were costing about 20 per cent of the annual profits of most businesses.

In analyzing jaggedness or degree of compactness of the city of Dar es Salaam, urban gradient density values were established from the built up areas by the Adapting to Climate Change in Coastal Dar es Salaam Project (ACC-Dar) in Bhayo (2014). By the year 2002, compactness of the Dar es Salaam city was limited to 6 kilometres (inner radius) from the city centre. This figure increased to 11 kilometres from the city centre (outer radius) in the year 2012 (Figure 2). The reason for increased distance with compactness is due

to the increase in land coverage especially in the outer radius where many of the vacant plots have been developed (be it low rise or high-rise buildings). In the inner city neighbourhoods, Floor Area Ratio (FAR) is increasing by transforming the old low-rise buildings into high-rise. Detailed results from gradient analysis indicate that land coverage was 45 per cent at 5 kilometre radius in the year 2002. This gradient increased up to 57 per cent within the same distance in 2012. Land coverage was 24, 5, 2, 1, 0.6, 0.4, 0.17 per cent at 10, 15, 20, 25, 30, 35 and 40 km radius respectively, which has reached up 80 to 39, 22, 13, 7, 4, 2, 0.4 per cent, with the same distance intervals in 2012. Therefore, land coverage has significantly increased between 2002 and 2012. In other words it can be argued that although density gradient decreases as one move far away from the city centre, with increase in time, inner city neighbourhoods consolidate in terms of land coverage and floor area ratios registering higher percentage in density gradients.

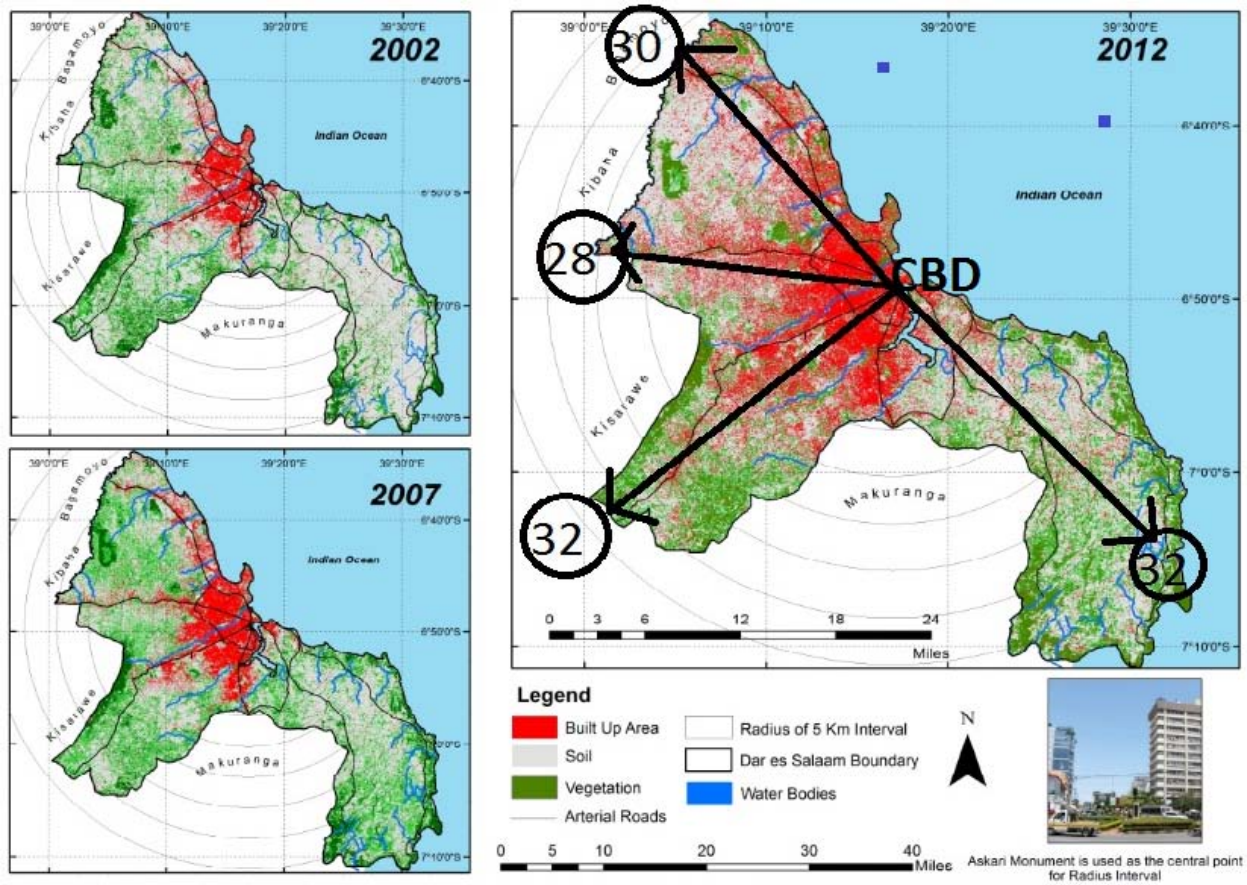

Figure 1 : Spatial growth trends for the city of Dar es Salaam (2002-2012)

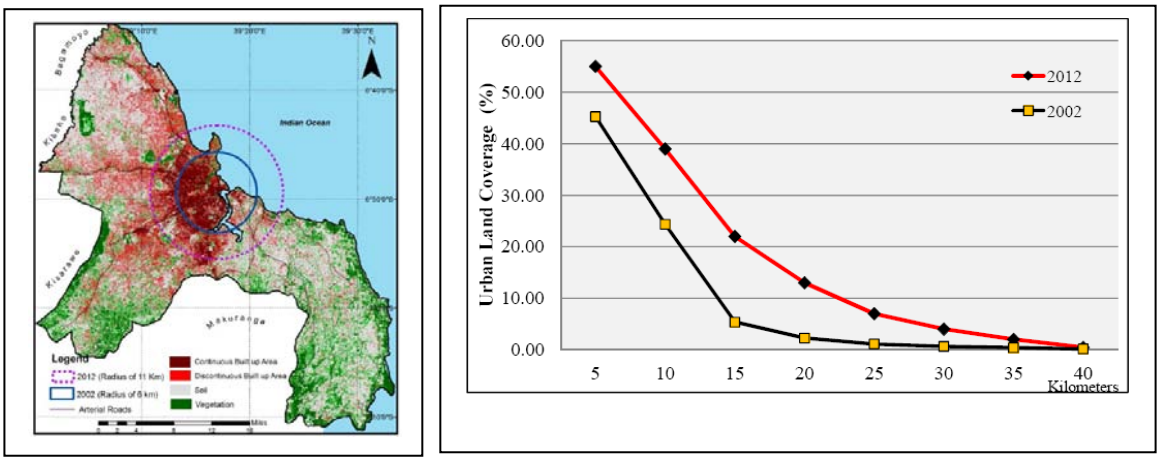

Figure 2 : Jaggedness and density gradient for Dar es Salaam (2002-2012)

IV. Research Methodology

The thrust of this paper was to examine densification processes as a strategy towards compact city development and sustainability. Two neighbourhoods of Kariakoo and Sinza in Dar es Salaam City were selected for data collection and analysis. While Kariakoo has densified to 'saturation stage', similar trends are emerging from Sinza. In these two neighbourhoods, buildings were, and are being transformed in terms of form and uses from residential to commercial, office and other functions. While Kariakoo was part of the Central Business District as recommended by the 1979 Master Plan of Dar es Salaam, Sinza was planned as a "sites and services area" implemented under the World Bank programmes of the 1970s. Therefore dynamics in Kariakoo are more apparent than those in Sinza because of its prime location and relatively higher land values.

In capturing data from the two sites, transect walks, measurement of buildings and observations methods were used. Observation was facilitated by taking photographs and sketching. Observation and measurements were used to capture height and spatial coverage of buildings. These methods helped to capture data on size, spatial form (coverage) and Floor Area Ratios (FARs). Literature review and interviews with officials of Kinondoni Municipality especially on current guidelines used to determine use, height of buildings and plot coverage complemented field studies in the two neighbourhoods. Maps for analyzing jaggedness of Dar es Salaam were obtained ACC-Dar Project (2014). Three blocks were selected from each neighbourhood (Kariakoo and Sinza) for detailed data collection and analysis as shown in Figure 3.

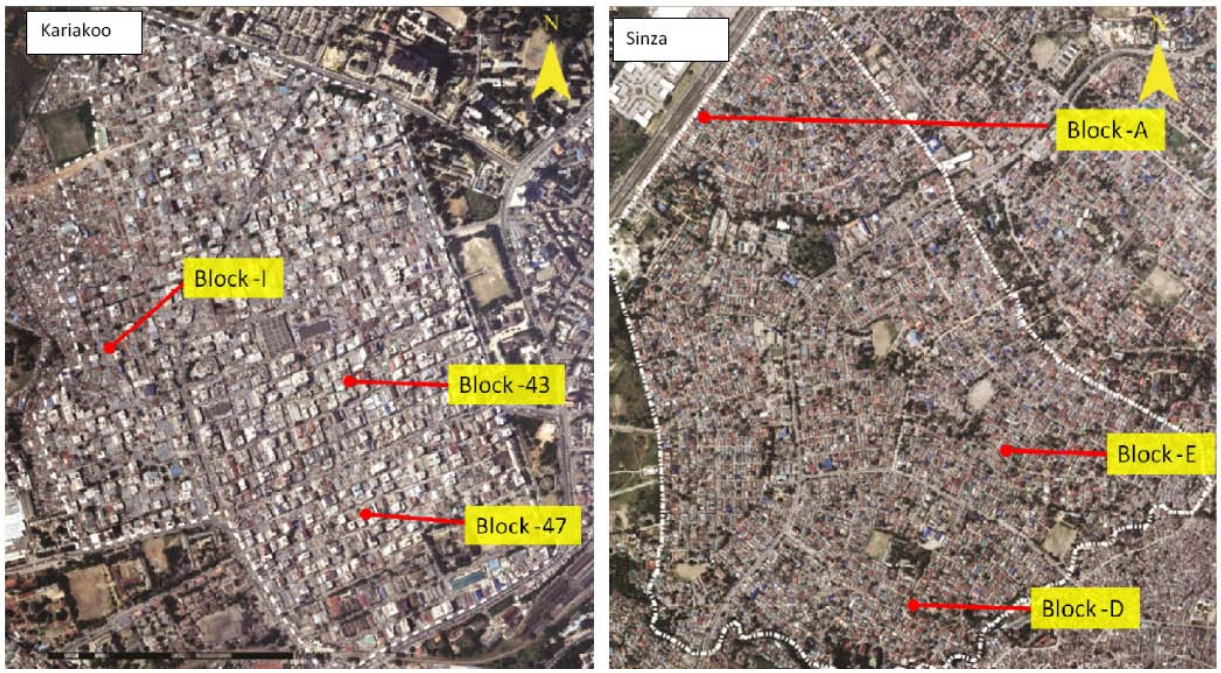

Figure 3 : Location of case study blocks in Kariakoo and Sinza

V. Results from Kariakoo

a) Building densification guidelines for Kariakoo

Owing to the rapid transformation of buildings in Kariakoo, the Ministry of Lands, Housing and Human Settlements Development in collaboration with the Ilala Municipal Council prepared a redevelopment scheme of the area in 2002. Four distinct zones were proposed namely; areas whose development in terms of buildings should not go beyond two storeys, two to four storeys, five to seven and above eight storey (Table 1, Figure 4). Additional guidelines included plot coverage and maximum Floor Area Ratio. While the recommended minimum plot coverage was 30 percent, the maximum coverage was set at 70 percent (Table 1). In terms of building height the recommended minimum was one to two (1-2) a nd eight to ten (8-10) storeys as the maximum.

Table 1 : Redevelopment design guidelines for Kariakoo

Land use	Plot Coverage (%)	Maximum Plot Ratio	Building height (storeys)	Minimum plot size (m^2)
Commercial	66-70	5.3	8-10	900
Commercial residential I	60	3.6	6-8	600
Commercial residential II	60	1.2	3-5	380
Institutional buildings	30-50	1.0	1-2	15000
Other Institutions	50-60	2.5-3.3	5-7	1200

Source: Kariakoo Area Redevelopment Scheme (URT, 2002)

It is important to note that despite the existence of these guidelines, some developers have been violating these rules especially on the aspect of number of storeys. Some buildings were observed to have 10 storeys in an area that was earmarked for 5 to 7 storey buildings (Figure 4). This situation has been caused by partly the weak enforcement of the guidelines and on the other hand, developers' urge to maximize use of plot.

Figure 4 : Building height zones for Kariakoo area and emerging buildings

b) Changing landscape of building heights in Kariakoo

The history of Kariakoo dates back from the 1920s when the first subdivision plan was laid down. Kariakoo draws its name from *"carrier corps",* a settlement that was designed to resettle Tanzanian soldiers who fought in the First World War (1914-1918). Originally, Kariakoo was dominated by single storey houses. Until 1980s, most of the buildings in Kariakoo were still single storey houses. Building transformation in this area was discouraged by the then Building Acquisition Act of 1971 that sought to nationalize all buildings valued at TZS 100,000 (US$ 20,000) during that period. The enforcement of this Act was supported by the country's socialism policy that discouraged private sector investment in real estate development. Rapid building transformation, however, started to emerge in the 1980 following the waiver of this Act (Kironde, 1994, Kombe 1995, Lupala 2002 and Lupala 2007). By 1999, about 87 percent of buildings in Kariakoo constituted single storey houses. Only 12 percent had 2 to 5 storeys. This pattern changed drastically in the decades to follow whereby the proportion of single storey houses diminished to 65 percent and further down to 46 percent in 2006 and 2013 respectively (Figures 5 and 6) (Bhayo, 2014).

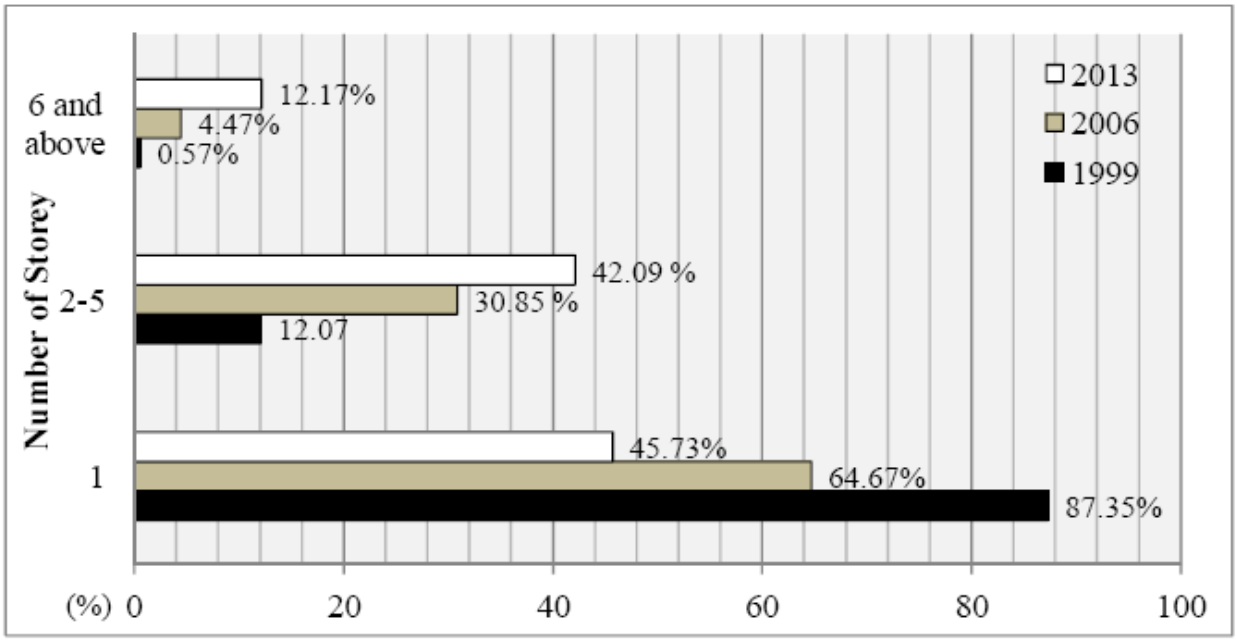

Figure 5 : Trend in changing pattern of buildings forms in Kariakoo (1999-2013)

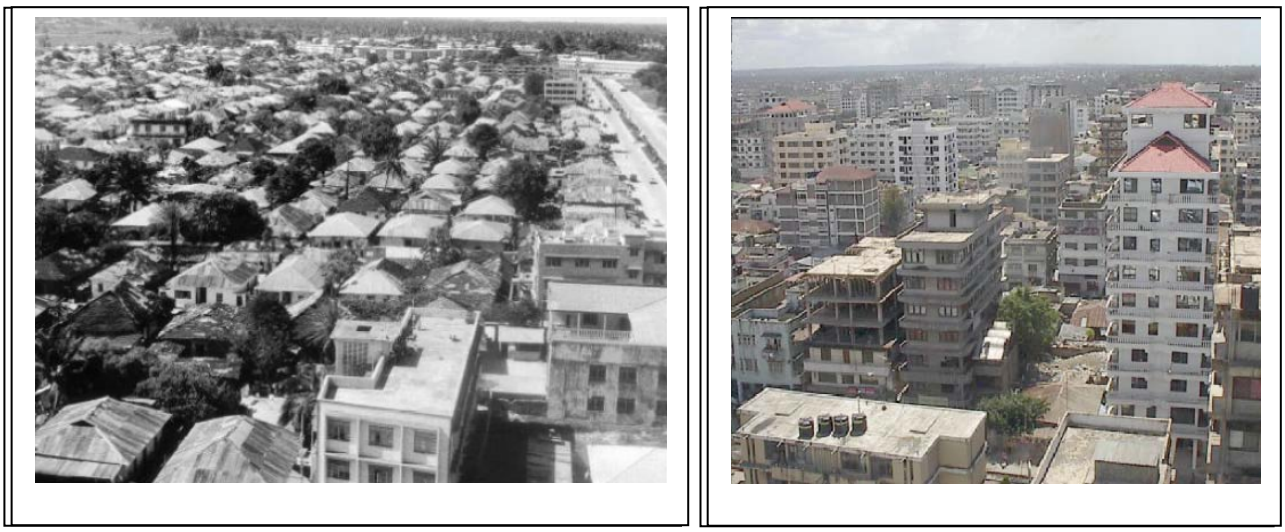

Figure 6 : The changing landscape of Kariakoo in 1960s (left) and 2014 (right)

In the three blocks where detailed studies were conducted, while the number of single storey houses was 9 out of 14 in Block 47 in 2006, all the single storey houses were phased out in 2014. Many building are being transformed from typically single storey residential to multi storey commercial residential and office functions. Redevelopment trends in Block I were relatively slow apparently because of its peripheral location from the commercial centre (Table 2).

c) Floor Area Ratio (FAR)

The minimum Floor Area Ratio (FAR) ranged from 0.1 to 0.5 in block I and 47. The recommended Floor Area Ratio for commercial buildings was 5.3. and 3.6 for residential cum commercial uses. One building on plot 6 Block 43 had a Floor Area Ratio of 8.4. This is a case of violation of the approved ratio of 5.3. Further observations in the areas zoned for residential cum commercial revealed an average Floor Area Ratio that ranged between 4 and 5 as compared to the recommended ratio of 3.6. This pattern of development contributes to informal vertical development in Kariakoo (Table 3).

Table 2 : Trend in building height changes in Kariakoo (2006-2014)

Number of storeys	Block 43			Block 47			Block I		
	2006	2010	2014	2006	2010	2014	2006	2010	2014
1	9	2	-	10	8	3	11	10	9
2	-	-	-	-	-	-	-	1	1
3	1	2	2	-	1	-	-	-	-
4	1	2	4	-	-	1	-	-	-
5	1	2	2	-	1	3	-	-	1
6	1	3	3	1	1	2	-	-	-
7	-	1	1	1	1	1	1	1	1
8	-	1	1	-	-	1	-	-	-
9 and above	1	1	1	-	-	1	-	-	-
Total	14	14	14	12	12	12	12	12	12

Source: Bhayo, May 2014

Table 3 : Floor Area Ratio for Blocks 47, 43 and I in Kariakoo

FAR	Block 47	Block 43	Block I
0.1-0.5		-	-
0.5-1.0	2	-	9
1.0-1.5	-	-	-
1.5-2.0	-	-	1
2.0-2.5	-	2	-
2.5-3.0	-	3	-
3.0-3.5	1	1	1
3.5-4.0	2	-	-
4.0-4.5	2	3	-
4.5-5.0	1	3	-
Above 5.0	3	2	1
Total	**11**	**14**	**12**

Source: Bhayo, May 2014

d) Plot coverage

Fieldwork results from Kariakoo indicate that the majority of the plots had higher plot coverage of over and above those recommended in the guidelines. While the recommended maximum coverage was 70 percent, results from field observations indicate that out of a total of 37 plots, 16 plots had 80 to 90 per cent and 15 plots had 71 to 80 per cent coverage. Two buildings had plot coverage of 90 to 100 percent (Table 4). In general terms, 89 percent of all buildings had plot coverage exceeding ratios recommended in the Redevelopment Scheme of Kariakoo. These findings indicate that building developers are not adhering to guidelines as stipulated in the redevelopment plan. The effect of excessive plot coverage is culminating into problems associated with limited capacity to attend emergency measures such as fire rescue, poor ventilation and poor sunlight in the interior rooms.

Table 4 : Plot coverage in Kariakoo

Plot coverage (%)	Number of plots	Percentage
50 or less	-	-
51-60	-	-
61-70	4	10.8
71-80	15	40.5
81-90	16	43.2
91-100	2	5.4
Total	37	100.0

Source: Bhayo, May 2014

e) Land coverage at block level

In terms of land coverage at block level, Block I had the highest coverage of 83 percent followed by Block 43 with 77 per cent and block 47 that had 73 percent (Table 5). These ratios are again over and above the recommended coverage of 70 percent. Although house form in Block I was still dominated by single storey houses the horizontal extensions has culminated into higher plot coverage. Higher plot coverage is contributing to uncomfortable indoor living especially in hot and humid climatic conditions of Dar es Salaam.

Table 5 : Land coverage at block level in Kariakoo

Block	Total area (m2)	Total built up area	Land coverage per block (%)
43	4207.48	3226.87	77
47	4295.84	3135.65	73
I	3140.86	2615.89	83

Source: Bhayo, May 2014

f) Spatial growth pattern in Kariakoo

The emerging spatial growth pattern in Kariakoo depicts a compact settlement of building with varying heights, size and plot coverage. Although the trend in densification is in line with the view towards optimizing land and infrastructure use in Kariakoo, excessive compactness of buildings closely juxtaposed to each other is resulting into poor spatial qualities of the indoor living environment. Controls on the limitation of building height and coverage seem to have failed. The fact that development is taking place on plot-by-plot basis, the skyline is broken depicting what can be called *"informal vertical landscape"*. View from side balconies is blocked due to narrow building side set-backs and side spaces cannot be used for any meaningful function. Tall buildings are casting shadows on adjacent buildings and streets resulting into dark corridors (Figure 7d). This spatial growth pattern is not sustainable when spatial quality requirements of visual, indoor sun lighting, skyline, space between buildings and cross ventilation are taken into consideration.

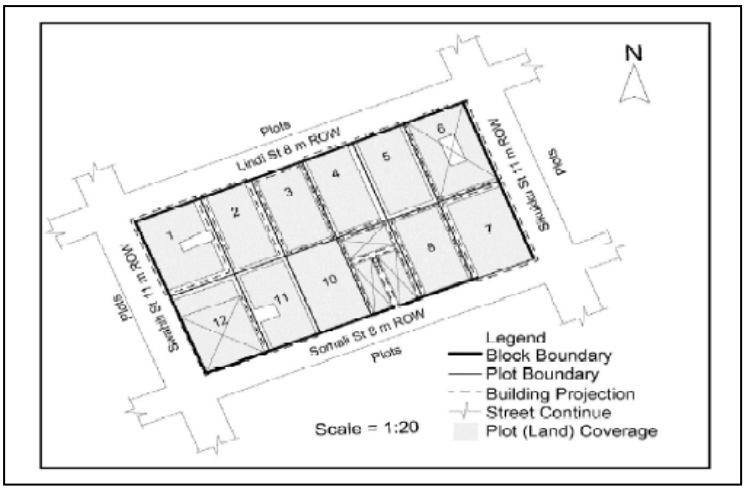

Figure 7a : Plot layout in Block 47 in Kariakoo Area

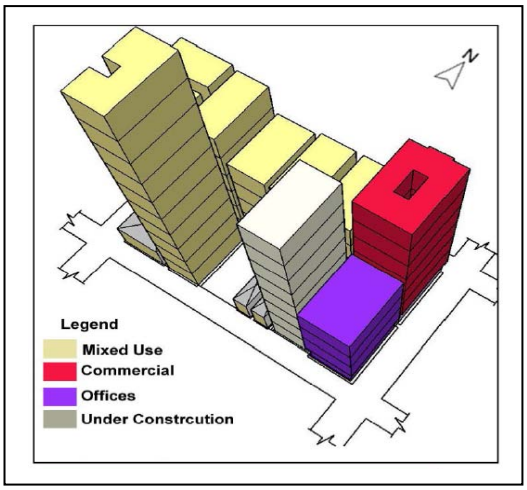

Figure 7b : Block Coverage 73%; Approved height 5-7 storeys

Figure 7c : Small side setbacks cause dark alleys and indoors spaces

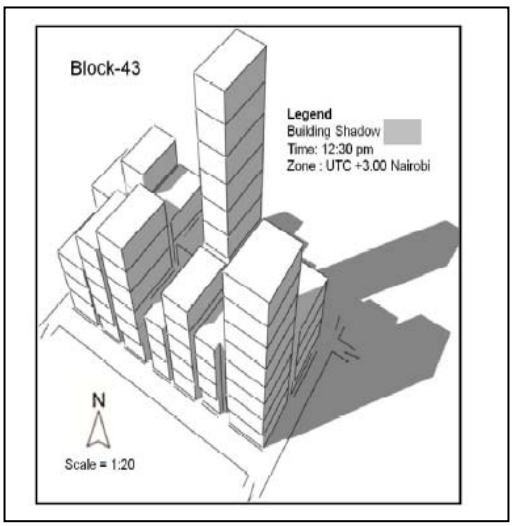

Figure 7d : Shadow effects on adjacent buildings and streets

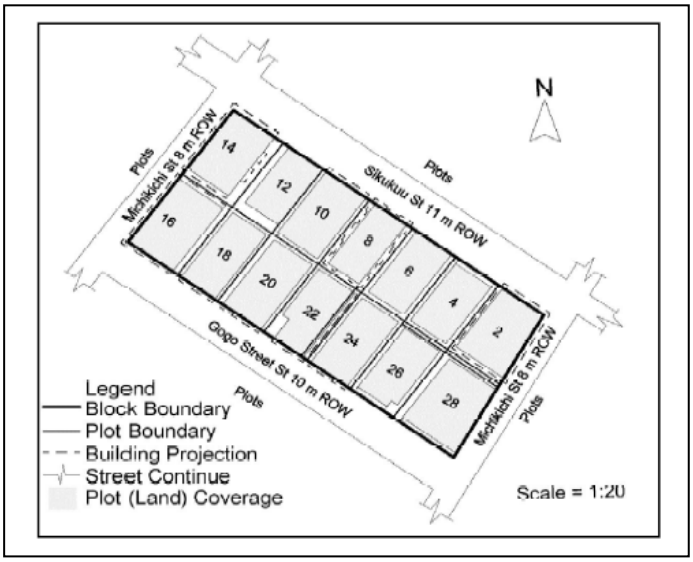

Figure 8a : Plot layout and building coverage in Block 43, Kariakoo Area

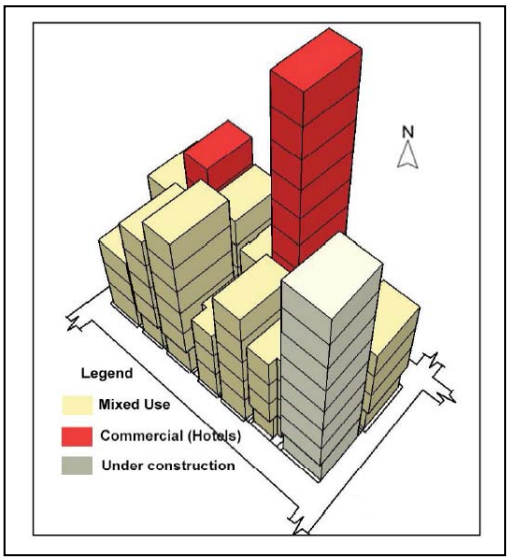

Figure 8b : Plot coverage 77%; approved height 5-7 storeys

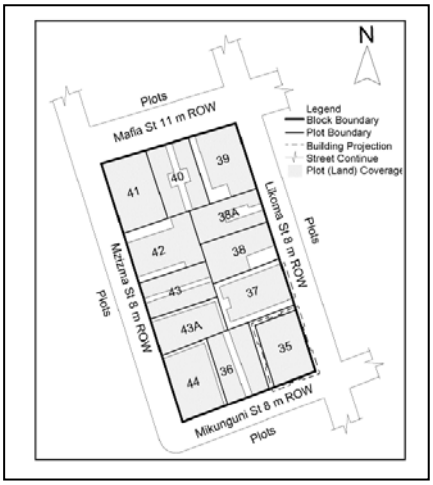

Figure 9a : Plot layout and building coverage in Block I

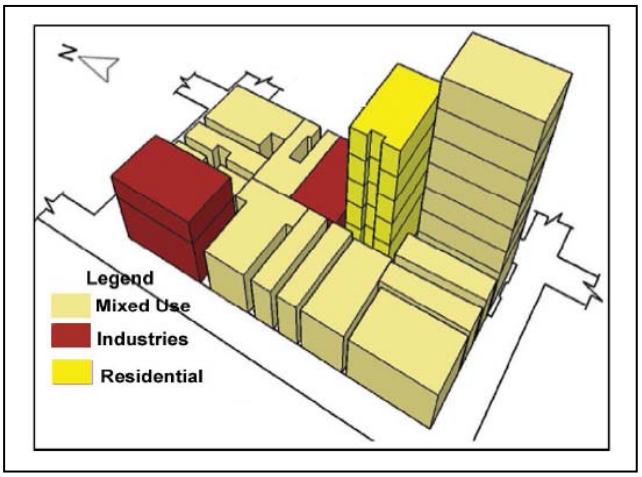

Figure 9b : Plot coverage 83%; approved height 2-4 storeys

VI. Results from Sinza

a) Building redevelopment guidelines for Sinza

Until 2014, the municipality of Kinondoni was yet to develop building densification guidelines for Sinza neighbourhood. Results from interviews with the Kinondoni Town Planner revealed that on average, they were receiving *3 to 10* applications for change of land and building use from residential to commercial from Sinza. In absence of a guiding framework for building redevelopment, plot coverage and floor area ratio were determined by using Government Notices, Orders and Circulars issued by the Ministry of Lands, Housing and Human Settlements Development of 1996. These guidelines are used to make decisions on plot by plot basis and as per specific requirement submitted by the plot developer. The Government Notice Number 157 of 16th May 1996 provides for the following guidelines as summarized in Table 6.

Table 6 : General guidelines for minimum plot size, plot ratio and site accommodation density

	ZONE I RESIDENTIAL							ZONE II SHOPS AND OFFICES		ZONE III SERVICE TRADE		ZONE IV	ZONE V	ZONE VI PUB. BUILD/ PRIVATE OPEN SPACES		
	A	B	C	D	E	F	G									
	Detached houses			Terraced	Multi storey/Block of Flats			Multi storey	One storey	Multi storey	One storey	General indu	Spec indu	Public build.	Schools	Sports grounds
	HD	MD	LD		HD	MD	LD									
Min Plot size	372	930	1395	112	930	930	2790	279	233	233	233	-	-	-	-	-
FAR	0.4	0.25	0.20	0.5	0.7	0.6	0.3	2.5	0.71/ 0.511	-	-	-	-	-	-	
Max coverage (%)	40	25	15	50	40	20	15	70	70	70	70	80	80	50	20	10
Habitab. rooms/ housing area	80	50	40	120	150	120	70	-	-	-	-	-	-	-	-	-

Source: Government Notice No. 157, (URT, 1996). (HD-High Density, MD-Medium Density, LD-Low Density)

Approval of applications for change of use and building permit is usually done by the Building Permit Committee which is a Sub-Committee of the Urban Planning Committee (UPC). Applicants have to lodge an application for change of use first and upon approval, one has to submit detailed drawings that indicate the intended developments.

b) Changing landscape of building heights in Sinza

Sinza was designed as a residential settlement for low-income people under the site and services schemes of the 1970s (Bhayo 2014; Lupala, 2002). The standard plot size was 288 square metres. By that time, this was the smallest plot size which was considered affordable by the low income people. Starting from mid 1980, commercial uses started to emerge in Sinza. These included retail shops, guest houses, hotels, small groceries, restaurants, service industries, social halls and boutiques (Lupala, 2002). In blocks A, D and E, 15 per cent of all buildings had been transformed from residential to residential cum commercial uses. Middle and high income people have been buying off low income people and reconstructing larger high-rise commercial residential buildings. The changing landscape of Sinza is largely attributed to the increase in land value following the establishment of the Mlimani City commercial complex and completion of the Sam Nujoma highway that marks the border with Sinza. As the case was for Kariakoo redevelopment is carried out is piecemeal and on plot-by-plot bases. While the original houses forms in Sinza were predominantly single storey residential buildings, increasingly, commercial and high-rise buildings of 6 to 10 storey buildings are emerging. Although this pattern of settlement development maximizes land uses, it also poses potential challenges to spatial qualities. The fact that plot sizes in Sinza are relatively smaller than those of Kariakoo, unguided building redevelopment is likely to lead into crammed housing with adverse effects on urban spatial qualities.

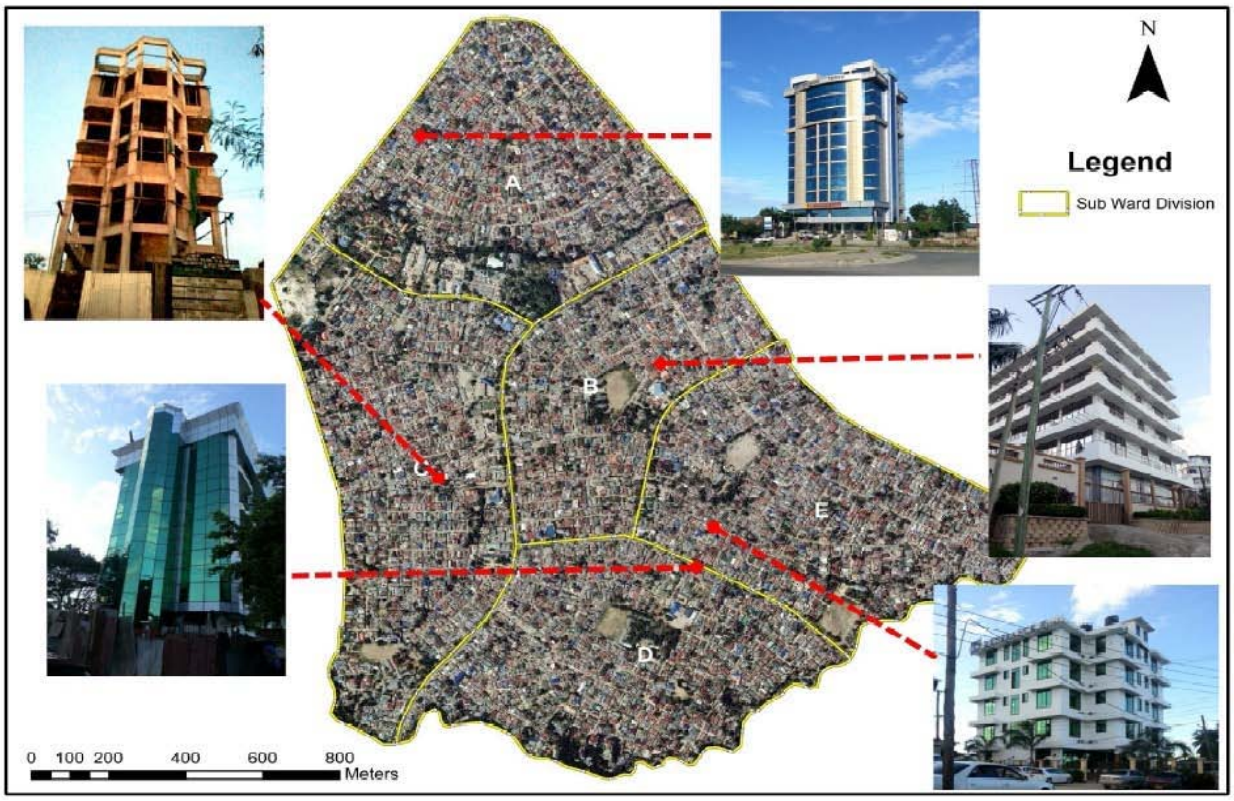

Figure 10 : Sinza settlement and the emerging high rise buildings

c) Building height in Sinza

The newly emerging buildings in Sinza are multi-storey but are still scattered and isolated to form a continuous skyline. The isolated buildings pose a threat of privacy to the surrounding low rise houses because people in the high-rise houses can have a view of indoor and outdoor activities taking place in the low-rise houses. If this trend will continue unchecked, the challenges of loss of privacy, blocked cross ventilation and sun lighting will be more apparent than the case is in Kariakoo.

d) Floor area ratio

The Floor Area Ratio (FAR) for Sinza was revealed to range from 0.1 to 0.5 in block A, D and E. Most of the buildings had FAR of between 0.5 and 1.0 and only two commercial buildings in block A and D had FAR of 3.5 and 5.5 (Table 6). Based on redevelopment guidelines relevant to Sinza, the maximum recommended FAR for residential plots is 0.7. As for commercial developments, the recommended FAR is 2.5. As was the case for Kariakoo, developers in Sinza were also violating the approved guidelines motivated by the urge of maximizing plot use. (Table 7)). Although the extent and number of high-rise buildings in Sinza is still limited, the emerging isolated cases pose a challenge on how new buildings development should be managed to contribute toward compact city without compromising liveability and spatial qualities.

Table 7 : Floor Area Ratio for Sinza

FAR	Block A	Block D	Block E
0.1-0.5	5	5	4
0.5-1.0	4	6	12
1.0-1.5	1	-	-
1.5-2.0	-	-	-
2.0-2.5	-	-	-
2.5-3.0	-	-	-
3.0-3.5	0	1	0
3.5-4.0	-	-	-
4.0-4.5	-	-	-
4.5-5.0	-	-	-
Above 5.0	1	-	-
Total	11	12	16

Source: Bhayo, May 2014

e) Plot coverage in Sinza

Results from field observations and measurement revealed that 15 out of 39 plots had plot coverage ranging between 51 and 60 per cent. The trend diminishes as coverage increase or diminishes around this figure. Only a few plots had higher coverage ranging from 91 to 100 percent. The latter represent newly constructed building (Table 8). The recommended maximum plot coverage for offices, shops and service trade is 70 percent and for residential categories is 50 percent. Again this shows the tendency of having plot coverage exceeding the recommended standards.

Table 8 : Plot coverage in blocks in Sinza

Plot coverage	Number of plots	Percentage of total plots
0-30	1	2.6
31-40	5	12.8
41-50	8	20.5
51-60	15	38.4
61-70	5	12.8
71-80	3	7.7
81-90	1	2.6
91-100	1	2.6
Total	39	100.0

Source: Bhayo, May 2014

f) Land coverage at block level

The established land coverage in blocks A and D was 54 per cent, while in block E was 56 per cent. The small variation in land coverage in Sinza at block level is attributed to the standardized plot and block size with smaller house sizes. In Kariakoo, there was a significant variation in plot sizes from one block to another (Table 9).

Table 9 : Land coverage at block level in Sinza

Block	Total block area (m2)	Total built up area (m2)	Land coverage (%)
A	3504	1906	54
D	3288	1781	54
E	4717	2651	56

Source: Bhayo, May 2014

g) Spatial growth pattern in Sinza

Although the skyline of Sinza is still dominated by single storey houses, isolated cases of high-rise buildings are protruding as monuments breaking the skyline amidst low-rise buildings. In terms of plot and block coverage, the present pattern indicate a modest coverage of about 50 percent. This creates a harmonious living and working environment with visual impressions within human scale. However, one of the potential challenges that is ahead of building redevelopment in Sinza is the small plot sizes which limits flexibility in designing functional multi storey buildings. For example the tall building in Block A (with 10 storeys) could be developed better if more than one plot were combined to provide ample surrounding spaces (Figure 11b). If it happens that adjacent plots will also developed in the same form, then the future spatial pattern will be too compact to provide the requisite qualities of sun lighting, ventilation, view and comfortable indoor living and working environment.

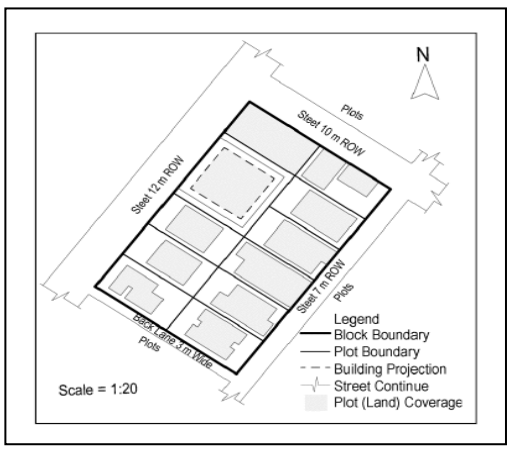

Figure 11a : Plot layout for Block A in Sinza Area

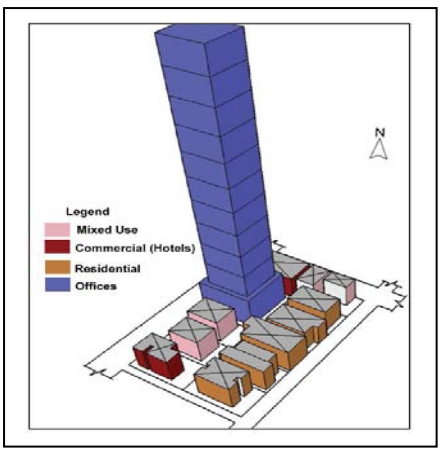

Figure 11b : Block coverage 54%, Approved height: Variable

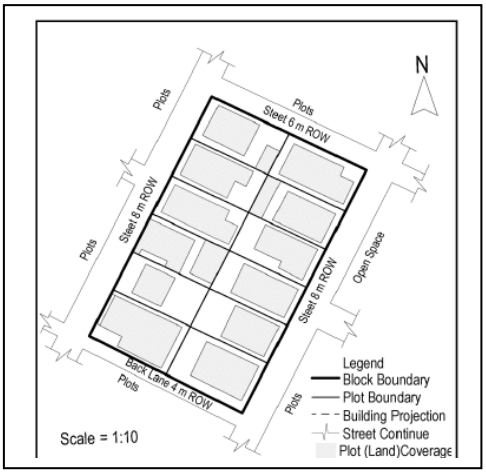

Figure 12a : Plot layout for Block D in Sinza Area

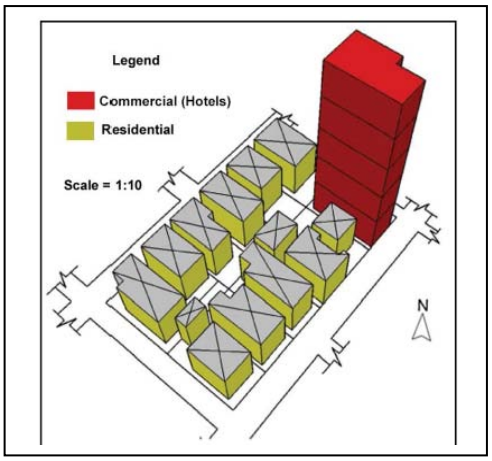

Figure 12b : Block coverage 56%, Approved height: Variable

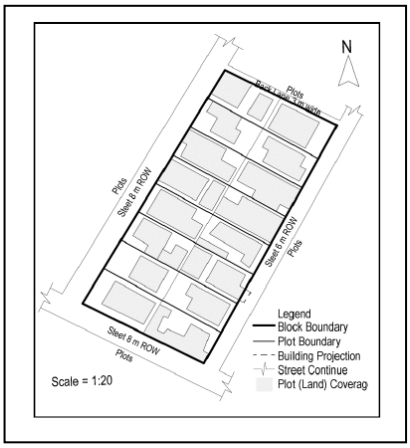

Figure 13a : Plot layout for Block E in Sinza Area

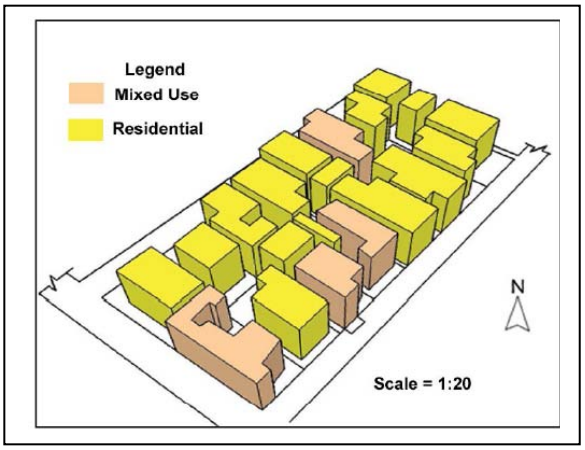

Figure 3b : Block coverage 56%, Approved height: Variable

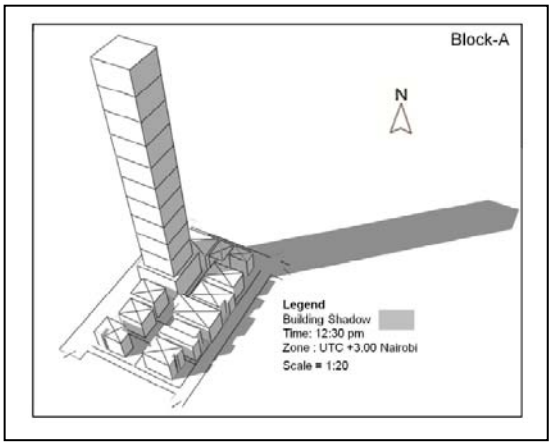

Figure 14a : Shadow effects on adjacent buildings and roads for block A Sinza

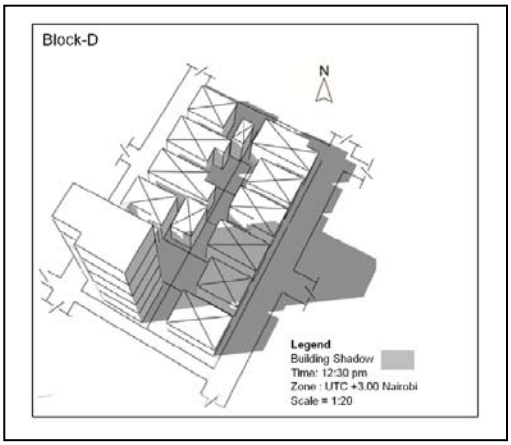

Figure 14b : Shadow effects on adjacent buildings and roads for Block D Sinza

VII. Discussion

Even though the spatial extent of growth of Dar es Salaam has reached as far as 32 kilometres, the revealed density gradients values are still as low as 20 percent at 15 kilometres for the year 2012. Compactness of the city is notable within a distance of less than 10 kilometre distance with density gradient values being more than 40 percent. If the 50 percent compactness is considered as optimal in most of the redevelopment schemes, only settlements developed within a distance of 5 kilometres from the city centre reveal this threshold. Arguing from compact development point of view or jaggedness, the city compactness is still too low to guarantee city spatial sustainability in terms of effective utilization of land and infrastructure. In other words, the city has sprawled horizontally with larger parts beyond the 5 kilometre radius having low land coverage. Based on similar premises for Dar es Salaam City, Lupala (2007) observed as follows; *"if the number of storeys in the low rise house types areas could be doubled, the extent of the built up area for the city could be reduced from 57,211 hectares to only 11,331 hectares. Similarly the horizontal expansion of the city could be reduced from 30 kilometres to 14 kilometres radii".* In other words the study indicated that house forms (low rise or high rise) had a significant contribution in urban sprawl compromising spatial sustainability of Dar es Salaam City.

In both cases, (Kariakoo and Sinza), it has been noted that the guidelines for building redevelopment are inadequate, and where availed, they were being violated with limited or no control from the concerned authorities. This has been revealed in terms of developers constructing buildings with more number of storeys, more plot coverage and floor area ratios than those recommended in the guidelines. Excessive plot coverage especially in hot and humid climatic zones like Dar es Salaam not only undermine spatial quality requirements for sun lighting, cross ventilation and view but also contributes to excessive use of electricity energy (Table 9). Electricity was usually put on during day times because of the shadows and darkness casted by tall buildings in Kariakoo. Reporting findings from Kariakoo, Monterroso (2008) wrote as follows; *"comfort in indoor living environment was largely dependent on orientation of openings. For buildings that had windows on the sides, natural sun lighting was blocked creating dark spaces and compelled residents to use electricity light during day times. This was caused by the compact siting of building closely juxtaposed from one another".*

Table 9 : Cross case analysis

Issue	Kariakoo	Sinza	Emerging issues
Building densification guidelines	• Guidelines were stipulated in the Kariakoo Redevelopment Scheme (2002) • Zoning plan for building height, uses, FAR, coverage provided	• There was no scheme to guide building densification • Government notices, circulars were used as guidelines	• Developers were violating guidelines on coverage AND FAR • There was weak enforcement of guidelines
Changing landscape in building heights	• Rapid transformation started in 1990s • Densification has reached 'saturation stage'	• Still in its infancy stages of transformation • High rise buildings are isolated and scattered	• Although densification leads towards compact development, spatial qualities are largely being compromised.
Floor Area Ratio (FAR)	• Recommended maximum FAR was 5.3 • Observed maximum FAR was 8.4	• Recommended maximum FAR was 2.5 • Observed maximum FAR was 5.5	Developers were violating recommended standard in urge of maximizing plot use.
Plot Coverage	• Recommended maximum plot coverage was 70 percent • Observed maximum coverage was 100 percent	• Recommended maximum plot coverage was 70 percent • Observed max coverage was 100 percent	Developers were violating recommended standard in urge of maximizing plot use.
Land coverage at block level	If recommended guidelines were followed, land coverage at block level was supposed to be 70 percent	If recommended guidelines were followed, land coverage at block level was supposed to be 70 percent	Excessive land coverage leads to excessive compactness, loss of spatial qualities and comfortable indoor living
Spatial growth pattern	Broken skyline due to varying building heights	Isolated cases of tall building with predominant low rise house forms	Broken skyline leads to poor visual impression, unused spaces, informal vertical development and loss of privacy for low rise house forms

VIII. Conclusion and Recommendations

It is apparent from the foregoing discussion that building densification is one of the key parameters for achieving compactness and sustainability. While compactness can be achieved both by increasing coverage and floor area ratios, this approach ought to be careful designed, guided and controlled to avoid the negative externalities emanating from crammed development. The cases of Kariakoo and Sinza serves to illustrate the fact that without proper guidelines for building densification process and effective development control, initiatives for achieving spatial sustainability in cities will not be realised. The potential challenges associated with unguided building densification have been revealed to include; blocked ventilation, loss of view, loss of privacy, broken skyline and creation of unused spaces between buildings. On the basis of these observations and empirical findings from the two cases the following are recommended. Firstly, there is a need of identifying all areas potential for building densification and preparing redevelopment schemes that will guide the densification process. Secondly, there is a need of establishing effective urban development control mechanisms to see to it that the recommended guidelines are followed by developers. Thirdly, in designing and redeveloping areas that command higher land values, the possibility of combining more than one plot should be considered. This will provide flexibility in design and address some of the spatial quality challenges that were identified in Kariakoo and Sinza.

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