

# Spatial Changes in Planning Status and Building Density in Dar es Salaam City, Tanzania

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## Abstract

There is abundant information on the extent and changes in coverage of human settlements in Dar es Salaam City, Tanzania but information on changes in building density, building consolidation levels and unbuilt-up or undeveloped areas is limited. The main objective of this research was to establish the planning status and changes in the spatial coverage of settlements, unbuilt areas, number of buildings, building densities and building consolidation levels in Dar es Salaam City between 2007 and 2017. The study deployed a literature review, remote sensing imagery and field verification. The study revealed firstly, that there are three main categories of planning status, two of which are well documented, that is planned and unplanned settlements, and unbuilt areas which are not extensively documented. Between 2012 and 2017, the spatial extent of planned areas remained more or the same, unplanned areas increased and unbuilt-up areas decreased. The city had a total of 367,278 buildings in 2007 and 675,644 in 2017 with an annual growth rate of 8%. The average building density for Dar es Salaam City in 2017 was 4.2 and the highest building density in unplanned areas was 48 buildings/ha while in planned areas, was 22 buildings/ha. The study recommends that concerted efforts are needed to control urban sprawl.

**Keywords:** regular pattern, unplanned areas, scarcely built areas, buildings consolidation levels, spatial coverage, undeveloped areas

## 1. Introduction

Dar es Salaam City is the main commercial centre of Tanzania located along the coast of the Indian Ocean in East Africa. It is still a relatively young city with rapid population changes, in the number of buildings, of planned and unplanned settlements, buildings consolidation levels and urban green areas. The city has five administrative districts which are also called municipalities of Kinondoni, Ilala, Temeke, Ubungo and Kigamboni, and 90 wards. As is common in many urban areas in -sub-Saharan Africa, Dar es Salaam is characterized by a development deficit in terms of infrastructure and services and dominance of unplanned settlements (Kiunsi, R. 2013). However, in recent years the city has witnessed a remarkable improvement in infrastructure and services as reflected by an increase in tarmacked roads, water supply, public transport, IT infrastructure and its related services. Studies conducted for several years reflect on the status and changes in the physical and socio-economic aspects of the city. Based on the literature review the following is an overview of the changes in the city area, population, planned and unplanned areas and building numbers over time.

According to Lupala (2002), the spatial coverage of Dar es Salaam in 1891 was only 122 hectares, 3081 in 1963 and 57,111 in 2001. In 2018 the spatial coverage of the city was extended to 159,000 hectares (Todd, G. 2019). The extent of planned and unplanned areas in 1992, based on spatial coverage, was assumed to be 65% and 35% respectively and 65% of the population was believed to be living in unplanned settlements (Sliuzas, 2004). As per the Tanzania State of Cities Report (2014), 64% of Dar es Salaam city was categorized as unplanned. However, in the same year, a report prepared by the Ministry of Lands and Housing and Human Settlements development pointed out that 77% was categorized as unplanned (Taarifa ya Urasimishaji, 2019). Informal settlements in urban areas of Tanzania are not illegal and are occupied by a good proportion of middle-class communities (Three City Land Nexus Research Team, 2020).

In terms of population dynamics, Lupala (2002), and the National Bureau of Statistics (2014); The United Republic of Tanzania (URT), Ministry of Finance and Planning, Tanzania National Bureau of Statistics and President's Office - Finance and Planning, Office of the Chief Government Statistician, Zanzibar, 2022) Dar es Salaam's population has consistently increased over time. In 1948 the population was 68,277 people, 782,000 in 1978, 1.4 million in 1988, 2.5 in 2002, 4.36 million in 2012 and 5.4 million in 2022. In terms of population growth rates, it can be said that the city has witnessed positive and negative changes in growth rates with an overall decline in growth rates. As an example population growth rates, between 1948 and 1957 was 7.1% per annum, 9.7% between 1967 and 1978, decreased to 4.8% between 1978 and 1988, further decreased to 4.3% between 1988 and 2002, increased to 5.6% between 2002 and 2012 and finally decreased to 2.6 between 2012 and 2022. The city has witnessed fluctuations in population density due to both population increase and changes in city boundaries. According to Lupala (2002) and NBS (2012), the population density in 1963 was 49 persons/ha, 66 persons/ha in 1967 and 74 persons/ha in 1978. In the year 2001, the population density decreased to 52 persons per ha probably due to a major expansion of city boundaries, in 2012 the population density went down to 31.3 persons /ha and the current density (in 2022) based on initial population results is 33.3.

Data on the number of buildings and building densities in Dar es Salaam as a whole is scarce. However, there is some historical data on residential buildings for the whole city and in some cases the number of buildings in selected areas. According to Lupala (2002), there were 170,000 dwelling units in Dar es Salaam in 1992 and as per the Dar es Salaam City Master Plan (2016-2036) in 2016 it was estimated that there were 952,334 housing units in the city in 2016 (URT, 2018). On urban greenery not a lot has been documented, however, it can be pointed out that the city has two main categories of green areas. The first category is green areas within built-up areas, also known as open spaces, which are prohibited from being developed due to planning decisions or due to their ecosystem characteristics. The second category is the undeveloped or unbuilt-up areas found in peri-urban areas. There are some studies on urban greenery within built-up areas for example (Mwageni & Kiunsi, 2021; and Persson & Liljeström, 2021) documented the extent and use of urban green areas. However, only a few studies are focusing on urban greenery in peri-urban areas.

The extent of planned, and unplanned areas, demography, number of buildings and scarcely built or urban greenery are constantly changing with time due to several reasons. This paper aimed to explore the status and changes in the recent past of planned and unplanned areas, scarcely built areas, building numbers and density and building consolidation levels. This is important firstly because some studies in the past used population distribution to characterize the extent of planned and unplanned areas in the city. Secondly, in the past, no comprehensive studies were done to establish the number of buildings and building density for the whole city. Thirdly is to show the extent of changes in undeveloped or unbuilt-up or green areas in peri-urban locations. Currently, only a few papers have documented these changes of greenery in peri-urban areas. Due to climate change, the protection of urban greenery is now more important as it can be used as one of the climate change mitigation options. Fourthly is to establish a more rigorous method for establishing building consolidation levels at the ward level. In the past buildings consolidation levels were established based on the number of buildings in a unit area. It is therefore expected that the results of this work will not only enhance the methodology for determining spatial dynamics including greenery in urban areas but will also be used as a base for determining future land use changes and building density in Dar es Salaam city.

## 2. Methodology

Several methods were used including a literature review, analysis of remote sensing images in which high-resolution satellite images (1m of pixel resolution) of 2007, 2012, and ortho-rectified aerial imagery of 2017 with a pixel resolution of 0.1m were interpreted followed by field verification. The ortho-rectified aerial imagery was sourced from the Ministry of Lands, Housing, and Human Settlements Development (Tanzania). Ward's shapefiles obtained from the National Bureau of Statistics (NBS, 2012) were used to demarcate each ward.

The planning status was established by polygon digitization of buildings and road infrastructure patterns using the high-resolution Dar es Salaam City ortho-rectified aerial imagery of 2017. Areas with regular building patterns and roads were classified as planned; areas with irregular buildings and road patterns were demarcated as unplanned areas; areas with very few buildings and road infrastructure and with no clear human-induced pattern were demarcated as scarcely built-up. Areas which had a combination of regular, irregular or with no human-induced patterns were classified as a complex of planned and unplanned areas. Based on spatial coverage of patterns of buildings and roads eight types of settlements or areas were identified in Dar es Salaam City as seen in Table 1. The coverage in the percentage of regular or irregular patterns in each ward was obtained by dividing the area of the particular pattern type by the respective ward area. The limitation of this method is that it can misclassify planned with poor development control as unplanned areas. This is because a lack of development control in a

planned area can lead to the loss of regular patterns.

Table 1. Criteria for determining planning status

S/N	Planning status	Percentage coverage of regular pattern
1	Planned	>90 of the regular pattern
2	Predominantly planned	51 to 90 of the regular pattern
3	Unplanned	< 10 of the regular pattern
4	Predominantly unplanned	< 49 of the regular pattern
5	Scarcely built	< 30 of regular or irregular pattern
6	Predominantly planned and scarcely built	Regular pattern > 50 and scarcely built > 25%
7	Predominantly unplanned and scarcely built	Regular pattern < 49 and scarcely built > 25
8	Planned, unplanned and scarcely built	<u>Regular pattern &lt; 50, irregular pattern &lt; 50 and scarcely built &gt; 25</u>

Building numbers were established by point digitization using high-resolution satellite imagery of 2007, 2012, and ortho-rectified aerial imagery of 2017. The number of buildings in each ward was automatically generated by overlaying the point shapefile with the ward's boundary. Density is a complex concept and can be derived in many different ways but in urban design and housing building density can be calculated by dividing the number of buildings in a unit area (Lupala and Bhayo, 2014; Visagie, & Turok, 2020). Therefore to get building density, the number of buildings in each ward was divided by area in hectares of the corresponding ward. Building density for each ward was obtained by overlaying the point shapefile of the building number and the polygon of the respective type of ward. Based on local conditions and to some degree literature review data on densities were classified into seven groups; sparsely built-up areas (< 1 building/ha) to extremely high (41 to < 50 buildings/ha). The details are provided in Table 2. The main limitation of this method is that it cannot differentiate between single and multi-storey buildings and also between buildings under construction and those which are fully constructed.

Table 2. Criteria for building density classes

S/N	Buildings/ha at ward level	Density class
1	41 to < 50	Extremely high
2	31 to 40	Very High
3	21 to 30	High
4	11- 20	Medium
5	6 to 10	Low
6	1 to 5	Very low
7	Less 1	Scarcely built

Building consolidation levels in wards were determined by taking into account both building density and building density change in a particular ward (Table 3). The idea is areas that are already more or less fully built or mature or saturated with buildings will have high building density and low building density changes. This is because such areas have limited space for additional buildings hence the low change in building density. The opposite is true for areas with low building consolidation levels, which will have few buildings, low density and ample space for additional buildings. The ample space in such areas can be used to construct many additional buildings over time and hence a high level of change in building density.

Based on local knowledge of the level of building development and planning status in the city wards, it was found that consolidation levels cut off points based on building density and change in building density was not the same

between planned and unplanned areas. This is because in planned areas the number of buildings which can be built is pre-determined, while in the unplanned areas, it is not. Therefore a planned area can attain its maturity at a relatively low number of buildings compared to an unplanned area. To differentiate consolidation levels between planned and unplanned areas the cut-off point of building density and change in building density was lower for planned or pre-dominantly planned areas compared with unplanned or predominantly unplanned areas. The same logic was used to differentiate cutoff points of building consolidation levels between low, medium and -high-density planned areas. Low-density planned areas had lower building densities and building density change compared to high-density planned areas. Table 3 shows the criteria for determining the planning status of settlements.

Table 3. Criteria for determining settlement consolidation types

S/N	Buildings consolidation types	Planning status	Building density (buildings/ha) and building density change levels
1	Highly consolidated	Planned ward	Building Density = 1.7 – 7 Building density change = 0 to 30%
		Predominantly planned ward	Building density = 4 -32 Building density change = 0 -22%
		Unplanned wards	Building density = 37 – 47 Building density change = 2 -3%
		Predominantly Unplanned wards	Building density = 12 – 47 Building density change = 1.5 – 8%
2	Consolidated	Planned ward	None
		Predominantly Planned wards	Building density = 4 – 23 Building density change = 10 -35%
		Predominantly unplanned wards	Building density 6 – 24 Building density change = 12 – 40%
3	Nearly consolidated	Planned areas	None
		Predominantly planned wards	Building density = 2 – 18 Building density change = 25 – 85%
		Predominantly Unplanned areas	Building density = 2 – 18.2 Building density change = 23 - 92%
		Unplanned areas	Building Density = 3.15 -16.9 Building density change = 45 -71%
4	Consolidating	Planned wards	None
		Predominantly planned wards	Density = 3 -9 Building density change = 112 -148%
		Unplanned wards	Density = 1 – 2.2 Building density change = 113 – 150%
		Predominantly unplanned wards	Density = 1 – 11 Building density change 100 – 400%
5	New buildings development area		Building density = 0.2 -0.12 / Building density change >100%
6	Scarcely built-up area		Building density < 0.2 Building density change > 300%

### 3. Findings

#### 3.1 Planning Status of Settlements in Dar es Salaam City

Planning status in terms of either planned, unplanned, scarcely built or a combination of two or three types was analyzed at two levels. Level one was to establish settlement status and its spatial coverage and the second level was to identify the types of planning status found in each district and ward. The main types of settlements in 2012 as can be seen in Table 4 were unplanned areas with spatial coverage of 32% of the city area, predominantly unplanned areas (24%), followed by scarcely built-up areas (35%), predominantly planned areas (7%) and planned areas (3%). If the unplanned and predominantly unplanned areas are combined and also if the same is done for planned and predominantly planned, the total unplanned area in 2012 was 56% and 10% for planned. The spatial distribution of planned areas in the five districts was as follows; Kinondoni District had the largest share at 54% of the total planned, followed by Ilala (20%), Temeke (17%), and Ubungo (8%). The spatial coverage of planned areas within each district was as follows; Kinondoni had the largest coverage at 8% of its area, followed by Temeke (5%), Ilala (2%) and Ubungo (1%).

Ubungo District had the largest share of the unplanned area at 49%, followed by Ilala at 39%, Temeke at 10%, Kigamboni at 3% and Kinondoni at less than 0.2%. The coverage of unplanned areas within each district was as follows; Ubungo at 95%, followed by Ilala at 53%, Temeke at 35%, Kigamboni (3%) and finally Kinondoni at 0.4%. In terms of scarcely built areas, Kigamboni District had the largest share of scarcely built-up areas (91%) and Kinondoni (9%). The spatial coverage of scarcely built areas within each of the two districts was 91% in Kigamboni and 19% in Kinondoni.

Table 4. Planning status at the District level, 2012

District	Kinondoni	Ubungo	Ilala	Temeke	Kigamboni	Total Area(Ha)	Total %
Area (km sq)	268.92	267.47	364.56	149.05	571.70	1621.70	
% of the planned area	8.39	1.25	2.32	4.91	0.00		2.57
% of the predominantly planned area	26.22	3.73	1.91	8.70	1.93		6.87
% of the unplanned area	0.43	93.10	52.60	35.22	2.88		31.50
% of the predominantly unplanned area	45.64	1.92	43.17	51.17	4.08		23.73
% of scarcely built	19.32	0.00	0.00		91.11		35.32
<b>Total</b>						<b>1621.70</b>	<b>100</b>

In 2017 as can be seen in Table 5, there was an overall reduction in spatial coverage of planned, unplanned, predominantly planned and scarcely built areas, giving rise to new complex types of settlement planning status. Unplanned areas were reduced to 25% of the city area, predominantly unplanned areas to 19%, planned areas to 2.4%, and scarcely built areas were reduced to 25%. Three new types of planning statuses identified in 2017 are first a complex of planned, unplanned and scarcely built-up areas which covered 8% of the city area, secondly predominantly planned and scarcely built 4%, and predominantly unplanned and scarcely built 10%. Ubungo District had the largest share of unplanned areas in the city at 44%, followed by Ilala at 36%, Temeke at 11%, Kinondoni at 5% and Kigamboni at 3%. The spatial coverage of unplanned areas within each district was as follows; Ubungo 68%, Ilala 41%, Temeke 32%, Kinondoni (7%) and Kigamboni (2%).

Kinondoni District still had the largest share of planned areas covering 7% of its total area, followed by Temeke at 9% and Ilala at 2%. Predominantly planned areas were again mostly found in Kinondoni District, covering 27% of its total area. The coverage of predominantly planned areas in the other four districts was low. A complex of planned and scarcely built was mostly found in Ubungo District covering 26% of its total area.

Table 5. Planning status at the district level (2017)

Planning status	Kinondoni	Ubungu	Ilala	Temeke	Kigamboni	Total area (Ha)	Total %
<b>Area (Km sq)</b>	<b>268.50</b>	<b>267.04</b>	<b>364.50</b>	<b>148.95</b>	<b>571.16</b>	<b>1620.16</b>	
% of the planned area	6.95	0.00	2.30	8.69	0.00		2.47
% of the predominantly planned area	27.19	4.46	0.16	3.09	0.85		5.86
% of predominantly planned and scarcely built	0.00	25.99	0.55	0.00	0.00		4.41
% of planned, unplanned and scarcely built	32.48	0.00	5.38	0.00	3.97		7.99
% of unplanned	7.19	67.63	40.77	31.35	2.10		25.13
% of the predominantly unplanned area	26.60	1.93	43.18	53.04	0.00		19.25
% of predominantly unplanned and scarcely built	0.00	0.00	7.65	3.83	21.55		9.67
% of scarcely built	0.00	0.00	0.00	0.00	71.54		<b>25.22</b>
<b>Total</b>						1620.16	<b>100</b>

A complex of planned, unplanned and scarcely built found mainly in Kinondoni District and covering 32.5 % of its total area. Scarcely built areas were found only in Kigamboni District and covered 72% of its total area. Figure 1 shows the spatial distribution of the different types of planning status in Dar es Salaam.

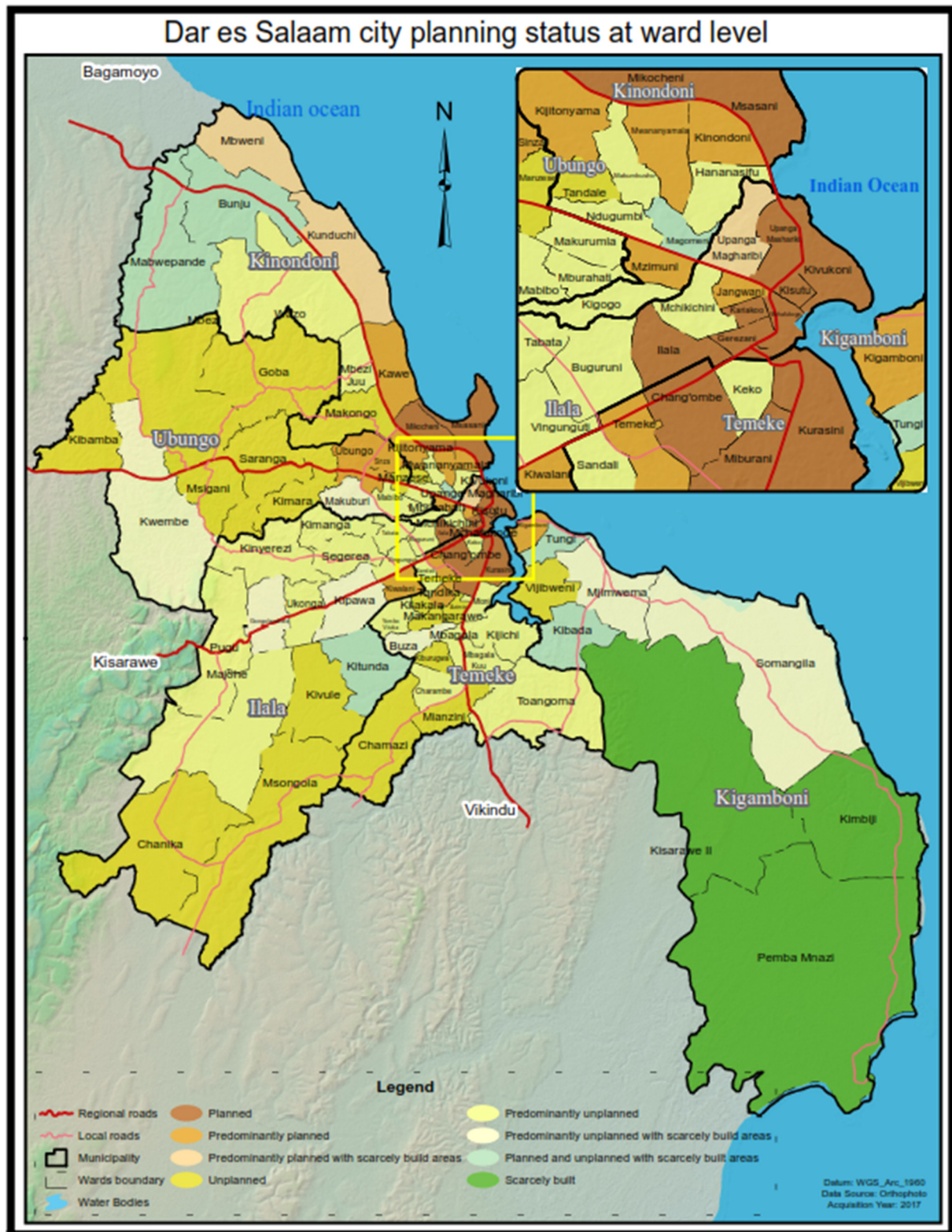


Figure 1. Planning status at ward level in Dar es Salaam City

### 3.2 Buildings in Dar es Salaam

Based on remote sensing image counts, the city had a total of 367,278 buildings in 2007, 500,291 in 2012 and 675,644 in 2017. A building in this context includes all types of buildings used for different purposes both single

and multistory structures. Table 6 shows that Temeke District consistently has had the highest increase in the number of buildings between the two periods, followed by Ilala, Ubungo, Kinondoni and Kigamboni Districts. In terms of change of the number of buildings percentage-wise, Kigamboni had the highest per cent followed by Temeke, Ilala, Ubungo and least of all is Kinondoni. Between 2007 and 2017 the number of buildings in the city increased by 8.4% annually. On the other hand, based on the preliminary population and household census report of 2022 the number of buildings in 2022 was 913,707 (The United Republic of Tanzania (URT), Ministry of Finance and Planning, Tanzania National Bureau of Statistics and President's Office - Finance and Planning, Office of the Chief Government Statistician, Zanzibar, 2022)). This means that between 2017 and 2022 the number of buildings was increasing by 7% annually. The majority of buildings in Dar es Salaam are single storey and this was confirmed by the 2022 census report which points out that 90% of structures are single-storey buildings, 4% are storey and 6% are under construction.

The rate of increase in the number of buildings differed among the five districts. Mature districts in terms of building and infrastructure development including Kinondoni had a low rate increase in buildings compared to districts such as Kigamboni which still have vast sparsely built areas.

Table 6. Buildings distribution and changes per district (2007-2017)

District/year	Area (Ha)	Number of buildings			Change building Numbers	% change	Annual % change
		2007	2012	2017	2007-2017	2007-2017	
Kinondoni	26892	93401	112668	129982	36581	39.17	3.92
Ubungo	26747	73441	100713	112974	39533	53.83	5.38
Ilala	36456	105646	149267	217581	111935	105.95	10.60
Temeke	14905	82871	114248	164415	81544	98.40	9.84
Kigamboni	57170	11919	23395	50692	38773	325.30	32.53
Total	162170	367278	500291	675644	308366	83.96	8.40

Table 7 shows the number of buildings in each type of planning status. It shows that predominantly unplanned areas had the largest share of buildings both in 2007, 2012 and 2017 followed by predominantly planned, unplanned, scarcely built and lastly planned areas. Scarcely built areas had the highest rate of annual increase of buildings, followed by predominantly unplanned areas, unplanned, predominantly unplanned areas and planned areas had the lowest annual increase of buildings.

Table 7. Number of buildings per planning status

Planning status	Number of buildings per year			Annual % change of buildings (2007-2017)
	2007	2012	2017	
Predominantly planned areas	71,937	79,131	86,634	2
Predominantly unplanned areas	256,029	355,750	509,793	10
Planned areas	2,197	2,210	2,481	1.2
Unplanned areas	35,086	58,392	63,774	8.1
Scarcely built-up areas	2,593	4,808	12,962	39.9

### 3.3 Building Density and their Trends in Dar es Salaam City

Figure 2 shows overall building densities in the city and at the district level between 2007 and 2017. The average building density for Dar es Salaam City in 2007 was 2.3 buildings/ha, 3.0 in 2012, 4.2 in 2017 and 5.6 in 2022. At the district level, Temeke has consistently shown high building densities over the years, followed by Kinondoni, Ilala, Ubungo and Kigamboni.



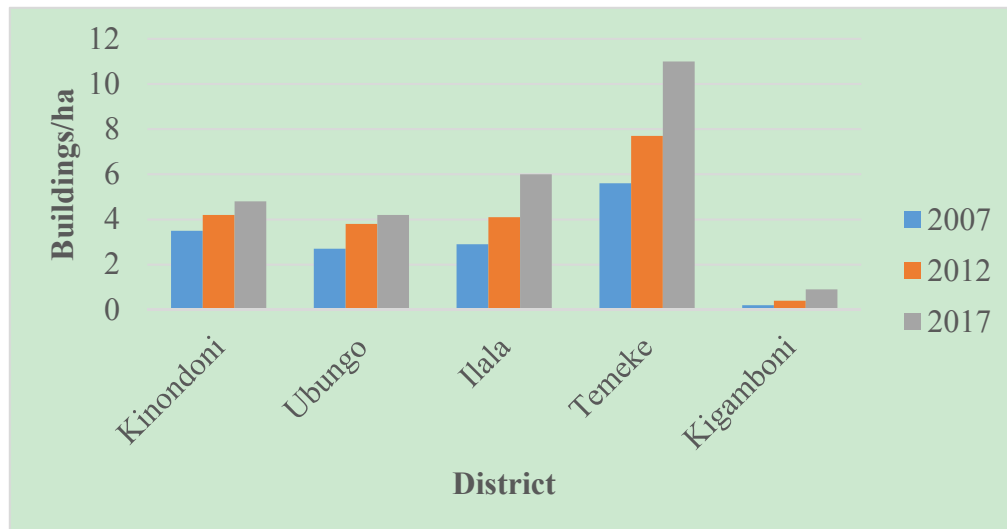


Figure 2. Building density trends at the district level in Dar es Salaam City

Analysis at the ward level showed that building densities ranged from less than one building in some of the wards located in peri-urban areas to about 50 buildings per hectare in highly consolidated unplanned settlements. Figure 3 shows the distribution of densities at the ward level in 2017 as follows. Planned wards in the CBD including Kivukoni, Kisutu, Mchafukoge, all located in the Ilala District, had very low to medium building densities (1-5 to 11-20 buildings/ha). Building densities increased to extremely high (41-50) and very high (31- 40) in unplanned wards located adjacent to the CBD. Examples of such wards include Tandale has the highest density in the city at 48 buildings per hectare, and unplanned include Makumbusho, Manzese, Makurumla, Kigogo, Ndugumbi and Mburahati for wards with very high densities. Figure 3 shows the appearance of buildings in Mburahati ward which has a building density of 31 to 40 buildings /ha. Thereafter, building densities commenced a gradual decrease towards peri-urban areas: from high, medium, low, very low and scarcely built. Examples of high-density wards (21-30 buildings/ha) include Mabibo, Makangarawe, Keko and Kilakala which are all unplanned.



Figure 3. Part of the unplanned Mburahati ward with a building density of 31-40 buildings/ha

Source; Fieldwork 2020

Medium-density wards which included both planned and unplanned wards included Charambe, Hananasifu, Mbagala Kuu, Tandika, Jangwani and Ilala. Low-density wards (6-10 buildings/ha) comprising both planned and unplanned included Temeke, Kawe, Mbezi Juu, Kitunda, Changombe and Miburani. Figure 4 shows part of low low-density planned area in Kawe ward in Kinondoni District. Very low density (1-5 buildings/ha) included Toangoma, Wazo, Goba, Kibada, Upanga Magharibi and Mikocheni, Scarcely built wards (<1 building/ha) included Kisarawe II, Kimbiji and Pemba Mnazi.

Between 2007 and 2017 there was an overall increase in building density by 84.5 per cent in Dar es Salaam. At the district level, the highest building density increase was in Kigamboni Municipality at 325% followed by Iala at 106% and Temeke at 98%. The municipalities with the lower percentage increase were Ubungo (50%) and Kinondoni (41%). Between this periods all wards experienced an increase in building density though at different levels. The level of increase in building density for the wards which had extremely high, very high or high building density in 2007 was low compared to wards with lower building densities. Similarly, the increase in building density was low in wards which were planned or predominantly planned and already built up. Examples of unplanned wards with low-density increase but with high density include Tandale (3%) and Manzese (2%).



Figure 4. Low building density planned area in Kawe ward

Source: Fieldwork 2020

The examples with high increases in density but relatively low densities are Chanika (966%) and Chamazi (857%). Examples of planned wards with a low increase in building density wards but with relatively high density are Karikoo (2%) and Chagombe (11%). In addition between 2007 and 2017, there was a significant reduction of wards which were scarcely built from 11 to three.

### 3.4 Building Consolidation Levels

In 2017 six types of building consolidation levels at the ward level were identified and are; highly consolidated, consolidated, nearly consolidated, consolidating, new buildings development areas, and scarcely built-up areas as shown in Figure 5. Highly consolidated wards covered only 6% of the total city area, consolidated 4%, nearly consolidated 14%, consolidating 10%, new buildings development area 35%, and scarcely built-up areas 31%. As can be seen in Figure 6 building consolidation levels were highest in Central Bussines District but decreased with increasing distance from the city centre.



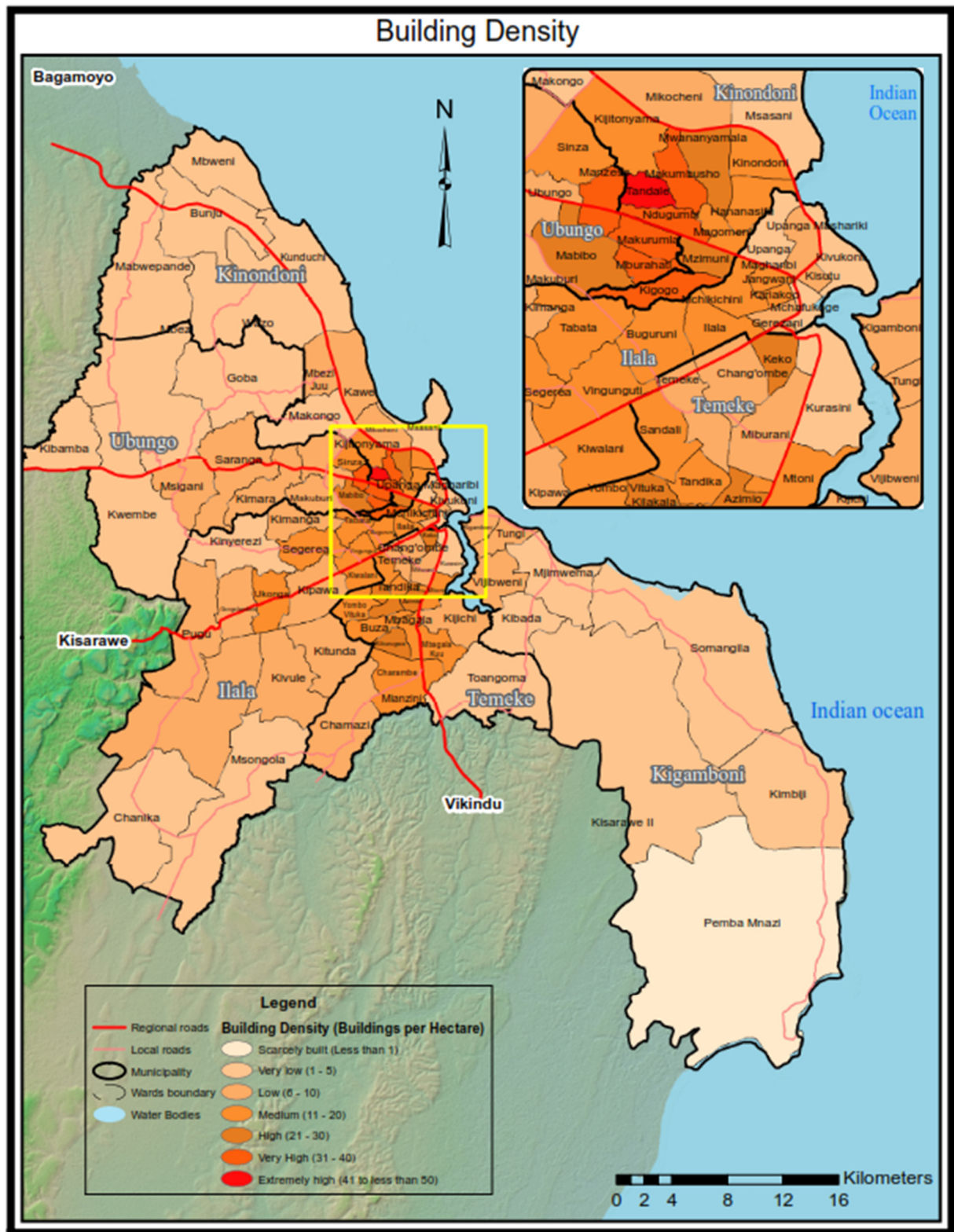


Figure 5. Building density at the ward level in Dar es Salaam (2017)



Figure 6. Buildings consolidation levels at ward level

Table 8 shows building consolidation types in each District. Ilala District has the highest number of highly consolidated wards followed by Kinondoni. Temeke has the highest number of consolidated wards followed by Kinondoni. Temeke has the highest number of nearly consolidated wards followed equally by Ilala and Kinondoni.

Temeke has the highest number of consolidating wards followed equally by Kinondoni and Temeke. New building development areas are found mostly in Ilala District followed equally by Kigamboni and Ubungo. Scarcely-built wards are found only in Kigamboni District.

Table 8. Types of buildings consolidation levels in districts (2017)

District	Number of wards				New building development areas	Scarcely built area	Total
	Highly Consolidated	Consolidated	Consolidating	Nearly Consolidated			
Ilala	13	1	2	4	6		26
Kigamboni			1	1	3	4	9
Kinondoni	10	3	2	3	2		20
Temeke	3	6	5	5	2		21
Ubungo	5	1	1	4	3		14
Total	31	11	11	17	16	4	90

Table 9 shows that 34% of highly consolidated wards were either predominantly planned or planned. 12 per cent of consolidated ward areas were either predominantly planned or predominantly unplanned. Nearly consolidated accounted for 19% of the wards, the majority of which were predominantly unplanned. While consolidating areas which accounted for 12% of the wards, the majority were predominantly unplanned. New building development areas were predominantly unplanned areas and accounted for 18% per cent of all wards. Finally scarcely built areas equal to 4% of all wards were found only in Kigamboni District.

Table 9. Buildings consolidation level against planning status

Buildings consolidation level	Planned	Predominantly planned	Predominantly unplanned	Scarcely built	Unplanned	Total	%
Highly Consolidated	6	14	9		2	31	34.4
Consolidated		6	5			11	12.2
Consolidating		3	7		1	11	12.2
Nearly Consolidated		5	10		2	17	18.9
New building development areas		2	11	1	2	16	17.8
Scarcely built area				4		4	4.5
Total	6	30	42	5	7	90	100

### 3.5 Number of Buildings in Different Types of Buildings Consolidation Levels

Table 10 shows the number of buildings and the change in the number and percentage of buildings in different types of consolidation levels between 2007 and 2017. In 2007 the number of buildings was highest in highly consolidated wards and low in scarcely built areas followed by consolidated wards. In 2017 new building development areas had the highest number of buildings followed by nearly consolidated wards. Change in the number of buildings between 2007 and 2017 was highest in new building development areas followed by consolidated. Change in building number percentage-wise was lowest in highly consolidated wards and highest in scarcely built areas.

Table 10. Number of buildings in different types of consolidated levels

Buildings Consolidation types	Buildings in 2007	Buildings in 2017	Change in the number of buildings	Percentage change (%)
Highly Consolidated	123,083	125,959	2,876	2
Consolidated	44,902	49,759	4,857	11
Nearly Consolidated	88,144	141,865	53,721	61
Consolidating	50,412	111,761	61,349	122
New buildings development areas	56,774	223,749	166,975	294
Scarcely built area	3,963	22,551	18,588	469

#### 4. Discussion

Based on the literature review two main types of planning status are normally taken into account in the city which are planned and unplanned areas (Magina, *et al.*, 2020). This paper has brought into focus a third dimension of planning status which is unbuilt or undeveloped or green areas. Due to climate change, green areas in peri-urban parts of the city have a huge potential to be used for climate change mitigation (Nero, *et al.*, 2017). Therefore green areas need to be protected and become part and parcel of city development plans as it is already being done in many other urban areas (Govindarajulu, 2014). As 80 per cent of the wards are made up of complexes of more than one type of planning status and therefore development plans should also take into account this matter. This paper has shown that unplanned settlements are increasing more rapidly than planned settlements and their coverage within districts is much higher than documented in the past (Kuffer, & Barros, 2011).

As in other cities in sub-Saharan Africa, Dar es Salaam is characterized as a sprawling city with 90 per cent of its buildings being single-storey and with an annual growth rate of 7 per cent between 2017 and 2022. Urban sprawl can negatively impact on environment, transport and energy, public health and provision of public services (Yiran *et al.*, 2020). The largest increase in the number of buildings was in predominantly unplanned and unplanned wards. Planned areas had the lowest increase in number of buildings. The increase of the number of buildings against building consolidation types is higher in new building developing areas which are located in peri-urban areas. These results tally with studies by Dar es Salaam and Mwanza Land Nexus Research Team (2020) which found that population increase was higher in areas located further from areas that were much more consolidated. The increase in higher number of buildings in unplanned was probably due to the easiness of getting a piece of land for building a house in terms of low price and limited development conditions of acquiring a piece of land (Dar es Salaam and Mwanza Land Nexus Research Team, 2020). The average building density for the city in 2017 was 4.2 buildings per hectare. The density could not be compared with other African Cities due to a lack of data.

#### 5. Conclusion

As expected areas covered by unplanned settlements increased more than planned areas. The unplanned settlements had higher buildings and building densities compared to planned wards. Building densities in unplanned wards with higher density values ranged from 21 to 48 buildings/ha while the highest value for building density in planned was 22 buildings/ha. Both building density and change in building density at the ward level were taken into account in establishing building consolidation levels. In 2017 only 24 per cent of the city area which is equal to 59 per cent of the wards was either highly consolidated, consolidated or nearly consolidated. The rest of the city was either still consolidating or were new building areas or scarcely built. The majority of the planned consolidated wards were found within the Central Business District (CBD) and residential areas for unplanned wards. About 50 per cent of buildings in 2017 were located in highly consolidated, consolidating and nearly consolidated areas. This finding tallies with the results of Dar es Salaam and Mwanza Land Nexus Research Team (2020) which found out that consolidated informal settlements housed half of Dar es Salaam's population.

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