FRAMEWORK FOR AN URBAN INFORMATION SYSTEM (UIS) IN AN AFRICAN TRADITIONAL URBAN ENVIRONMENT.

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Abstract
Frameworks used for acquiring and up-dating spatial information for digitization in African urban areas are usually based on a street address system. Although this is useful in many towns, the arrangement and on-going developments in traditional urban areas makes this type of framework inappropriate particularly because many plots are not accessible by any nameable route, and the number and size of plots over a given area is not finite over time. This paper reports on-going research intended to obtain a more appropriate framework for an urban information system (UIS) in Nigeria. It is based on a grid system and uses large scale multidate aerial photographs and existing maps to obtain a reference system for the UIS.

Introduction.
Data acquisition and organisation is still one of the most difficult problems in urban research in African countries. In traditional urban areas, where very detailed information is essential to understand more complex spatial relationships the situation is compounded by the fact that the framework used for organising data is not appropriate for the structure and on-going developments.
This paper presents a physical framework for organising detailed data and tracing developments in African traditional urban areas with the help of aerial photographs. The towns used are from Nigeria but the many characteristics these have in common with other African traditional urban areas makes it possible to use the framework widely.

**Data Organisation Problems in African Traditional Urban Environments.**

The term "traditional urban areas" in Africa refers to those towns whose structure and arrangement is characterised by a pattern used in building towns before western ideas of town planning were introduced (Mabogunje 1962, 1966; Sada and Akinbode, 1978; Urquahart, 1977). The towns are widely scattered, especially in West Africa, in former ancient kingdoms and empires, and include Ibadan (estimated population over 2m) Kano Zaria, Kumasi Bamako e.t.c. Although many of these have been more recently modified, the arrangement of buildings shown in Plate I is common in large zones within most of them.

Attention has been given in many countries to improving these towns because of their recent unprecedented growth (see for example Olorunfemi, 1983; Group V, 1977; Nkambwe, 1982). Due to a complete mix-up of land uses in their most traditional zones, information for planning and tracing developments is required to the details of an individual plot.

The most widely used system for locating individual plots in these urban areas is the one based on street addresses systematically numbered ascending order along a named route.
This framework is not appropriate for locating plots and tracing urban change for many reasons. Firstly, as Plate I shows a clear and identifiable route along which plots can be numbered is not always available. Many "plots" are only accessible by footpaths or alleys, while others use verandahs of neighbouring houses for accessibility, the latter clearly not nameable. Even where footpaths and alleys exist, they are not permanent features of the urban landscape as private developers have commonly erected building across them (Nkambwe, 1982, 1985). Secondly, while in most urban areas open spaces marked for later residential buildings are divided up into plots whose size is permanent and whose number is finite, here the number and size will depend on the demand for land in a particular extended family that owns the land. Continuous sub-divisions and restructuring or replacements further complicate the situation by increasing the number of plots without increasing the area necessitating re-numbering all the time. Moreover, as 'plots' develop by subdivision at different times on all sides of those existing, the numbering would have to be done in time sequence, and not in spatial sequence. Thus 100A need not be next to 100B since in time other 'plots' would develop between the two.

Concerning units of data collection, the current unit used, the ward, has three major disadvantages. Firstly, ward boundaries are in many cases not clear and not fixed and disputes on boundaries between wards are common. Secondly, the area that is supposedly under one ward is not always
contiguous and a ward may grow by leap-frogging over other wards. In some cases whether data collected in the sub-wards is taken as separate or as part of the original mother ward may depend on the political muscle of the chief of the mother ward at the time of data collection. Thirdly, the majority of wards include zones highly contrasted in density of buildings.

**An Operational Framework for the UIS**

Large scale multidade aerial photographs and maps were used in designing the framework for the UIS. Nigeria's national mapping is based on a system of rectangular coordinates from a Modified Transverse Mercator (MTM) Projection well described in a booklet from Nigeria's Federal Surveys Department (Federal Surveys, 1963). Each urban area in the country fits in this system and most towns have large scale maps on which the system coordinates have been drawn in 10-second square grids. Using information obtained from previous work on three traditional urban areas in southwestern Nigeria, namely Akure, Ilorin and Ile-Ife (Nkambwe, forthcoming), the 10-second square grid for Ile-Ife was divided into 5-second grid squares (about 2.64 hectares) as a suitable grid to be used as a unit of data collection. The geographic and the national coordinates for the town are given in Figure 1. This town was chosen for further development of the UIS as a good representative of traditional urban environments in Nigeria (Nkambwe, 1984, 1985). The original grid measurements as given in the figure use the imperial system but can be used to advantage since it fits in well with the geographical coordinates with 1000 feet equal to
10 seconds and therefore each 500 feet of the new grid equal to 5 seconds.

It may be noted that the figures in the national system of coordinates based on the MTM discussed above are very large. Also because Ile-Ife is more to the north than to the east of the starting point in the national system the northings are larger numbers than the eastings. To overcome both these problems the whole framework for the UIS for Ile-Ife was given a false $0$ in a southwest corner of the town to give positive readings north and east of this $0$. In placing the $0$ it was necessary to look for a point which would not be overtaken by the development of Ile-Ife in a few years. The Master Plan for the town to the year 2002 (Group V, 1977) gave some indication of this. However, to avoid any miscalculations by the Master Plan the $0$ was located 1.5km to the west and south of what the Master Plan has projected will be the furthest southwest corner of Ile-Ife in the year 2002. It may also be pointed out that any point chosen may be shifted and this will be reflected in any location by addition (if it is moved westwards or southwards) or substraction (if it is moved eastwards or northwards). The starting point chosen is any grid 122500N 740000E on the national grid which is taken as ON and OE in the UIS for Ile-Ife. To obtain the location of grid in the UIS for Ile-Ife these figures must be substracted from those given for the national coordinates. Thus grid square 1262500N/778000E becomes $(1262500 - 1225000)N (778000 - 740000)E$, or 37500N 38000E. However, the new starting point
must be given with the latter readings to put the new location in the national system which will be easily done by adding the true readings of the starting point to the reading given for the framework for UIS for Ile-Ife.

Figure 2 illustrates the framework for the UIS in greater detail for part of Ile-Ife to the south and west of the palace. The area covered has a southwestern corner marked 36500N 37500E. This actually is 1261500N 777500E in the national coordinates. The buildings in the figure are those that existed in 1970. The time periods in which they were constructed are divided into three: before 1950, between 1950 and 1960, and between 1960 and 1970, as was interpreted from aerial photographs taken in 1950, 1960 and 1970 at scales of 1:3,600, 1:9,600, and 1:10,000 respectively.

The area of Ile-Ife shown in Figure 2 ranks with the most problematic in the town in terms of accessibility to individual houses. It may be observed from the figure that the older houses are larger in general. The smaller houses constructed at later periods are mainly those that have resulted from the breaking up of the original large compounds, especially in the northern part of the area west of the palace. To the south of the area shown in the figure is a culvert and a valley which in 1950 was an open space especially in grid square 36500N 38500E. In 1950 therefore the area in the figure had a densely built up zone and an open space. More recent intense constructions reveal an increasingly complex
problem of accessibility. This has manifested itself within more recent years in many traditional urban environments in Nigeria in those zones of the urban areas which were not densely built up till recently. The aerial photographs for 1970 for Ile-Ife showed that foundations of new buildings were filling up the open spaces shown in Figure 2 complicating the numbering of plots or buildings further.

Within each 5 by 5 second grid it was necessary to obtain a finer subdivision to give the framework a system that exclusively identifies buildings in a spatial order. Starting in the southwestern corner of a grid as 00, each grid was divided up into 100 subdivisions to give smaller grid squares equivalent to about 1:97 by 1.97 m on the ground. This was small enough to identify the location of each house individually. A method of incorporating these finer subdivisions into the grid system formulated for the framework for the UIS was then devised to complete it. Since the last two figures of each grid for the UIS are 00 they were used to add the 100 subdivision of each grid of UIS. Also since 100 subdivisions represent 500 units in the grid each subdivision is 5 units. Therefore before adding the reading within the grid to the figures of the national grid, it had to be multiplied by 5. Thus if within grid 26500N 38500E a house is 22N 56E the later being within the grid square subdivisions, location in the UIS for Ile-Ife is (36500 + (22 x 5)) N (38500 + 56 x 5)E or 36610N 39780E. The location of this point would be easily done in a computerised UIS.
Table 1: Selected Information for Ile-Ife 37500N 38500E

Ile-Ife 1225000N 7400000E = 000N 000E.

Grid Square 37,500N 38000E.

Total Number of Buildings = 79

<table>
<thead>
<tr>
<th>Period of Construction</th>
<th>Number</th>
<th>Average Size (m²) (Ground floor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-1950</td>
<td>15</td>
<td>319</td>
</tr>
<tr>
<td>1950-1960</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1960-1970</td>
<td>64</td>
<td>152</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number</th>
<th>Location</th>
<th>Period of Construction</th>
<th>Size m² (Ground floor)</th>
<th>Number of Residents (1983)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37598</td>
<td>38012</td>
<td>1960-70</td>
<td>219</td>
</tr>
<tr>
<td>2</td>
<td>37530</td>
<td>38003</td>
<td>1960-70</td>
<td>150</td>
</tr>
<tr>
<td>3</td>
<td>37590</td>
<td>38010</td>
<td>1960-70</td>
<td>38</td>
</tr>
<tr>
<td>4</td>
<td>37584</td>
<td>38008</td>
<td>1960-70</td>
<td>56</td>
</tr>
<tr>
<td>5</td>
<td>37595</td>
<td>38021</td>
<td>1960-70</td>
<td>175</td>
</tr>
<tr>
<td>6</td>
<td>37582</td>
<td>38018</td>
<td>1960-70</td>
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</tr>
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<td>20</td>
<td>375773</td>
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<td>100</td>
</tr>
<tr>
<td>68</td>
<td>37530</td>
<td>38058</td>
<td>Pre-1950</td>
<td>250</td>
</tr>
<tr>
<td>75</td>
<td>37546</td>
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<td>Pre-1950</td>
<td>563</td>
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<td>76</td>
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<td>77</td>
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<td>Pre-1950</td>
<td>220</td>
</tr>
<tr>
<td>78</td>
<td>37508</td>
<td>38017</td>
<td>Pre-1950</td>
<td>438</td>
</tr>
<tr>
<td>79</td>
<td>37506</td>
<td>38028</td>
<td>Pre-1950</td>
<td>188</td>
</tr>
</tbody>
</table>
Table 1 gives some selected information from the UIS for Ile-Ife for grid 375000E. The individual buildings referred to in the table are numbered in Figure 2 for easy reference. The table combines information that was obtained from the maps and aerial photographs.

Conclusion.

The framework presented in this paper provides a base for obtaining data on the physical aspects of urban areas. This would be useful for example in keeping up with developments of buildings in order to combat illegal structures, finding out the rate of change in structures, getting information on the quality of houses etc. The demands of each urban area would determine what information would be collected. It may be argued that planners need a lot more information than this to be successful. The physical arrangements themselves are reflections of social practice and cannot be analysed in isolation. Furthermore, a whole range of social, economic and political data, essential to planning is not considered here. Much of this latter category of data has continuously been collected by individuals without a framework for organising it. Currently, although lack of secondary sources of data has forced each researcher to collect almost all data as primary data from the field, the absence of a framework on to which this data may be stored and retrieved, makes it difficult to use previous data even where it is relevant to many other subsequent researches, by the same or other
researchers. Consequently the rate at which one research builds on to previous researches is slowed. This framework offers researchers the opportunity of having access to previous data collected in traditional urban areas and thus probably speeding up the rate of research.

Reference


-------- (1985) "Route development versus planning in the traditional urban areas of southwestern Nigeria" Third World Planning Review Vol. 7 (no. 4), p. 323-338.


Plate I - Part of Central Ibadan
Fig. 2 The UIS Grid for part of Ille—Ilfe