GEOGRAPHIC TARGETING FOR POVERTY ALLEVIATION IN NIGERIA: A GEOGRAPHIC INFORMATION SYSTEM (GIS) APPROACH

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ABSTRACTS

The scourge of poverty and its resultant negative impact on Nigeria's economic development has been notably great. The economic recession experienced since the 1980s did wipe out the economic gains of the post-colonial oil boom era of the early 1970s. The government has had to contend with low or negative economic growth, tight fiscal constraints, and external debt burden. This situation has led to the increased use of targeting mechanisms in transferring benefits to the poor. While the importance of geographic targeting (GT) in tackling poverty is well known in literature, the employment of GIS as a tool for effective and efficient GT is relatively unknown. Thus its great potential in relating non-spatial data to its corresponding location on ground and its superb analytical mapping prowess remains widely unutilised. In this pilot study, digital cadastral maps form the spatial database and socio-economic, demographic data of the populace in the selected region form the attribute (non-spatial) database in the Geographic information system for geographic targeting (GTGIS). The focus of the GTGIS project is two dimensional in nature. It is concerned with utilizing GIS for poverty assessment on the one hand and utilizing GIS for geographic targeting on the other hand. This paper is more concerned with the latter, that is, attempting to demonstrate the utilization of GIS in simulating geographically targeted poverty alleviation programmes at household and neighbourhood levels within the city of Ibadan (a World Bank/UNDP, UNCHS (Habitat) "Sustainable Urban Management Programme" case study). The GTGIS project is aimed at making the use of GIS standard for geographic targeting.

1 INTRODUCTION

Geographic targeting has been employed in several poverty alleviation programmes worldwide. In Latin America, programmes such as the Mexican Tortilla and Milk programs, the Venezuelan Day Care Centres program, and the Honduran Food Stamp Program, use geographic location in targeting direct transfer. The potentials of geographic targeting for minimizing poverty in India and Indonesia have also been investigated (see Ravallion and Datt, 1991 and Ravallion, 1992 cited in Baker and Grosh, 1994).

There are some GIS related poverty application studies. Brent and Conning (1992) in their bid to identify pockets of poverty, integrated population census database (microcomputer-based software package) with GIS via software-interface. Data on some indicators such as the physical condition of dwelling units, overcrowding and income were collected at household level. The work of Asensio (1997) focused more on the targeting aspect of poverty alleviation. In his work, census figures were used alongside air photo interpretation within a GIS environment. Indicators used were numerous and varied, which revolved around unemployment rate, health-infant mortality rate, ethnicity, educational attainment of female household heads and housing quality. The level of data aggregation was the building block. Manansala, (1999) developed and demonstrated a GIS-based poverty monitoring system for the city government of Angeles in the Philippines to improve poverty monitoring and analysis. This would enhance the formulation, planning and implementation of poverty alleviation programmes. The system was developed in a GIS environment to integrate and structure different poverty data sets from various sources in a common database to facilitate data analysis and their integration to the geo-information of the city to provide for their spatial dimension. Furthermore a simple interactive graphic user interface was designed so as to enable users with limited knowledge of computing to operate and interact with the system.

On the African continental scene, the use of GIS is a phenomenon of the 1990s. Its importance is just beginning to be appreciated and its adoption is a new trend in Africa, particularly in Nigeria. This situation is replicated in other African countries. According to Mhango (2000), "In Africa, GIS applications are largely limited to natural resource management and exploitation. This makes the technology look a bit alien in addressing basic human needs". The use of GIS as a tool for geographically targeting benefits to the poor is novel.

Pervasive human deprivation and poverty have become the plight of oil-rich Nigeria. Despite her huge natural and human resources, the country remains very poor, having been ranked as one of the 25 poorest nations on earth. Well over 67 million (61%) of Nigeria's 120 million people are living in poverty. The incidence of poverty showed that of the Nigerian households about thirty-six percent (36%) are extremely poor (those who are unemployable and are unskilled, whose daily meals are not guaranteed because their incomes are very low or nil), thirty-five percent (35%) are moderately poor (FOS, 1996). The application of GIS to the field of poverty alleviation is viable, since problems of poverty and other social ills have spatial dimension (that is, vary from one geographical location to another). It is now imperative to annex and demonstrate the usefulness of mapping for proper targeting and identification of who and where the nation's poor are. Nigeria has the obligation to channel the gains of her external debt cancellation to reform the economy and ensure provision for the economic and social development of her people.

This paper attempts to describe efforts directed at designing and implementing a GIS for simulating geographic targeting to the poor. This is in order to fine-tune geographic targeting procedures as utilized in the design and implementation of poverty alleviation programmes. This will make such programmes more objective, effective, economical and standardised.

2. BASIC PROCEDURES IN GEOGRAPHIC TARGETING

2.1 Definition of Geographic Targeting

GT aims at targeting benefits to the poor based on certain criteria in relation to where they live (residence) or where they are found (region). In this study, households and neighbourhoods are ranked based not only on the income (or consumption) of the households but also on several indicators of quality of human life (QHL). The poorest households and neighbourhoods are assigned benefits based on their actual needs as against their supposed needs. Programmes to improve or extend infrastructure, social service, or transfer programs can then operate in those identified households (neighbourhoods). According to Baker and Grosh (1994) sometimes indicators of social service availability or social outcome are used singly or in a compound index. The poverty measures used for this study are:

2.2 The Place of GIS in Geographic Targeting

GIS is useful not only in inventory mapping of poverty but also in its use for mapping the results of the various poverty measures chosen for geographic targeting (whether income based or composite QHL indices). The poverty state of each household based on a given criterion can be mapped. This helps to identify poor households based not only on where they live but also on their income and welfare levels. The usefulness of GIS in geographic targeting surpasses that of other information systems since it seeks to establish a direct relationship between information and their locations on the earth in an ordered spatial framework (Ayeni, 1979). It provides important insight into poverty reduction and alleviation through the mapping of variations in household income (consumption) with their socio-economic characteristics in specific locations.

2.3 Feasibility Study

Since the adoption of GIS is still in its inception in Nigeria, there is the need to demonstrate its applicability to targeting poverty at household (micro-economic) level. The amount of success achieved in the GTGIS project would go a long way to accelerate the adoption of GIS for geographic targeting, not only at the micro but also at the meso and/or macro-economic levels. Household poverty is the main focus of this study because it is at this level that the primary manifestation of poverty occurs.

GIS is superior to classical methods in that it has a larger capacity for storage and manipulation, and derives effective results on making decisions by analysis and mapping (see Maras and Altan, 2000). With the gradual shift from manual to digital data processing in the Federal office of Statistics (FOS), procedures should be put in place to begin to utilize GIS. Its adoption will greatly improve the type and use of household data collected by the FOS. This will definitely foster the increased use of household data, such as data from the National Integrated Survey of Households (NISH) for policy decision-making on poverty alleviation.

3. GEOGRAPHIC TARGETING COMPONENT OF GTGIS

Prior to the use of any GIS is the design and implementation of a database. The database is very crucial with its management being the major force in GIS design.

3.1 The Design of GTGIS

The database for the GTGIS was conceptually modelled following the entity-relationship (ER) approach (see Date, 1995) as shown in figure 1. All datasets and their relationships required for the application were identified. The conceptual schema was defined using a relational data structure.

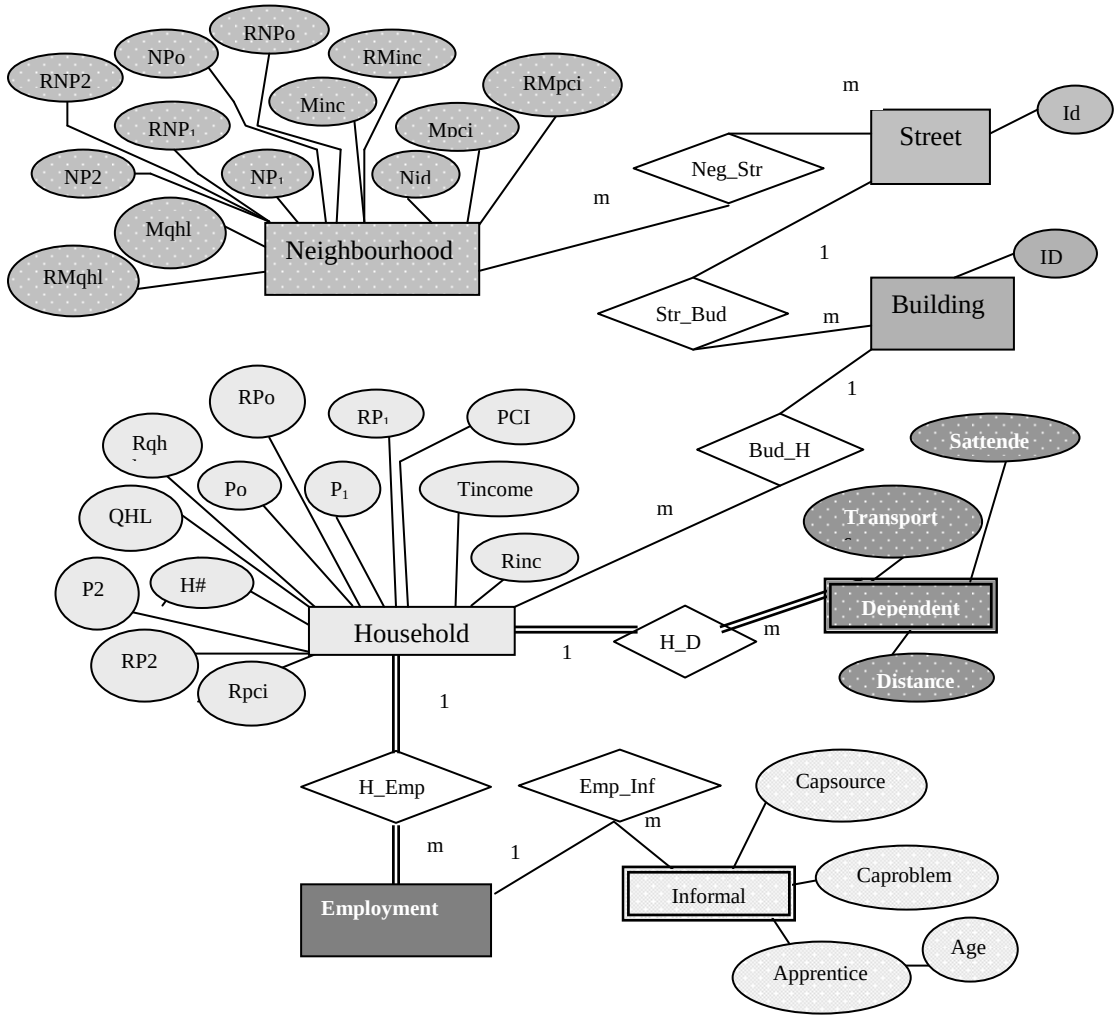

Figure 1: Conceptual Data Model for Geographic Targeting in GTGIS
(Po-Incidence, P_1-Intensity, P_2-Severity, PCI-Per capita income, N-neighbourhood, inc-Income, M-Mean, R-Ranking, Tincome-Household total income, Capsource-Source of capital, Caproblem-Problem encountered at business set up, Sattended-School attended, Qhl-quality of life)

3.2 The Implementation of GTGIS

The database design made was implemented to full specification by using the ARCVIEW GIS 3.1 package. For the six local government areas (LGA) making up Ibadan metropolis, digital and paper maps on scales 1:10,000 and 1:1000 are available from the Oyo state ministry of physical planning. From the 1:1000 cadastral paper maps, the street network and housing blocks were digitised using the ILWIS 2.2 software. This formed the spatial database in the GTGIS. Data in the attribute database concerning the socio-economic characteristics of each household, buildings and neighbourhoods were keyed in manually via the keyboard. The hardware utilized are Pentium-III 550 Intel MHz, 13GB, 64MB Ram, 44X CD, CTX 14" VGA colour monitor, A3 size digitiser and an HP DeskJet 710c series colour printer. The functional architecture of the GTGIS is shown in figure 2.

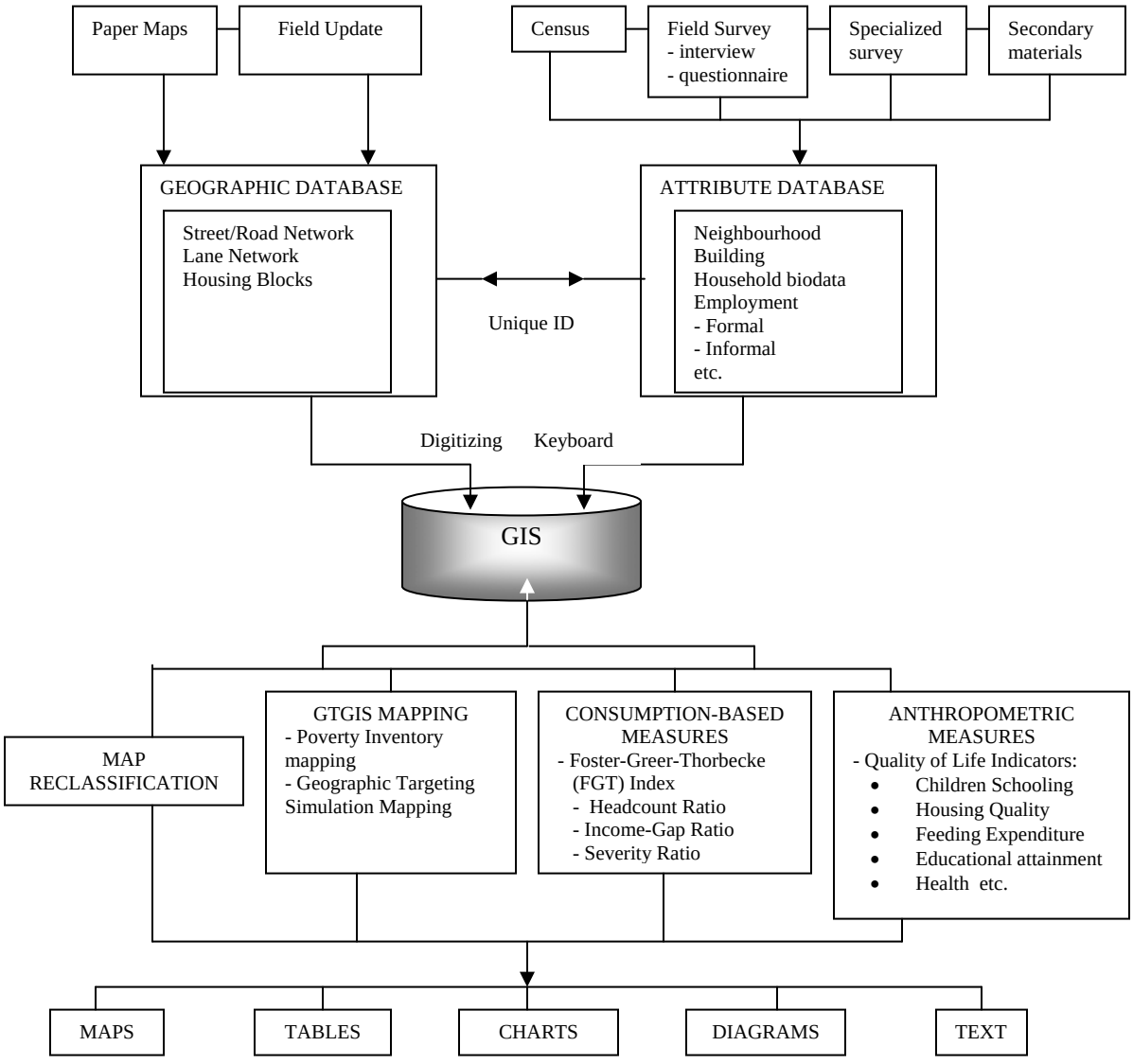

Figure 2: Functional architecture of GTGIS

A Nigerian urban centre was selected as case study, Ibadan. The city of Ibadan is one of the twelve (12) urban centres selected worldwide for the study "Sustainable Urban Management Programme" in 1996. The three sample neighbourhoods consisted of high, medium and low residential density zones (RDZs) respectively (see figure 3).

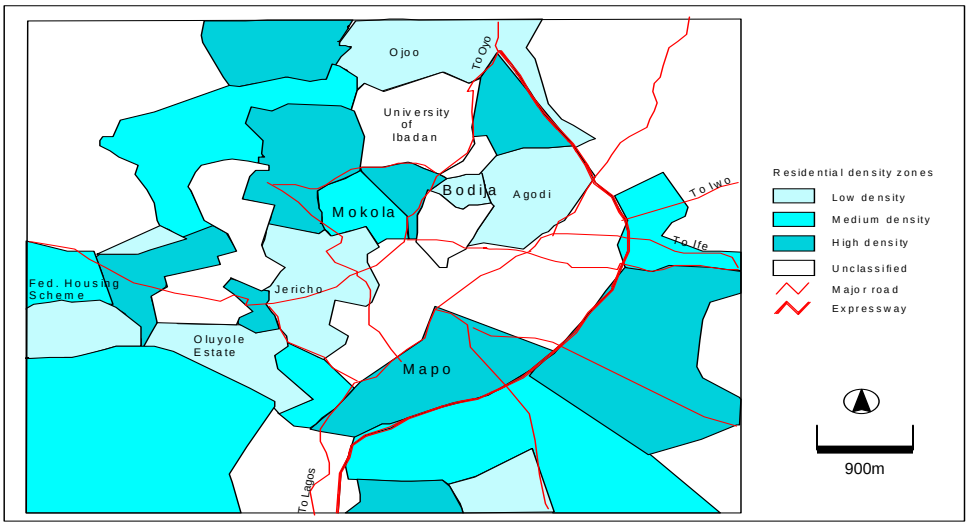

Figure 3: Residential density zones in Ibadan Metropolis (Adapted from Ayeni, 1995)

It was considered as appropriate to borrow standardized poverty measures from the fields of Economics and Sociology for assessing urban poverty in the sample areas. The Foster-Greer-Thorbecke (FGT) poverty index (see Foster et. al, 1984) and Quality of life (QHL) indices were calculated at both the household and the neighbourhood levels. For this study, GIS was used to carry out poverty inventory mapping and geographic targeting simulation using different schemes in targeting poor households and/or neighbourhoods for transfers. It is with the mapping of these schemes that we are concern ourselves in this paper.

3.2.1 Geographic targeting simulation mapping

Poverty alleviation necessitates the redistribution of resources from the non-poor to the poor (see Afonja, 1996). Poor households and neighbourhoods needing intervention (transfers) are at various degrees of vulnerability to poverty. This necessitates that simulation for geographically targeting the poor is at household and neighbourhood level. Geographic targeting simulation involves ranking each household and neighbourhood according to their scores using a given poverty measure. A rating scale from 1….n: where 1 is most vulnerable and n is least vulnerable (n is the last number signifying the position of the last vulnerable household/neighbourhood) was used. An example is figure 4, which shows the household per capita income (PCI) scheme in the three sample areas. Under this scheme the moderate poverty line (MPL) of ₦2203 ($15) per person per month was used in demarcating poor households from non-poor households. Households with per capita income below the MPL were noted as poor and were ranked according to their level of vulnerability to poverty. Households in the 'most vulnerable' class are in greater need of transfers than households in the other categories. Household PCI is derived by assuming equal sharing of household income among members of a household.

At the neighbourhood level, vulnerability to poverty varies as well between the sample areas. From figure 5, we can deduce the vulnerability of these neighbourhoods to poverty from the intensity of extreme poverty occurring in them. The extreme poverty line was set at ₦1101 ($7). The intensity of poverty (income-gap ratio) helps in targeting poor neighbourhoods based not only the fact that they are poor but also on how poor these neighbourhoods are.

Figure 4: Household per capita income scheme

Alternatively, QHL poverty indices can be used as geographic targeting schemes. However FGT and QHL poverty measures are best seen as complementary. This is because the former is purely income based, which does not take into consideration welfare aspects of poverty as the QHL does. A close look at figure 6 reveals that households in the 'lowest quality of life' category as obtains in the high RDZ would be in greater need of intervention than households in other categories. About thirty-three different socio-economic variables were weighted to make up the household composite QHL index value for each household (see Moser, et al., 1996).

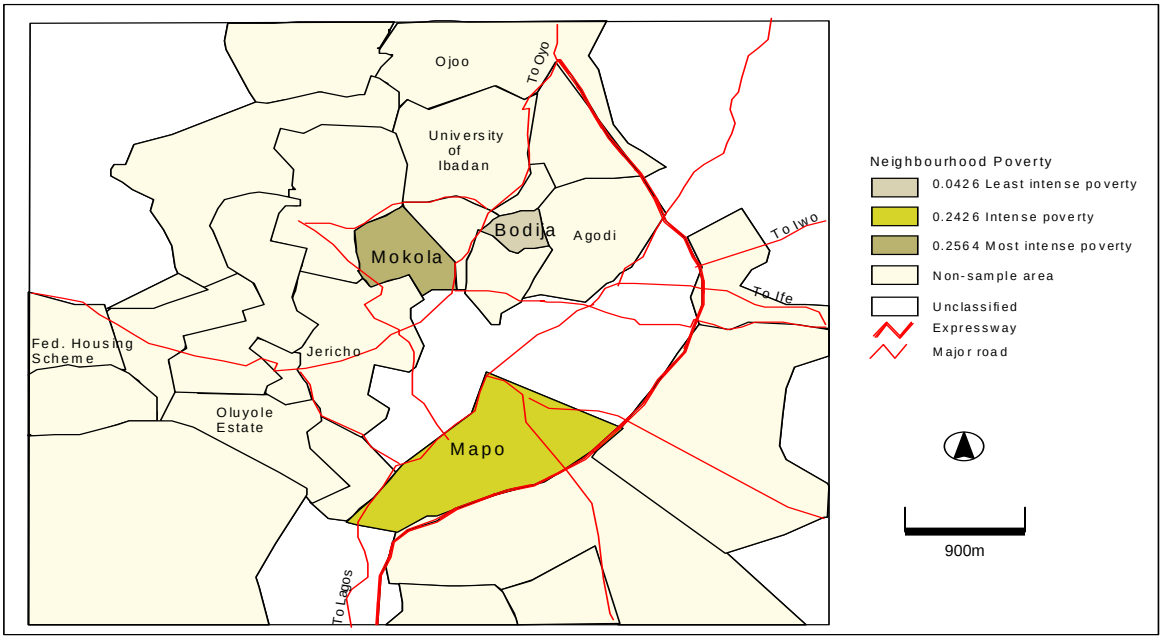

Figure 5: Intensity of neighbourhood extreme poverty

Apart from targeting the poor either at household or neighbourhood level, it is of utmost importance to be able to alleviate their poverty by intelligently getting transfers across to them in various forms based on their actual needs as opposed to their supposed needs. A targeting strategy for a poverty alleviation programme aimed at building primary/secondary schools in a poor neighbourhood was designed using the parameters in table 1.

Table 1: Simulating transfer to a poor neighbourhood (primary/secondary school)

Parameters		**Neighbourhoods**		
		High RDZ (%)	Low RDZ (%)	Medium RDZ (%)
Percentage of school-age children		63	71	71
Type of school attended	Public	67	7	69
	Private	18	77	29
	Private/public	4	3	0
	Dropout	4	0	0
Mode of transportation	Trekking	44	0	57
	Taxi and Bus	39	20	34
	Private Cars	0	70	6
	Boarding	0	7	0
Average distance to school		1083m	1417m	882m

The mapping of these parameters helps to fine-tune geographic targeting in order to improve upon its efficiency as a targeting mechanism for poverty reduction (figure 7). Where the students attend public schools, majority trek to school while the few minority board commercial vehicles such as buses and taxis. In the medium RDZ, none of those attending public schools have access to private cars. Looking at the distances

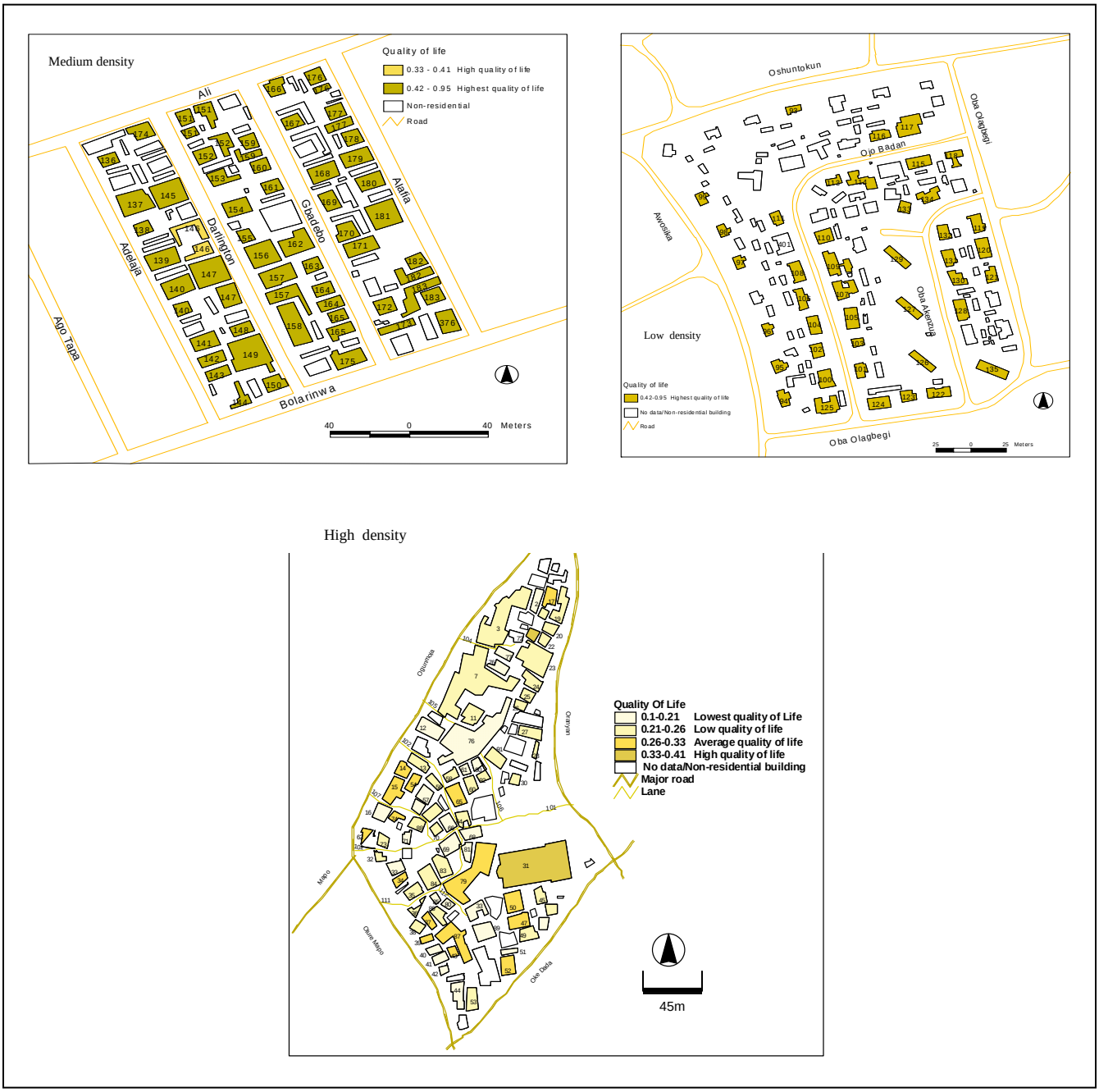

Figure 6: Household composite quality of life scheme

travelled from home to school, students having access to private cars are more likely to travel longer distances, as is the case of the low RDZ. However in the high RDZ, the students do not have access to private cars and

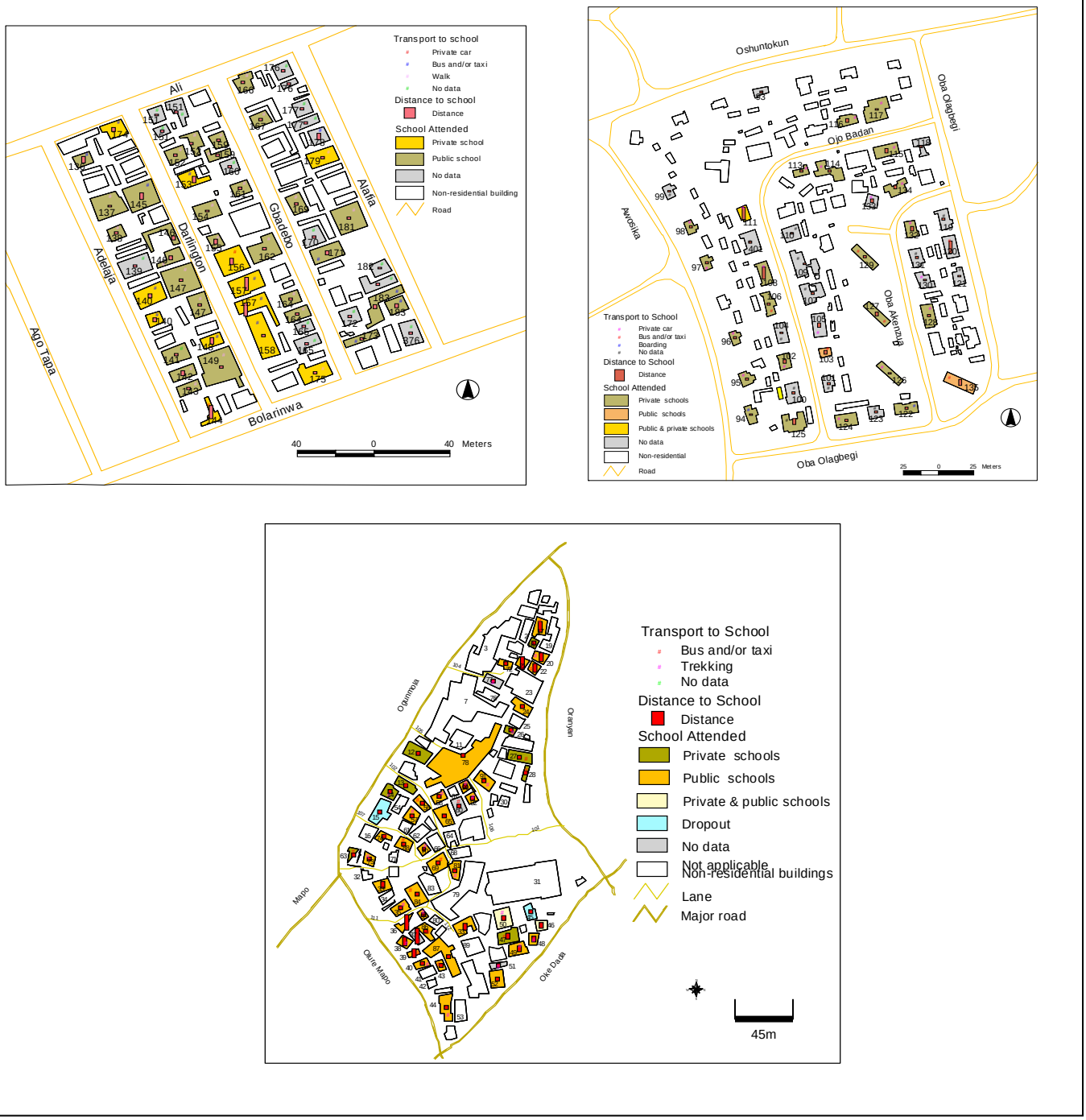

Figure 7: Pattern of children's schooling

they still travel an average distance of 1083m. From this analysis, we discover that students in high RDZ are in greater need of public schools, which are close by as against private schools because of their higher level of poverty. By having such an intervention their level of education will be enhanced, the drop out syndrome could be eradicated and the distance they travel to school.

4. CONCLUSION

Geographic targeting analysis and mapping using GIS enabled the vulnerability of each household and neighborhood to poverty to be related to their actual locations in space. It not only targeted the poor, but in a situation where a planner's budget can only run a poverty alleviation programme in few households or neighbourhoods, transfers to the poor can be according to their ranking under a given poverty measure. Moreover, mapping helped us to discover several causal relationships between socio-economic variables, which tend to engender poverty in households. Had the results been left only in tabular, spreadsheet form or aggregated as charts or graphs, such relationships may be hidden. Mapping helps to identify the patterning of poverty as it occurs in each sample area. This reveals that there is a spatial dimension to poverty and its alleviation.

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