Planning for Location and Distribution of Regional Facilities Using Central Place Theory and Location-Allocation Model

Authors : Danjuma Bawa

Abstract : This paper aimed at exploring the capabilities of Location-Allocation model in complementing the strides of the existing physical planning models in the location and distribution of facilities for regional consumption. The paper was designed to provide a blueprint to the Nigerian government and other donor agencies especially the Fertilizer Distribution Initiative (FDI) by the federal government for the revitalization of the terrorism ravaged regions. Theoretical underpinnings of central place theory related to spatial distribution, interrelationships, and threshold prerequisites were reviewed. The study showcased how Location-Allocation Model (L-AM) alongside Central Place Theory (CPT) was applied in Geographic Information System (GIS) environment to; map and analyze the spatial distribution of settlements; exploit their physical and economic interrelationships, and to explore their hierarchical and opportunistic influences. The study was purely spatial qualitative research which largely used secondary data such as; spatial location and distribution of settlements, population figures of settlements, network of roads linking them and other landform features. These were sourced from government ministries and open source consortium. GIS was used as a tool for processing and analyzing such spatial features within the dictum of CPT and L-AM to produce a comprehensive spatial digital plan for equitable and judicious location and distribution of fertilizer deports in the study area in an optimal way. Population threshold was used as yardstick for selecting suitable settlements that could stand as service centers to other hinterlands; this was accomplished using the query syntax in ArcMapTM. ArcGISTM' network analyst was used in conducting location-allocation analysis for apportioning of groups of settlements around such service centers within a given threshold distance. Most of the techniques and models ever used by utility planners have been centered on straight distance to settlements using Euclidean distances. Such models neglect impedance cutoffs and the routing capabilities of networks. CPT and L-AM take into consideration both the influential characteristics of settlements and their routing connectivity. The study was undertaken in two terrorism ravaged Local Government Areas of Adamawa state. Four (4) existing depots in the study area were identified. 20 more depots in 20 villages were proposed using suitability analysis. Out of the 300 settlements mapped in the study area about 280 of such settlements where optimally grouped and allocated to the selected service centers respectfully within 2km impedance cutoff. This study complements the giant strides by the federal government of Nigeria by providing a blueprint for ensuring proper distribution of these public goods in the spirit of bringing succor to these terrorism ravaged populace. This will ardently at the same time help in boosting agricultural activities thereby lowering food shortage and raising per capita income as espoused by the government.
Keywords : central place theory, GIS, location-allocation, network analysis, urban and regional planning, welfare economics
Conference Title : ICEURP 2020 : International Conference on Environmental, Urban and Regional Planning
Conference Location : London, United Kingdom
Conference Dates : January 20-21, 2020