

APPLICATION OF GEOGRAPHIC INFORMATION SYSTEM IN REAL ESTATE MARKET ANALYSIS OF THE RETAIL SUB-MARKET

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ABSTRACT

The study aims at investigating and implementing aspects of opportunities that exist for utilizing Geographic Information System(GIS) techniques in the real estate industry with emphasis in the retail submarket using geospatial data. Data was obtained through geographic information system (G.I.S) making use of the street map of the study area and digitalized administrative boundary of local government areas of Lagos State. This is linked with the GPS (Global Positioning System) locations of some points of interest like hotels, schools and educational institutions. Findings from the study indicated the best route that has the lowest impendence that can aid the real estate analyst as to the most appropriate locations where retail outlets could be located for easy accessibility of prospective customers. It also shows that lack of technology, poor information and interchange among stakeholders are major problems. In spite of growing investment interest in the subsector, research in retail outlet is still limited. This study provides information in the market segment which will be of interest to investors in the retail market and enhance investment sustainability.

Keywords: Geographic Information System (GIS), Global Positioning System (GPS) Location, Real Estate Market, Real Sub-Market, Sustainability.

INTRODUCTION

The inherent spatial immobility of land and property means that location is an intrinsic attribute of a dwelling, which is a direct determinant of housing quality and market value. One of the four classic textbook characteristics that differentiates property from other commodities is locational fixity (the others are high cost of supply, durability, and heterogeneity; see Quigley 1979). This has been reiterated on many occasions; Fraser (1991) concluded that “of dominant importance in understanding the demand for any property is its location both in a regional as well as a local sense”. This implies that access to employment opportunities, shopping, public service facilities, and other centers of activity is obtained jointly with the dwelling unit’s physical characteristics.

This is in line with the classical adage that, “Location, location, location” remain the most important factors when choosing a home or positioning our business (Waters, 2003). Davies made a strong point in his autobiography that setting a shop in the wrong place is like tying hands behind one’s own back (Davies, 1991, as cited in Clarke, 1995). Thus, choice of a location is the single most important decision facing retailers and service providers (Jones et al., 2003). Location is repeatedly stressed in the business press as a requirement for success in retailing (Chan et al., 2005). This is because location can affect business competition and performance, hence, level of profitability and economic sustainability.

Choosing a location is an important decision for a firm. A favorable location can increase a firm’s productivity through improved access to local productive amenities such as infrastructure, and to the suppliers and customers with whom the firm interacts. In urban areas, firms may also benefit from access to thick labor markets, better matching, and knowledge spillovers (Rosenthal and Strange, 2004). Firms must weigh up the advantages of potential locations against the higher land prices that the location is likely to command

Hence, the importance of the spatial aspects of real estate markets is unquestioned. Despite widespread recognition by both theorists and practitioners of the complex roles of location and spatial interaction and the resulting geographically segmented nature of real estate markets, however, an explicit “spatial” treatment of these markets in empirical real estate research is still in its infancy. In recent times GIS has been applied to various fields ranging from market and advertising to transport/ logistics, insurance, healthcare, environmental resource management, even archeology amongst others. There has been a growing interest among the academia and the private sector for the use of GIS techniques in the real estate market analysis. Geographical Information System (GIS) application to real estate have become important for three reasons; the information explosion, technological innovation, and structural changes within the real estate industry (Castle (ed)1998). Almost without exceptions, various organizations need to plan for complex real estate markets and keep up with competitions. Over the past few decades the methodologies used for research of sighting of retail outlets have become more sophisticated as a result of applicable modeling procedures being developed with GIS. The aim of this study is to investigate and implement some of the possibilities that exist for utilizing GIS techniques in the real estate industry with emphasis on real estate sub market. This aim will be achieved with the following objectives: To employ geospatial datasets in location analysis of potential land/property hotspots and also to perform spatial queries of market location and spatial analysis of

customer distribution; To employ route network analysis in determining accessibility of these locations and best/alternative routes interconnecting them; To integrate spatial information with the whole platform of the real estate information operation system to realize the modern market analysis strategy and optimize decision making processes. Using GIS to choose location will help in integrating the appropriate sustainability features into the building design in line with the environmental needs of the area.

LITERATURE REVIEW

Real estate market analysis involves the analysis of the current and future land market to examine the relationship between the development rights anticipated to be generated in the sending zone and the likelihood of their utilization in the designated receiving zone.

Previous literatures by (Carn, Rabinaski, Racster and Seldin 1988; Clapp, 1993; and Myers and Mitchell, 1993, Fanning 2005) have laid out the basic structure of a well-conceived market analysis for any type of proposed income-producing property. Malizia and Howarth (1995) extract from these sources three essential components of a systematic, logical, market analysis: (1) the market overview; (2) the market study; and (3) marketability study. These components each have a unique objective and set of tasks. The order of these tasks leads the market analyst from general insights about the market (market overview), to forecasts of rent levels and vacancies at the metropolitan or sub- metropolitan level (market study) and, finally, to specific forecasts of project absorption (marketability study).

Howarth and Malizia (1998) point out that the key tasks of market analysis include : (1) discussing megatrends affecting user preferences and product design; (2) estimating the long-term attractiveness of the location and site; (3) forecasting balance or imbalance between future demand and supply; (4) segmenting demand and differentiating supply, which allows the analyst to identify the relevant market segments and subset of competitive projects and to subsequently assign market capture rates; and (5) conducting sensitivity analysis of key variables in the project's cash flow projections.

The primary purpose of real estate market analysis is to quantify the relationship between supply and demand for a given property type in a local market. Real estate market analysis research has long recognized the importance of location. In fact, the spatial dimension of real estate is a principal distinguishing characteristic that has contributed to the creation of a separate field of study. However, before the development of geographic information systems software, it was difficult to accurately measure the impact of location in real estate models. (Arbia, 1989; Tomlin, 1990; Huxhold, 1991; Star and Estes, 1990).

During the initiation of real estate development, the location and market analysis is of an outstanding importance for market research. It helps to prevent building companies, investors and city planners from excessive vacancy rates due to new construction, which ignores the requirements of the market.

While the markets for office space, industrial buildings and undeveloped land often do not dispose satisfactory geo-referenced information available for market analysis, the retail market is actually the most important field of GIS-elaborated location and market analysis. Indeed, the power of and easiness in using a GIS package has led to a rapid adoption of GIS by users in real estate over the last 15 years. Landis (1998) tabulated the major users, the tasks and the GIS functions used in real estate. His report includes users such as appraisers, brokers, developers, investors and fund managers, lenders, market researchers and analysts, sales, as well as shopping center owners and operators; tasks such as property database maintenance, visualization of property/property value distributions, site analysis and planning, property performance evaluation, proximity measurement, market area analysis and trend analysis; and functionalities such as database operations (address matching/geo-coding, database updating, data query, spatial query.), variable extractions (distance calculation, point-in-polygon identification, buffering), and thematic mapping. In academic publications, more and more researchers applied GIS. For example, the *Appraisal Journal* published 38 articles that have something to do with GIS in the period 1992-2006; *The Journal of Real Estate Research* published 18 articles which used GIS somehow in the period 1995-2005. With the lowered barriers to entry everyone seems empowered by GIS, and many real estate researchers use GIS as a tool kit in data management, visualization and analysis. In order to expand the GIS application to other market segments, the focus of the following description of the theoretical base and the subsequent analysis is on *retail markets*. Despite the necessary differentiations in submarkets created by quality level of the building, location, building size and economic sectors, the retail market is rather homogeneous and can serve as an archetype for real estate markets in general.

GEOGRAPHICAL INFORMATION SYSTEM REAL ESTATE MARKET RESEARCH AND SUSTAINABILITY

The utility of real estate parcel and its value are directly affected by whatever is happening within the surroundings of the parcel. For this reason real estate is recognized as a spatial commodity. Hence the importance attached to location, location, location attest to real estate spatial dependency. The need for a comprehensive market research for real estate investments is therefore critical to the sustainability of projects. According to Wilkinson, Reed and Cadman (2008), the importance of sound market research is often underestimated in property development process. Professional property developers acknowledge that well planned and executed market research will substantially increase the probability of success. The fast growing area of market research continues to embrace different specialism including information and database services, strategic and site specific analysis, forecasting and portfolio analysis.

GIS technology provides real estate professionals with tools which will help them to study the spatial contexts of their decisions. This is important because the quality of decision can either enhance or retard project sustainability over time. The use of GIS can enhance the efficiency in appraisal by reducing the time required to perform many types of conventional real estate analysis. Real estate marketing is directed towards creating a product that is uniquely sensitive to the needs of the consumer and reduces other cost (user cost) to the consumer thereby encouraging sustainability design (economic and environmental). Not spending time and resources on research

about the prospective consumer is one of the reasons of many real estate project business failure which also hinders sustainability.

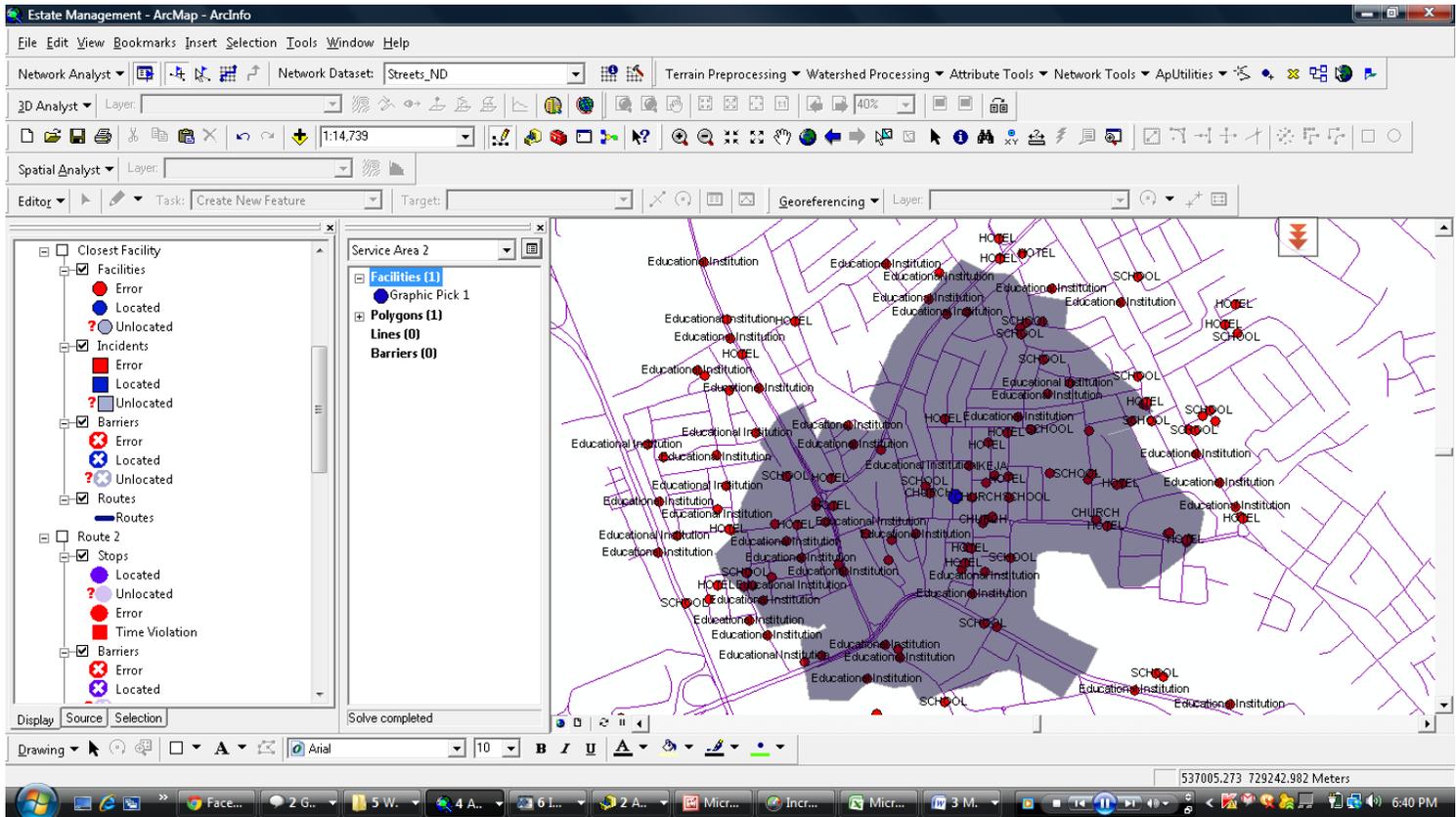


Fig 1.3 Analysis carried out to show new service areas with reference to any selected location

A network service area is a region that encompasses all accessible streets (that is, streets that are within specified impedance). Once built, you can use service areas to identify how many people, how much land, or the quantity of anything else that is within the neighborhood.

Here a church location was selected and the display shows a polygon of which any new retail outlet can be cited. The outlets are selected within the polygon that has been highlighted in the display. A competitive analysis i.e. Range expansion can be carried out to identify how many outlets are within that region and to know where exactly another outlet should be cited for maximum profit.

Also with new service areas, market coverage analysis can be carried out whereby the range of each location will be a function of customer density, transport costs and the location of other competitors.

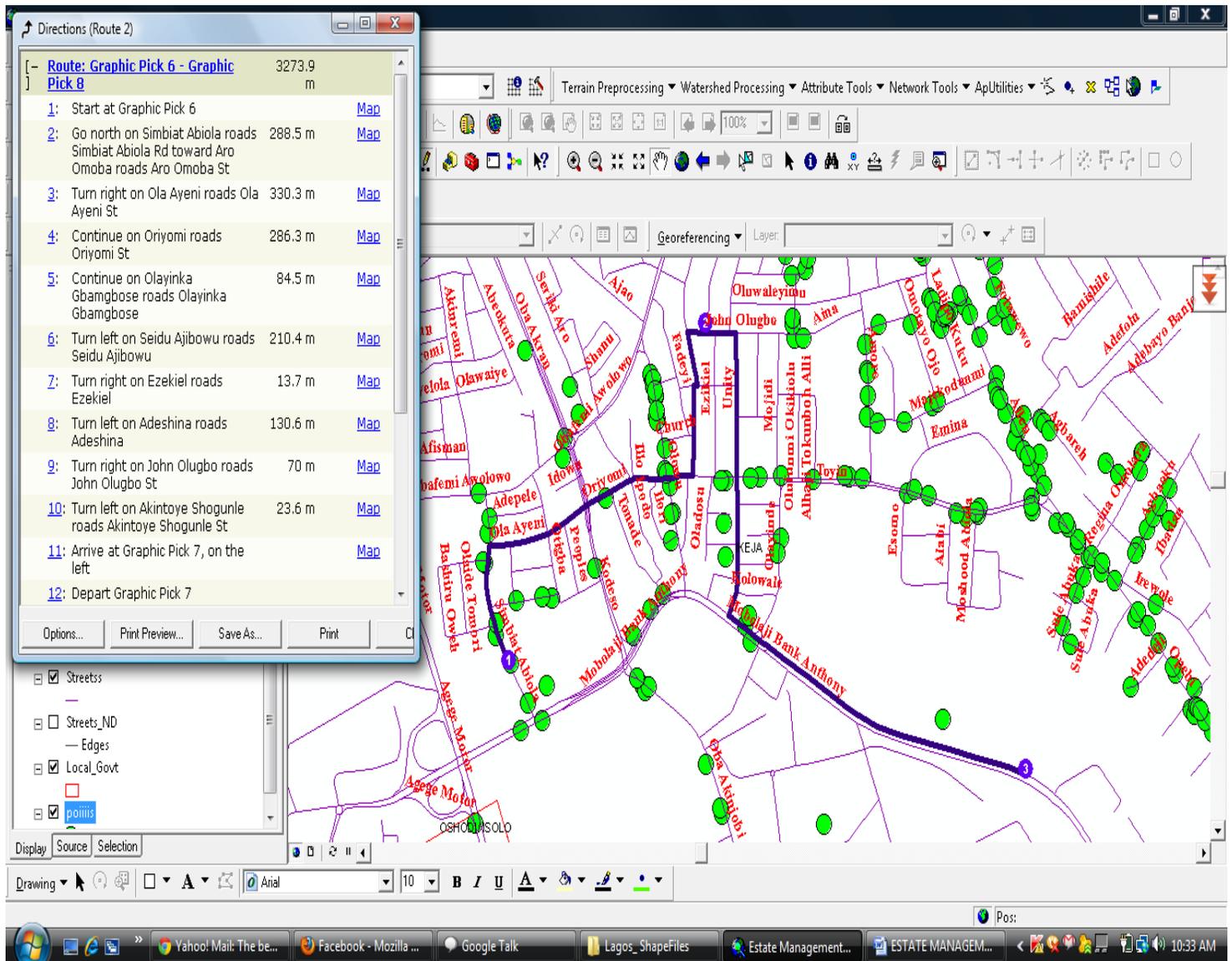


Fig 1.4 Best Route between three locations

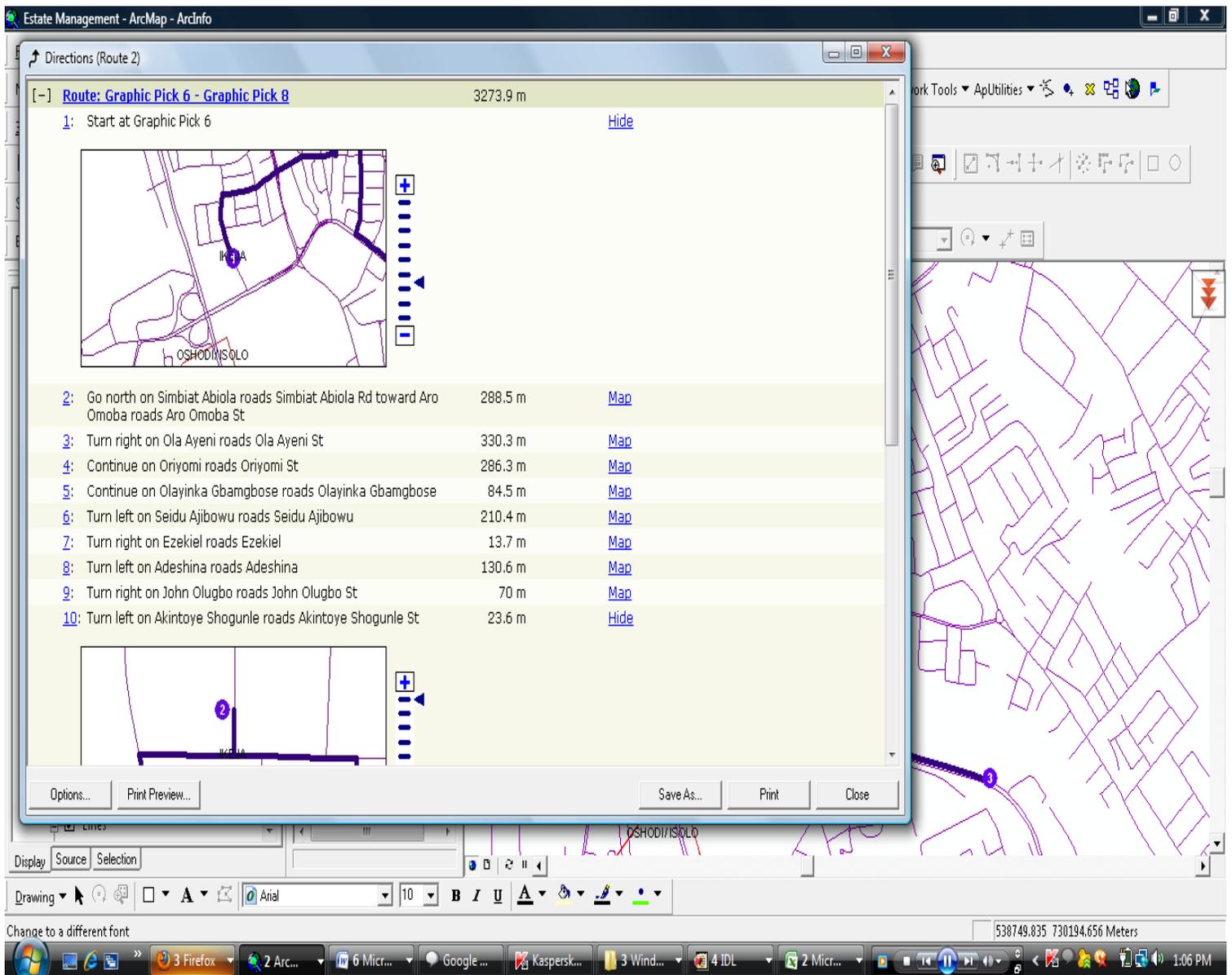


Fig 1.5 Drive directions between the first and second locations chosen

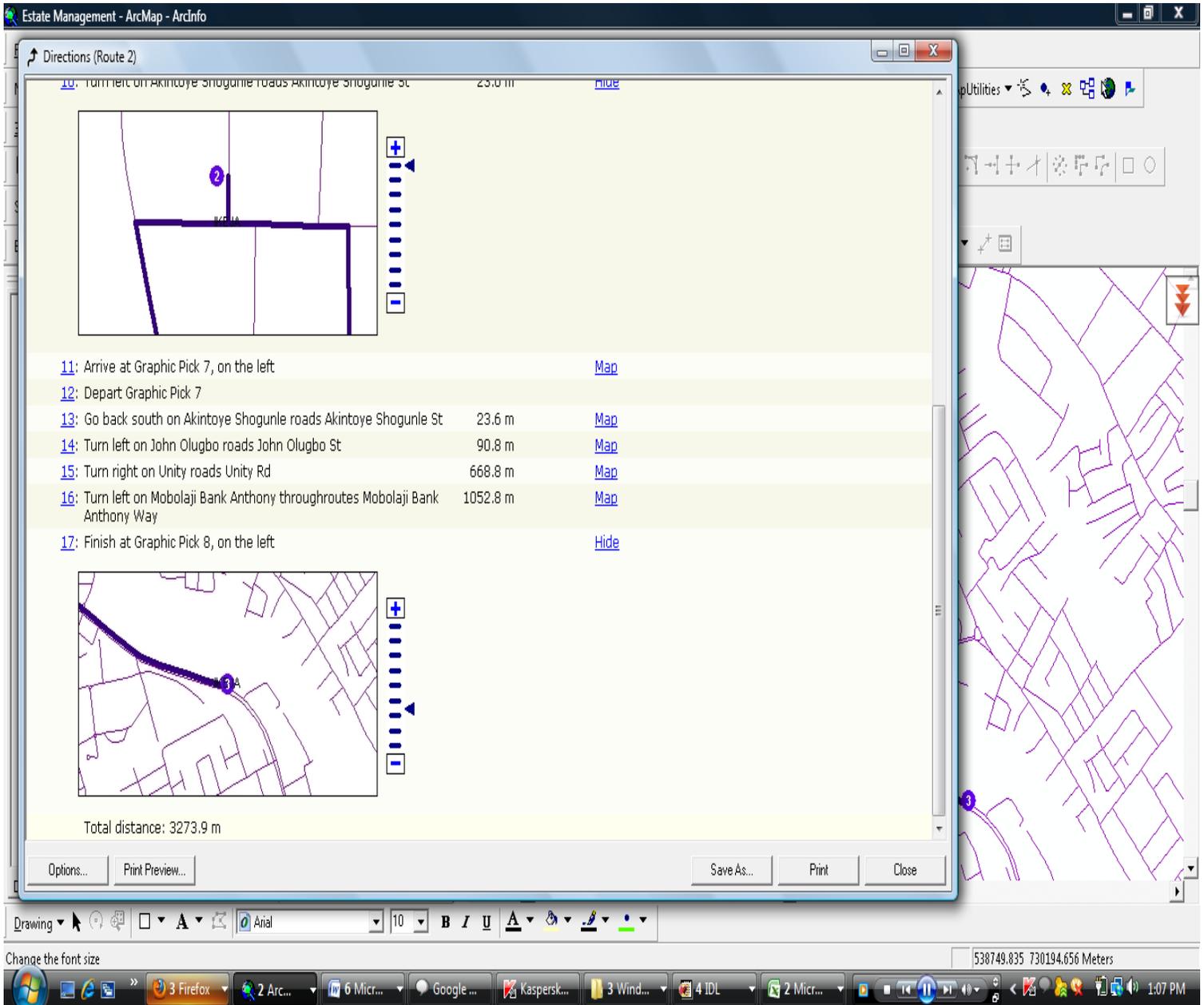


Fig 1.6 Drive directions between the second and third location with the total distance covered

Creating a route means finding the quickest, shortest, or most scenic route, depending on the impedance chosen. The impedance used in figure 1.4 is distance and the best route is the quickest route from one location to the other. Hence, the best route can be defined as the route that has the lowest impedance, or least distance from where the impedance has been chosen. Any cost attribute can be used as the impedance when determining the best route.

From the three locations chosen, we could estimate the total distance between them as shown in figure 1.6 above. However, this information aids the real estate analyst as to the appropriate locations where the retail outlets could be cited for easy accessibility for prospective customers.

This will guide investors in making informed investment decisions and also enhance project sustainability.

SUMMARY OF FINDINGS AND CONCLUSIONS

In spite of the importance of GIS in real estate market research particularly in market analysis of the retail sub market, there are a lot of challenges constraining its widespread adoption as a tool for market study. These include lack of technology and awareness as most practitioners are unaware of its applicability in investment studies. Most of them lack the skill to use it in their studies. It is however an emerging area in the Nigerian property market which the estate surveying regulatory body is giving serious attention. There is also the issue of standardization and unorganized/incomplete datasets coupled with poor record keeping as most practice tend to practice in secrecy and hoard information. The professional and the regulatory body (Estate Surveyors and Valuers Registration Board of Nigeria) and the Government are yet to provide an appropriate framework to support information and interchange among stakeholders. GIS application to real estate is yet to be incorporated into the curriculum of estate management and valuation among Nigerian universities and Polytechnics.

In spite of the above challenges, the GIS has potential uses in market research than in any other real estate activity. Real estate practitioners who choose to ignore the rising application of GIS as a veritable tool in market research and the fundamental benefits of its application do so at their own risk. This study has shown that the application of GIS in market analysis of the retail sub market will help substantially in investment sustainability and informed decision making.

REFERENCES

Castle H.ed (1998) GIS in Real Estate. USA Appraisal Institute

Myers, D. and P. S. Mitchell, (1993) Identifying a Well-Founded Market Analysis, *The Appraisal Journal*, 61, 500–08.

Odland, J., (1988). *Spatial Autocorrelation*, Vol. 9 in G. I. Thrall, editor, *Scientific Geography Series*, Newbury Park, Calif.: Sage Publications.

Pittman, R. and G. I. Thrall, (1991). Using Geographic Information Systems in Economic Development: An Introduction, *Economic Development Review*, 9:4, 14–21.

Quigley, John. (1979). What Have We Learned about Housing Markets? *In Current Issues in Urban Economics*, ed. Peter Mieszkowski and Mahlon Straszheim, 391–429. Baltimore: Johns Hopkins University Press.

Star, J. and J. Estes, (1990). *Geographic Information Systems: An Introduction*, Englewood Cliffs, N.J.: Prentice-Hall.

Soderbaum .P (2008) Understanding Sustainability Economics; Towards Pluralization in economics. London Eathscan

Thrall, Grant Ian. 1979. A Geographic Criterion for Identifying Property Tax Assessment Inequity. *Professional Geographer* 31(3):278–83.

Thrall, Grant Ian. 1993. Using a GIS to Rate the Quality of Property Tax Appraisal. *Geo Info Systems* 3(3):56–62.

———, editor, *Scientific Geography Series*, Newbury Park, Calif.: Sage Publications, 1985–1988.

Thrall, G. I. and A. P. Marks, (1993). Functional Requirements of a Geographic Information System for Performing Real Estate Research and Analysis, *Journal of Real Estate Literature*, , 1:1, 49–61.

Thrall, G. I., C. F. Sidman, S. Elshaw-Thrall and T. J. Fik, (1993). The Cascade GIS Diffusion Model for Measuring Housing Absorption by Small Area with a Case Study of St. Lucie County, Florida, *Journal of Real Estate Research*, 8:3, 401–20.

Tomlin, C. D. *Geographic Information Systems and Cartographic Modeling*, Englewood Cliffs, N.J: Prentice-Hall, 1990.

Warden, J. T., Industrial Site Selection: A GIS Case Study, *Geo Info Systems*, 1993, 3:8, 36–45.

Weber, M.J., *Industrial Location*, Vol. 3 in G. I. Thrall, editor, *Scientific Geography Series*, Newbury Park, Calif.: Sage Publications, 1984.

Weber, B. R., Applications of Geographic Information Systems to Real Estate Market Analysis and Appraisal, *Appraisal Journal*, 1990, 58:1, 127–32.

Wilkinson .S, Reed . R, Cadman. D (2008) Property Development. London Routledge

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