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Location Analysis for Retail Property Investment - A GIS Based Approach: Case Study of Blantyre City

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Abstract: Although there is an increased retail property investment interest, location analysis for retail outlets is inadequate. Site selection is the most significant process in retail property investment decision making. Due to its complexity, location determination can contribute to the success or failure of real estate investment. Optimal location is relevant in a competitive market as it contributes to guaranteed increased returns. Real estate investors can evaluate a set of potential sites for locating a new retail outlet. This study aimed at analyzing how GIS can contribute to the success of retail property investment positioning through spatial data analysis. The study used GIS application to find optimal location for retail property investment in Blantyre City, Malawi. The criteria for finding suitable sites were demographics, transportation and competiveness. The findings presented the applicability, efficiency and productivity of using GIS in location analysis. Based on the findings GIS can help in identifying optimal location through maximizing retail store patronage thereby increasing retail investment return.

Keywords: GIS, retail, location, allocation, real estate, investment

1. Introduction

The importance of location on business success is emphasized in the adage "location, location, location" (Geltner, et al, 2014). The success of any real estate investment highly depends on location (Rees, 2021). Different studies have pointed out on the importance of finding optimal location as a strategy for improving real estate business performance (Abramovich, 2012; Donlon, 2007). Setting a business in a wrong location can highly affect the business performance, competition and its profitability. This is because customers prefer accessibility and convenience among other things. There are various locational attributes that determine the overall performance of the retail store. These include; proximity, demographics, existing competitors, distance, visibility and accessibility. For effective business, these attributes need to be examined (Donlon, 2007). The process of examining numerous spatial data is known as locational analysis (Longley, 2005). This conveys the need for an analytical tool that can be used to conduct the location analysis to help in finding ideal location for setting up retail stores (Abramovich, 2012).

This study sought to examine the use of GIS in finding ideal location for setting up commercial property investments such as shopping centers, malls, offices and retail properties. GIS is a method that can be utilized to find suitable location for any real estate investment (Rees, 2021). Studies have shown that there is a growing interest in the adoption and implementation of GIS in different real estate sectors (Longley, 2005; Donlon, 2007). This is due to its ability to analyze, visualize and interpret spatial data by displaying information in maps thereby revealing patterns, trends and opportunities that may not be identified in tabular data alone (Podor & Nyiri, 2010).

Abramovich (2012) points out that most private firms and government agencies are gradually depending on GIS based analysis to locate their businesses. This is because GIS is not only capable of managing vast amounts of spatial data but it also allows analysts to have a visual display of the geographic data which may not be visible in tabular data. Using visual maps, spatial relationships, patterns and attributes can be seen (Lauff, 2005). Firstly, the analysts identify

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the location in which the analysis is to be conducted. Data is then collected using data collection tools available, such as remote sensing and Global Positioning System. The data is inputted in a GIS software in the form of layers (Longley, 2005). The data is then analyzed using different tools available in the software. After which the results and findings are interpreted (Ringo, 2009). GIS is now being used in many countries for different real estate reasons and so far, it has proven to be effective (Locurcio, et al, 2020). Therefore, GIS can contribute to the success of real estate business by reducing risks and uncertainties, measuring the viability and potential of the business success through location analysis, hence increasing returns on investment (Podor & Nyiri, 2010). However, in spite of awareness theories reflecting the essence of conducting locational analysis for commercial real estate investment purposes, this is not fully practiced (Roib & Roib, 2014) despite data collection being expensive and time consuming. One of the reasons for poor quality inquiry is lack of proper tools to manage, maintain, explain, view, analyze and make optimal decisions on the massive amount of data involved. As such real estate market still faces lack of comprehensive and effective information systems for conducting such analyses (Hernandez, 2000). Consequently, most property investors resort to human intuition, therefore making subjective investment decisions (Bashir & Ismael, 2014). This study sought to evaluate the application of GIS in location analysis for commercial real estate investment in Blantyre city. Specifically, the study sought to map and identify existing locations for retail shopping centres in Blantyre urban; analyze existing locational factors and urban patterns that impact the performance of retail shopping centres in the area using GIS and identify optimal location for setting up retail store using location allocation modelling in GIS.

2. Literature Review

2.1 Retail Location Analysis Using GIS

This involves analyzing business information using location based data to make better informed decisions. This is a technique for discovering, assessing and specifying the optimal placement of an organization, information materials and other activities. It involves the use of different techniques, models and tools that help to solve different locational problems (AlSabbagh, 2020).

2.2 Benefits of Location Analysis Using GIS for Retail Investment

Location analysis is very crucial to both the private and public sector as it helps in informed location choice decision making. Location analysis helps to identify where the consumers are and their buying habits. This assists in improving business performance, minimizing investment risk, boosting due diligence and allowing better collaboration across organizations thereby increasing marketing response (Stepniak & Turek, 2020).

Location-allocation is referred to as the practice of finding a set of facilities that will best serve demand from surrounding areas. Location-allocation is a two-fold problem that simultaneously locates facilities and allocates demand points to the facilities. This helps to find out where to locate and how to locate demand for different services (Gebennini, 2008). This is a type of network analysis that helps in choosing the store locations that would generate the most business for a retail chain. The main objective is to locate stores close to population centers, which provide demand for the stores. This objective is based on the premise that people tend to shop more at nearby stores than at those that are farther away (Donlon, 2007). The location-allocation analysis is performed using different problem types including: maximize attendance, maximize market share, and target market share. The differences among these problem types becomes apparent when exercising location-allocation (Gebennini, 2008). This involves allocating sites that are less serviced thereby meeting the demand available (Manatkar, Karthik, & Tiwari, 2016).

Through location-allocation modelling, different solutions can be provided to a number of questions in the retail real estate industry. For example, in case where there are a number of existing facilities for setting up a new store, the question is which among them would service most people. Another scenario is when a retail company has to decide which stores to close so as to maximize the overall demand, through scaling back. Sometimes it might be that the business needs to be expanded by opening one more branch. It also determines where a facility should be constructed to minimize the distance travelled. In a nutshell location-allocation helps to define the where that maximizes return and also achieves the investors objectives by locating facilities and allocates demand to these facilities (Snyder, 2006).

Fig. 1 - Location-allocation analysis

2.3 Location-Allocation Problem Types

The Location-Allocation tool can be used to solve several related but distinct kinds of problems. To solve location problems with location-allocation package, appropriate inputs to the service need to be provided. There are two stages to solving these problems. Firstly, a number of facilities must be located from a set of feasible locations. Secondly, demand must be allocated to these facilities (Masudin, 2019).

Minimize Impedances

Minimize impedance problem also known as P-Median, locates facilities such as shops in a way that the distance which is cost is minimized between demand points and the facilities. The distance is the cost, thus if the distance is minimized it means cost has been minimized (Snyder, 2006).

Maximize Coverage

Facilities are located such that they as many demand points as possible are allocated to solution facilities within the impedance cutoff (Stepniak & Turek, 2020).

Maximize attendance

Facilities are chosen such that as much demand weight as possible is allocated to facilities. At the same time distance between the facilities (Namaziana & Roghanianb, 2002).

Minimize Facilities

Facilities are located such that as many demand points as possible are allocated to solution facilities within the impedance cutoff; additionally, the number of facilities required to cover demand points is minimized (Abramovich, 2012).

Target Market share

Target Market Share chooses the minimum number of facilities necessary to capture a specific percentage of the total market share in the presence of competitors. Locate store with competitors but without budget limit (Ahmed & Ibrahim, 2017).

Maximize market share

A specific number of facilities are chosen such that the allocated demand is maximized in the presence of competitors. Locate store that have competitors (Gebennini, 2008).

2.4 Factors That Impact Retail Shopping Centres

Table below summarises some of the key determinants of real estate business success. These factors are used as bases for determining if a location is good or bad (Hernandez, 2000).

Table 1 - Selected Location Factors (Source: Ciari & Axhausen, 2008)

Customer	*Accessibility*	*Competition*	*Proximity*
Number of demographics, (e.g.	Road networks	Existing retail activity (direct/ indirect)	Proximity to Customers
Population density, age profile, household size.	Visibility/Signage Parking Capacity/ Space/ Site space	Competitors, anchor stores, cumulative attraction, compatibility)	Proximity to Competitors
Housing density	Public transport types		Proximity to Offices
Neighborhood classification	Restriction/ Zoning Main street Convenience		

2.5 Application of GIS in Business Decision Making

The paper focused on finding the best location for business using GIS application. This was done by creating a geodatabase which was used to choose the optimal locations. The study explained how decision makers in business can easily visualize or trace the result that can support the decision making process for choosing the more profitable places to open a new branch out of the suggested districts that contain the most of all traffic generators, most of all high-traffic count accessibility, and targeted customers. The present paper also aims to protect decision makers from making a random or subjective decision (Bashir & Ismael, 2014).

2.6 Application of Geographic Information System in Real Estate Market Analysis of the Retail Sub-Market

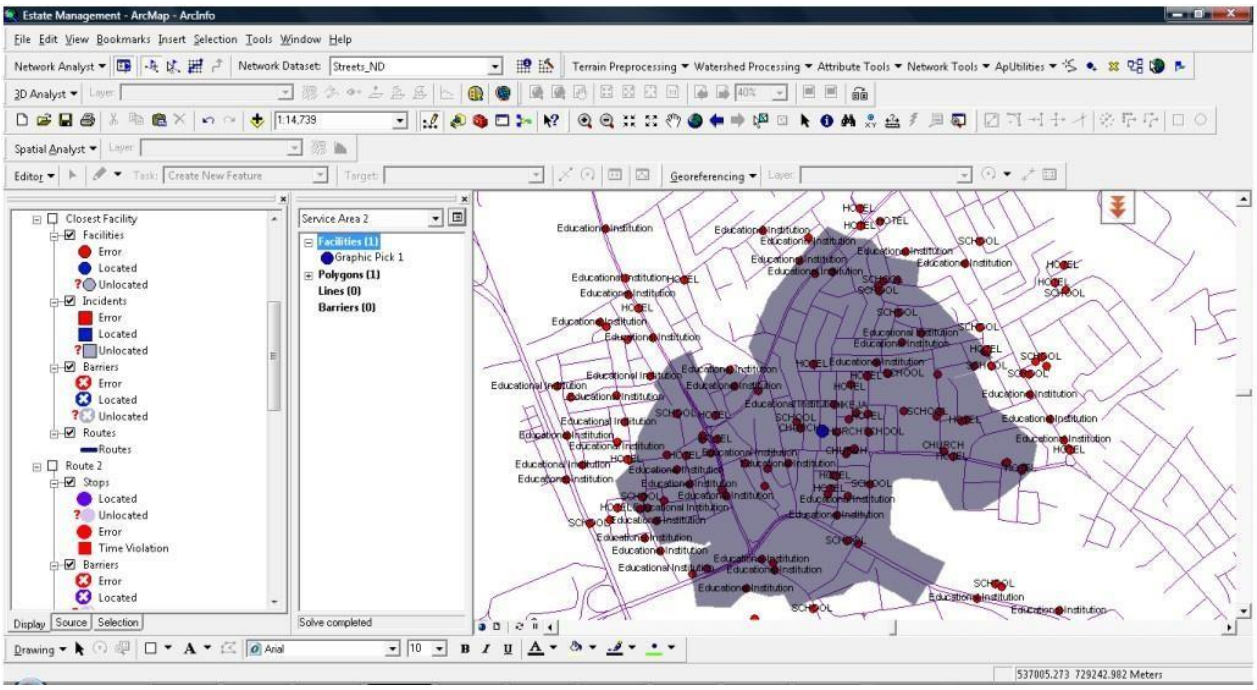

Fig. 2 - Analysis of new service areas with reference to investment locations (Otegbulu, 2015)

3. Methodology

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3.1 Research Approach

The study adopted both qualitative and quantitative approaches since it sought to have a comprehensive inquiry on the best locations for retail store investment (Creswell, 2014).

3.2 Study Area

The study was carried out within Blantyre which is located in the southern region of Malawi at an elevation of (688) 2257.22 ft. It is bounded by the longitude 34.93956º East and latitude 15º39'50" South.

3.3 Sampling Technique

The study used purposive sampling technique. In additional there are numerous locational factors that can be considered and only a few were selected to best achieve the objectives of the study in time and also due to availability of data. The main goal of purposive sampling is to focus on particular characteristics of a population that are of interest to enable the study to answer the research questions (Creswell, 2014).

3.4 Data Collection

Key informant lessons were done with GIS experts who were most knowledgeable about the subject matter. ArcGIS was used to surrounding area and using secondary datasets (Road networks, Buildings i.e., houses, other surrounding retail shops, etc.) from OpenStreetMap which was used as a base map. Secondary data was digitized as points, lines and polygons.

3.5 Data Analysis

Data was analysed using hardware and software tools which consisted of the computer and ArcGIS 10.6 software. Locational factors were analyzed using ArcGIS, using network analysis tools available in the ArcGIS. Arc-GIS software was used to build and analyze the data using location-allocation modelling. ArcGIS Desktop consists of advanced GIS applications, includes ArcMap and Arc Catalog. The analysis was done using ArcMap application in ArcGIS Desktop. However, the Arc Catalog application was used to organize and manage all GIS information, including datasets and maps (Nyika, 2015).

4. Results and Discussion

Data that was required and was used to conduct location analysis for shopping stores included: road network dataset; existing shopping centers; other amenities and building population census tracts.

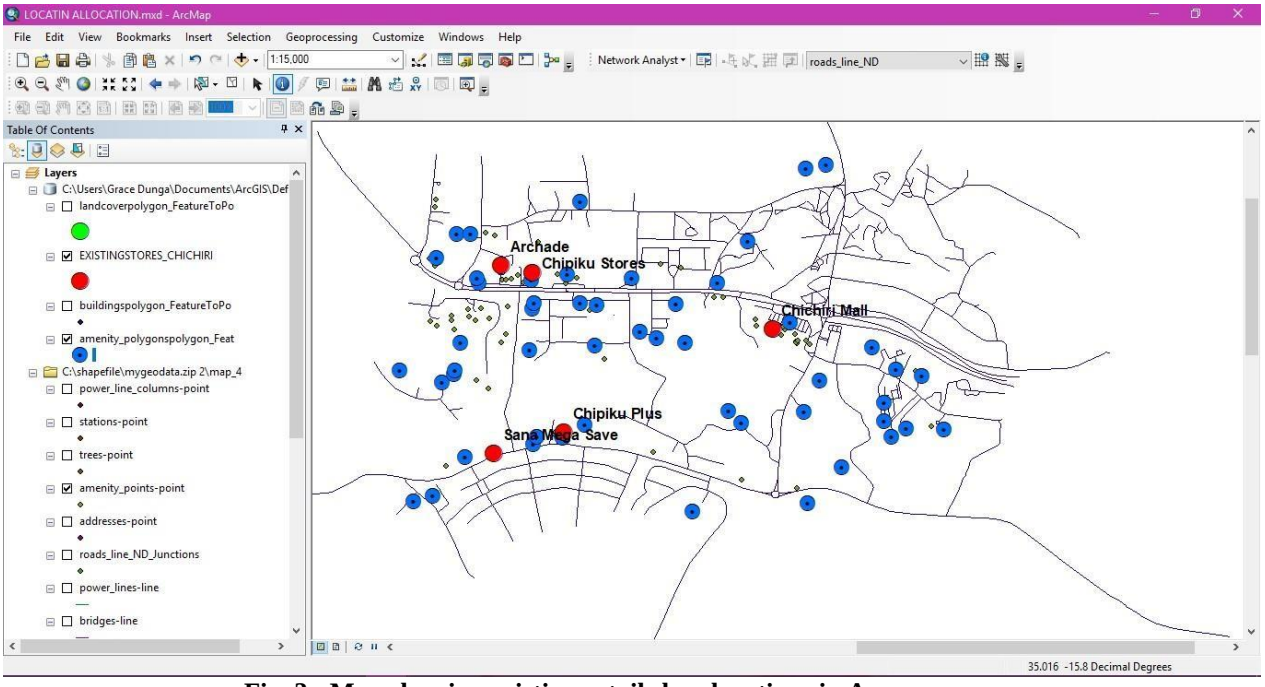

Fig. 3 - Map showing existing retail shop locations in Arc map

The already existing retail shops were represented by the red dots whereas the blue dots represented the existing amenities which are considered as potential suitable locations where other stores can be located. Road networks data was represented by the block lines. The above locational data is described as layers or data sets and is displayed as lines, points and polygons in ArcMap. The methodology used and the findings is dependent on the data that is available.

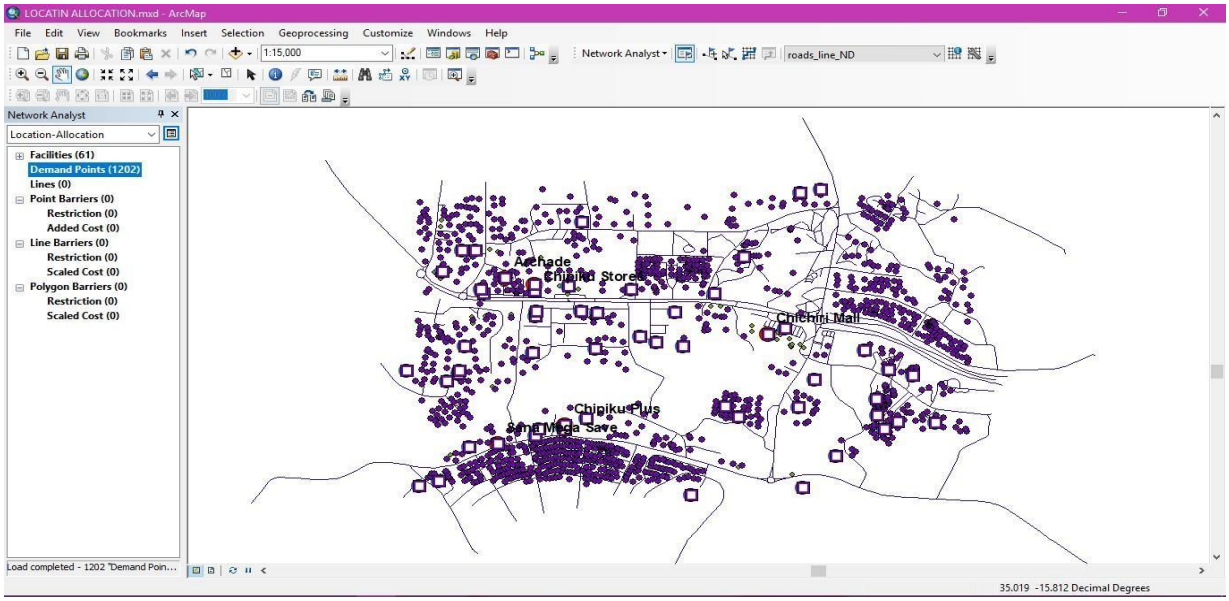

Fig. 4 - Map showing demand points, where potential customers are located (purple dots)

Due to overcrowding factors, only a few locational factors were analyzed. The best optimal site for placing up a new retail outlet was obtained by conducting a location-allocation analysis in Arc GIS environment. The optimal locations for setting up other two retail stores are presented using the boxes marked with stars.

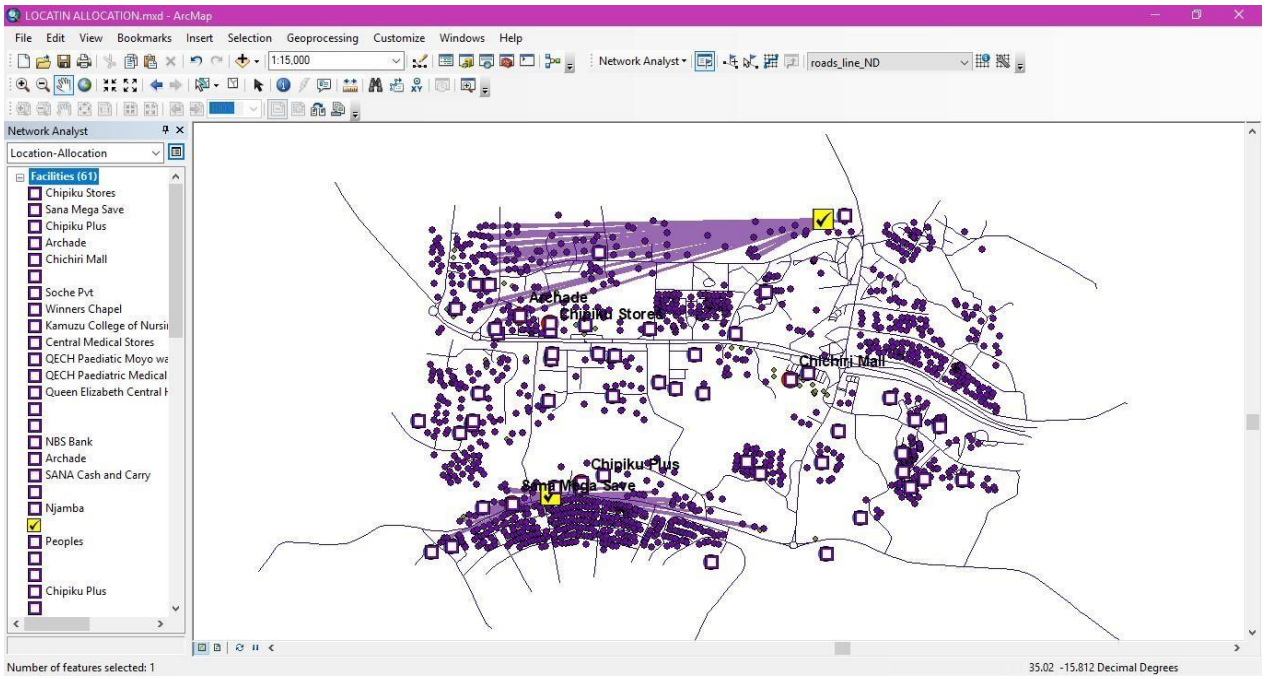

Fig. 5 - Map showing optimal locations where new stores can be located (Yellow ticked boxes)

The chosen location is where more people are located which implies proximity to many customers thereby increasing patronage which in turn increases total return on investment. These results show that the areas chosen are the ones that are easily accessible to many people at the same time minimizing travel distance. This means more people

will be able to patronize the retails shops at the locations as it is a location close to customers thereby maximizing patronage and minimizing travel distance.

5. Conclusion and Recommendation

Based on the results, GIS can help investors in deciding where best to locate in order to minimize risk and enhance quality of the investment. By analyzing spatial data investors can make better informed decisions. If proper datasets can be stored behind the geographical information system, it can be utilized in site selection decision making process, highlight future trends, make location analyze and visualize the data and the analyze trough maps (Podor & Nyiri, 2010).

The study has demonstrated how GIS application can be used in property investment decision making through location analysis. It introduced tools aimed at conducting location analysis, available in the ArcGIS Desktop. Location-allocation was used to identify optimal locations where new retail shopping centres can be opened. GIS has proved to be a reliable tool to carry out location analysis for investment decision making.

References

Abramovich, A. A. (2012). Using GIS to Assist Location and Site Selection Decisions. MSc Thesis, University of Washington, Washington, USA.

Bashir, M. S., & Ismael, A. A. (2014). Applications of GIS in Business Decision Making: The Case of Egypt. [Online]. *International Journal of Computer Applications (0975 – 8887), 94*(14). [Viewed on: 22 August, 2021]. Available from: Doi: 10.5120/16413-6044

Christensen, J. L. & Drejer, I. (2005). The strategic importance of location: Location decisions and the effects of firm location on innovation and knowledge acquisition. [Online]. Journal of *European Planning Studies. 13*(6). [Viewed on: 17 March, 2021]. Available from: Doi: 10.1080/09654310500187862

Ciari, F. M., & Axhausen, K. (2008). Location choice of retailers – an agent-based approach. *15th International Conference on Recent Advances in Retailing and Services Science.* Zagreb.

Ciari, F., Löchl, M., & Axhausen, K. W. (2008). Location decisions of retailers: an agent-based approach. *15th International Conference on Recent Advances in Retailing and Services.* Switsland, Zurich: Eidgenossche Technische Hochschule Zurich.

Clapp, J. M., & Rodríguez, M. (1998). Using a GIS for Real Estate Market Analysis: The Problem of Spatially Aggregated Data. [Online]. *Journal of Real Estate Research, 16*(1). [Viewed on 28 August, 2021]. Available from: https://www.researchgate.net/publication/5142007

Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches* (4th Ed.). United States of America: SAGE Publications, Inc.

Geltner, D.M., et al. (2014). *Commercial Real Estate Analysis and Investments,* (2nd Ed.). London.

Donlon, K. H. (2007). Using GIS to Improve the Services of a Real Estate Company. *Department of Resource Analysis, 10.*

Hernandez, T. A. (2000). The art and science of retail location decisions. *International Journal of Retail & Distribution Management, 28*(8), 357-67.

Joseph S. Rabianski, J. R. (2001). Corporate Real Estate Site Selection: A Community - Specific Information Framework. *JRER, 22*, 1/2.

Kumar, R. (2011). *Research Methodology; A step-by-step guide for beginners.* London: SAGE Publications Ltd.

Lauff, K. M. (2005). *GIS-Based Real Estate Market Analysis.* Chapel Hill, NC.

Locurcio, M., et al. (2020). An Innovative GIS-Based Territorial Information Tool for the Evaluation of Corporate Properties: An Application to the Italian Context. *Sustainability, (12),* 5836.[Online]. [Viewed on 22 August, 2021]. Available from: DOI: 10.3390/su12145836

Namaziana, Z., & Roghanianb, E. (2002). *A decision problem for bank branch site selection: A GIS Mapping perspective with Maximal Covering Location Problem: A case study of Isfahan, Iran.* Iraq.
Naoum, S. G. (2019). *Dissertation Research and Writing for Built Environment Students* (4th Ed.). Routledge. London, UK.

Nyika, S. W. (2015). Application of Geographic Information System in Property Valuation. *International Journal of Scientific & Technology Research, 4*(8).[Online]. [Viewed on 20 September, 2021]. Available from: http://www.ijstr.org

Longley, P.A. (2005). *Geographical Information System and Science* (2nd Ed). (ESRI, Ed.) John Wily & Sons, Ltd. England, UK.

Otegbulu, A.C., Ukpong, U and Umeh, O.B (2015). Application of Geographic Information System in Real Estate Market Analysis of the Retail Sub-Market. *Journal of Sustainable Development in Africa, 17*(1). ISSN: 1520-5509.

Podor, A., & Nyiri, J. (2010). GIS Application in Real Estate Investment. *Scientific Journal of Riga Technical University, Economics and Business. Economy: Theory and Practice, 20*. [Online]. [Viewed on 20 September, 2021]. Available from: www.researchgate.net/publication/267405887

Rees, E. V. (2021). Travel Time. *Journal of Real Estate Investment:* [Online] [Viewed on 22 May, 2021] Available from: https://traveltime.com/blog/gis-real-estate-investement

Ringo, L. G. (2009). Utilizing GIS-Based Site Selection Analysis for Potential Customer Segmentation and Location Suitability Modeling to Determine a Suitable Location to Establish a Dunn Bros Coffee Franchise in the Twin Cities Metro, Minnesota. *Papers in Resource Analysis, (11),* 11. [Online]. [Viewed on 20 August, 2021]. Available from: http://www.gis.smumn.edu

Roib, V., & Roib, I. (2014). Using GIS System in Assessing Real Estate Property. *Land measurement, Natural and Human Sciences Short Communications,* [Online] *71*(2). [Viewed on 22 May, 2021]. Available from: doi: 10.15835/buasvmcn-hort; 10654

Saxena, R., & Hashemi, B. A. (2011, January). Importance of Location in Successful Retailing. *International Journal of Knowledge, Culture and Change Management*. (22) 5. Pp. 79-101. [Viewed on 20 August, 2021]. Available from: doi:10.18848/14479524/CGP/v11i01/49337

Sharma, A., & Rout, C. (2013). Potential Role of Geographic Information Systems in Real Estate Industry-An Overview. *2nd International Conference on Evolution in Science & Technology & Eye on Educational Methodologies.* Hisar, India. [Online]. [Viewed 05 September, 2021]. Available from: https://www.researchgate.net/publication/284032269

Thomsett, J. K. (2005). *Real Estate Market valuation and analysis.* Hoboken, New Jersey: John Wiley & Sons.

Thrall, G. I. (1998). GIS Applications in Real Estate and Related Industries. *Journal of Housing Research,* **9** (1), pp. 189-105.

Williams, K. (2018). *Planning Your Dissertation* (2nd Ed.). London, 4 Crinan Street, UK: Red Globe Press.