

https://dspace.org/

Domes and minarets: a study on the effect of Musjid-Ur-Rahma on surrounding property

Lockhat, Yaseen

2018
https://hdl.handle.net/10539/26763

Downloaded from a DSpace repository. https://dspace.org/

DOMES AND MINARETS: A STUDY ON THE EFFECT OF *MUSJID-UR-RAHMA* ON SURROUNDING PROPERTY

Yaseen Lockhat

A Research report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, in fulfilment of the requirements for the degree of Master of Science in Development Planning

Johannesburg, 2018

Declaration

I declare that this research report is my own unaided work. It is being submitted for the Degree of Master of Science to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University.

……

(Signature of Candidate)

…….. day of …….., ……

Acknowledgements

To my supervisor, Professor Aly Karam, thank you. The last year could not have been possible without your advice, guidance and motivation.

Thank you to the National Research Foundation and South African Research Chair in Spatial Analysis and City Planning for awarding me a bursary.

Dr Tesfamichael, thank you for always making time to help me.

I am indebted to all my teachers who led me on my educational journey.

“Whoever has taught me one letter has made me his slave.”

Dedication

In the name of Allah, the Most Gracious, the Most Merciful,

I dedicate this research report to my beloved grandparents, my late father Yusuf Lockhat and my mother Gadija Lockhat. This is a fruit of your seeds.

Mother, thank you for allowing me the time and comfort to finish this degree.

Thanks to my sister Nadeen for always encouraging me.

To my family and friends:

Ungayeka ukuclea ukuthi ngikwenzile manje

Abstract

The Mosque has a symbolic and spatial significance that transcends its immediate locality. Muslims are required to pray five times a day in congregation at intervals throughout the day, which alludes to the importance of the Mosque. Many Muslims centre their daily life around the prayer, indicating the symbolic significances of the Mosque. These symbolic significances have a spatial manifestation, as the Mosque is the focal point of the community.

In post-Apartheid South Africa, affluent Muslims are migrating to previously white-only suburbs to take advantage of the services and amenities these neighbourhoods offer. The growth of the Muslim population in these areas increases considerably with the construction of a Mosque, with new families settling in the immediate vicinity. A similar effect is seen within the Jewish community, with Jewish families settling around the Synagogue. Studies conducted in these areas found that Synagogues add value to surrounding properties.

This study examines the effect of the Greenside Mosque on surrounding properties by investigating if the Mosque increases the price of the surrounding properties. One objective is to shed light on new spatial trends that have emerged in post-Apartheid Johannesburg. Besides the physical characteristics, the price of property is determined by its location in relation to external factors. Certain external factors can have a positive effect on the price of properties. For example: a scenic view, close proximity to transport, services or other amenities while other characteristics can be detrimental to the property price, such as if the property is within close proximity to a cemetery or dump yard.

Hedonic value assigns value to individual characteristics of the property. To ascertain the value of the Mosque on surrounding properties, the study employs a hedonic analysis. Property prices in Emmarentia and Greenside have been analysed in a Geographical Information system as well as a statistical program to examine the relationship between the Mosque and the surrounding residential property. The analysis covers a seventeen-year period. The study has a low R-squared value and, therefore, does not conclusively establish a link with the Mosque having an effect on value.

Contents

Declaration

Acknowledgements

Dedication

Abstract

List of Figures

List of Tables

Glossary

1. Chapter One: Introduction to the Study on the Effect of *Musjid-ur-Rahma* on Surrounding Property 1

1.1. Background 1

1.2. Problem Statement 2

1.3. Rationale of Study 3

1.4. Objectives 4

1.5. Research Question 4

1.6. Outline of Study 5

2. Chapter Two: Conceptualising Critical Concepts of Residential Location Around Mosques 7

2.1. Property: Key Definitions and Context 7

2.2. Location Theory 8

2.3. Residential Location Theory 10

2.4. Property Valuation 14

2.4.1. Methods of Property Valuation 20

2.4.2. Hedonic Analysis 22

2.5. Importance of the Mosque 23

2.5.1. Mosques in South Africa 26

2.6. Conceptual Framework 29
2.7. Conclusion 30
3. Chapter Three: Hedonic Spatial Analysis: Methodology and Case Study 31
3.1. Research Methods 31
3.1.1. Data and Data Collection 31
3.1.2. Regression Models 32
3.1.3. Hedonic Pricing Model 33
3.1.4. Geographically Weighted Regressions 34
3.1.5. Geographic Weighted Regression versus Hedonic Pricing Model and the Role of Spatial Software 35
3.2. Context to Study 36
3.2.1. History of the Area 36
3.2.2. Present Time 37
3.3. Conclusion 40
4. Chapter Four: Preliminary Findings 41
4.1. Preparation of Data for Analysis 41
4.1.1. Estimation of Null Values 41
4.1.2. Deriving Distance Data 42
4.1.3. Controlling for Time and Inflation 46
4.2. Description of Variables 46
4.2.1. Value 46
4.2.2. Physical Characteristics of the Property 47
4.2.2.1. Age of the Property 47
4.2.2.2. Cadastral Size 47
4.2.2.3. Number of Bedrooms 47
4.2.2.4. Number of Bathrooms 47
4.2.2.5. Year 47
4.2.3. External Factors 48

4.2.3.1. Distance to Schools 48
4.2.3.2. Distance to Retail 48
4.2.3.3. Distance to Green Space 48
4.2.3.4. Distance to Mosque 48
4.3. Statistical Description of Data 48
4.4. Model Specification 51
4.4.1. Hedonic Pricing (Ordinary Least Squares) Model 51
4.4.2. Geographically Weighted Regression (GWR) Model 52
4.5. Conclusion 52
5. Chapter Five: Significance of the Mosque on Housing Prices 54
5.1. Results of Analysis 54
5.1.1. Results of the Ordinary Least Squares Hedonic Model 54
5.1.2. Results of the Geographically Weighted Regression Model 58
5.1.3. Model with the Best Result 68
5.2. Impact of Mosque on Value 69
5.2.1. Impact of Physical Characteristics 73
5.2.2. Impact of Time on Value 74
5.3. Impact of Amenities and Externalities on Value 75
5.3.1. Impact of Schools on Value 76
5.3.2. Insignificance of Amenities 76
5.4. Conclusion 77
6. Chapter Six: Conclusion 78
6.1. Answering the Research Questions 78
6.2. Recommendations 79
6.3. Limitations 79
6.3.1. Data 80
6.3.2. Time 80
6.3.3. Budget 80

6.4. Future Studies 80
6.4.1. Internal 81
6.4.2. External 81
6.5. Conclusion 81
REFERENCES
APPENDIX A: ABSA Housing Index
APPENDIX B: Spatial Autocorrelation Report OLS
APPENDIX C: Spatial Autocorrelation Report GWR
APPENDIX D: Ethics Clearance Certificate

List of Figures

Figure1: Map of Greenside/Emmarentia (Source: Author, 2017) 4
Figure 2: Conceptual Framework (Source: Author, 2017) 30
Figure 3: Map of Johannesburg (Source: Author, 2017) 36
Figure 4: Study Area (Source: Author, 2017) 38
Figure 5: Musjid-ur-Rahma (Source: Author, 2017) 39
Figure 6: Madrassah, Library and Janaza Facilities of the Mosque (Source Author, 2017) 40
Figure 7: Map of the study area, with pins indicating the houses included in the study (Source: Author, 2017) 42
Figure 8: Aerial photograph of study area showing selected house (Source: Author, 2017) 44
Figure 9: Map of study area showing selected house (Source: Author, 2017) 44
Figure 10: Script of Google Maps API code (Source: AnalystCave, 2014) 45
Figure 11: Graph showing the average sale price of houses within the study area by year (Source: Author, 2017) 50
Figure 12: Variable Distribution and Relationships (Source: Author 2017) 57
Figure 13: Histogram of the Standardised Residuals (Author, 2017) 58
Figure 14: Heat map indicating R-Squared of each house (Source: Author, 2017) 61
Figure 15: Heat map indicating the spatial significance of bathrooms (Source: Author, 2017) 62
Figure 16: Heat map indicating the spatial significance of bedroom (Source: Author, 2017) 63
Figure 17: Heat map indicating the spatial significance of cadastral size (Source: Author, 2017) 64
Figure 18: Heat map indicating the spatial significance of Greenside Primary School (Source: Author, 2017) 65
Figure 19: Heat map indicating the spatial significance of the Mosque (Source: Author, 2017) 66
Figure 20: Heat map indicating the spatial significance of the age of the property (Source: Author, 2017) 67
Figure 21: Map indicating distance of petrol station to the Mosque (Source: Author, 2017) 70

Figure 22: Map showing the proposed development in relation to the Mosque (Source Author, 2017) 71
Figure 23: Perspective of the Proposed Development (Source: Emmarentia Residents' association, 2016) 72
Figure 24: Average sale prices (in real value) of the houses (Greenside/Emmarentia) over the 17-year period (Source: Author,2017) 73
Figure 25: Average Real Value of South African Houses (Source: Author,2017)..... 74

List of Tables

Table 1: Summary Statistics for the Combined Areas of Greenside/Emmarentia. ... 49
Table 2: Statistical Analysis of the OLS Hedonic Model. ... 54
Table 3: OLS Analysis per Variable ... 55
Table 4: Variance Inflation Factor of Variables ... 59
Table 5: Geographically Weighted Regression ... 60
Table 7: Comparison of Akaike Information Criterion ... 69

List of Acronyms

AIC - Akaike Information Criterion

API - Application Programming Interface

CBD - Central Business District

GIS - Geographic Information Systems

GWR - Geographically Weighted Regression

KML - Keyhole Markup Language

LSM - Living Standard Measure

NIMBY - Not in My Backyard

OLS - Ordinary Least Squares

VIF - Variance Inflation Factor

Glossary

Athaan – Islamic call to prayer

Fajr – Islamic Morning prayer

Imam - Islamic leader or leader of the prayer

Jamaat Khana – An Islamic place of worship, with a lesser status than a Mosque

Janzah ghusl – Islamic ritual that initials washing and preparing of the body of a person who has passed on

Jummah – Islamic Friday Afternoon prayer

Maddrassah – Arabic term for school. Modern usage denotes a school where principles of the Islamic faith are taught.

Madinah – City of Saudi Arabia, Second holiest city in Islam. Known as Yathrib pre-Islam.

Moran's I test – A test used in a spatial study to examine clustering

Mosque/Masjid – Place of worship for Muslims (Followers of the Islamic faith)

Musallah - An Islamic place of worship with a lesser status than a Mosque

Muslims – Followers of the Islamic faith

Radio Bilaal – A radio that broadcasts the Athaan at the time of prayer.

Regression model – A quantitative statistical method used to measure the influence of one variable with another or to predict the influence one variable may have on another.

Sabbath – An auspicious day for followers of the Jewish faith

Shaykh – An Arabic/Islamic honorary title, in particular denoting a spiritual leader

Synagogue – Place of worship for followers of the Jewish faith

1. Chapter One: Introduction to the Study on the Effect of *Musjid-ur-Rahma* on Surrounding Property

The aim of the first chapter is to outline the study and give it context, thus granting the reader insight into the study. The study investigates the effect of a Mosque on the surrounding residential property. This introductory chapter offers a background to the study, providing a rationale, and sets out what the study aims to achieve with the research question, problem statement and objectives, examining expected findings and lastly giving an overview of the chapters to come.

1.1. Background

“Location, location, location” (Jost *et al.*, 2008, pg. 61) is a common saying, often expressed in many conversations regarding property, that highlights the fact that location is central to the property discourse. The obsession with a location is due to its intrinsic link to value. Property, like any other product, is governed by basic economic principles, but with an added component of location (Tse, 2002). For example, the economic principle of supply and demand might explain why two properties with the same characteristics but in two separate locations are priced differently. For instance, these properties could be in two different neighbourhoods of one city. The demand can be attributed either to particular characteristics of the property or the area being highly sought after. Therefore, demand has a direct influence on the value of property.

The economic principle of utility is a second related example. In economic theory, a product might be priced higher due to its utility. Utility refers to how useful a product is; the more useful the product, the greater its value. This works twofold with properties as, firstly, the physical features of the property will define its utility. For example, if it is a residential property, its utility will be defined by several factors, which may include the number of bedrooms, size of the plot, number of bathrooms, size and shape of the kitchen and the number of garages. The second aspect of the property’s utility is attributed to the property’s location, which will have an influence on the property’s value. Thus, the amenities and services provided in the vicinity may increase the utility of the property.

Amenities are defined by the Oxford dictionary (2007, no pagination) as “a desirable or useful feature or facility of a building or place.” Thus, an amenity is a broad classification that includes several features and facilities. For example, the following would be classified as amenities: places of worship, public facilities, recreational facilities, economic and transport hubs. However, it should not be assumed that all amenities affect surrounding properties equally. The relationship between amenities and a property is far more complex; how amenities affect property is dependent on multiple factors.

Urban planning plays a vital role in maximising the potential of neighbourhoods and amenities. Relationship planning is the process of matching areas to beneficial and necessary amenities. The planner must deal with the complexity of strategically placing the amenities in a manner that it is beneficial and not detrimental. Amenities need to be ordered and placed correctly for several reasons. For example, amenities should not be placed in such a way that they favour one section of society; this is particularly true in the South African context where planning should correct Apartheid spatial planning and not reinforce it. Moreover, amenities must be strategically placed as they may create more harm than good. For example, a dumpsite is a much-needed amenity but will be detrimental if placed too close to residential property. Planners should be conscious of the impact amenities have on the surroundings. Thus, the aim of urban planning is to create valuable and habitable spaces for all citizens.

1.2. Problem Statement

The proposed study will investigate the impact places of worship have on surrounding properties in areas that were previously demarcated for white people only. In particular, the study will seek to determine if Mosques are responsible for a significant (hedonic) decrease or increase in the property price. Anecdotal evidence indicates that the Mosque has a positive increase in property prices. Property listings emphasise properties that are close to the Mosque, and it's commonly believed that the Muslim community prefers to reside close to a Mosque. However, there is no empirical evidence to support these claims.

1.3. Rationale of Study

The previously discussed background is closely related to the rationale of the study. The study aims to provide insight into the push and pull factors of the area. The neighbourhood amenities are investigated by discovering the positive and negative impacts on the properties in the proximity and to what extent. This is important for planners and the planning discourse as it is vital to creating valuable areas that are not limited to economic benefits.

In particular, the study will examine the effect of Mosques on surrounding properties. The Mosque plays a critical role in the lives of Muslims. Muslim men are required to pray five times a day, preferably in a Mosque. Previous studies (Vandell, 1995; Thrall, 1998; Simons and Seo, 2011) conducted in Jewish communities found that houses closer to synagogues have a higher value than those further away. This phenomenon is explained by understanding the *Sabbath*, a religious day were orthodox Jews are prohibited from using technology. On the *Sabbath*, the only way to get to the synagogue is by foot. Consequently, houses that are in walking distance have a higher property value than those further away.

There is also a gap in the literature on how amenities affect value, particularly places of worship, as the literature on South African cities in post-Apartheid, for the most part, covers white flight away from the city centre into the suburbs. There is very little work done on new emerging spatial patterns of movement, predominantly examining the movement of non-whites into previously white communities.

This study will examine the Greenside/Emmarentia area. Greenside and Emmarentia (Figure 1) are suburbs located North of Johannesburg that were formerly reserved for people classified as white. Since the 1990s, Muslims from former Indian townships have moved into the area. This migration is attributed to the supposedly superior access to services and amenities of Greenside compared to the townships (Dinath *et al*., 2014). Within the last two decades, a Mosque [Islamic place of worship] has been established, which is further perceived to have increased the migration of Muslims from other parts of the city to this area.



Figure1*:* Map of Greenside/Emmarentia (Source: Author, 2017)

1.4. Objectives

The study aims to achieve the following objectives:

- To gain an understanding of how places of worship affect the property market in post-Apartheid South Africa
- To determine if a hedonic analysis is a suitable method to derive a value for external factors of property

1.5. Research Question

From the problem statement, there are several questions that arise. These questions centre around the Mosque and its effect on surrounding property in terms of value. Therefore, the main research question is:

What effect does the Mosque have on surrounding properties prices?

The study will also aim to answer the following sub-questions:

- Is the Mosque an amenity or disamenity?
- How great of an area does the Mosque influence property prices?
- What effect does distance from the Mosque have on the price of residential properties?
- What amenity exerts the most value in the area?

1.6. Outline of Study

The first chapter served as an introduction to the study. This section will now outline the chapters included in this study as a conclusion for the first chapter.

Chapter Two:

This chapter is titled Conceptualising Critical Concepts of Residential Location Around Mosques. This chapter will serve as the literature review in addition to offering a conceptual framework. The literature review and the conceptual framework will examine relevant themes of this study, such as property, residential location theory, property valuation and Mosques.

Chapter Three

Chapter three, titled Hedonic Analysis *of Musjid-ur-Rahma,* will explain and detail the methodology employed in this study. The section of the chapter dedicated to the methodology will thus examine the data collection process and the strategies used to process the data. This chapter examines the study area, giving a historical account of the neighbourhood as well as providing information as to the present status of the neighbourhood.

Chapter Four

The fourth chapter will present the preliminary findings. This is the first step in processing the data, ensuring that the data is ready to be analysed. It is in this stage where the preliminary results are found and documented. This chapter examines how the data is processed and prepared before being analysed. It describes all the variables used in the study and presents a statistical description of the data.

Chapter Five

The fifth chapter, titled The Effect of *Masjid-ur-Rahmah* on Surrounding Properties, will present the findings of the study, starting with the results of the analysis. The results will be then discussed in more detail while trying to rationalise the findings in the context of the study.

Chapter Six

The purpose of the sixth chapter is to conclude the study. It will start by answering the research questions, then examining the limitations and new areas of research that have emerged. The final section of chapter six will offer a summary of the entire report to conclude the research report.

2. Chapter Two: Conceptualising Critical Concepts of Residential Location Around Mosques

This chapter reviews the relevant literature. The literature is examined by themes and offers an international and local perspective, moving from the international to the local and from the broad to the specific. The chapter will first uncover the key concepts around property, examine location theory's effect on a property, how the value of a property is derived, including hedonic value, and ultimately how a place of worship's hedonic value is estimated. The final theme of the literature review examines the literature regarding Mosques. Lastly, a conceptual framework is presented, which is a graphical representation of all the topics and themes and how the different themes and topics are linked.

2.1. Property: Key Definitions and Context

Real estate, real property and property differ from one another in their technical definitions. However, these terms are often used interchangeably (Cortesi, 2003). Differences need to be explored to understand the real estate property discourse. Floyd and Allen (2002) differentiate between real property and personal property. The most notable and most valuable difference for this discussion is that real property is immovable (spatially fixed) while personal property refers to movable property, such as vehicles, jewellery and furniture. It is widely accepted that when property is spoken of, it refers to real property and real estate rather than personal property. This is particularly true in the South African context.

Real estate consists of the land, including the area above and below it, and all components of the built and natural environment situated on the land (above and below). For example, aquifers, buildings and vegetation (Cortesi, 2003). In contrast, real property includes the real estate definition in addition to the associated rights of the property, which governs the use of the land (including the area above the land and below) (Cortesi, 2003).

As one can gather from the definition, property is a broad subject matter. This further implies that there are many facets that need to be understood when examining the property discourse. One important aspect of property is that it is not homogenous. Epley and Rabianski (1986) describe the property market as being disaggregated, as

properties can be classified into different segments at various levels. Consequently, Epley and Rabianski (1986) classify property at the broadest level into three main segments, namely: commercial, industrial and residential.

In contrast, Glickman (2014) divides the property into either commercial or residential, placing industrial as a submarket within commercial properties. There are further subdivisions within the residential and commercial markets. Residential property includes single-family dwellings as well as multifamily units whereas commercial properties have a far greater diversity of properties, which includes hotels offices and retail.

Epley and Rabianski (1986) further explain that the disaggregation of properties continues until the specific features of a property have been defined, such as the aesthetic of the property, the size of the property, the size of the building on the property, the facilities on the property and so forth. Thus, the disaggregation of properties creates niche property markets, which caters to different segments of the market (Epley and Rabianski, 1986).

2.2. Location Theory

Epley and Rabianski (1986) argue that location is a critical factor in examining property markets, attributing the importance of location to property as it is immovable. All property is located in space and has a spatial dynamic. Property will, therefore, be inherently affected by its environment and surroundings. Location theory is valuable in explaining such phenomena. The aim of this section is thus to understand what factors determine residential choices.

Location theory is rooted in Classical Economic theory. In recent times, location theory can be most commonly found in the fields of economics, geography and other spatial disciplines (Chan, 2011). However, Location theory can be traced back to the early 19th century. Ricardo (1821) assigns a value to property (land) in the form of rent. Rent (value) is determined by the fertility (ability to provide natural resources) of the land: the more fertile the land the greater the value. However, it is Von Thünen who is credited as being the founder of Location theory (Isard, 1956A).

Von Thünen (1966, cited in Chiaradia *et al*., 2013) [Von Thünen's work was translated to English in 1966], added the dimension of distance to Ricardo's theory. Von Thünen

was not only concerned by the fertility of land but rather the fertility of land around a city and how the land can be best used in relation to the distance of the (fertile) land to the markets of the city. Von Thünen thus developed a model that explained how land should be best used around the city (1966, cited in Chiaradia *et al.,* 2013). Early theories on location were centred on how agricultural land should be located in relation to the city. Later studies replaced agriculture with industry, and studies by scholars such as Marshall Weber examined how industries and firms should be best located within cities (Blaug, 1979; Biscaia and Mota, 2013). The primary concern of these studies was understanding the production and consumption of goods within space (Scott, 2000).

> Isard (1956B), a prominent scholar in the location theory discourse, was the first to offer a more nuanced application (approach) of location theory, arguing that location is influenced not only by economic factors but rather a combination of social and economic factors. Moreover, Isard (1956B) founded a new discipline termed Regional Science. Fujita (1999) further argues the need for location theories to be more encompassing in their understanding of how humans organise themselves, which is not strictly due to economic reasons. Thus, due to changes in the academic world, particularly with the cultural turn and the critique of classical location theories since the 1960s, location theory has taken a broader approach in examining phenomena regarding location. Church and Murray (2013, no pagination) describe location theory as"The topic of location theory has generally been associated with the descriptive characterization of observed patterns across geographic space typically associated with human settlement, industry siting, service competition, and more generally consumer behaviour."

Location theory is concerned with questions regarding the interconnectedness of property with other features of the surrounding area, such as how one property is related to another form of property or the organisation of property (aiming to answer questions of what, where and why regarding a property's location). Or, as Church and Murray (2013, no pagination) clarify, the scope of location theory in the present as "… wanting to better understand why places were where they were, but ultimately the goal was to gain a sound grasp on the factors associated with locational decision making and what makes a good location." Thus, to reiterate, studies over the years have become more nuanced as studies employ location theory to examine the decision-making process involved in choosing a location. For example, location theories are used to explain the location of residencies or businesses. In addition, location theories began to look further than merely exploring the economic decisions around location

as it was discovered that location was not only selected because it was economically efficient in supplying goods to the market.

2.3. Residential Location Theory

Residential location theory, a branch of location theory, aims to shed light on why individuals or families choose specific areas to reside in (Jordaan *et al*., 2004). Similar to early works on location theory, early residential location theories (termed bid rent theories) by Alonso (1964), Mills (1972) and Muth (1969) argue that people choose to reside in specific areas either for its accessibility or due to the amount of space the area offers, further arguing that the choice will be dictated by a person's economic circumstances (Straszhem, 1987). These theories are known as monocentric models and assume the city is a flat area; in the centre of the flat area is the central business district (CBD) where jobs are located; and as one moves away from the CBD, the residential areas are situated where the workers reside (Straszhem, 1987).

These models claim that residential homes found closest to the city are said to be the most expensive, whilst the homes furthest away are the cheapest. However, these models do consider transportation costs, which is the inverse of the cost relationship between residencies and the city centre. Transport to the city centre is the cheapest when travelling from homes closest to the CBD, whereas transport from distanced areas to the CBD is the most expensive (Straszhem, 1987). The model further assumes that property sizes increase as one moves further away from the CBD and that population increases as one move towards the CBD. Thus, it is a compromise as a person has to decide to live in an area that has more space but less accessibility or an area with higher accessibility but less space. These models are, thus, referred to as density-gradient models.

It was not long after that such theories were critiqued. Criticisms can be divided into two categories: criticisms against certain aspects of the models and those that reject the models in their entirety. Yamada (1972) argues that residential decisions are not confined only to trade-offs between accessibility and space and that early monocentric models are one dimensional as they do not consider other reasons why people would choose to reside in a particular area. Decisions to reside in an area could be based upon other factors. Yamada (1972) in particular argues that people could reside in an area due to its pristine natural environment or for the leisure activities found in the

locality that, in most instances, are found away from the CBD. Thus, Yamada (1972) does not reject the monocentric model but rather the notion that property prices diminish with distance from the CBD, arguing that the demand to be close to nature will result in an increase in the price of residential property and a decrease of prices away from nature towards the CBD.

There were a number of other scholars who produced literature around the time of Yamada, who uncovered factors that affected residential location decisions, that further highlighted the limitations of the monocentric model. Ellis (1967, cited in Richardson, 1977) is of the opinion that potential residents will have to restrict their selection to houses that are available on the market. Yet, it is the work of Senior and Wilson (1974, cited in Richardson, 1977) that strongly opposes the monocentric model. Senior and Wilson (1974, cited in Richardson, 1977) argue that people do not only interact between two zones of the city but rather people will travel daily to a host of other areas in the city. In some cases, people are not even linked to areas where there are jobs, such as those who are retired or jobless.

Cities since the late 20th century have become more polycentric (multicentric) or dispersed, meaning that cities are decentralised and sprawling, made up of a number of different nodes. These nodes are areas where jobs and the population are concentrated rather than homes and jobs found within and around one central area or node. The current planning discourse indicates that there is a conscious move by governments, city official and planners towards promoting and planning for polycentric cities. This can be seen in the development of corridors, which aims to link important areas within cities, thus creating a network of hubs within a city. An example would be the City of Johannesburg's *Corridors of Freedom* (Brand *et al.,* 2015). Polycentric cities have a considerable influence on residential location theory. As Richardson (1977) argues, an individual may have an option to reside in a number of areas that are similar (i.e. a similar housing typology), the potential buyer will base their decisions on other factors, such as the house where the potential buyer can bargain for the best price.

Kraus (2003) argues that monocentric models still hold value in examining the polycentric city when conducting a simple study, which investigates two variables, particularly for those who have no formal training in economics. However, an important

aspect that the monocentric model does not consider is the neighbourhood characteristics as residential areas are not homogenous. Residential areas have characteristics that will differ from one another; these characteristics can be seen in both the physical structure of the area (i.e. the built environment) as well as the social makeup of the area (Richardson, 1977). Thus, individuals might choose to reside in an area due to its neighbourhood characteristics, such as the social makeup of the area, the perceived prestige or for the amenities and services it offers. This leads to the hedonic analysis, which aims to measure the value that certain features add to the homes within an area. Hedonic analysis can, thus, be used to evaluate why people choose to reside in specific areas (Richardson, 1977). Hedonic analysis will be discussed at length in the subsequent section of this literature review.

In recent years, Huang *et al.* (2013) found that location theories and models have become far more nuanced, with studies considering a number of factors, unlike the monocentric models, which only studied a limited number of variables. This furthered the understanding and explanation of newer phenomena, such as gentrification and urban renewal. Residential location theory prior to the 1970s believed that the wealthy would reside in spacious green areas away from the clutter of the city. In the 1970s, however, a trend emerged in cities around the world whereby young professionals started moving to the city, renewing certain industrial areas or working-class neighbourhoods close to the CBD.

The new demand for properties in these areas increased the prices of the properties and drove out those who could no longer afford to reside in the area. This process was termed gentrification (Lees *et al.*, 2013). New phenomena, such as gentrification, contributed to the development of residential location theory as there was a need to understand the driving forces behind these shifts. Neighbourhoods and other areas of the city are fluid and can be characterised by being in either a state of decline or revitalisation. Building upon what has been previously mentioned by Richardson (1977) regarding residential location choices, Revington (2015) and Zuk *et al.* (2017) add investment and urban renewal as one of the factors that can lead to people moving to previously undesirable areas as people are attracted to the culture and new services these places offer.

van Duijn and Rouwendal (2011) explains that if services and amenities are not conveniently located in neighbourhoods near the city centre, the affluent will choose to reside in more spacious areas away from the city. However, van Duijn and Rouwendal (2011) further argue that a city's cultural heritage can add to the appeal of being close to the city; people are drawn to these cultures centres, which in turn attract amenities, businesses and services that ultimately entice more residents.

Lawton *et al.* (2013) argue that residential decisions are not simple but rather complex as they are primarily based upon the preferences and needs of the family or individual. For example, university students prefer to live close to the campus they attend, whilst families with young children prefer living in spacious suburban homes rather than inner city apartments (often rentals), which are preferred by young individuals and couples (Lawton *et al*., 2013; Nijënstein *et al,* 2014).

The life-cycle hypothesis suggests that residential choices are informed by the size and status of the household. Couples with no children or children who have moved out of the home favour other factors above spaciousness, whilst those with children favour homes with an abundance of space (Frenkel *et al.,* 2013). Queries using academic search engines (Google scholar and other databases) reveal that literature examining residential preference is based on an individual's or family's socio-demographic or socio-economic status. For example, class, culture, race, marital status, occupation and religion. This is confirmed by the work of Petkar and Macwan (2017). Thus, in some instances, places of worship have an effect on where people decide to live. Such is the case in Lisbon, Portugal, where Muslim migrants choose to reside in close proximity to the Mosque, with listed houses in the area marketed by the phrase "close to Mosque" to attract Muslim buyers (McGarrigle, 2015).

There is minimal literature that examines South Africans' residential choices. Much of the recent literature examines segregation and spatial trends in post-Apartheid South Africa and not residential choices in isolation. Studies, such as those by Hamann and Horn (2015) and Donald and Kotze (2006), examine desegregation in post-Apartheid South Africa. A study by Lehohla and Shabalala (2014) found that most amenities in South Africa are found in areas that were previously demarcated as white only neighbourhoods. Moreover, the authors attribute these amenities to having a favourable economic influence on those residing in these areas. The next section will

examine how value is derived from property and how these external factors can influence the value of property.

2.4. Property Valuation

Millington (2014) defines value, in terms of property, as the price at which a buyer is willing to buy at and the seller willing to sell. This is more commonly referred to as the market value. Neither the buyer nor the seller is forced into buying or selling a property that they believe is above (for the buyer) or below (for the seller) market value. The property market, as with any other product or commodity, is governed by basic economic principles, such as demand and supply. Usually, the scarcer a property, the higher the value and vice versa.

There is, however, a question of subjectivity as the buyer or seller will have a value they perceive the property to be worth. This subjective value is based on the utility of the property. If a property is deemed to fit all the needs of the buyer, they will be willing to pay a greater amount for a property than one that does not fulfil all their needs. Due to the complexity of the property market, subjective value often takes precedence over demand and supply, and thus might inflate or reduce the value of the specific property. Thus, French (2004) makes an important distinction between market value and worth: the market value is merely an approximation of the price for which the property could be sold, while worth is the price an individual assigns to a property based on the individual's perceived benefit of the property to them. The function of assigning value to a property is termed either as property valuation or property appraisal.

Valuation is vital to understanding property and the property discourse (Abidoye and Chan, 2016). Calhoun (2001), as well as Kanojia *et al. (*2016), states that property valuation is an important topic in the economic, social and political spheres. Homeowners are concerned with the value of their residential property as, in most circumstances, it is the single biggest investment acquired in their lifetime (Scatigna *et al*., 2014). According to Statistics South Africa (2010), South Africans spend the greatest percentage of their income on housing. Moreover, value is critical to individuals and businesses who purchase property for investment purposes (Abidoye and Chan, 2016). Thus, property – and more specifically residential property – can be both a consumable good as well as an investment. Property valuations are not only an important concept for microeconomics but also macroeconomics, the prime

example being the 2008 financial crisis, which was caused by a slump in the USA property market (Ivashina and Scharfstein, 2010). Furthermore, a study by Dettling and Kearney (2014) highlights how housing values can influence other aspects of life as the authors found a correlation between housing values and fertility: higher property values resulted in lower fertility rates and lower property values resulted in higher fertility rates.

According to Oloke *et al*. (2013), there are a number of aspects that determine the value of a property. Understanding property and its valuation can thus be complex; one needs to have a firm grasp of the property discourse as well as basic knowledge of economics to understand how valuation is determined. In particular, residential property valuations are complex due to residential property being a heterogeneous good. As previously mentioned, there are many types of residential property (Araujo and Cheng, 2017; Oloke *et al.*, 2013). Residential property is described as heterogeneous as there are many factors, both external and internal, that affect the value (Beracha *et al*., 2016). Dividing property value into external and internal factors may also be described as either tangible or intangible aspects of value. There is a relation between the internal and the tangible aspects of a property as these aspects refer to the actual aspects of the property, such as the structure and the land (Melanda *et al.,* 2016). Likewise, there is a link between the external and intangible characteristics of the property as these aspects affect the property but cannot be directly seen.

Dziauddin (2014) mentions that value is primarily derived from the internal and tangible factors of the property, such as the structural makeup of the building as well as the size of the plot. Intangible and external factors, however, contribute significantly towards the market value of the property. There is an overlap of the factors that inform residential choices and the factors that add value to property prices. These factors are often external and intangible because they are not physically part of the property. A property cannot be viewed in isolation to its surrounding; external factors that are in proximity to the property may affect its value. As alluded to in the previous section, location plays a vital role in the valuation of property. Aliyu *et al.* (2012) divides the aspects of location from which value is derived into two categories, namely: attributes of the physical location and abstract attributes of location. Thus, Aliyu *et al*. (2012)

provides a comprehensive list of the attributes of the physical location and the abstract location.

Aliyu *et al.* (2012, pg. 66) states that the attributes of the physical location include

> "closeness to central business districts, accessibility, community facilities, utilities and services, transportation building codes, demand, supply, planning restrictions, population increase, zoning regulation, closeness to place of work, components or elements that form part of a building structure, building codes, environmental protection laws, subdivision regulations, waste dumpsites, and the likes."

In comparison, Aliyu *et al*. (2012, pg. 66) states that the attributes of the abstract location include "crime, native inclination, race, religious inclination, safety, cultural identity, ethnic background, security, indigeneship, household preference, socio-economic background."

An individual intending to purchase a property might be willing to pay a premium for one of these factors or for a bundle of factors (Oloke *et al.,* 2013). Affordable housing is made affordable by compromising on two factors, namely: location and quality of materials used in construction (Mulliner *et al.,* 2016). This further highlights the significance of location and its inherited benefits. What has become apparent is the importance of the multifaceted relationship between value and location. On the one hand, location theory can explain how individuals and families choose to locate to one area based on certain factors, but on the other hand, there is value assigned to these factors. Not all factors would contribute an equal amount of value towards the property (Balbotain *et al.,* 2015).

There is an abundance of literature that examines factors that increase and decrease the value of property, which will now be explored. There is a consensus among scholars (Melanda, 2016; Rahadi *et al*., 2016; Kok *et al*., 2014; Araujo and Cheng, 2017; Das *et al*., 2017) that certain amenities, facilities and services that are in close proximity to residential properties add value to these properties. These (Xaio, 2017) amenities can be broadly classified under the following headings:

- Location and accessibility characteristics, which may include distance to shopping centres, distance to employment, transportation network and the general walkability of the area

- Neighbourhood characteristics, such as the quality of schools, social status, culture, race and class

- Environmental characteristics, which includes the quality of the environment and green amenities such as parks

- Other, which would include amenities not included in the other areas, such as places of worship

Amenities can include tarred road, streetlights, electricity, schools, shopping centres, walkability of the area, places of worship, services and waste disposal (Famuyiwa and Babawale, 2014). Controversially, Das *et al.* (2017) found that certain amenities have an effect on informal dwellings in India. Amenities are primarily seen as beneficial due to the convenience, service and aesthetics they offer. According to Bercha (2016), areas with a number of external amenities only increases property values when the property market appreciates, whilst in instances when the property market is in decline, these amenities have the opposite effect on the value of the property.

While certain factors may increase the value of the property, naturally there are also factors that may decrease the value of the property. While amenities are used to describe a facility or service that adds value, the term disamenities is used to describe facilities and services that devaluate properties (Sunak and Madlener, 2016). The most common externalities that cause property devaluation have been examined by Bell, a prominent scholar in the property disamenities discourse who has produced numerous works. Property can be devalued by more than 200 factors as stated by Bell (1999). The majority of these factors have to do with environmental hazards, such as landfills, and other places that may cause pollution or are negatively perceived, such as petrol stations. Other factors include social and cultural norms. Certain societies may display prejudice against people who are of a different ethnicity, race, culture or social class, while some cultures may see certain disamenities as a taboo, such as having homes close to a cemetery.

There are few studies in South Africa that examine the relationship between land values and external amenities/disamenities, and these will now be explored. Although there are few South African studies that investigate the effect of external amenities on surrounding property, Mcgaffin and Brown-Luthango are two South African scholars

who have a particular interest in the property value discourse. However, most of their studies examine how value can be created in South African to fit its unique context. A study by du Preez *et al*. (2014), in Port Elizabeth, investigates how a landfill is classified as a disamenity due to it having a negative impact on surrounding property prices, finding that property prices increase as one moves away from the landfill.

Valuation, as previously stated, is complex, and for that reason, one cannot adopt the results of one study as a standard and assume it to apply to another occurrence. In some instances, factors that increase value may decrease value in another area. For example, green infrastructure in Seattle, Washington, increased residential property prices, while in Gainesville, Florida, green infrastructure devalued properties (Ward *et al.*, 2008, and Williams and Wise, 2009, cited in Netusil *et al*., 2014). It may be that two factors have a combined effect on the property price. For example, transport stations increase value, but the noise generated from these stations may devalue a property. It may also be that a factor that increases value in one place would not normally have an impact in other areas. Rahadi *et al.* (2016) found that in Jakarta, Indonesia, individuals value homes that are closer to where their family members reside as higher than those further away. Araujo and Cheng (2017) is of the opinion that the value that amenities add to properties is based on the type of property as well as the status of those residing in the property. Their study found that cultural amenities add value to apartments while accessibility to employment added value to freestanding houses (Araujo and Cheng, 2017).

As previously mentioned, subjective value plays a large part in property valuations. Often, external factors may have a positive impact or no effect on the neighbourhood, yet people perceive it to be negative and it therefore negatively affects the price (McCluskey and Rausser 2001). This is closely related to not in my backyard (NIMBYISM). There is extensive literature of NIMBYISM. Thus, potential homeowners are willing to pay a premium for homes in areas where residents are of the same race, ethnicity and culture as them.

As previously mentioned, there is little work done on the effect of amenities/disamenities on the South African property market let alone literature on the effect that places of worship have on surrounding property. However, international studies by Chin and Chau (2002), Thompson (2011) and Brandt *et al*. (2014) examine

the effect of places of worship on surrounding properties' value. Vandell (1995), Thrall (1998) and Simons and Seo (2011) found that synagogues increase the value of properties within walking distance. This is due to the Sabbath, an auspicious day for people of the Jewish faith. Thus, houses that are in walking distance to a synagogue fetch a higher price.

The effect of churches on residential property is far more nuanced and complex as studies indicate mixed results (Kinney and Winter, 2006; Babawale, 2011). Kinney and Winter (2006) found that freestanding churches have a greater effect on value than storefront churches in St. Louis Missouri USA. However, this could be attributed to the type of residential property that is naturally more expensive than the residential property found close to storefront churches. Babawale and Adewunmi (2011), however, found that churches in Lagos, Nigeria, had a negative effect on residential apartments. However, the negative effect was often offset by other amenities in close proximity, which had a much stronger positive effect on the value of the residential apartments. Babawale and Adewunmi (2011) do not explicitly express what aspects of the churches causes the decrease in value.

This seems to be the case with Mosques in western countries, where they have been seen in a negative light (Saint-Blancat, 2005; Zhang, 2012). In contrast, a study conducted in Berlin indicated Mosques have a positive effect on properties in the vicinity. However, the author attributes this to Berlin being a liberal, open-minded city (Brandt *et al*., 2014).

A study conducted by Dziauddin (2014) in Malaysia, a predominately Muslim country, however, indicated a positive increase in surrounding property prices, with property prices decreasing when moving away from the Mosque. Dziauddin (2014) explains that, in this study, the Mosque was seen to add value despite being associated with factors that would normally decrease surrounding property prices. As Dziauddin (2014) mentions, homeowners in a suburb of Dubai attribute lower property prices to a newly constructed Mosque. These homeowners argue that the Mosque increases traffic and noise, with the call to prayer transmitted via loudspeaker.

The Intrinsic value of a property is the cost of the land and the cost of improvements. For example, the cost of materials used for a building, excluding the intangible aspects. Therefore, most valuations take into account the market value, which consist

of both external and internal factors that influence the property (Monson, 2009). Determining the market value of a property is complicated when assigning value to intangible factors (Melanda *et al*., 2016).

The true value of a property, however, is only revealed once the property has been sold. Property is unique in that the listed prices are not definitive and is up to the buyer and seller to agree on a price. Thus, any value that an estate agent or appraiser assigns to the property is merely speculative (Adegoke, 2014). The hedonic model is often used to predict value on the various aspects of the house. Before exploring the hedonic model, methods of valuation will be explored.

2.4.1. Methods of Property Valuation

Since property is a complex good, valuating properties will naturally be complex too. This is partly due to the various factors that contribute towards the value of a property, as previously described. It is also due to there being different purposes for valuation. An appraisal of a property is primarily undertaken to estimate a sale price, but there are numerous other, equally important, reasons to valuate a property. Companies often valuate their properties as the value of their properties is important for accounting and financial statements. Valuations are critical to the expropriation of properties, especially when compensation needs to be paid out. Valuations are needed for insurance purposes, and used by governments to derive rates and taxes as well as by banks that may use properties as collateral for loans (Pagourtzi *et al.,* 2003; French, 2004; Bellman and Öhman, 2016).

There are multiple methods to appraise properties, with property appraisers from a host of professions, which Pagourtzi *et al.* (2003, pg. 1-2) list as

> "real estate agents, appraisers, assessors, mortgage lenders, brokers, property developers, investors and fund managers, lenders, market researchers and analysts, shopping centre owners and operators and other specialists and consultants."

The different methods of appraisal may result in ascribing different values for a single property as the methods use different pieces of information about the property to reach a value. Often, valuations that determine property rates and taxes are solely based on the intrinsic valuation (Almy, 2013). This is in contrast to French (2004), who is of the opinion that the property will inform the valuation rather than the purpose. The mainstream opinion seems to be held by Abidoye and Chan (2016), who believe that

methods of valuation will be selected for the purpose of the valuation or the valuator's profession. In addition, Pagourtzi *et al.* (2003) state that property valuation methods also depend on the country and the cultural norms as there might be slight variations of one particular method across countries.

Property valuation is said to be an art and a science as the methods dictate that an appraiser have practical knowledge of the workings of the property market. The appraiser should be aware of the quantitative information that informs the property value as well as an understanding of the qualitative information (e.g. property size) and the science formulating a value (Abidoye and Chan, 2016; Bell and Bell, 2015).

The most commonly employed property valuation methods are:

- Comparable method
- Investment/income method
- Profit method

These methods are referred to as the traditional methods of property valuation. Recently, more advanced methods (of which two are critical to this study) have come about:

- Fuzzy logic
- Autoregressive integrated moving average
- Artificial neural networks
- Spatial analysis methods: This method is made up of a number of methodologies. Spatial analysis methods are primarily done with the aid of GIS geographical information system.
- Hedonic pricing method: This method is employed to find the particular value of either an internal or external aspect of the property. Since this is vital to the study, it will be examined in greater detail in the subsequent section as well as in the subsequent chapter.

Traditional methods of property valuation are often criticised. One of the shortcomings with traditional methods is with regards to determining the value of external factors or assigning a value to a specific feature of the house (Adair *et al.,* 1996). Greaves (1985)

critiques traditional methods as they either inadequately explain or fail to explain the effect of external factors on properties, arguing that the traditional methods oversimplify the role of external factors in the valuation of property.

Pagourtzi *et al.* (2003) compares the traditional methods of property valuation with the advanced methods by explaining that the traditional approaches have different purposes. For example, some approaches are for investment or insurance purposes. The most commonly used approach is the comparable method, but this method does not factor in external influences. Furthermore, Pagourtzi *et al.* (2003) describes the main issue with the traditional approaches is the confusion it creates when applied to academic studies as different approaches yield different results. Moreover, the methods used do not find the intrinsic value but rather the market value, which can be exaggerated or undervalued. An advanced approach, promoted by Pagourtzi *et al.* (2003), to establish the effect of external influences on property values is the hedonic pricing model using regression analysis. It estimates the value for each component of the property.

2.4.2. Hedonic Analysis

Goodman (1998) provides a comprehensive history of hedonic analysis, which is a method that has been adopted by property appraisers. The method was first used by Court (1939, cited in Goodman, 1998), an economist working in the motor vehicle industry. Court was interested in finding the value in a different aspect of the car and thus devised a regression formula to understand how value is attributed to the many components of the vehicle .

Hedonic is derived from the term hedonism, which is a concept that the ancient Greek philosopher Hobbes theorised. Hobbes believed that the ultimate aim of an individual was to live a life of maximum pleasure. Hedonism was the belief of living a life with the most pleasurable experiences (Ryan and Deci, 2001). Court (1939, cited in Goodman, 1998) adopted the term hedonic value as he sought to find the ‘‘usefulness and desirability” aspects of the car.

In property, the hedonic pricing model, also known as hedonic analyses or the hedonic regression is described by Milington (2004) as a method used to obtain a specific value, which is part of the entire value. The hedonic value is abstract as it cannot be directly observed. Hedonic value is the breakdown of value to the various aspect of

the property. This can either be the value added or subtracted from a specific aspect of the property or the value added or subtracted from an external aspect that influences the property (rather a cumulation of tangible and non-tangible to make up the entire value).

There are various means of conducting a hedonic analysis, and the methodology will differ from study to study. Strand and Vagnes (2001, pg. 137) explain their method "through a hedonic price study where the statistical relationship between property prices and railroad proximity is estimated," whereas Peterson and Flanagan (2009), employ an advanced statistical analysis, using an artificial neural network to uncover the hedonic value.

Páez (2004) and Sirmans *et al.* (2005) review the literature on property studies, which evaluates the usefulness of the hedonic methods. In all the papers reviewed, there was a success in measuring hedonic value. In some instances, the hedonic value was sought for internal factors of a property, while in other studies, it was for external factors. Both external factors and factors of the physical property indicated that it could either lead to an increase or decrease in the property value. As an example, Páez (2004) found that repossessed houses have a negative effect on surrounding houses and that the effect of the devaluation weakens with distance from the house. In contrast, Sirmans *et al*. (2005) examined a study that indicated that gated communities in California increased the value of properties within the enclosure.

2.5. Importance of the Mosque

A Mosque *or Masjid,* as it is referred to in Arabic, is an Islamic building where Muslims offer their prayers. The first Mosque was erected in the city of Madinah (then known as *Yathrib*), Saudi Arabia, by the prophet Mohammed, peace be upon him (PBUH). This Mosque has been the model for many other Mosques, particularly within Islamic cities, where the Mosque is at the centre of the city and surrounded by the marketplace and other important public buildings. Thus, the Mosque was located in a convenient and accessible location (Hamid *et al*., 2012), with the Mosque serving not only as a place of worship but also as a community centre, serving political and social needs (Ghorbannejad and Mohammadi, 2014).

Muslims are required to pray five times a day at prescribed times. For example, *fajr* [the morning prayer] sets in at dawn and last until sunrise. Many Muslim scholars

argue that it is incumbent for Muslim males to pray in a Mosque with a congregation. There are certain times when the prayers are seen as more important, for example the *Jummah* [Friday afternoon prayer], and the catchment area will be greater during this time than it is during the other five daily prayers.

An important aspect of the Mosque is the *Athaan*. The *Athaan* is the Islamic call to prayer, which is broadcast from the Mosque when the time of prayer sets in. It is a tradition that dates back to the time of the prophet Mohammed (PBUH), who asked his disciples to think of a way to call the community to prayer when the time of prayer sets in. Such a call was needed as the community grew larger. One of the prophet's disciples had a dream about using a chant to call the people to prayer. The two important aspects of this study regarding the *Athaan* are, firstly, that it partially determines the Mosque area of and influence, and secondly, the *Athaan* contributes to why the Mosque could be seen as a disamenity.

In Islam, there are certain conditions to pray in congregation (Islamqa, 2008). One of the conditions is based on distance. If one lives at a distance where they cannot hear the *Athaan,* then one is not mandatory to attend the congregational prayer. Moreover, one must be at a distance where the *Athaan* can be heard without amplification (i.e. the loudspeaker); noise that is unnatural or wind does not negate the call. For example, if one is at a distance where they can normally hear the *Athaan,* but due to unnatural noise from a construction site can't hear it for a period, then it is still incumbent upon them to attend the prayer in congregation (Islamqa, 2008). Islamic scholars have ruled that if one's travel time is reasonable (irrespective of mode of transport), one should attend the prayer. This is to compensate for modern forms of transport (Islamqa, 2008).

In present times, the *Athaan* is transmitted via a loudspeaker, which is often attached to the minaret of the Mosque. This is a new addition to the religion from around the twentieth century. Previously, the *Athaan* was called using only the natural voice. *Athaan* called out over a loudspeaker can be seen as a nuisance, particularly in two instances. The first is when there is a minority Muslim community around the Mosque and most of the people around the Mosque do not understand the need of the call at various hours of the day. The second is in Muslim majority countries and communities

where numerous *Athaans* of different Mosques are transmitted at the same time creating a “cacophony” as no one *Athaan* is distinguishable.

Islamic religious scholars have mixed views on the *Athaan* given over the loudspeaker. Some argue that the *Athaan* is an integral part of the prayer and to prohibit the call in any way is to infringe and oppress the freedom of worship; while others view the *athaan* given over the loudspeaker in a negative light arguing that the “cacophony” takes away from the beauty and the essences of the *Athaan.* Thus, these are the possible reasons *Athaan* over the loudspeaker could cause the Mosque to be a disamenity. It is a common problem. Muslim-oriented countries, such as Saudi Arabia and Egypt, have made unsuccessful attempts to unify the *Athaan* in certain cities by broadcasting one *Athaan* at the time of prayer instead of each Mosque broadcasting their own *Athaan* (Shavit and Spangler, 2016).

Possible reasons for the Mosque to be seen as an amenity, however, are based on the prophet Mohammed’s (PBUH*)* recorded traditions known as the *Sunnah.* The *Hadith* is a collection of the *Sunnah,* which is based on the prophet Mohammed’s (PBUH) teachings, sayings and practices, which are meant to supplement the Qur’anic text. In Islam, the *Sunnah* and Qur’an are the two highest regarded sources of authority, and Muslims are governed by these two sources. One *Hadith* describes that there is a great reward for the person who walks to the Mosque at the time of prayer. This can, thus, be seen as a reason why Muslims would like to live in close proximity (walking distance) to the Mosque.

Ghorbannejad and Mohammadi (2014) examine the conditions under which the Qur’an and *Hadith* prescribe where the Mosque should be located. From these recommendations, there are important conditions that might impact the Mosque being seen as an amenity, including:

- The Mosque’s physical environment: the Mosque should be built in an area that is unsoiled. The environment should be pristine as the Mosque is seen as a place where worshipers come to cleanse themselves both physically and spiritually.
- The Mosque should be built on land with historical significance or named after historical events.

- The Mosque should not be constructed in a place where it will disrupt daily activities or create traffic.
- The Mosque should be located on higher ground so that it can be seen from afar. Congruently the Mosque should also act as a place of refuge in times of danger and the Mosque should be accessible to all at any time of the day or night.
- The Mosque should be aesthetically pleasing, using light in particular to achieve this. Light in Islam is linked to spiritually and is said to attract angels. Thus, light is used in the Mosque to create a pleasing ambience with a mixture of bright and dim lights in niches.
- The Mosque should not be built in a place where there is excessive noise.

In modern times, the Mosque often has more than one function. As the Mosque is a central place to Muslim communities, it is also used for other purposes in many instances, most commonly as a *Madrassah* [Islamic school]. Other common functions include clinics, libraries and community halls. In most cases, the facilities are located in dedicated buildings found on the Mosque compound and activities outside of worship do not necessarily take place within the Mosque (Sumaryanto, 2016).

As previously mentioned, the literature on NIMBYISM is extensive. There is work on Mosques and people's opposition to the Mosque in literature. Most of the work is in Europe. Belbah (2009) explains the effect of NIMBYISM on a Mosque's location and the Muslim community. French authorities in the past dictated that Mosques should be placed on the periphery of the city and not in accessible locations close to residential areas, and Muslim communities in particular, due to strong NIMBY attitudes. This move is shown to encourage radicalisation amongst Muslims who are marginalised. Belbah (2009), however, cautions that radicalisation cannot be attributed merely to the location of the Mosque.

2.5.1. Mosques in South Africa

Muslims have a long history in South Africa, but Islam is not indigenous to South Africa; it came to the area via migration. The first Muslims who were settled in South Africa came as political prisoners and slaves during the colonial era. The Dutch East India Company was the first western force to colonise the Cape, and Cape Town acted

as a refreshment stop for the company's ships travelling from Europe to it's colonies in Asia (Mahida, 1993).

The first Muslims who arrived at the Cape came from the Dutch East Indies colonies. These migrants were critical in establishing the Cape colony, deployed either as labourers or soldiers to defend the Cape Colony from the indigenous people. Once the Dutch East India Company had firmly established the colony, the company sent its political exiles from other of their colonies to Cape Town (Mahida, 1993). The most influential prisoner was *Shaykh* Yusuf, who was exiled to the Cape for resisting the Dutch occupation of Goa. *Shaykh* Yusuf came to the Cape in 1694 with an entourage of 49 people, including 12 imams [Islamic leader]. *Shaykh* Yusuf and his entourage were credited with establishing the first organised Muslim community in South Africa, although they were not allowed to practise Islam in public and were restricted to a farm outside of Cape Town (Mahida, 1993).

In 1743, prisoners from Indonesia were sent to the Cape to serve out their sentences. Many of the prisoners decided to stay in the Cape once they had finished their sentences. These ex-convicts became the first community of free "blacks" (Non-Europeans) in Cape Town (Mahida, 1993). Tayob (1999) argues that it is from this community and in this period that Islam became "institutionalised." Although there were many restrictions placed on the community, they were allowed to practise Islam as well as to preach the religion to the slaves of the region. Colonialists viewed Islam favourably at the time as Muslim slaves were preferred due to Islamic religious laws that prevented them from consuming alcohol and other intoxicants.

In the 1790s, the British occupied the Cape, which brought greater freedom to the Muslims of Cape Town. It was under British rule that the first Mosque in South Africa was established. In 1798, the Awaal Mosque in Cape Town was founded by Abdullah Kadi Abdus Salaam, who was more commonly known as Taun guru, a prominent political exile, and Frans van Bengalen, a slave who bought his freedom. The Awaal Mosque , however, was not allowed to resemble a Mosque. This was purposefully done by the authorities to conceal the status and legitimacy of Islam from outsiders and the greater community (Tayob, 1999). Ironically, the Awaal Mosque had a profound impact on the political and social lives of the Muslims who lived in the Cape,

even more than the spiritual impact as the Mosque did not attract many adherents for the daily prayers (Tayob, 1999).

A second influx of Muslim migrants began to arrive in 1860, settling on the east coast of South Africa. Indian indentured labourers were brought to Natal to work in the sugar cane fields until their debts were repaid after which they had a choice to remain in South Africa or return to their homelands (Mahida, 1993). A minority of the Indian labourers were Muslim, and very few of these Muslim labourers decided to remain behind. Following the Indian indentured labourers were Indian economic migrants from the state of Gujarat in 1869; a large portion of these migrants were Muslim. These Indian migrants were of a higher economic status than the indentured labourers, and wilfully choose to come to South Africa. Many of these Indian migrants were entrepreneurs who came to start businesses in South Africa. They were successful traders in Natal, and later the Transvaal (Gauteng), and were responsible for constructing many of the Mosques in these two parts of the country (Mahida, 1993).

The first Mosque in Johannesburg, Gauteng, then the Transvaal, was the Jumaa Mosque located on Kerk Street. A tent was first erected in 1870 with a permanent structure built in 1888 (Mahida, 1993). This Mosque was built by Malays (Muslims from the Cape) who settled in Johannesburg during the gold rush (Harrison, 2004). The building of Mosques and the successful businesses set up by Muslims displeased the government and white businessmen. It was believed that the construction of a Mosque would signal the start of Muslim domination in that area, of both residency and business (Tayob, 1999). In the 1890s, the government passed laws that made it difficult for Indians to conduct business. The most profound of these laws prohibited Indians from owning land in certain areas. Thus, the land Mosques were built on were often registered in the names of Malay Muslims in the community (Tayob, 1999). During the Apartheid regime, laws became much harsher and extended to all people of colour. Mosques then were restricted to Indian and Malay townships. The number of worshipers at Mosques that were in city centres dwindled as these areas were exclusively reserved for the white population (Tayob, 1999).

At present, there are Mosques found in several parts of Johannesburg with Mosques appearing in suburbs that were previously demarcated for white people only (Harrison, 2004). It is important to note that most Muslims were part of the oppressed classes as

Muslims were mainly non-white and thus oppressed by the Apartheid government's policy of separate development. Muslims, although a small percentage of the population, have contributed greatly to South African society (Esack, 1997); this can be seen in the built environment with many Mosques found in cities and towns across the country.

This section of the review aimed to explain concepts regarding Islam and the Mosque. As well as moving from the broad topic of property to the specifics of how a Mosque may impact value in the South African context, this relationship is further explained in the conceptual framework below.

2.6. Conceptual Framework

The conceptual framework indicates the relationship of the various concepts as detailed in the literature review. Residential property has two downward links, showing the Muslim community buying property and that a property's value is informed by hedonic prices, thereby indicating that amenities found in areas can either positively or negatively affect the hedonic value of a property. The broken lines indicate what the study wants to establish connections with. Thus, the study wants to investigate if Muslims attracted to the Mosque initiate a higher value. The study is cognitive of other amenities found in the area, which can also influence the hedonic value, and that the Mosque may result in a decrease in the hedonic value.

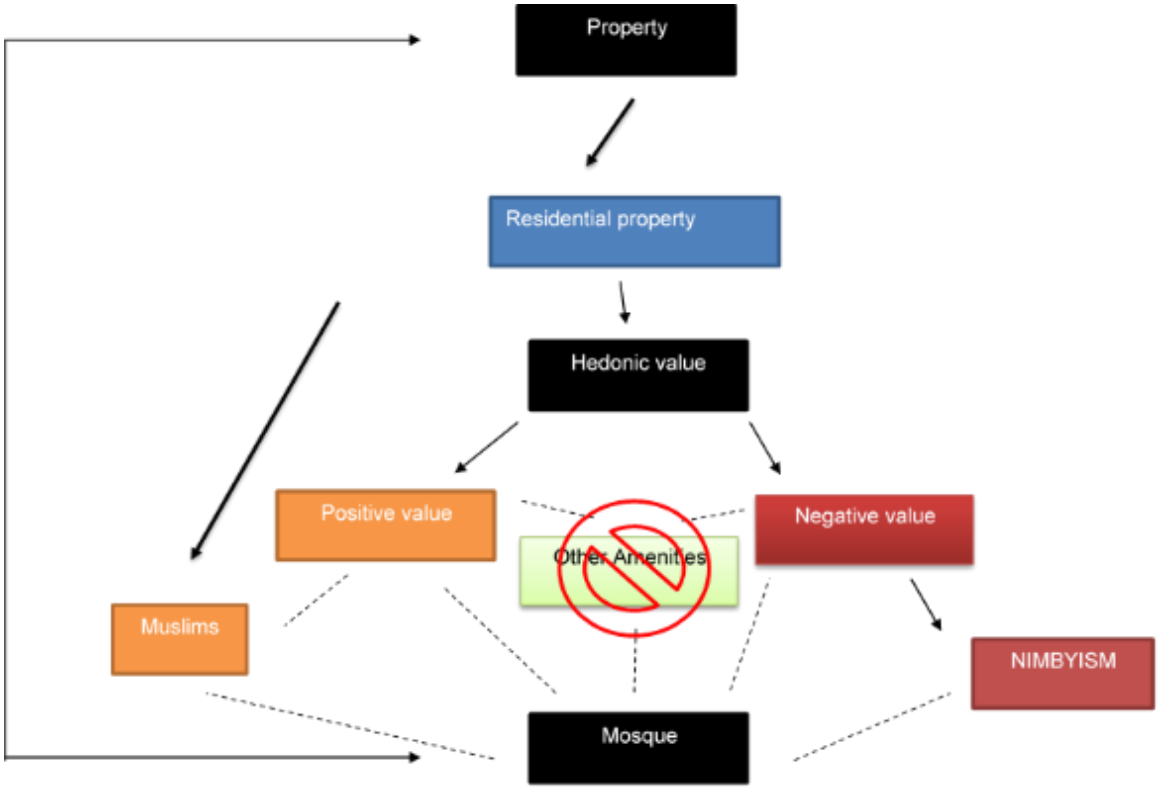


Figure 2: Conceptual Framework (Source: Author, 2017)

2.7. Conclusion

In conclusion, this chapter reviewed critical literature needed to provide a better perspective of the study and how it is located within current theories and discourses. The literature began with basic definitions regarding property thereafter examining theory around location and property valuation. Location theory explains how residential housing is centred around services and amenities, so it could offer an explanation as to why people would choose to reside close to a Mosque or further away from a Mosque. The next theme investigated was value, which is a crucial factor linked to residential location theory. Understanding property value allows one to understand how important property and certain aspects are to an individual or family due to the ascribed monetary value. It was found that a hedonic analysis can be used to determine the value that these services and amenities have on residential property. Thus, hedonic value could be used to determine the value of living close to the Mosque. The final themes explored by the literature review examined the Mosque, offering an in-depth view at the factors that may classify the Mosque as an amenity or a disamenity while probing the limited literature on Mosques in South Africa.

3. Chapter Three: Hedonic Spatial Analysis: Methodology and Case Study

The purpose of this chapter is twofold: to detail the methodology of how the study is going to be conducted and to provide context for the study by offering a case study. The methodology will detail the various techniques the study will employ in order to obtain results, detailing the entire process from the data required for the methods employed, whilst the case study provides an overview of the study area. Context of the area is provided with a historical account as well as the areas presently. It moves from the general to the specific, from the whole of Johannesburg to the specific area of the study.

3.1. Research Methods

The study is a cross-section analysis that examines property prices since the Mosque was established. This section aims to detail the data required and the methods employed in conducting this study. The research method will explore the use of two regression models used in this study and examine their differences.

3.1.1. Data and Data Collection

This study makes use of three dimensions of housing data:

- Data relating to the attributes of the house, which may include the value of the house, the size of the property, number of rooms, number of bathrooms and other characteristics of the residential property
- Data relating to the social and economic status of the household, which may include income, race, religion, age and other data relating to the household composition
- Data pertaining to the externalities of the houses, the distance to shopping nodes, distance to schools, distance to green spaces and most importantly the distance to the Mosque

Thus, two forms of data are critical to this study: would-be spatial data, which is data pertaining to the location of the houses, and data that describes the attributes of these houses.

The data used for this study is secondary data that has been previously collected. The main data is of recorded transactions of houses sold in Emmarentia and Greenside. Besides the prices, the houses sold for the dataset includes: the date the property was sold, the number of bedrooms and bathrooms, the address, the age of the property and the cadastral size. The data required for this study is neither freely nor readily available, so there was difficulty in obtaining and sourcing this data. The data was obtained for a fee from Lightstone, a property company based in Johannesburg, and was provided in the form of an Excel spreadsheet.

The data covers a 17-year period, from 2000 to 2016, so the study is a cross-section analysis of the same period. The study is not a time series analysis as the data is of random houses sold within the time period and not repeated sales of the same houses over the 17 years. A dataset of the Housing Price Index was obtained for the same period of time (2000-2016) to supplement the data and control for time and inflation over years. The Housing Price Index is freely available from Quantec (a data company), but the data is collected by ABSA on a monthly basis. The Housing Price Index used in this study can be found in Appendix A.

3.1.2. Regression Models

This study will employ two regression models: the hedonic pricing (Ordinary Least Squares (OLS) model) and Geographically Weighted Regression (GWR), which aims to attribute the value of the Mosque on the surrounding properties. A regression model is a quantitative statistical method used to measure the influence of one variable with another or to predict the influence one variable may have on another (Kane *et al*., 2004). For example, a regression model can be used to examine if there is a relationship between exercise and weight loss. Moreover, it will indicate how meaningful the relationship is, which means an indication can be given if exercise does result in weight loss. Similarly, it can then be used to either predict or measure (estimate) the amount of weight loss based on the time a person spends exercising.

There are two main types of regression models: a simple linear and multiple regression. A simple linear regression model examines the relationship between a dependent variable and a single independent variable, whilst a multilinear regression model examines the relationship between one dependent variable with more than one independent variable (Kane *et al.*, 2004). In this study, two multiple regression

analyses, namely the Hedonic Pricing model and the Geographically Weighted Regression model, will be employed to understand the relationship between value and housing characteristics (including the effect of externalities).

3.1.3. Hedonic Pricing Model

As previously stated in the literature review, Hedonic Pricing (OLS model) is the most commonly used method to obtain values of specific components that make up the value of a house. Moreover, the hedonic model has been used in several hedonic and property studies, including studies examining the impact of places of worship.

The hedonic method uses a multiple regression analysis to understand the value of individual characteristics of the external and internal aspects of the house. This model is explanatory rather than predictive as the sale price of the house is known. If it were a predictive model, the model would aim to predict the sale price. Rather, what the study aims to achieve is to estimate and understand the relationship between the variables, uncovering which variables influence value and which do not. The housing price will then be the dependent variable. The independent variables are the individual characteristics of the house. The cumulation of the independent variables should, thus, equate the house's total value. This can be expressed as a statistical equation as shown below:

$$HP = \beta_0 + \beta_1 p + \beta_2 e + \varepsilon$$

Where:

HP = house sale price

P = physical characteristics of the house

E = external amenities based on distance to the house

β0 is the intercept, while β represents the dependent variables and ε is the error term.

The most commonly used regression method in hedonic models is the OLS. The data will be input into Stata, a statistical program that automatically computes the statistical analysis. Stata outputs a table that displays the results of the analysis. Included in the table is the F-test, the R-squared, the coefficient, the standard error and P-value of each variable.

3.1.4. Geographically Weighted Regressions

Geographically Weighted Regression (GWR) is a regression model with a spatial component that is increasingly being used in property studies due to its spatial modelling abilities unlike other regression models. The model combines the OLS regression method with the first law of geography, which states that objects closer to one another are more likely to have the same characteristics than objects further away.

GWR, therefore, is a local regression method where non-spatial regression methods are global regression models. The key difference in a local model is that does not assume that all the data across the study area is spatially heterogeneous, and thus does not compare variables across the entire sample. Rather, it creates a kernel that divides the samples into smaller samples and compares the variables that are closest to each other. Two techniques the kernel size can be based on is either fixed or adaptive: fixed will create a kernel that has a constant size, while an adaptive kernel size is dependent on the number and distribution of the sample. Using the adaptive option determines the size of the kernel based on the density of the data. In areas where the data is sparse, the kernel size increases, and in places where there is a higher density of data, the size of the kernel decreases. Thus, GWR allows for spatial correlation, and is therefore able to understand spatial relationships that vary over space. The statistical equation is similar to the hedonic pricing method OLS regression mentioned previously, but it importantly adds the aspect of location:

$$HP_i(\boldsymbol{l}) = \beta_{0i}(\boldsymbol{l}) + \beta_{1i}(\boldsymbol{l})p_{1i} + \beta_{2i}(\boldsymbol{l})e_{2i} + \varepsilon_i$$

Where:

HP = house sale prices

P = physical characteristics of the house

E = external amenities based on distance to the house

β0 is the intercept, while β represents the dependent variables and ε is the error term.

The notation (l) , however, indicates a unique location for each investigated variable, thus allowing spatial distribution to be analysed in the regression. The location of (l) for each variable is determined by the geographic weighting, which is sought by the equation:

$$\hat{\beta}(l) = (X^t W(l) W)^{-1} X^t W(l) y$$

Chartlon *et al.* (2009, pg. 6) explains this expression as

> "W(l) is a square matrix of weights relative to the position of u in the study area; $X^t W(l) X$ is the geographically weighted variance-covariance matrix (the estimation requires its inverse to be obtained), and y is the vector of the values of the dependent variable."

Thus, the adaptive kernel, as previously mentioned, sought by the GWR software uses the following expression:

$$w_i(l) = (1 - ({}^{d_i(l)}/_{h})^2)^2$$

The data will be input into a Geographic Information System (GIS). ArcGIS software is a GIS that allows for a range of spatial queries.

3.1.5. Geographic Weighted Regression versus Hedonic Pricing Model and the Role of Spatial Software

International studies (Chan, 2014; Widlak *et al*. 2015; lai and Fischer, 2017) reveal that GWR yields superior results to hedonic models in most cases as it achieves a greater accuracy. This is due to the hedonic model not being a spatial model. In order to negate this spatial problem, scholars who employed hedonic pricing models used a number of techniques to control for the spatial aspect. This includes increasing the size of the sample, including locational and attribute (socioeconomic) data [to the model] and measuring proximity from a given residential property to amenities with distance. However, the Hedonic Pricing Model does not explicitly model the spatial effects.

A benefit of using GWR and GIS over the hedonic model is that it allows one to visualise results as spatial model maps, which indicate the phenomena's effect across space, can be created in addition to the tables and graphs that Stata and other statistical software produce.

To test if the models are not misspecified, a Moran's I test can be run to ensure that there is no dispersion or clustering as clustering indicates that the model is misspecified. In simple terms, a misspecified model is one that lacks crucial variables and, thus, cannot accurately describe or predicate the relationship between the

dependent and independent variables. Moran's I test should be run using the results of a standard residuals test obtained in both the hedonic pricing model and the GWR analysis. ArcGIS has an option to run a Moran's I test.

3.2. Context to Study



Figure 3: Map of Johannesburg (Source: Author, 2017)

3.2.1. History of the Area

The history of Johannesburg can be traced back to a single farm, the Braamfontein farm. In the latter part of the 19th century, gold was found on this farm, leading to an explosion of the population. Gold prospectors from all over the country, as well as the globe, immigrated to the area in the hope of finding fortunes (Beavon, 2004). Businessman closely followed the prospectors, setting up businesses that provided for their needs. Over the next few years, the farm was divided into smaller holdings, and it was ultimately these farms that became the most well-known neighbourhoods in Johannesburg (Davie, 2015).

Greenside and Emmarentia are two of many neighbourhoods located in the northern suburbs of Johannesburg. The two suburbs were originally a single portion of the Braamfontein farm. The farm was located adjacent to a portion of the Braamfontein farm where a gold-rich reef was found on. Lourens Geldenhuys purchased the farm, hoping that it would have gold, but this was not the case. Upon Lourens's death, the farm was divided into two, with Louren's sons, Louw and Frans, each inheriting a portion. It is these two farms that would eventually become the suburbs of Greenside and Emmarentia. Louw's farm was first occupied by Afrikaner veterans of the Boer War who had no source of income. Louw provided them with housing and an area to farm. They sold the produce that they farmed, and a percentage of the profits they made were given to Louw as a monthly rental. It wasn't until the mid-20th century that the city grew, and these farms were declared suburbs of Johannesburg (Davie, 2015). In 1930, the suburb of Greenside was proclaimed, and in 1945, the suburb of Emmarentia was proclaimed, named after Louw's wife Emmarentia (Leyds, 1964).

3.2.2. Present Time

The two suburbs have become trendy neighbourhoods with a number of amenities in close proximity, such as the Johannesburg Botanical Gardens, Melville Koppies, Emmarentia Dam, Gleneagles high road and a number of prominent public schools as well as a golf course.

Emmarentia has an estimated population of 5,116 people (3,948 adults, 1,168 children), with an average monthly household income of R90 000 – R115 000. The majority of the residents fall in bracket 10, the highest bracket, of the living standard measure LSM. The majority of the properties found in the area are freehold properties, with a count of 1,038 making up 95.76% of the properties. There are 42 sectional schemes that make up of 3.87% of the properties (Lightstone, 2017).

Greenside has an estimated population of 4,889 people (3,647 adults, 1241 children) with an average monthly household income of R115 000 – R135 000. The majority of the residents fall in bracket 10 of the living standard measure LSM, while the majority of the properties found in the area are freehold properties, with a count of 1,145 making up 94.86% of the properties. There are 62 sectional schemes that make up of 5.14% of the properties (Lightstone, 2017).

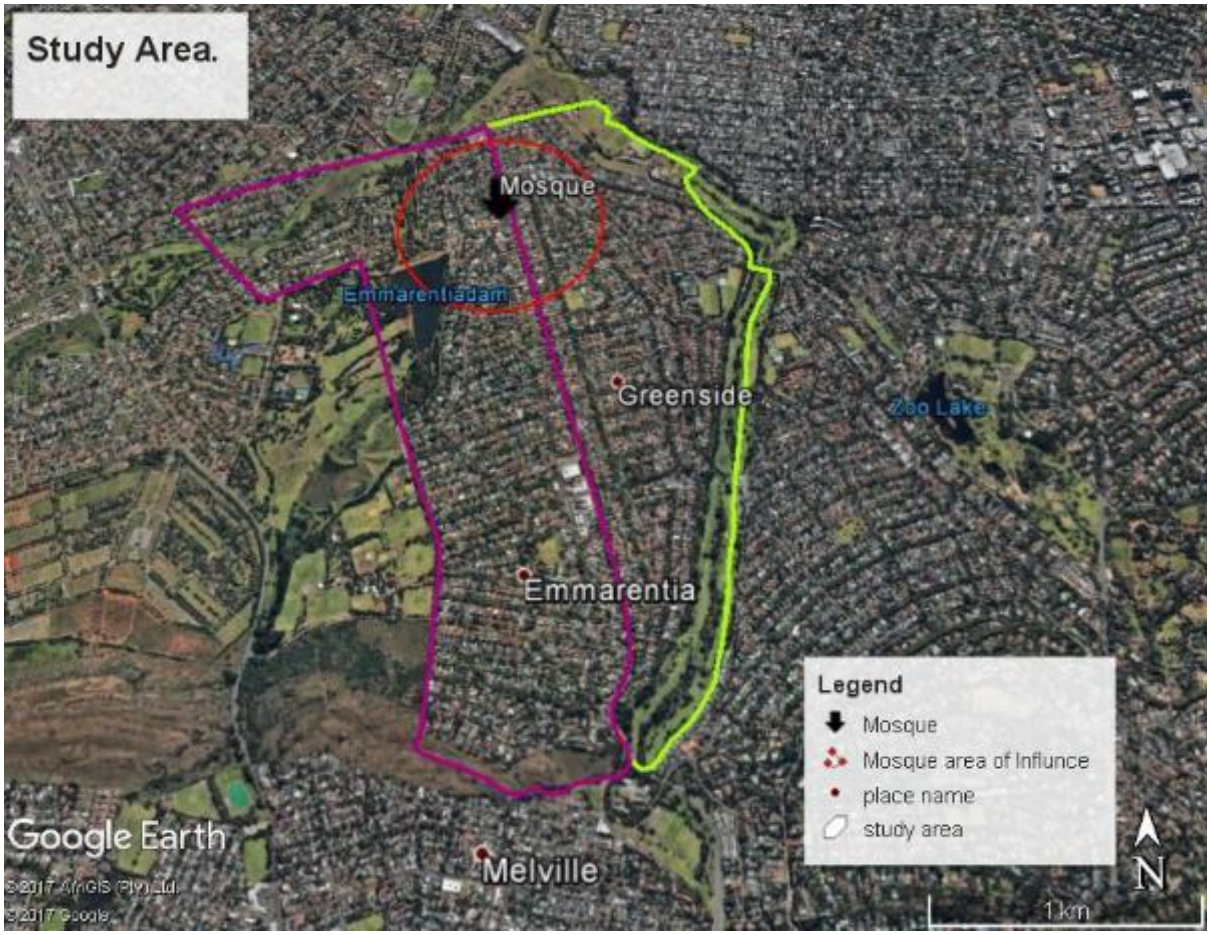


Figure 4: Study Area (Source: Author, 2017)

Post-Apartheid South Africa is still highly segregated, and former white-only areas display a high degree of NIMBYism. Newspaper articles indicate that there is a trend of residents opposing Mosques in previously white areas (Hess, 2016; Francke, 2017; Kamaldien, 2017).

Dinath *et al*. (2014) explains that, since the 1990s, Muslims in Johannesburg who resided in areas that were previous reserved for Indians, particularly Lenasia and Fordsburg, have been moving to the northern suburbs of Johannesburg to take advantage of the better schools and other services and amenities found there. Furthermore, Dinath, *et al*. (2014) describe how Muslim communities develop around Mosques in formerly white areas, referring to Mosques as “spatial anchors”; this creates a process Viruly (2009, cited in Dinath *et al*., 2014) termed “Value-shadow.” This term describes how properties surrounding the Mosque increase in value due to the demand from Muslims who want to live near it.



Figure 5: Musjid-ur-Rahma (Source: Author, 2017)

The Greenside Mosque was the second Mosque built in the northern suburbs of Johannesburg after the fall of Apartheid. A house was bought and converted into an Islamic place of worship called a *Musallah,* or more commonly referred to as a *Jamaat khana,* by the South African Muslim community. A *Jamaat khana* is a prayer facility that has a lesser status of a Mosque. The *Jamaat khana* was a temporary place to offer prayer while discussing, planning and raising funds to construct a Mosque. During the planning phase, there was opposition from the community, which feared the impact the Mosque may have on the neighbourhood. Harrison (2004, pg. 30) describes the incident as a "messy dispute with local residents." In order to negate some of the complaints, the Mosque does not broadcast the *Athaan* over loudspeakers but rather uses a radio-based system, which has become popular in South Africa. Worshipers can purchase a personal radio speaker and tune into Radio *Bilal;* the *Athaan* is then broadcasted directly to households via the radio at the time of prayer (Mulugeta, 2009).

The Mosque officially opened in 2005 and has a number of added facilities that offer services to the community, as discussed in the literature review, such as: a

Maddrassah (a school where children receive an Islamic education), *Janazah Ghusl* facility (a room to conduct the ritual washing of people who have passed on before burial], a lady's section for women to offer prayer and a library.



Figure 6 Madrassah, Library and Janaza Facilities of the Mosque *(Source Author, 2017)*

It is interesting to note that there is currently no other place of worship located within the boundaries of either Greenside and Emmarentia. However, along the main road, Barry Hertzog, that divides Emmarentia from Greenside there is a *shul* [Jewish place of worship], which is no longer in use.

3.3. Conclusion

This chapter firstly outlined the methodology of the study and provided a case study. The methodology detailed the data collocation as well as the techniques used in this study to extract results from the data. The subsequent section will build on methodology as it will further detail the techniques used and offer preliminary results. The second part of this chapter examined the study area in the form of a case study. The land examined in the study was once a farm, which has become trendy neighbourhoods located in the north of Johannesburg. However, the area is devoid of places of worship besides the Mosque.

4. Chapter Four: Preliminary Findings

Building on the methodology, this section details the initial results obtained from the study. As the data is processed, preliminary findings begin to emerge. The first section of the chapter examines how the data is prepared for the analysis. This step ensures the suitability of the data and that it is free from errors in addition to extrapolating data and controlling for certain phenomena.

The following section describes the data in terms of the variables used in the study as well as why these variables (data) are appropriate. Following from the above, the next section is a statistical description of the data, which is essential as the study is a quantitative study and thus offers important information regarding the quantification of the variables. The final section of the chapter examines the models that will be used in the study once all the variables have been finalised.

4.1. Preparation of Data for Analysis

Before an analysis could be run, the data first had to be prepared so that it was suitable for analysis. This is an essential step to ensure that the data is accurate, consistent and uniform. Preparation further ensures that the data is in the accepted format for the software used to run the analysis.

As previously mentioned, data was provided by Lightstone in the form of an Excel spreadsheet. The data provided contained 1,454 records of residential property transactions between the years 2000 and 2016. The data set had the following data pertaining to the property and details of the transaction: Lightstone property ID number, province, suburb, year (of sale), month (of sale), cad size (the cadastral size), age of property, number of bedrooms, number of bathrooms, property type, street name, street number and sectional scheme. Socioeconomic data could only be obtained at a neighbourhood level and not for the individual houses, which is further discussed in the limitations. Among this data, the data describing the physical attributes of the house will be used in the analysis of the study, which will be discussed further in a subsequent section that details the variables employed in the study.

4.1.1. Estimation of Null Values

The first issue encountered with the data was an incomplete data set that describes the number of bedrooms and bathrooms. Out of the 1,454 records, 1,013 records had

a null value for number of bedrooms and 1,024 had a null value for number of bathrooms. To complete the analysis, this data had to be extrapolated. The estimation was based on houses that had data and were of a similar profile in terms of cadastral size, location and value.

4.1.2. Deriving Distance Data

The next step was to derive data pertaining to the externalities found in the area, whilst the data pertaining to the location of the homes was used to derive more data. In order to run an analysis, data of external amenities needed to be extracted. This data would be distances from the houses to important amenities found within the area. This is possible using the data provided from the Lightstone data set.

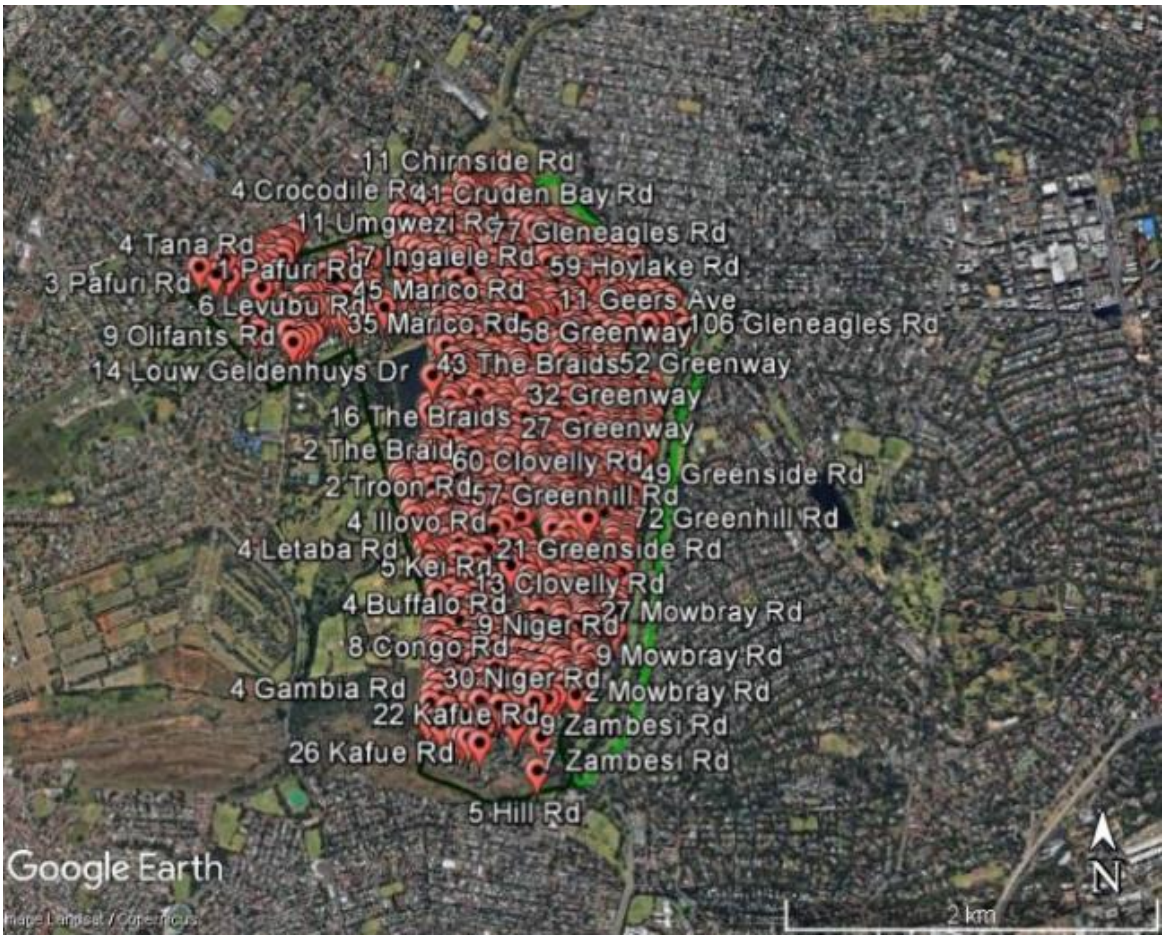


Figure 7: Map of the study area, with pins indicating the houses included in the study (Source: Author, 2017)

Using the residential addresses, each house was entered into Google Earth and saved as a place mark as depicted in Figure 7. This process is known as geocoding, which is the process of converting street addresses to geographic coordinates. This process is beneficial to the study as it allowed the houses to be plotted and visualised in space,

using maps and diagrams. In this process, there were two inaccuracies found in the data. One house was found to be located outside the study. Moreover, 26 houses were found not to be geolocated correctly. i.e. the address and coordinates do not correspond. These houses had to be excluded from the study as they would result in inaccuracies in the latter part of the analysis.

Once all the houses had been correctly added and the locations verified, the houses were exported and saved as a Keyhole Markup Language (KML) file. A KML file is the file most commonly associated with spatial software as it stores data based on its geographic coordinates. ArcGIS only accepts spatial data that is geocoded. In Arc Catalogue, the KML file could be imported and converted into a Geodatabase that then was converted into a shapefile.

The data was then opened in ArcGIS (version 10.3.1). There are a number of benefits with geocoding and processing the data in ArcGIS. ArcGIS allows spatial data and its attributed data (non-spatial data that is related to the spatial data) to be visualised and manipulated. It allows one to run spatial quarries and offers a range of spatial options that other software do not. Figures 8 and 9 depict the 1,427 correctly geocoded houses. When a KML file is converted into a geodatabase, it extracts vital information from the geocoding process; it extracts a full address line (street number, street name, town and postal code) to a single cell. This has more information than the address provided by Lightstone. This data was then exported to Excel where data that described distances from each address to the externalities could be entered.



Figure 8: Aerial photograph of study area showing selected houses (Source: Author, 2017)



Figure 9: Map of study area showing selected houses (Source: Author, 2017)

The distance data was collected using Google's Maps Application Programming Interface (API), which allows one to calculate batch distances between one or more places. A script, as seen in Figure 10, using Google's Maps API was adopted from AnalystCave (2014) and input into Excel using visual basic editor. This was then used to calculate the distance between addresses, which is stored in two individual Excel columns. This was more efficient than calculating distances on ArcGIS, which calculates distance based on straight-line distances. Instead, Google Maps calculates distance based on walking distance or distance travelled using a vehicle. These distances are a more accurate representation of what an individual may perceive in reality. In one instance, straight-line distance had to be used due to the nature of the feature, Emmarentia Dam, as it is not possible to work out the distance of the dam to a single point since it is a continuous feature. The other externalities that were selected for the study were distances to schools, retail spaces and, most importantly, the Mosque. These externalities will be discussed in greater detail in the following section.

```
'Calculate Google Maps distance between two addresses
Public Function GetDistance(start As String, dest As String)
    Dim firstVal As String, secondVal As String, lastVal As String
    firstVal = "http://maps.googleapis.com/maps/api/distancematrix/json?origins="
    secondVal = "&destinations="
    lastVal = "&mode=walking&language=pl&sensor=false"
    Set objHTTP = CreateObject("MSXML2.ServerXMLHTTP")
    Url = firstVal & Replace(start, " ", "+") & secondVal & Replace(dest, " ", "+") & lastVal
    objHTTP.Open "GET", Url, False
    objHTTP.setRequestHeader "User-Agent", "Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.0)"
    objHTTP.send ("")
    If InStr(objHTTP.responseText, """distance"" : {") = 0 Then GoTo ErrorHandl
    Set regex = CreateObject("VBScript.RegExp"): regex.Pattern = """value"".*?([0-9]+)": regex.Global = False
    Set matches = regex.Execute(objHTTP.responseText)
    tmpVal = Replace(matches(0).SubMatches(0), ".", Application.International(xlListSeparator))
    GetDistance = CDbl(tmpVal)
    Exit Function
ErrorHandl:
    GetDistance = -1
End Function
```

Figure 10: Script of Google Maps API Code (Source: AnalystCave, 2014)

Thus, we see the importance of having houses correctly geocoded as incorrect coordinates would result in an incorrect measurement of distance. The data was then ready to be analysed in both Stata and ArcGIS.

4.1.3. Controlling for Time and Inflation

The housing prices data from Lightstone are for a 17-year period. Pertinent issues arise in this study due to it being a cross-section analysis over a significant period of time. Due to inflation, housing prices could not be analysed as it is across a 17-year period. Houses sold in the earlier years would have a considerably lower value than houses sold in more recent years even though the house may be of the same profile. There are numerous methods to deal with this issue, such as creating a variable or dummy variable for the date of the transaction (Chan, 2007). Simons and Seo (2011) controlled for time by only selecting two years pre- and post-construction of the place of worship and examined how the place of worship affected value over this time. Due to numerous limitations, the most significant being the number of houses sold in this period, this method could not be used in this study.

The method used in this study is the adjusted sales price, which adjusts the price across the study to a particular time in the study. The prices are indexed to November 2016. Below is as an example of the equation used. Thus, a property that was sold for R100 000 in January 2000 would have an adjusted price of R 621 358, 61.

$$R100000 \times \frac{HpINov2016}{HPIJan2000} = R100000 \times \left(\frac{568{,}51}{91{,}49466855}\right) = R621358{,}6095$$

4.2. Description of Variables

This section will examine the variables that were employed in the study and justify why these variables were selected. The variables used in this study are divided into three categories: the dependent variable and the independent variables, the latter of which is the physical features of the house and the features external to the property. It is important to note that not all the variables that could make up value were explored. This will be examined further in the limitations of the study.

4.2.1. Value

Value is one of the two most important variables for this study and the only dependent variable. All the other variables of this study will be assessed to understand the relationship. Value refers to the recorded price at which the house sold. Value at which the house was sold was selected as it is superior to other values, which might be only an estimation. Other values might not capture the true valuation of all the houses external and physical features.

4.2.2. Physical Characteristics of the Property

These are a set of independent variables that relate directly to the physical characteristics of the property. As found in the literature review, these characteristics have a significant impact on the value of the house as it is the most apparent and directly impacts the utility of the property.

4.2.2.1. *Age of the Property*

The age of the property reveals when the houses were first built. Older homes could both have a positive or a negative impact on value. Older homes could add value when an architectural style has become rare and is thus valued for its antiquity. Alternatively, older homes could be in an outdated style as well as indicative of aged fixtures.

4.2.2.2. *Cadastral Size*

The cadastral size is the size of the actual property, including both the built-up and non-built up area. Thus, it is the area of the land that the owner is allowed to utilise in accordance with the title deed. Generally, property with a greater cadastral size sells for a higher price. Vacant land that is for sale is often expressed in rands per metre.

4.2.2.3. *Number of Bedrooms*

This variable examines the number of bedrooms each house has. Bedroom, in this case, only refers to a room that is primarily or potentially used to sleep in and is not utilised for a specialised function such as a kitchen, bathroom, study or any other living area. This variable was selected as it is linked to the utility and thus the value of the house. A house with more bedrooms will have a higher utility than a house with fewer bedrooms. Therefore, it could be argued that a house with more bedrooms will have a higher value than a house with fewer such rooms.

4.2.2.4. *Number of Bathrooms*

This is the number of specifically designated spaces that are used for sanitation. The room can contain a shower, bathtub and a toilet or only one of these. Similar to bedrooms, bathrooms are linked to the utility of the house. A house with more bathrooms is said to have a higher utility.

4.2.2.5. *Year*

Year signifies when the property was sold.

4.2.3. External Factors

These are the independent variables that are found in proximity to residential households. Again, the literature review revealed that amenities, although less apparent than the physical characteristics, have a considerable impact on the value of the house. Here, only the distance from the house to the amenity is examined as it is the distance that will express the impact of the amenity on the house.

4.2.3.1. *Distance to Schools*

Numerous international academic studies have found that schools increase the value of properties in the surrounding proximity. South African studies, conducted for the most part by property companies, indicate a similar trend (Mhlanga, 2014). Moreover, it is said that the impact is more profound when the school is a top performing school. There are three schools found in the area: Greenside Primary School, Greenside High School and Emmarentia Primary School.

4.2.3.2. *Distance to Retail*

The area offers a variety of retail spaces. There are two distinct retail locations, the first being an area with a shopping centre that houses a popular supermarket. The block adjacent to the shopping complex consists of restaurants, a bakery and various other smaller businesses. The second retail space is located on Gleneagles Road and is a trendy strip that has several bars, eateries, coffee shops and retailers. This road can be described as the high road of the locality.

4.2.3.3. *Distance to Green Space*

The area is home to the Johannesburg Botanical Gardens, which is an 81-hectare complex with many different gardens. The gardens are used by many for a host of recreational activities, such as running, picnics and jogging. There is also a dam, which is used for fishing and water sports.

4.2.3.4. *Distance to* Mosque

The second most important variable in this study examines the distance between each house and the Mosque.

4.3. Statistical Description of Data

This section of the report offers a statistical summary of the variables and its associated data used in this study. The following variables statistics are provided:

value, year, month, cadastral size, number of bedrooms, number of bathrooms, distance to Mosque, distance to Greenside Primary School, distance to Emmarentia Primary School, distance to Greenside High School, distance to the shopping centre and distance to the Greenside strip. Statistics for the entire area will be provided first and then those for the two individual areas.

Table 1: Summary Statistics for the Combined Areas of Greenside/Emmarentia

Variable	Obs	Mean	Std. Dev.	Min	Max
Value	1268	1793833	973231.4	100000	4200000
Year	1268	2008.61	4.934437	2000	2016
Month	1268	6.648265	3.358497	1	12
Cad_size	1268	1293.131	361.0948	668	3197
Number_Bed	1268	3.272082	.6760835	1	10
Number_Bat	1268	2.099369	.5726463	0	7
Age_of_Pro	1268	31.25528	12.80112	7.67	86.17
Distance_M	1268	1352.511	615.2429	38	3006
Distance_GPS	1268	1205.345	616.5414	4	2828
Distance_EPS	1268	1483.519	800.2888	15	3362
Distance_GHS	1268	1917.893	810.3363	13	3601
Distance_SHP	1268	1275.64	706.7733	74	3251
Distance_HS	1268	1536.968	777.354	0	3437
Distance_Bot	1268	747.1643	351.6234	23.7674	1455.951

There are 1,268 observations, and this is consistent for all 14 variables, which means that there is data for all 1,268 investigated houses. The data covers a 17-year period, from 2000 to 2016. Most of the transactions recorded are from the year 2008 to the year 2016, with most transactions recorded in 2016. The data covers transactions for all 12 months of the year with the 10th month being the month with the highest recorded sales. The average age of the houses is 31 years old; the most recent house built was seven years ago whilst the oldest house is 86 years old.

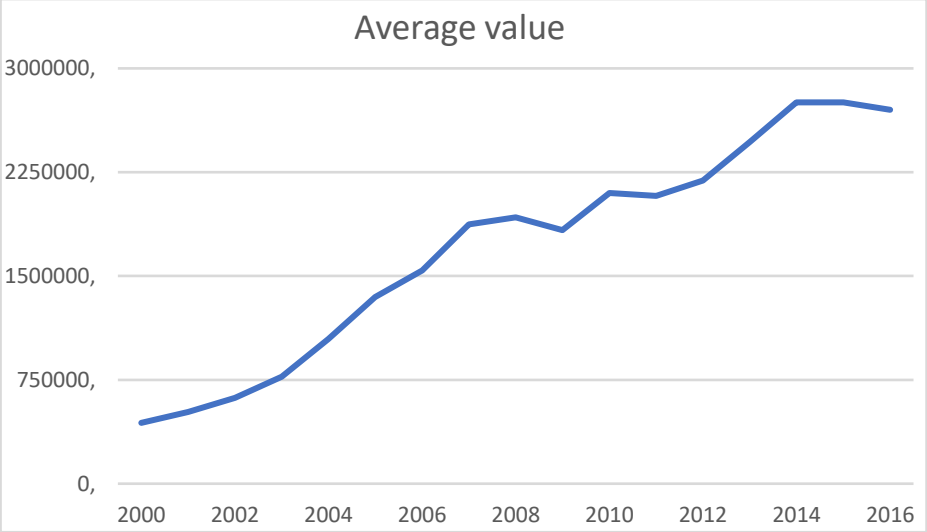


Figure 11: Graph showing the average sale price of houses within the study area by year (Source: Author, 2017)

The average value of a house in the study area is R1 793 833; the highest value of a house is R4 200 000 and the lowest value of the house is R100 000. Figure 11 is a graph showing the average value of a house sold from the year 2000 to 2016. The housing prices have increased over the years except in three instances (2009, 2011 and 2016) where a dip in the average price can be noticed.

The average cadastral size of the property is 1,293.13 square metres. The smallest cadastral is 668 square metres whilst the biggest cadastral is 3,197 square metres.

The average number of bedrooms is three. The minimum number of bedrooms is one, and the maximum number of bedrooms is 10. The average number of bathrooms is two. The minimum number of bathrooms is one and the maximum is seven.

The average distance to the Mosque is 1,352.51 metres. The nearest house is 38 metres away. and the greatest distance of a house to the Mosque is 3,006 metres. The average distance to Greenside Primary School is 1,205.34 metres. The nearest distance is 4 metres and the greatest is 2,828 meters. The average distance to Emmarentia Primary School is 1,483.51 metres. The nearest house is 15 metres and the furthest is 3,362 metres. The average distance to Greenside High School is 1,917.989 metres. The nearest distance is 13 metres and the greatest is 3 601 metres. The average distance to the shopping centre is 1,275.64 metres. The nearest distance is 74 metres and the greatest is 3,251 metres. The average distance to the strip is 1,548.796 metres. The nearest distance is 0 metres, as there is a house located on the same street, and the furthest is 3,671 metres. The average distance to the

botanical gardens is 747.16 metres. The nearest house is 23.76 metres, and the furthest house is 1,455.95 metres.

4.4. Model Specification

This section details the statistical models used in this study. The variables employed in these models are those explored in Section 4.2. These models can be explained in terms of an equation.

4.4.1. Hedonic Pricing (Ordinary Least Squares) Model

The equation below is the hedonic regression model used in this study:

$$ASP = \beta_0 + \beta_1 CAD_Size + \beta_2 Age + \beta_3 age^2 + \beta_4 Number_Bed + \beta_5 Number_Bathroom + \beta_6 Distance_M + \beta_7 Distance_GPS + \beta_8 Distance_EPS + \beta_9 Distance_GHS + \beta_{10} Distance_SHP + \beta_{11} Distance_HS + \beta_{12} Distance_BOT + \beta_{13} D_Year + \varepsilon$$

Where:

ASP = Adjusted Sale Price

CAD_Size = Cadastral Size

Age = Age

Age2 = Age squared

Number of Bedrooms

Number of Bathrooms

Distance_M = Distance to Mosque

Distance_GPS = Distance to Greenside Primary School

Distance_EPS = Distance to Emmarentia Primary School

Distance_GHS = Distance to Greenside High School

Distance_SHP = Distance to Shopping Complex

Distance_HS = Distance to High Street

Distance_BOT = Distance to Botanical Gardens

Age is squared due to the non-linear relationship it may have with value

4.4.2. Geographically Weighted Regression (GWR) Model

$$ASP_i(\boldsymbol{l}) = \beta_{0i}(\boldsymbol{l}) + \beta_{1i}(\boldsymbol{l})CAD_size_{1i} + \beta_{2i}(\boldsymbol{l})Age_{2i}\beta +_{3i}(\boldsymbol{l})Number_of_Bedroom_{3i} + \beta_{4i}(\boldsymbol{l})Number_of_Bathroom_{4i} + \beta_{5i}(\boldsymbol{l})Distance_M_{5i} + \beta_{6i}(\boldsymbol{l})Distance_GPS_{6i} + \beta_{7i}(\boldsymbol{l})Distance_EPS_{7i} + \beta_{8i}(\boldsymbol{l})Distance_GHS_{8i} + \beta_{9i}(\boldsymbol{l})Distance_SHP_{8i} + \beta_{9i}(\boldsymbol{l})Distance_HS_{9i} + \beta_{10i}(\boldsymbol{l})Distance_BOT_{10i} + \varepsilon_i$$

Where:

ASP = Adjusted Sale Price

CAD_Size = Cadastral Size

Age = Age

Number of Bedrooms

Number of Bathrooms

Distance_M = Distance to Mosque

Distance_GPS = Distance to Greenside Primary School

Distance_EPS = Distance to Emmarentia Primary School

Distance_GHS = Distance to Greenside High School

Distance_SHP = Distance to Shopping Complex

Distance_HS = Distance to High Street

Distance_BOT = Distance to Botanical Gardens

The variable year is excluded due to it being a dummy variable. In order to run a GWR, the model needs to have variables with a great amount of variation; the dummy does not allow for this as it is restricted to a certain range of values.

4.5. Conclusion

This chapter began by detailed the process of how the data was prepared for analysis. In this process, the data was cleaned for errors, then extracted and controlled. The process of error elimination involved estimating for houses with no data and removing data that was not relevant to the study. Additional data was derived using the Google

Maps API to calculate distances from houses to the amenities, and a housing index was used to control for inflation and time. The next two sections offered a description of the data and a statistical description of the data. The first examined each variable used in the study, its importance and any other additional information, whilst the next section examined the statistical description focused primarily on the quantitative aspects of the data. The final section presented the two regression models that will be used in the study of the ordinary least squares OLS and the geographically weighted regression, including the variables that were appropriate for each model.

5. Chapter Five: Significance of the Mosque on Housing Prices

This chapter reveals the findings of the study. The chapter begins by indicating the results of the two-regression analysis, the Ordinary Least Squares (OLS) and the Geographically Weighted Regression (GWR). The second part of the chapter examines the results in greater depth, exploring possible reasons why these results were obtained.

5.1. Results of Analysis

This section reveals the results of the regression analysis, starting with the OLS regression and then the GWR regression, thereafter comparing the two models and results obtained.

5.1.1. Results of the Ordinary Least Squares Hedonic Model

Table 2, depicted below, shows the results of the OLS hedonic regression analysis. The information describes the accuracy and strength of the entire model. The critical factors to be observed are the F-test, R-squared and Adjusted R-squared, which are discussed below.

Table 2: Statistical Analysis of the OLS Hedonic Model

Source	SS	df	MS		
Model	2.2527e+14	13	1.7329e+13	Number of obs	1268
Residual	8.5720e+14	1254	6.8357e+11	F(13, 1254)	25.35
Total	1.0825e+15	1267	8.5436e+11	Prob > F	0.0000
				R-squared	0.2081
				Adj R-squared	0.1999
				Root MSE	8.3e+05

All OLS regression analyses begin with the F-test, which describes if there is a relationship between the independent and dependent variables. It is assumed that all studies have a null hypothesis until proven otherwise. In this study, the null hypothesis is strongly rejected as the F-test indicates that there is a relationship between the independent and the dependent variables. The R-squared and adjusted R-squared signify the strength of the relationship between the independent and dependent variables, the strength of which is expressed in terms of a percentage. The R-squared for this study is at 20% and the adjusted R-squared is at 19%; the adjusted square is the value that is more accurate as it is adjusted for errors in the model. Thus, the

strength of the model indicates that there is a weak correlation between the variables and value.

Although low, the R-squared can be argued to be of an acceptable level. Studies in the social science can have a low R-squared, while studies within the natural sciences are expected to have a high R-squared. However, it must be said that other studies that employ hedonic regression analysis have much higher R-squared values. This could be attributed to numerous factors, which will be further examined in the following chapter. Table 3 is an extension of Table 2 as it describes the results of the individual variables.

Table 3: OLS Analysis per Variable

Adjusted	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
D_Year	38958.18	4754.997	8.19	0.000	29629.55	48286.81
Cad_size	568.2559	82.16627	6.92	0.000	407.0574	729.4545
Age_of_Pro	-13847.79	9777.591	-1.42	0.157	-33030.03	5334.452
Age_2	91.47152	119.6829	0.76	0.445	-143.3292	326.2723
Number_Bed	203304.8	44562.22	4.56	0.000	115880.1	290729.5
Number_Bat	319144.1	51966.29	6.14	0.000	217193.6	421094.5
Distance_M	394.3963	226.2609	1.74	0.082	-49.49532	838.288
Distance_GPS	-603.2262	187.0139	-3.23	0.001	-970.1208	-236.3316
Distance_EPS	-267.7785	185.8782	-1.44	0.150	-632.445	96.88797
Distance_GHS	13.441	135.5973	0.10	0.921	-252.5815	279.4635
Distance_SHP	347.0909	191.2836	1.81	0.070	-28.18022	722.3621
Distance_HS	107.3119	189.9156	0.57	0.572	-265.2755	479.8992
Distance_Bot	-1.049604	167.0141	-0.01	0.995	-328.7075	326.6082
_cons	693019.6	309841.3	2.24	0.025	85155.14	1300884

Table 3 describes the relationship between the dependent and independent variables. At the 0.01 confidence level and holding everything constant, the following variables are significant and thus influence value: year, cadastral size, number of bedrooms, number of bathrooms and distance to Greenside Primary School. A positive coefficient indicates that there is a positive relationship between the dependent and independent variables: as the independent variables increase so do the dependent variables (coefficient). Thus, the relationship between value and year indicates that the value of the houses increases over time. The relationship between cadastral size and value indicates that as the size of the property increases so does the value. A similar effect is seen with bathrooms and bedrooms as the value increases when a house has more bedrooms and bathrooms. A negative coefficient indicates an inverse relationship: as

the independent variable decreases, the independent variable (coefficient) increases. Thus, the relationship between value and distance to Greenside Primary School indicates that the value of the house increases as distance decreases towards the school.

At the 0.10 level of confidence, holding everything constant, two variables are found significant. The significant variables are the distance to Mosque and distance to the shopping centre. The relationship indicates an inverse relationship between distance and value:, as houses get closer to the Mosque and the shopping centre, value decreases.

At the 0.05 confidence level, no variable was found to be significant. The variables that are insignificant to the study are:

- Age of the property
- Distance to Emmarentia Primary School
- Distance to Greenside High School
- Distance to the high street (Gleneagles Road)
- Distance to the Botanical Gardens in Emmarentia

Figure 12 is a graphical representation expressing the relationship of value with the other variables (below is an explanation of the headings found on the figure). The variables outlined with a red circle indicate the significant variables. On the graphs, the line of best fit indicates how value increases or decreases: if the line is tilted to the right, it indicates a positive effect on value; if the line is tilted to the left, it shows a negative effect on value. The slope of the line indicates the effect of the relationship: the steeper the in-/decline, the greater the effect, whilst a more gradual in-/decline indicates a lesser effect.

- Distance_M = Distance to the Mosque
- Distance_G = Distance to Greenside Primary School
- Distance_E = Distance to Emmarentia Primary School
- Distance_1 = Distance to Greenside High School

- Distance_S = Distance to the shopping centre
- Distance_H = Distance to the high street (Gleneagles Road)
- Distance_B = Distance to the Botanical Gardens in Emmarentia

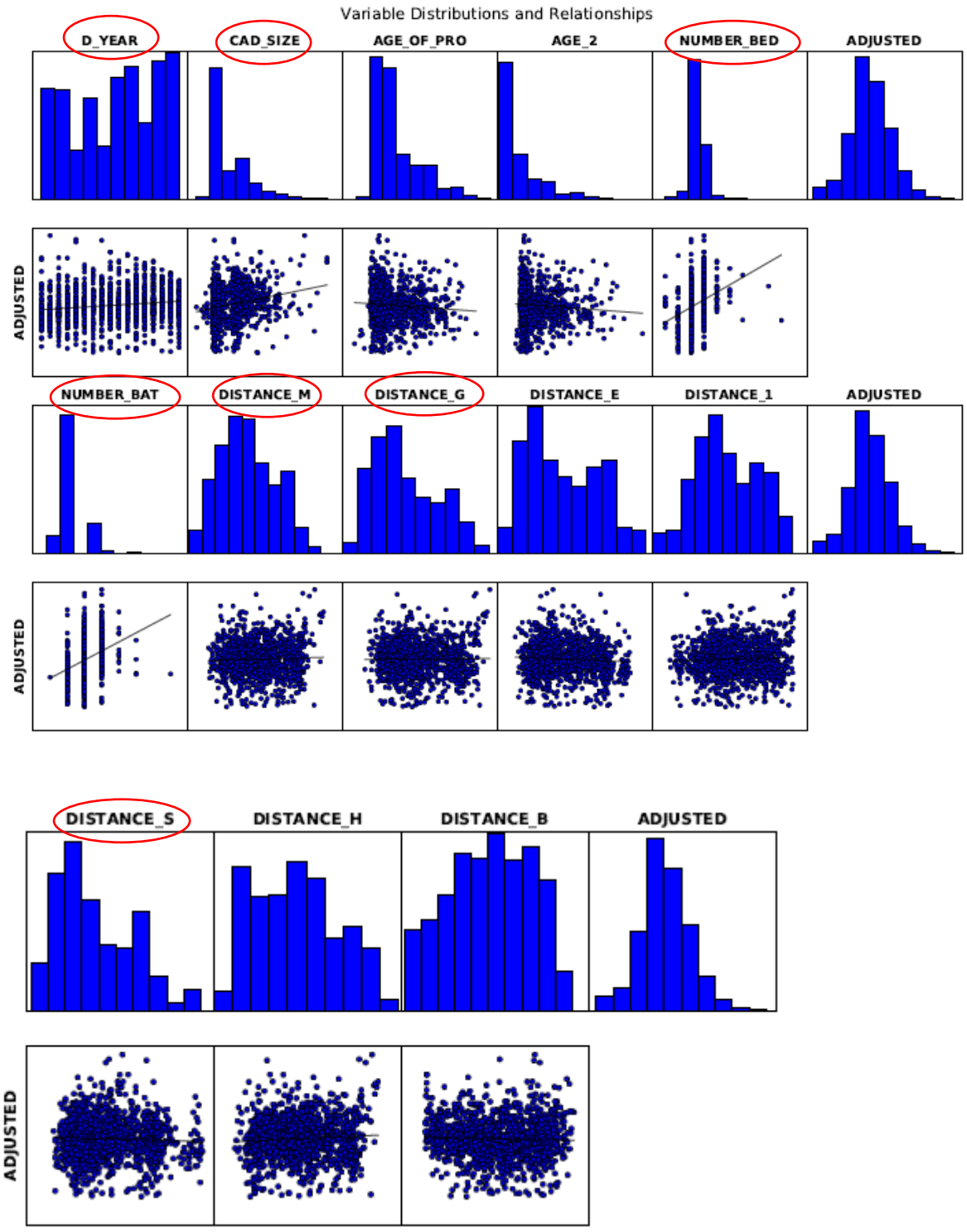


Figure 12: Variable Distribution and Relationships (Source: Author 2017)

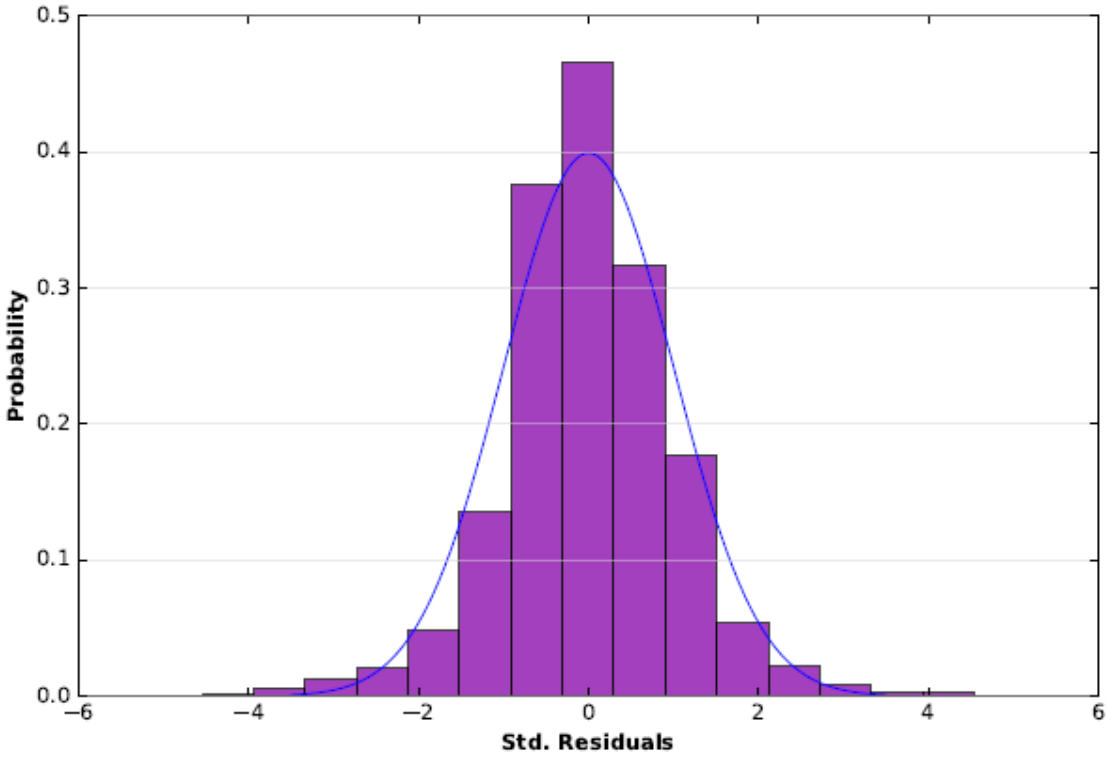


Figure 13: Histogram of the Standardized Residuals (Author, 2017)

A histogram of the standardised residuals reveals that the model has no statistical bias as the graph follows the blue bell curve shape in Figure 13. The graph is neither skewed to the left nor right and so there is no need to create a log regression or to express the regression exponentially.

A Moran's I test indicates that the standard residuals are randomly located across the samples and that the model is not misspecified. The model received a Moran's I index score of 0,016807. A full report of the Moran's I test can be found in Appendix B.

5.1.2. Results of the Geographically Weighted Regression Model

Due to severe model design problems, a GWR could not be run using all the variables. The cause of the problem was the high Variance Inflation Factor (VIF) amongst the variables (Table 4), particularly amongst the variables that measured distances from the houses to the external amenities. A high VIF number indicates that there is multicollinearity amongst the variables; collinearity indicates that there is redundancy amongst one or more variables (multicollinearity), thus making it difficult for the analysis to differentiate between individual variables and ultimately unable to find a correlation with the dependent variable. The multicollinearity issue only arises during the local regression and did not cause any issues in the global hedonic regression.

Table 4: Variance Inflation Factor of Variables

Variable	VIF
Dummy year	1.020398
Cadastral Size	1.631637
Age of Property	29.037101
Age of Property Squared	29.005620
Number of Bedrooms	1.682396
Number of Bathrooms	1.641384
Distance to the Mosque	35.917494
Distance to Greenside Primary School	24.641436
Distance to Emmarentia Primary School	41.015127
Distance to Greenside High School	22.378257
Distance to Shopping Sentre	33.877355
Distance to High Road	40.397337
Distance to Botanical gardens	6.392276

A possible reason for a high VIF amongst the distance to amenities is the many amenities in the study area, which could be due to the size and the location of the amenities, and that the amenities are clustered and not spread across the entire study area and/or that the study area is small, which creates redundancy in the data.

After trialling and testing, a GWR model could only be successfully run with the following variables:

- Cadastral Size
- Number of Bedrooms
- Number of Bathrooms

- Distance to the Mosque
- Distance to Greenside Primary School

Table 5 depicts the result of the GWR analysis. The information describes the accuracy and strength of the entire model. The R-squared for this study is at 19% and the adjusted R-squared is 17%; the adjusted square is the value that is more accurate as it is adjusted for errors. There is no F-test in GWR since each point has an independent R-squared.

Table 5: Geographically Weighted Regression

VARNAME	VARIABLE
Neighbors	1000
ResidualSquares	8,748042e+014
EffectiveNumber	24,850175
Sigma	838868,14271
AICc	38204,631093
R2	0,191843
R2Adjusted	0,176339

A GWR investigates each sample and generates a coefficient, standard error R square for each sample. Figure 14 is a map of the R-squared for each house; the darker shade of blue indicates a lower R-squared value while the darker shade of red indicates a higher R-squared value. The map indicates that the southern and eastern parts of the area have a higher R-squared value than the western and northern parts of the area. It can then be deduced that the area of Greenside has a higher R-squared value than that of Emmarentia.

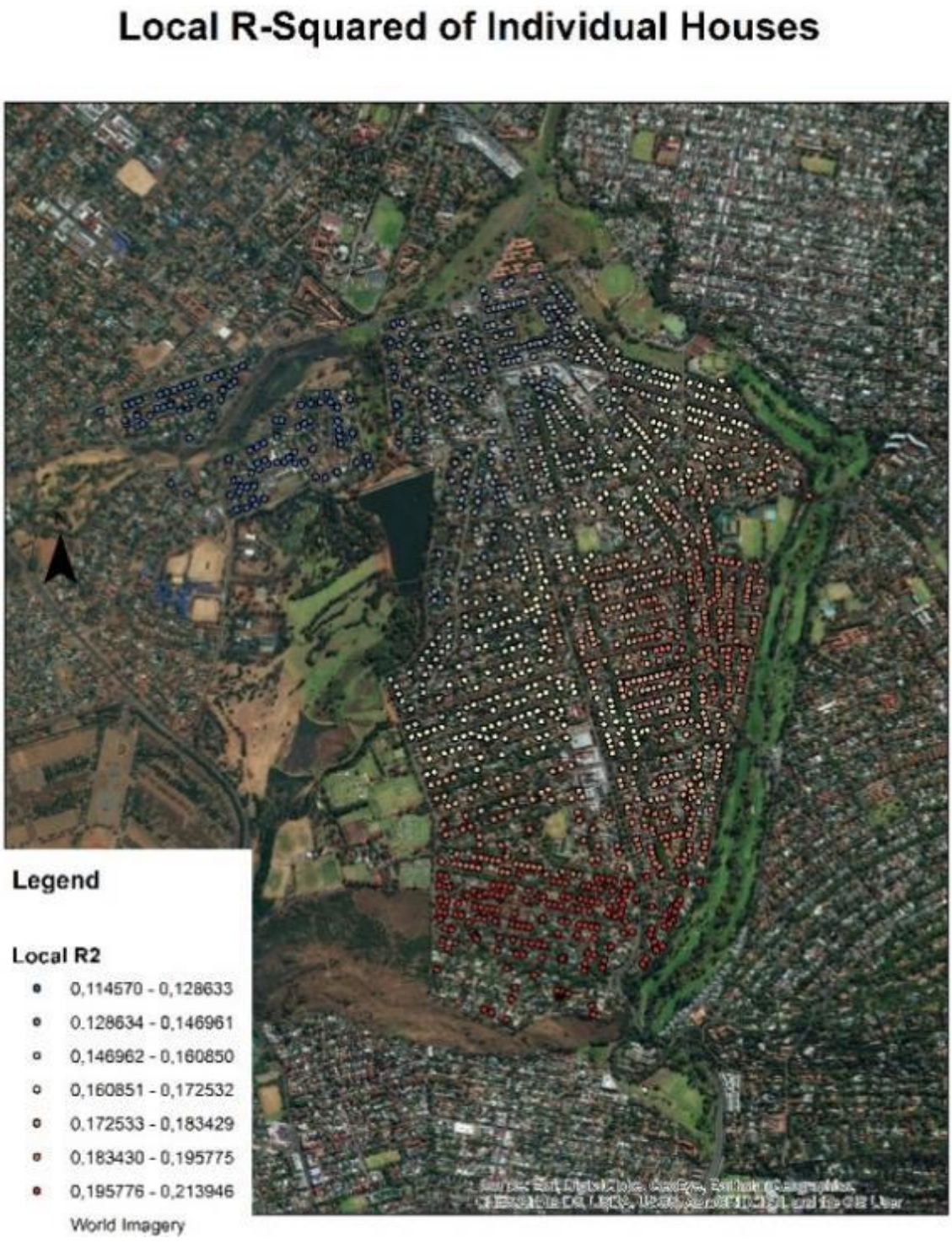


Figure 14: Heat Map Indicating the R-Squared of Each House (Source: Author, 2017)

A series of maps found on the subsequent pages indicates where the relationship between the dependent variable and the independent variable is most significant. The first map (Figure 15) explores the relationship between the number of bathrooms and value based on a scale from blue to red. The blue shades indicate areas with the least significance; the darker the shade of blue, the less the significance. The areas with

the red shade indicate areas that are most significant; the darker the shade of red, the greater the significance. The most significant area is found in the centre of the two areas while the least significant areas are found to the south and northwest of the area.

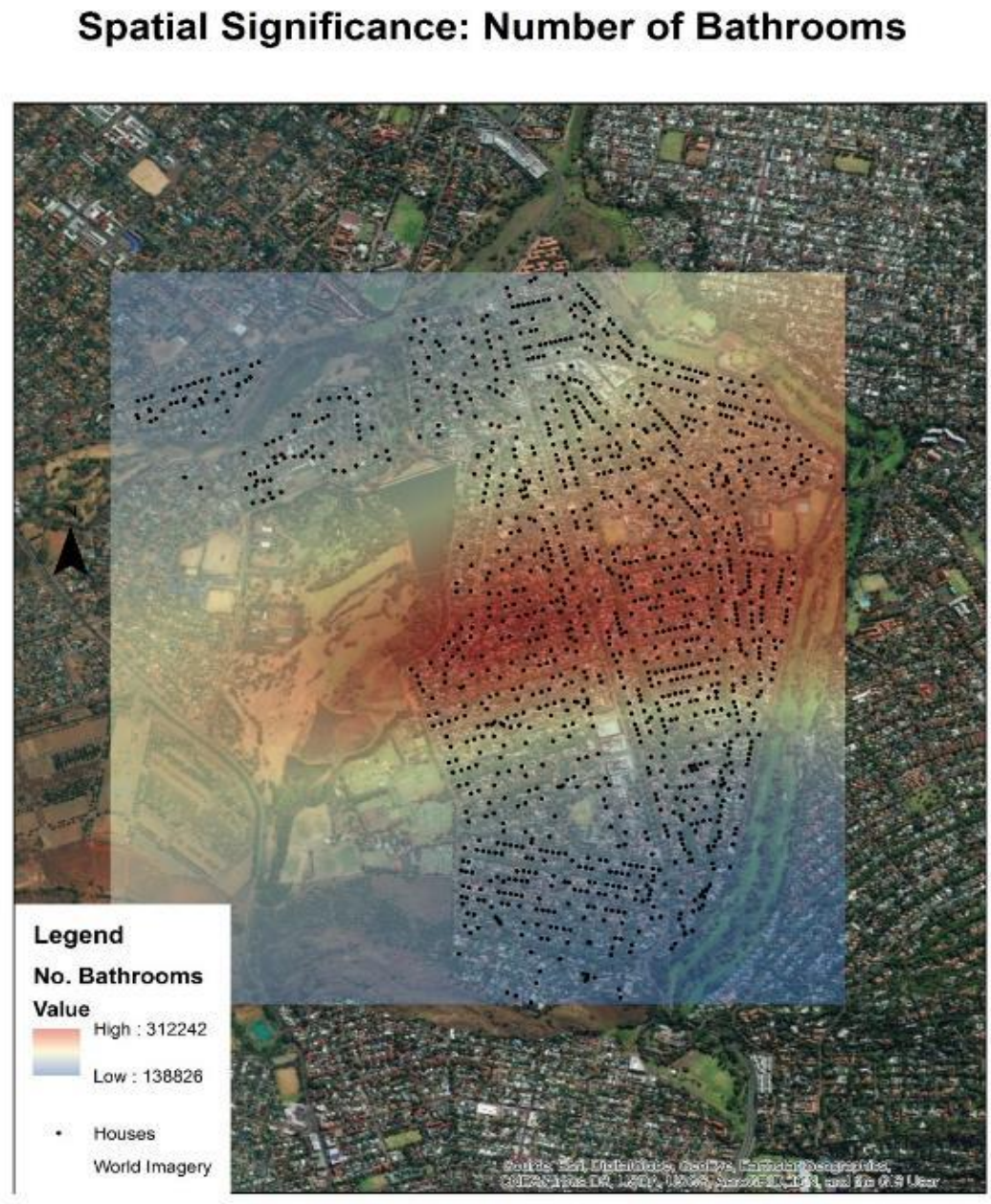


Figure 15: Heat Map Indicating the Spatial Significance of Bathrooms (Source: Author, 2017)

The map below (Figure 16) explores the relationship between the number of bedrooms and value, based on a scale from blue to red. The blue shades indicate areas with the least significance, the darker the shade of blue, the less the significance. In contrast,

the areas in red indicate those that are most significant; the darker the shade of red, the greater the significance. The most significant area is found to the east of the area while the least significant area is located to the west. This could be due to houses in Greenside (east side) that have fewer bedrooms than houses in Emmarentia (west side). Thus, houses with more bedrooms have a greater demand than in any other area.

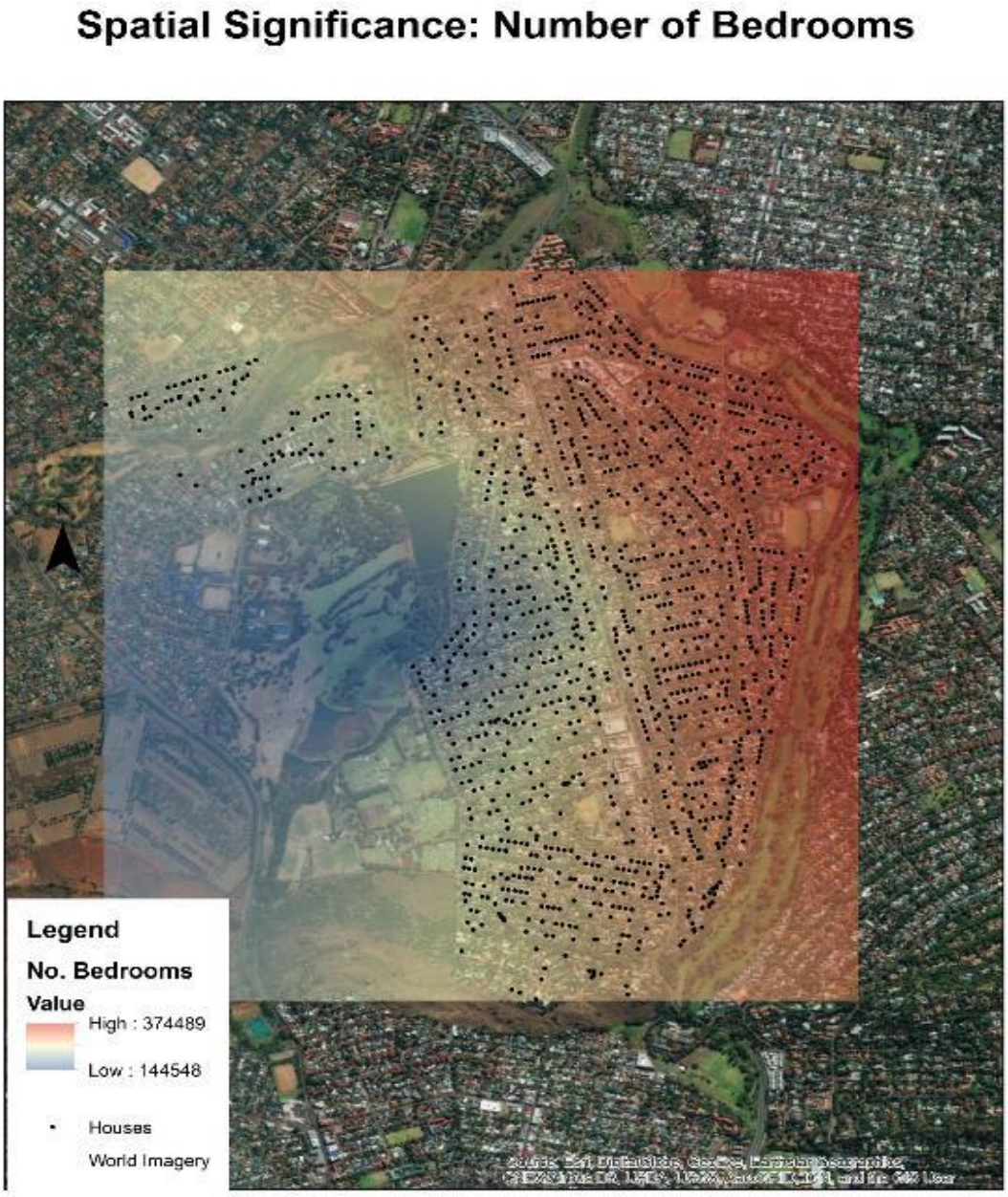


Figure 16: Heat Map Indicating the Spatial Significances of Bedrooms (Source: Author, 2017)

The map below (Figure 17) explores the relationship between cadastral size and value, based on a scale from blue to red. The blue shades indicate areas with the least significance; the darker the shade of blue, the less the significance. The areas in red

indicate those that are most significant; the darker the shade of red, the greater the significance. The most significant area is found to the south of the area, where the largest properties are found.

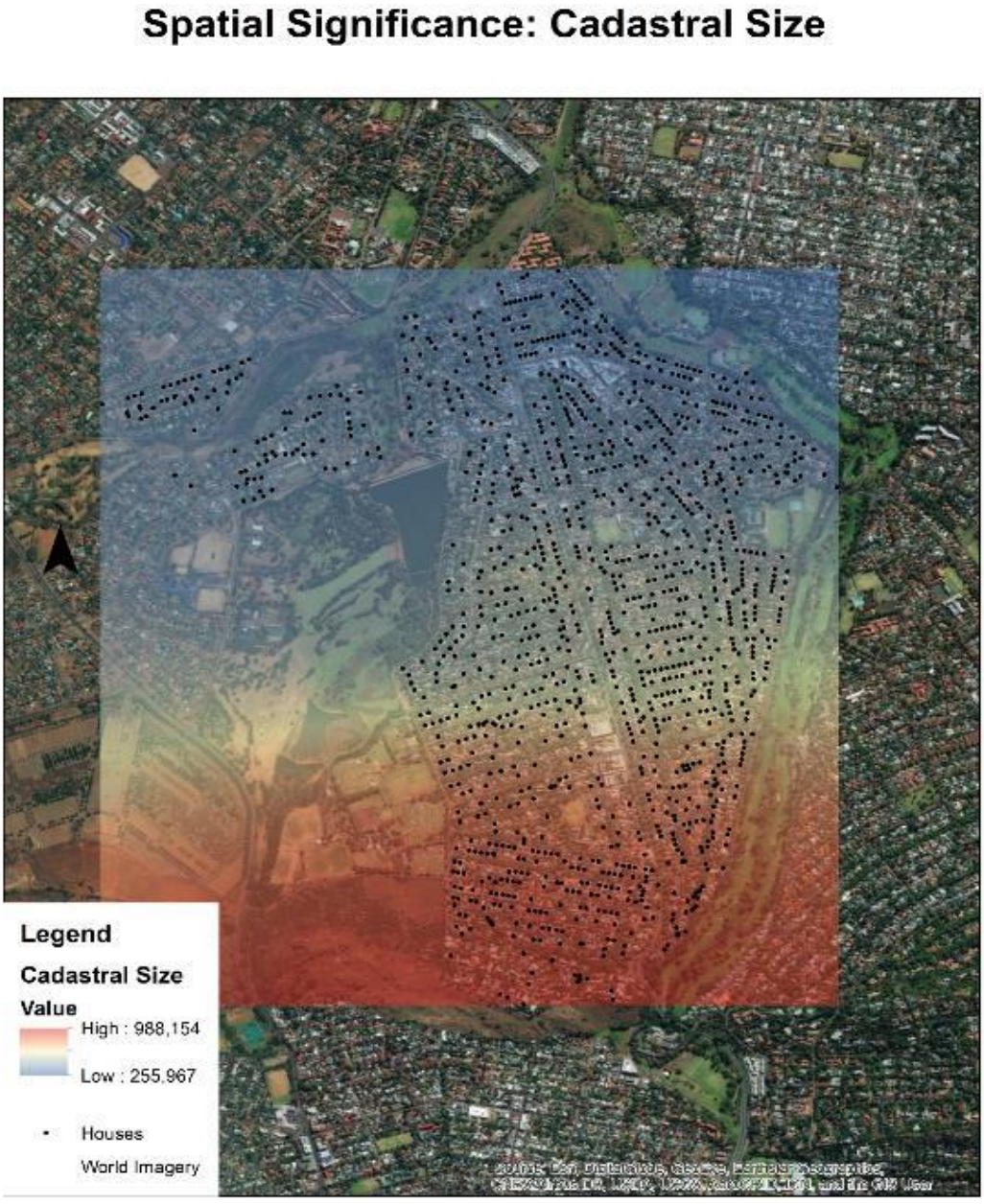


Figure 17: Heat Map Indicating the Spatial Significances of Cadastral Size (Source: Author, 2017)

The map below (Figure 18) explores the relationship of Greenside Primary School and value, based on a scale from blue to red. The blue shades indicate areas with the least significance; the darker the shade of blue, the less the significance. In contrast, the areas in red indicate the areas that are the most significant; the darker the shade of red, the greater the significance. The most significant area is found to be the central

and then the northern parts of the area. The central area may be the most significant due to its proximity to all the schools.

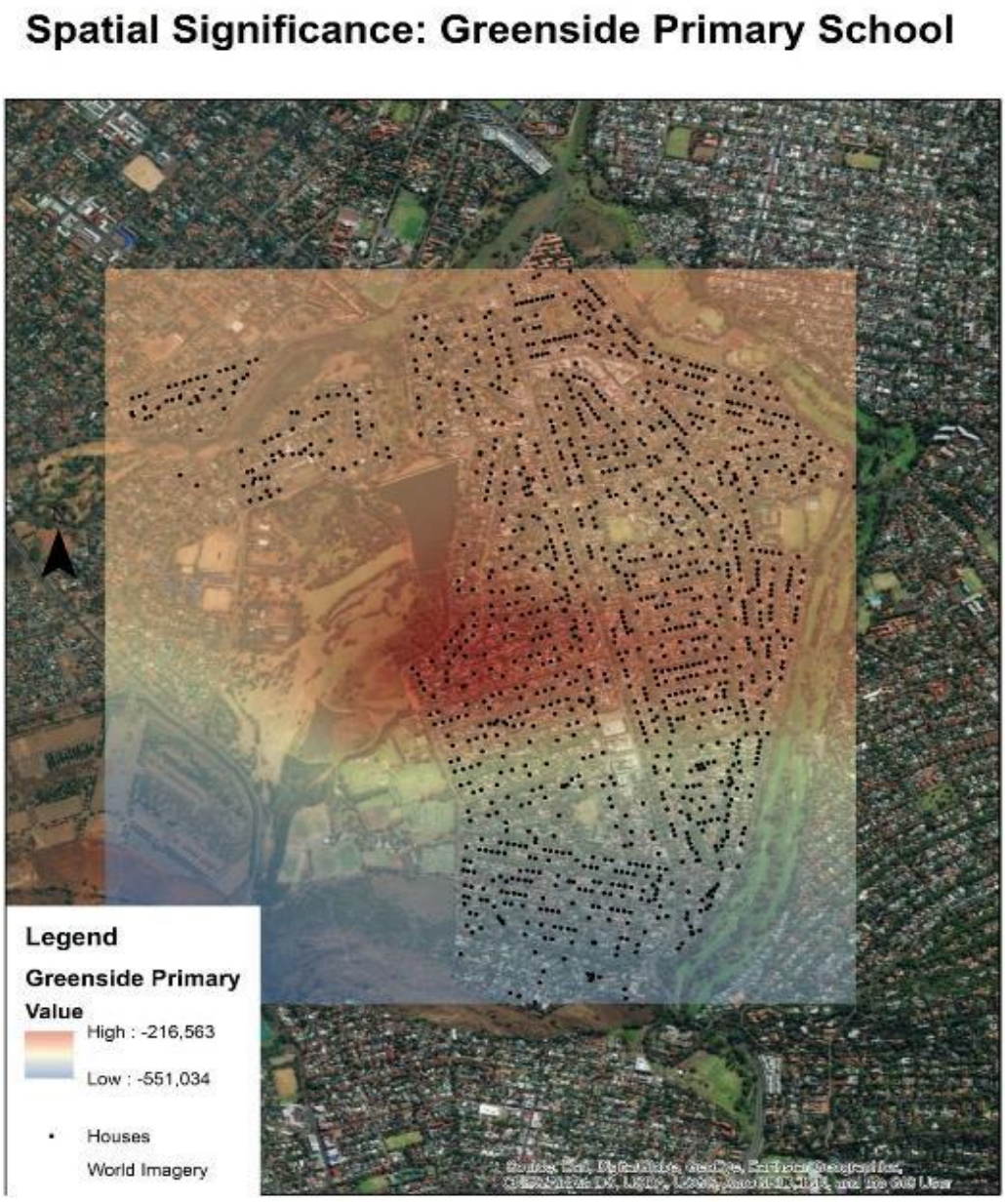


Figure 18: Heat Map Indicating the Spatial Significances of Greenside Primary School (Source: Author, 2017)

The map below (Figure 19) explores the relationship between the Mosque and value, based on a scale from blue to red. The blue shades indicate areas with the least significance; the darker the shade of blue, the less the significance. In contrast, the areas in red indicate the areas that are the most significant; the darker the shade of red, the greater the significance. The most significant area is found to be the southern parts of the area. This area is where the largest and most expensive houses are found,

and it could be that more expensive houses are more sensitive to the Mosque than less expensive houses.

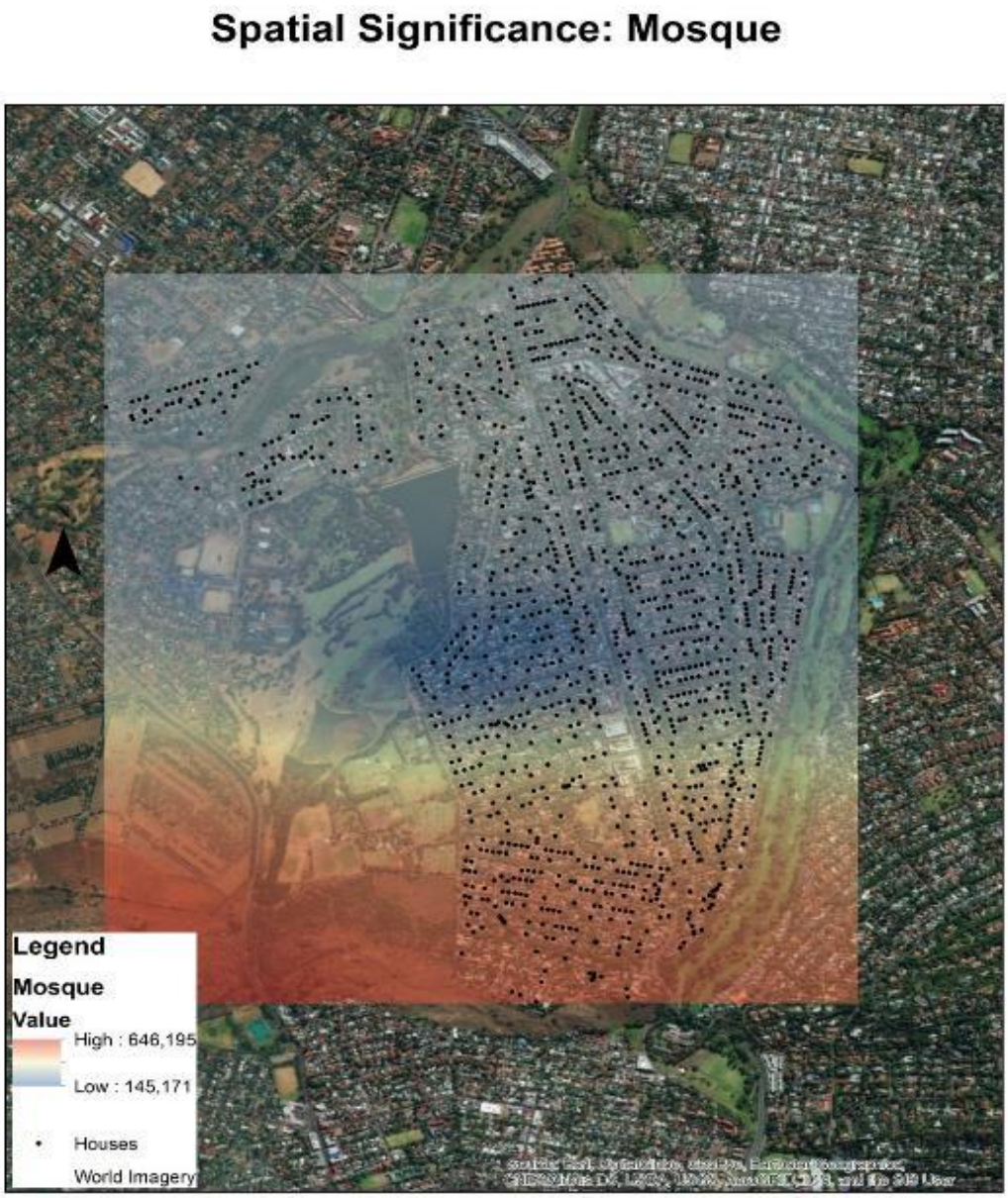


Figure 19: Heat Map Indicating the Spatial Significances of the Mosque (Source: Author, 2017)

The map below (Figure 20) explores the relationship of age and value, based on a scale from blue to red. The blue shades indicate areas with the least significance; the darker the shade of blue, the less the significance. In contrast, the areas in red indicate the areas that are the most significant; the darker the shade of red, the greater the significance. The most significant area is found in the northeastern part of the area.

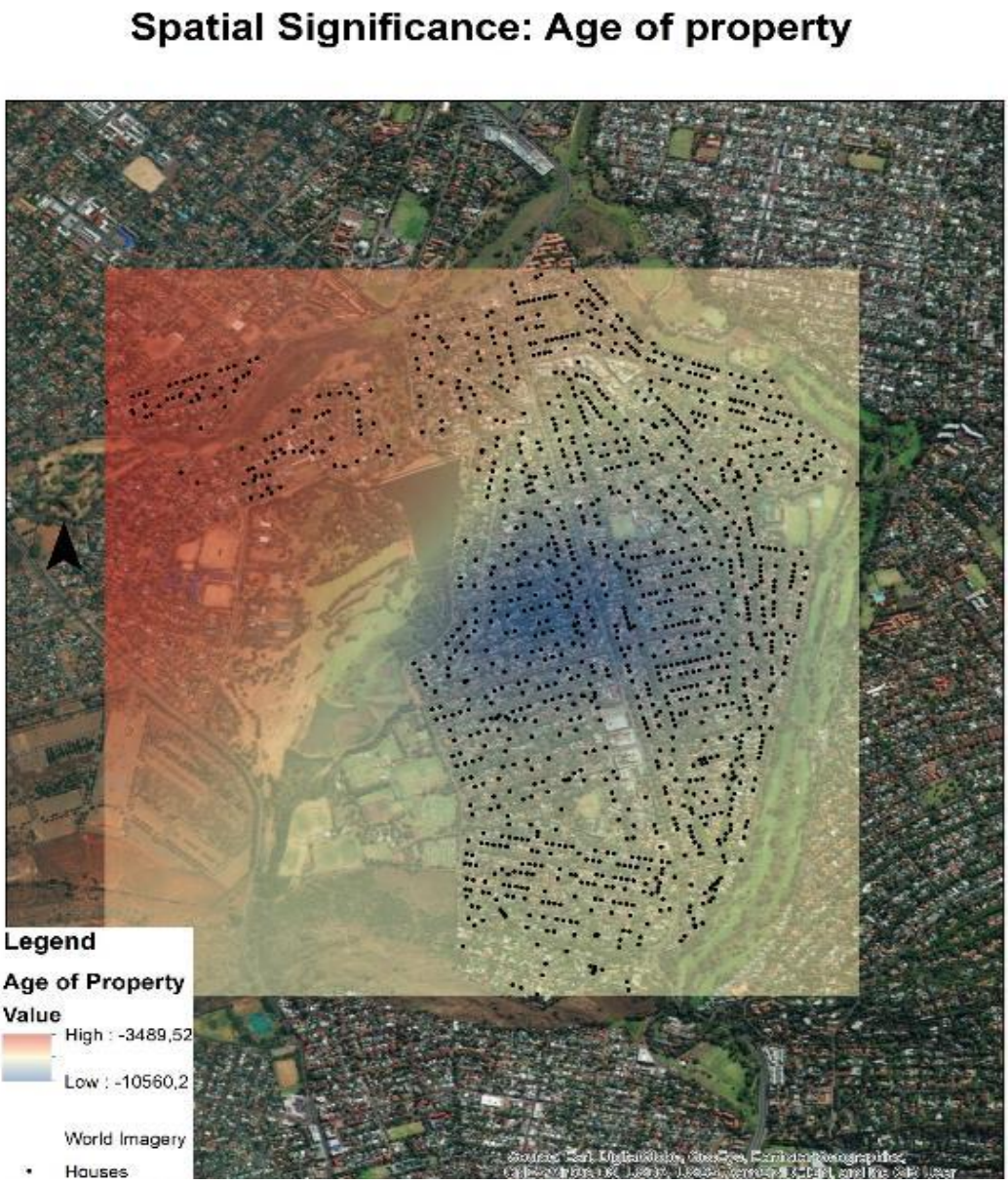


Figure 20: Heat Map Indicating the Spatial Significances of the Age of the Property (Source: Author, 2017)

Table 6: Averages of Geographically Weighted Regression Model

Adjusted	Avg. Coef	Avg. Std ERR	Avg. T	Avg. P
Age	-7443,93304	2579,694351	-2,908354239	0.003677
Cadastral Size	553,1725075	115,4804045	4,863521526	0.000
BedroomS	226701,19	63855,72755	3,537764803	0.000419
Bathroom	294935,3824	71698,7276	4,152160931	0.000
Distance to the Mosque	319,4199804	105,3215008	3,023368775	0.002
Distance to Greenside Primary School	-343,369384	109,3375204	-3,17019958	0.0015

To simplify the data and make an observation for the entire area, results of the individual variable were combined and the mean of each variables was sought to find the mean probability. All the variables that were included in the GWR model were, on average, found to be significant at the 0.01 level age, cadastral size, number of bedrooms, number of bathrooms, distance to the Mosque and distance to Greenside Primary School.

A Moran's I test indicates that the standard residuals are randomly located across the samples and that the model is not misspecified. The model received a Moran's I index score of 0,008802. A full report of the Moran's I test can be found in Appendix C.

5.1.3. Model with the Best Result

Naturally, the model that is best suited to this study is the Hedonic Pricing Method as it is able to use all the variables set out before the model was run. Furthermore, the

Akaike Information Criterion (AIC) score is used to compare regression models with one another and offers an indication of which regression model is superior. The AIC sore of the Hedonic Pricing Model indicates that it is better suited to the analysis than the GWR. Dziauddin *et al.* (2014, pg. 11), citing Fotheringham *et al.* (2002), states "…that the local model is an improvement over the global model if its AIC is more than three units smaller." Thus, the Hedonic Pricing Model, which is the global model, is superior in this study as the GWR, which is the local model, is not smaller than three units in comparison to the Hedonic Pricing Model. The AIC values for each model is shown below:

Table 6: Comparison of Akaike Information Criterion

Model	Type	AIC
Hedonic pricing model	Global	38168.487320
Geographical weighted regression	Local	38204,631093

The next section aims to contextualise the results that were obtained from the models. In particular, the discussion will rationalise the results, using evidence from the area and other studies.

5.2. Impact of Mosque on Value

The study has a low R-squared value, which is indicative that there is a weak correlation between the independent variable value and the dependant variables. If the level of confidence is to be accepted, it would indicate that the Mosque is shown to have a negative impact on value. There are various reasons why the Mosque could be negatively impacting value. It is possible that the effect is a direct result of the Mosque or it could be due to other factors that are causing the value to drop; due to the proximity of the Mosque to these disamenities, it could be that it is falsely attributed to the Mosque.

Possible reasons for the Mosque to be a disamenity may stem from NIMBYISM as explored in the literature review, where residents and potential residents view the Mosque negatively. However, the Mosque has employed measures to negate the two major complaints, namely noise and traffic. The Mosque does not broadcast the

Athaan over the loudspeaker and has measures to control traffic, such as creating a one-way road and parking areas. These measures, however, may not be sufficient and noise may be coming from the increased traffic and the Madrassah located on the property. It is important to consider all these factors and how it may impact value, but this falls outside the scope of this study.

There are two possible disamenities that are in close proximity to the Mosque, and it may be that the negative influence is emanating from these externalities and not from the Mosque. A petrol station is found on the block directly opposite the Mosque. There is literature, as reviewed in Chapter Two, that indicates that individuals and families prefer residing away from petrol stations. The petrol station in Greenside was recently closed to ensure that there is no leakage from the underground tanks that store the petroleum. The worry of a leak from the tanks is a particular concern to residents of the area due to the petrol stations being near Emmarentia Dam and in close proximity to a borehole that is used to supply water to the Mosque and a few properties around it (Pisanello, 2017). Figure 21 illustrates the distance of the Mosque (blue outline) to the petrol station (red outline).

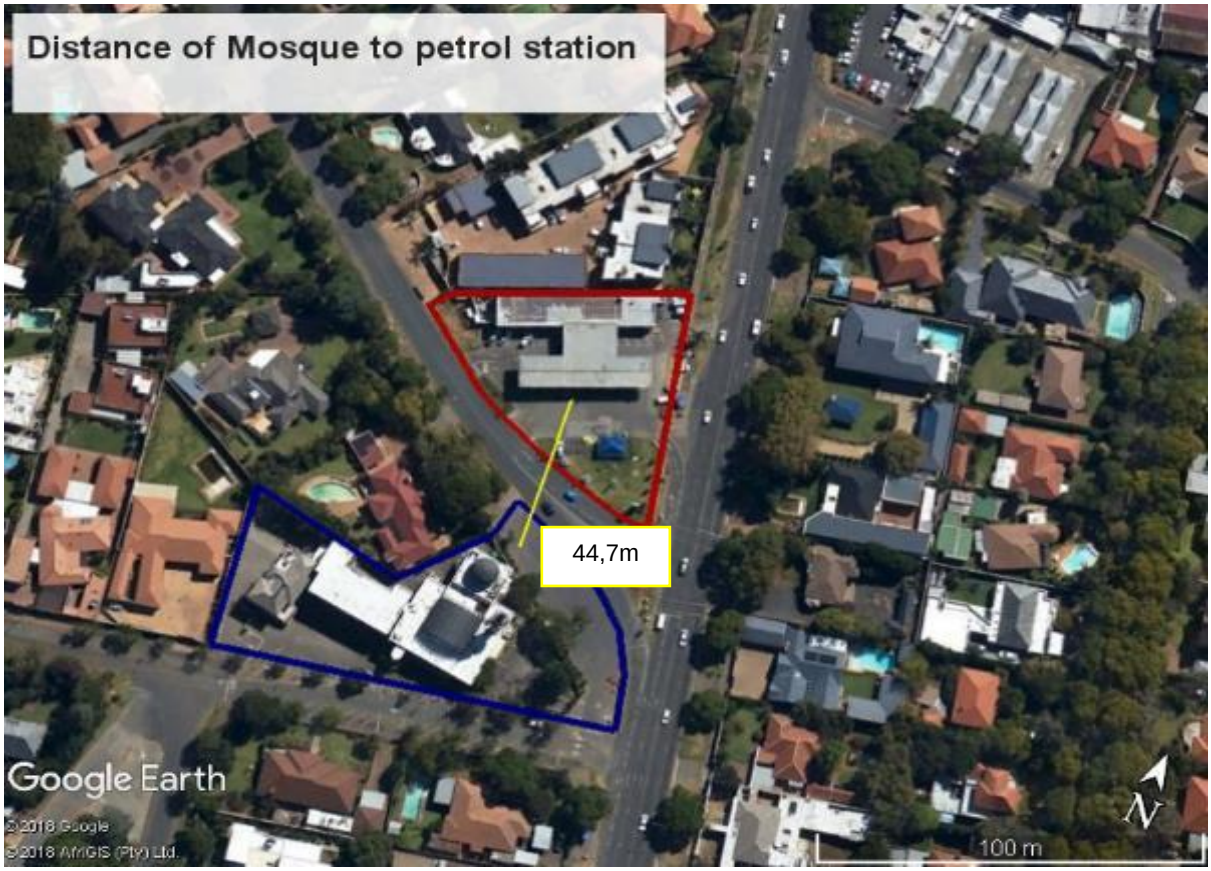


Figure 21: Map Indicating the Distance of Petrol Station to the Mosque *(Source: Author, 2017)*

The second external factor that may be causing a negative effect to emanate from the Mosque could be attributed to a proposed development. This development is proposed in the immediate area around the Mosque, with the developers wanting to create a mixed-use development. However, the two communities (Emmarentia and Greenside) both “strongly” oppose this development. The opposition to this development is primarily fought by the Residents’ Associations of Greenside and Emmarentia (Boorany, 2016). The Emmarentia Residents’ Association has a dedicated page on their website to keep the community informed about the action against the development.

The community opposes the development as the development does not adhere to the area’s existing precinct plan. The precinct plan was developed by the city in conjunction with the community, and the community was heavily involved in the process. Thus, the community is rejecting the development as various factors of the development go against the precinct plan. The developer wants to create a development that is not in line with the character of the area, creating a mixed-use facility consisting of retail and residential zones. The developer, thus, proposed to amend the precinct plan so that this development can go ahead; however, the community feels that this is a way for the developer to force through the development rather than the development conforming to the existing precinct plan (Boorany, 2016). Figure 22 illustrates the area where the development is proposed, highlighted in red; the blue outlines the area of the Mosque.



Figure 22: Map Showing the Proposed Development in Relation to the Mosque (Source Author, 2017)

The residents have a number of specific issues with the development. The height of the building is far higher than the tallest buildings in the area, which are only three stories high. Residents, therefore, argue that the building will not fit in with residential characteristics of the area. Residents are concerned that the infrastructure of the area will be overburden by the development and add to existing traffic woes. The residents further argue that the development will cause an oversupply of commercial and retail spaces as there currently is a number of shopping complexes in and around the area (Boorany, 2016).



Figure 23: Perspective of the Proposed Development (Source: Emmarentia resident's association, 2016)

Interestingly, the developer announced the development at the end of 2014 and shortly after, the prices of the property began to fall as seen in the following section. The developer has applied to rezone the area in addition to applying to amend the precinct plan. Both of these amendments are opposed by the community (Boorany, 2016).

Further suggesting that the Mosque is not a disamenity, in July 2014, an estate agent Borg (cited in Mhlanga, 2014, no pagination) was quoted as saying that

> "In their experience, he says [sic] suburbs such as Emmarentia, Risidale and Montgomery Park have become very sought after because of the construction of Mosques in those areas and they feel demand will exceed supply as buyers are prepared to pay a premium just to be near their place of worship."

This affirms what has previously been suggested by Dintah *et al.* (2014).

5.2.1. Impact of Physical Characteristics

Primarily in this study, it is the physical characteristics of the house that has the greatest effect on value. The following variables are all aspects of the physical attributes of the houses' cadastral size, the number of bedrooms and the number of bathrooms, which all have a positive effect on value. This is in line with previous hedonic studies that found that the physical characteristics of houses have the greatest impact on the value of houses (Xiao, 2017). Therefore, it can be said that

individuals and families attribute a significant amount of value to the physical characteristics of the house. Houses are mainly bought for people to reside in, and individuals and families spend a substantial amount of their time in their homes. Thus, this could be a possible reason why people are willing to spend the most on this aspect. The physical characteristics of houses are also the most studied variables in hedonic studies, further indicating the importance.

5.2.2. Impact of Time on Value

Time is shown to have a significant impact on the value of the houses in the study area. The model indicates that houses have appreciated over time, both in real value and in nominal value. The graph below depicts that the average sale prices (in real value) of the houses over the 17-year period.

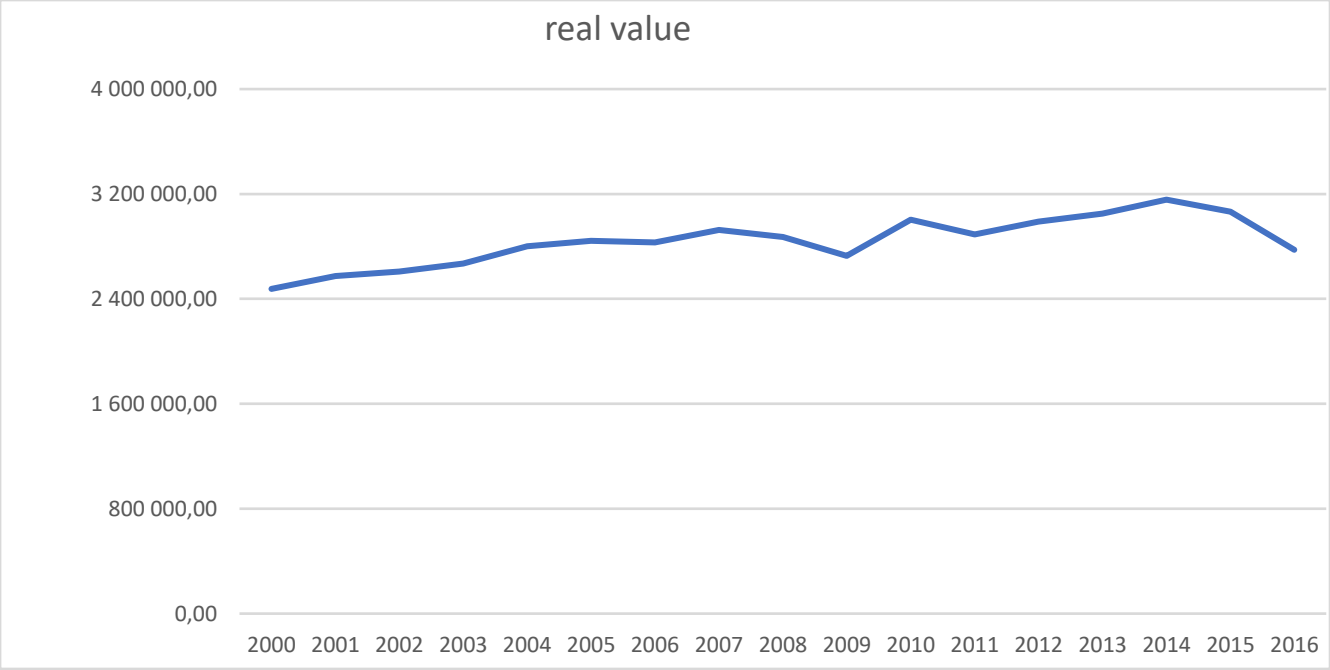


Figure 24: Average Sale Prices (in real value) of the Houses (Greenside/Emmarentia) Over the 17-year Period (Source: Author, 2017)

The graph indicates that, overall, there has been an increase in value: a house purchased in 2000 will have a higher value if sold in 2016. However, the increase has not been consistent. The property market is susceptible to fluctuations; this is referred to as the property cycle. The property market has booms and slumps, where external or internal factors cause the value of the property to rise (boom) and fall (slump). Major slumps were noted in 2009, 2011 and 2015. The slump in 2009 could be attributed to the global economic recession. In 2011, the slump could be due to the 2010 World

Cup where properties were returning to a normal price after the event caused inflation (Global Property Guide, 2011). The 2015 slump could be the South African economic downturn.

Greenside and Emmarentia fall under the greater Randburg area. The graph below depicts the average value of houses in the Randburg area in comparison to the suburbs of Greenside and Emmarentia. Greenside and Emmarentia's average house price is far greater than prices in Randburg. This trend emerged in 2004 as prior to 2004, houses were priced slightly higher in Greenside and Emmarentia. The Greenside and Emmarentia house prices are more susceptible to market pressures as there is greater volatility than in the Randburg area.

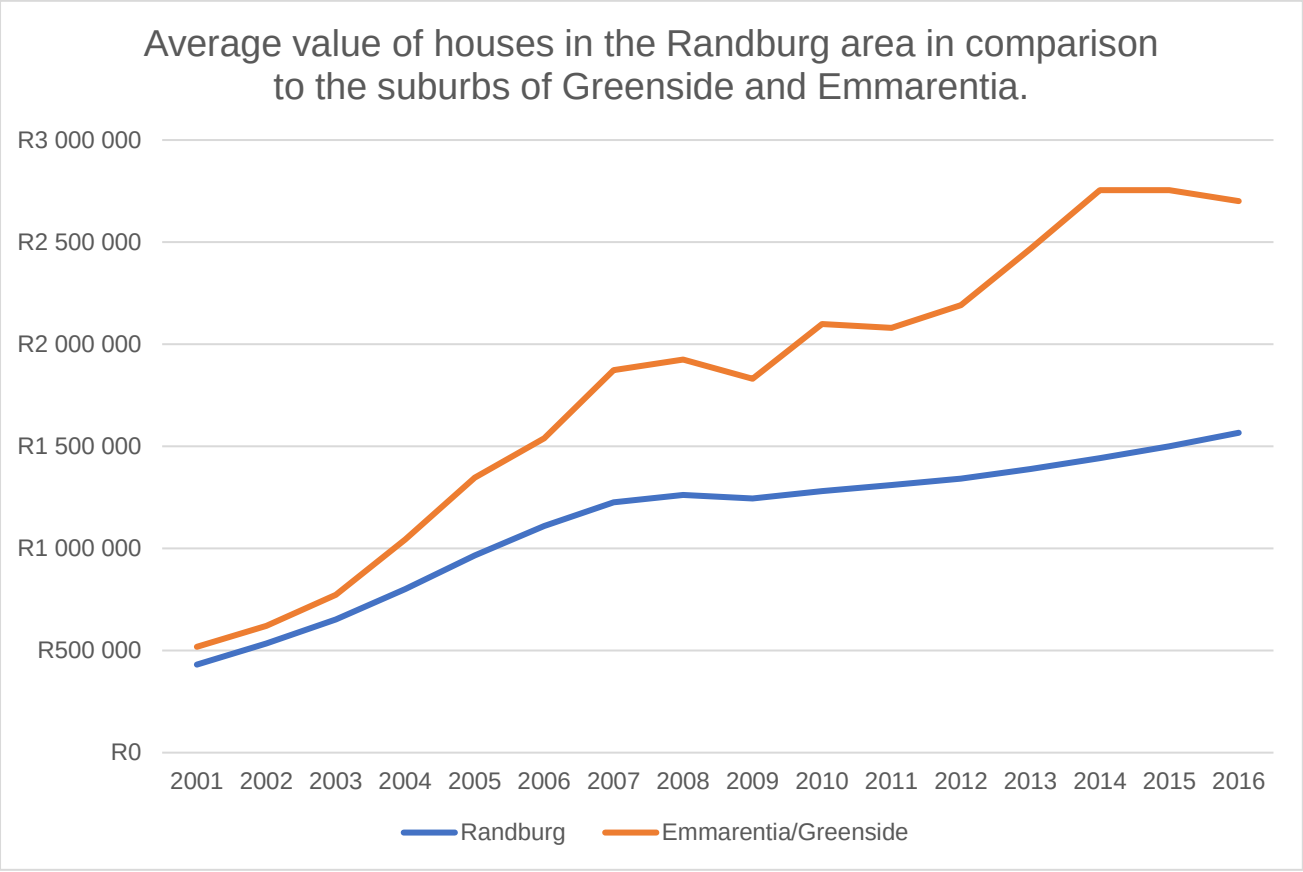


Figure 25: The Average Real Value of South African Houses (Source: Author, 2017)

5.3. Impact of Amenities and Externalities on Value

This section examines the effect of externalities and amenities, which impacts value. This study is shown to have a lesser impact in comparison to the other variables previously explored.

5.3.1. Impact of Schools on Value

Only one of the three schools in the area was found to have a positive influence on value: Greenside Primary School. The other schools in the area where found to be insignificant, which could be due to a number of factors. Des Rosiers *et al*. (2001) found various reason why a school might influence value. A positive influence on housing prices can be based on the school's proximity and size. The more accessible the school, the more value it exerts on surrounding property as parents prefer a shorter travelling time and there are fewer dangers, which may increase with distance, especially with children walking to school. With regards to size, schools with a larger size are said to have better and greater amount of facilities.

Greenside Primary School and Emmarentia Primary School are similar in profile and plot size. Greenside Primary School, however, has more structures and built up spaces compared to Emmarentia Primary School, which has more fields. In terms of accessibility, Greenside Primary School is more accessible to the entire area than Emmarentia Primary School; the average distance to Greenside Primary School is 1,205 metres whilst the average distance to Emmarentia Primary School is 1,484 metres. Another reason why Greenside Primary School has a positive influence on value while Emmarentia Primary School does not could be due to Emmarentia Primary School being located amongst houses that are more valuable. These households may prefer to send their children to private schools away from the area. It is interesting to note that the school fees at Greenside Primary School are higher than the school fees at Emmarentia Primary School.

Studies found that accessibility to high school does not matter to parents as much as primary schools, as parents are more cautious with younger children and do not necessarily locate as close as they would to a primary school. It may also be that parents in the Greenside/Emmarentia area prefer to send their children to private schools in the surrounding areas as there are a number of prestigious private schools in close proximity which is more fitting to the households' LSM (Gumede, 2017).

5.3.2. Insignificance of Amenities

Although a GWR could not be run including all the variables due to multicollinearity, the issue of multicollinearity could be interpreted as a major finding of the study as it indicates that there is redundancy across the variables that examine distance to

amenities. Redundancy indicates that the amenities are all found in close proximity and will therefore have similar distances. This could mean that an individual or family chooses to reside in a house where they could have the best access to all the amenities or access to the amenities they most commonly use.

Redundancy may also be due to the size of the area: the area at the longest side is 6,47km and the total area of 6,56 km^2. This indicates that the area is extremely accessible, particularly if you have a car. The LSM indicates that a car will be a norm in the households of the area. McKay *et al.* (2017) found that private vehicles are the preferred mode of transport amongst those who can afford it. This suggests that family/individuals can reside in a part of the area and have a similar access to all the amenities.

5.4. Conclusion

This chapter firstly examines the result that was produced by the two regression models. The OLS model indicates a higher degree of accuracy as well as being the model that could analyse all variables. The GWR, however, was far less accurate. The second part of the chapter examines the possible reason why such results were achieved. There is a number of possible reasons why the Mosque is seen to be a disamenity: a decrease in value could be attributed to the Mosque or external factors that are close to the Mosque.

6. Chapter Six: Conclusion

This chapter aims to conclude the study. The chapter begins by answering the research questions that were asked in the first chapter. Drawing from the findings, the chapter thereafter offers recommendations. Following this, the chapter examines the limitations as well as future studies that can be undertaken to supplement and shed further light on the relationship between property prices and the Mosque. The last section of this chapter is a conclusion of the entire report.

6.1. Answering the Research Questions

The study will now aim to answer the research questions that where proposed in Chapter One.

Question 1: The study has a low R-squared value and, therefore, does not conclusively establish a link with the Mosque having an effect on value. If the results are to be accepted, the Mosque in the Greenside/Emmarentia area is shown to have a negative effect on the surrounding property. This contradicts the popular belief that the Mosque adds value to the houses around it. However, the reason why the Mosque is exerting a negative value is unclear as there are multiple possibilities why this could be the case. In order to understand this, future studies will need to examine this phenomenon specifically. Further gaps uncovered in this report will be investigated in Section 6.3 to follow. It is important to add that the Mosque has a minute impact on value, with a low degree of confidence.

Question 2: Following from Question 1, the study has established that the Mosque may be perceived as a disamenity. It is not possible to assume from this study if the Mosque is a disamenity or an amenity.

Question 3: The Mosque impacts the entire area, but the effect is more significant in certain areas. The lower edge of Emmarentia, which has the most expensive houses, is shown to be the area where the Mosque;s impact is most significant.

Question 4: The amenity that exerts the greatest value is Greenside Primary School. This indicates that individuals and families are willing to pay a premium to be close to the school. The physical characteristic of the house that exerts the highest value is the

age of the property. Individuals and families are willing to pay a higher price for a newer house.

Question 5: The effect does not diminish with distances. Rather, it can be said that the effect is equal for most parts of the area. However, it can be said that the effect is more prominent on the edge of Emmarentia.

6.2. Recommendations

This study has found that how value is created in neighbourhoods is poorly understood, and the data needed for such studies is neither freely available nor is easily accessible. Therefore, more research is required, which will specifically understand how value is created in the post-Apartheid South African residential property market. Planners and policymaker should ensure that adequate research is done before constructing amenities, based on the needs and desires of the community.

It is equally important to know the best place to locate amenities due to the role amenities play in creating value. Amenities should be strategically placed across neighbourhoods, according to their best fit. Creating corridors of the amenities can increase the liveability of the neighbourhood. For example, creating pathways that connect the amenities may increase the walkability of the area.

Concerning the Mosque, the Muslim community could do more to ensure that the entire community sees the Mosque as an amenity, regardless of religion. New Mosque developments should accurately explain the role of the Mosque and identify mitigating solutions to dismiss any fears non-Muslims residents may have – solutions such as Radio Bilaal (previously mentioned). The Muslim community should also consider how the Mosque or facilities on its compound can be used for the benefit of the entire community rather than solely for the benefit of the Muslim community, offering certain spaces so the entire community may utilise it.

6.3. Limitations

This section examines the limitations of the study. There are various factors that limit the study; the factors are explored in detail below.

6.3.1. Data

The greatest challenge for this study was sourcing the appropriate data. Whilst housing sales are public information, to get detailed information to accompany this data, such as the physical characteristics of the house, one has to purchase this data. The same can be said for historical data as data for houses that are currently for sale are readily available on numerous property websites. However, finding historical data about houses that have been previously sold is more challenging. Thus, due to the lack of data prior to construction of the Mosque, a more appropriate method of examining housing values pre-and post-construction of the Mosque could not be undertaken.

The number of houses sold in the study area was a limiting factor. If the property market of the area was more active, it would have resulted in a larger sample. International studies, such as Simons and Seo (2011, have large samples that examine over a thousand transactions per year. The property market in the study area is much smaller. To put this into perspective, the area of Emmarentia only has 1,000 erfs.

6.3.2. Time

A limiting factor of this study was time. More time to undertake the study could have been used to collect more variables of the physical attributes of the houses and social demographic data of the individuals and families who reside in these houses. Surveys could have been conducted for residents to divulge information regarding the physical attributes of their homes as well as to answer questions that would reveal information regarding their social status. More time could have been used to explore and use other methods for analysis.

6.3.3. Budget

Due to budget constraints, a bigger sample could not be obtained. A larger budget could have been used to purchase a larger sample across more years and to include more variables.

6.4. Future Studies

There is extensive scope for future studies, both within the study area and to expand to areas outside of the study area.

6.4.1. Internal

Future studies that can be conducted in the Emmarentia/Greenside area can investigate who bought houses and what their motives were for purchasing the specific house. It can, therefore, be established by qualitative data if a premium was paid to be close to certain amenities. It could be found that Muslim people paid a premium to be close to the Mosque and people of other beliefs did not or they paid a discounted price.

6.4.2. External

A study can be conducted that compares multiple areas across Johannesburg, comparing areas where Mosques have been built and determining if there is a pattern between the building of the Mosque and the effect on property prices. Furthermore, a comparative analysis could be useful to examine the difference in the property price between areas that have a Mosque and areas that do not.

6.5. Conclusion

This study examined the impact the Greenside Mosque has on the neighbourhoods of Emmarentia and Greenside. In particular, it investigated the effect the Mosque has on value to the residential properties of the two areas. In the Islamic faith, the Mosque is not only central to adherents' spiritual life but also to their daily life as Muslims are required to pray five times a day in a congregation. This makes the suburbs of Emmarentia and Greenside a desirable neighbourhood for Muslims to live in. Not only does the area have a Mosque, it has a number of other amenities and services. The amenities found in Emmarentia/Greenside are far superior to the amenities found in the neighbourhoods that Muslims were previously confined to.

Residential location theory explains the reasoning and choices people make when deciding where to live. Families and individuals choose to live in a neighbourhood that suits their needs and preferences, but their choice is impacted by their economic status. A household made up of two parents and three children would thus want to live in an area that offers the best amenities and services for a family: a neighbourhood that includes or is in close proximity to good schools, parks, transportation, libraries and other suitable amenities. If a neighbourhood has these amenities, it is more valuable to families, and families would be willing to pay a premium for these

conveniences. Thus, there is a relationship between amenities, residential location and value.

Anecdotal evidence indicates that the Greenside Mosque has a positive effect on the value of the surrounding properties as Muslims place a premium on living close to the Mosque. It is believed that Emmarentia and Greenside are highly sought-after neighbourhoods for Muslims, which has resulted in a substantial increase in property price, especially for properties closest to the Mosque. However, there is no empirical or other evidence to substantiate this claim.

Hedonic value is best used to understand the aforementioned relationship (between amenities, residential location and value) and is a commonly used methodology in the property discourse. The hedonic analysis allows one to break down the total value of a property by its individual characteristics and features, thus the contribution of each of the property's characteristics and features can be estimated. To ascertain the value of the Mosque on surrounding properties, the study employed a hedonic analysis. Property prices in Emmarentia and Greenside were input into a Geographical Information System as well as a statistical program to analyse the relationship between the Mosque and the surrounding residential properties. The analysis covered a 17m-year period and included 1268 residential properties. Although it has been hypothesised that the Mosque will have a positive increase on the surrounding property, the study has a low R-squared value and, therefore, does not conclusively establish a link with the Mosque having an effect on value. However, if the R-squared value is accepted, it indicates that the Mosque has decreased the value of the surrounding properties, with the effect being equal and not diminishing with distances. The effect, however, will be most significant amongst the houses with the highest value.

REFERENCES

Abidoye, R.B., Chan, A.P. and Chan, A.P., 2016. Critical Determinants of Residential Property Value: Professionals' Perspective. *Journal of Facilities Management*, *14*(3), pp.283-300.

Adair, A., Berry, J. and McGreal, S. 1996. Valuation of residential property: analysis of participant behaviour. *Journal of Property Valuation and Investment*, 14(1), pp.20-35.

Aliyu, A., 2012. *Impact of intangible location attributes on residential property value in Nigeria* (Doctoral dissertation, Universiti Tun Hussein Onn Malaysia).

Almy, R., 2014. Valuation and Assessment of Immovable Property. *OECD Working Papers on Fiscal Federalism*, (19).

Alonso, W., 1964. Location and land use.

Analyst Cave (2014). *Google API distance VBA Function*. [image] Available at: http://analystcave.com/excelExcel-calculate-distances-between-addresses/ [Accessed 8 Aug. 2017].

Babawale, G.K. and Adewunmi, Y., 2011. The Impact of Neighbourhood Churches on House Prices. *Journal of Sustainable Development*, *4*(1), p.246.

Balbontain, C., Ortúzar, J.D.D. and Swait, J.D., 2015. A Joint Best–Worst Scaling and Stated Choice Model Considering Observed and Unobserved Heterogeneity: An Application to Residential Location Choice. *Journal of choice modelling*, *16*, pp.1-14.

Beavon, K.S.O., 2004. Johannesburg: The Making and Shaping of the City (Vol. 9). Unisa Press.

Belbah, M., 2009. Global and Local Dimensions of Islam in France. *South African Historical Journal*, *61*(1), pp.54-63.

Bell, R. and Bell, M.P., 2015. Real Estate Research Methods. *Appraisal Journal*, *83*(4).

Bellman, L. and Öhman, P., 2016. Authorised Property Appraisers' Perceptions of Commercial Property Valuation. *Journal of Property Investment & Finance*, *34*(3), pp.225-248.

Beracha, E., Gilbert, B.T., Kjorstad, T. and Womack, K., 2016. On the Relation between Local Amenities and House Price Dynamics. *Real Estate Economics*.

Biscaia, R. and Mota, I., 2013. Models of spatial competition: A critical review. *Papers in Regional Science*, *92*(4), pp.851-871.

Blaug, M., 1979. The German hegemony of location theory: A puzzle in the history of economic thought. *History of Political Economy*, *11*(1), pp.21-29.

Boorany, C. (2016). Emmarentia proposed development. [Blog] *Emmarentia Residents Association*. Available at: http://emmarentia.co.za/proposed-emmarentia-development-2/ [Accessed 4 Nov. 2017].

Brand, A. and Geyer, H.S., 2017. Corridor Development in Gauteng, South Africa. *GeoJournal*, *82*(2), pp.311-327.

Brandt, S., Maennig, W. and Richter, F., 2014. Do Houses of Worship Affect Housing Prices? Evidence from Germany. Growth and Change, 45(4), pp.549-570.

Calhoun, C.A., 2001. Property Valuation Methods and Data in the United States. *Housing Finance International*, *16*(2), p.12.

Chan, W.M., 2014. Comparison of Spatial Hedonic House Price Models: Application to Real Estate Transactions in Vancouver West.

Charlton, M., Fotheringham, S. and Brunsdon, C., 2009. Geographically weighted regression. *White paper. National Centre for Geocomputation. National University of Ireland Maynooth*.

Chau, K.W. and Chin, T.L., 2002. A Critical Review of Literature on the Hedonic Price Model.

Chiaradia, A., Hillier, B., Schwander, C. and Barnes, Y., 2013. Compositional and urban form effects on residential property value patterns in Greater London. *Proceedings of the Institution of Civil Engineers-Urban Design and Planning*, *166*(3), pp.176-199.

Church, R.L. Murray, A.T., 2009. Business site selection, location analysis, and GIS (pp. 259-280). Hoboken, NJ: John Wiley & Sons.

Cortesi, G. (2003). *Mastering real estate principles*. 1st ed. Dearborn Real Estate.

Das, S., Mitra, A. and Kumar, R., 2017. Do Neighbourhood Facilities Matter for Slum Housing? Evidence from Indian Slum Clusters. *Urban Studies*, *54*(8), pp.1887-1904.

Davie, L. (2014). *City of Johannesburg - Joburg's Only Dry Suburb*. [online] Joburg.org.za. Available at: https://joburg.org.za/index.php?option=com_content&task=view&id=289&Itemid=51&limitstart=1&limit=1 [Accessed 16 Jun. 2017].

de Araujo, P. and Cheng, K., 2017. Do Preferences for Amenities Differ Among Home Buyers? A Hedonic Price Approach. *Review of Urban & Regional Development Studies*.

Dettling, L.J. and Kearney, M.S., 2014. House Prices and Birth Rates: The Impact of the Real Estate Market on the Decision to Have a Baby. *Journal of Public Economics*, *110*, pp.82-100.

Dictionary, O.E., 2007. Oxford English Dictionary.

Dinath, Y., Patel, Y. and Seedat, R. (2014). Footprints of Islam in Johannesburg. In: P. Harrison, G. Gotz, A. Todes and C. Wray, ed., *Changing Space, Changing City Johnnesburg After Aparthied*, 1st ed. Johannesburg: Wits University Press.

Donaldson, R. and Kotze, N., 2006. Residential Desegregation Dynamics in the South African city of Polokwane (Pietersburg). *Tijdschrift voor economische en sociale geografie*, *97*(5), pp.567-582.

du Preez, M., Balcilar, M., Razak, A., Koch, S.F. and Gupta, R., 2014. *House Values and Proximity to a Landfill: A Quantile Regression Framework* (No. 15-16).

Dziauddin, F., 2014. The Determinants of House Prices in the Klang Valley, Malaysia. Jurnal Perspektif, 6(1), pp.70-80.

Dziauddin, M.F., Powe, N. and Alvanides, S., 2015. Estimating the effects of light rail transit (LRT) system on residential property values using geographically weighted regression (GWR). *Applied Spatial Analysis and Policy*, *8*(1), pp.1-25.

Emmarentia Resident's Association (2016). *Perspective of the propped development*. [image] Available at: http://emmarentia.co.za/category/uncategorized/ [Accessed 12 Oct. 2017].

Epley, Donald R., and Joseph Rabianski. Principles of Real Estate Decisions. Reston Pub Co, 1986.

Esack, F., 1997. Qurán, liberation and pluralism: An Islamic perspective of interreligious solidarity against oppression.

Famuyiwa, F. and Kayode Babawale, G., 2014. Hedonic Values of Physical Infrastructure in House Rentals. *Journal of Facilities Management*, *12*(3), pp.211-230.

Floyd, C. and Allen, M. (2002). *Real Estate Principles*. 1st ed. Dearborn Real Estate.

Francke, R. (2017). *Pig snout at* Mosque*: culprits to be charged* | *IOL*. [online] Iol.co.za. Available at: http://www.iol.co.za/news/south-africa/western-cape/pig-snout-at-Mosque-culprits-to-be-charged-7361261 [Accessed 9 May 2017].

French, N., 2004. The Valuation of Specialised Property: A Review of Valuation Methods. *Journal of Property Investment & Finance*, *22*(6), pp.533-541.

Frenkel, A., Bendit, E. and Kaplan, S., 2013. Residential Location Choice of Knowledge-Workers: The Role of Amenities, Workplace and Lifestyle. *Cities*, *35*, pp.33-41.

Glickman, E. 2014. *An Introduction to Real Estate Finance*. 1st ed. Waltham: Academic Press.

Global Property Guide. (2011). *South Africa's housing market weakens after FIFA World Cup*. [online] Available at: https://www.globalpropertyguide.com/Africa/South-Africa/Price-History-Archive/South-Africas-housing-market-weakens-after-FIFA-World-Cup-127020 [Accessed 6 Nov. 2017].

Goodman, A.C., 1998. Andrew Court and the Invention of Hedonic Price Analysis. *Journal of urban economics*, *44*(2), pp.291-298.

Gorbannejad, P. and Mohammadi, F.J., 2016. Surveying Location Pattern of Nabi Mosque According to Verses, Hadithes and Prophet's Sira. *International Journal of Engineering and Technology*, *8*(2), p.146.

Greaves, M., 1985. The Determinants of Residential Values: The Hierarchical and Statistical Approaches. *Journal of Valuation*, *3*(1), pp.5-23.

Gumede, M. (2017). *Nirvana of private schools getting costly*. [online] Business Live. Available at: https://www.businesslive.co.za/bt/business-and-economy/2017-07-01-nirvana-of-private-schools-getting-costly/ [Accessed 10 Nov. 2017].

Hamann, C. and Horn, A.C., 2015, March. Continuity or Discontinuity? Evaluating the Changing Socio-Spatial Structure of the City of Tshwane, South Africa. In Urban Forum (Vol. 26, No. 1, pp. 39-57). Springer Netherlands.

Harrison, P., 2004. *South Africa's Top Sites: Spiritual*. New Africa Books.

Hess, L. (2016). *'When Muslims move in, they expand' – anti-*Mosque *protesters in Pretoria*. [online] News24. Available at: http://www.news24.com/SouthAfrica/News/when-Muslims-move-in-they-expand-anti-Mosque-protesters-in-pretoria-20160414 [Accessed 9 May 2017].

Huang, Q., Parker, D.C., Filatova, T. and Sun, S., 2014. A Review of Urban Residential Choice Models Using Agent-Based Modeling. *Environment and Planning B: Planning and Design*, *41*(4), pp.661-689.

Isard, W., 1956A. Location and space-economy.

Isard, W., 1956B. Regional science, the concept of region, and regional structure. *Papers in Regional Science*, *2*(1), pp.13-26.

Islamqa. (2008). What is the distance within which it is obligatory to pray in the Mosque?- islamqa.info. [online] Available at: https://islamqa.info/en/20655 [Accessed 12 Apr. 2017].

Ivashina, V. and Scharfstein, D., 2010. Bank Lending During the Financial Crisis of 2008. *Journal of Financial economics*, *97*(3), pp.319-338.

Jordaan, A.C., Drost, B.E. and Makgata, M.A., 2004. Land Value as a Function of Distance from the CBD: The Case of the Eastern Suburbs of Pretoria. *South African Journal of Economic and Management Sciences*, *7*(3), pp.532-541.

Joshua Adegoke, O., 2014. Critical Factors Determining Rental Value of Residential Property in Ibadan Metropolis, Nigeria. Property Management, 32(3), pp.224-240.

Jost, A., Nelson, J., Gopinathan, K. and Smith, C., Hnc, Inc., 2008. *Real Estate Appraisal Using Predictive Modeling*. U.S. Patent 5,361,201.

Kamaldien, Y. (2017). *Man moaning about* Mosque *prayers wasn't even in SA | IOL*. [online] Iol.co.za. Available at: http://www.iol.co.za/news/south-africa/western-cape/man-moaning-about-Mosque-prayers-wasnt-even-in-sa-7404306 [Accessed 9 May 2017]. 14

Kane, M.S., Linne, M.R. and Johnson, J.A., 2004. *Practical Applications in Appraisal Valuation Modeling: Statistical Methods for Real Estate Practitioners*. Appraisal Institute.

Kanojia, A., Khan, M. Y., Jadhav, U., 2016. Valuation of Residential Properties by Hedonic Pricing Method-A State of Art.

Kinney, N.T. and Winter, W.E., 2006. Places of Worship and Neighborhood Stability. *Journal of urban affairs*, *28*(4), pp.335-352.

Kok, N., Monkkonen, P. and Quigley, J.M., 2014. Land Use Regulations and the Value of Land and Housing: An Intra-Metropolitan Analysis. *Journal of Urban Economics*, *81*, pp.136-148.

Kraus, M., 2003. A New Look at the Two-Mode Problem. *Journal of Urban Economics*, *54*(3), pp.511-530.

Lai, P.P.Y. and Fischer, D.A., 2017. The Price Impact of House Refurbishment Estimated by Geographically Weighted Regression and Hedonic Pricing Model. *International Journal of Property Sciences 6*(1).

Lawton, P., Murphy, E. and Redmond, D., 2013. Residential Preferences of the 'Creative Class'?. *Cities*, *31*, pp.47-56.

Lees, L., Slater, T. and Wyly, E., 2013. *Gentrification*. Routledge.

Lehohla, P. and Shabalala, N., 2014. Inequality in South Africa. *Development*, *57*(3-4), pp.497-511.

Leyds, G.A., 1964. *A History of Johannesburg: The early years*. Nasional Boekhandel.

Lightstone property (2017). *Suburb Report Greenside/Emmarentia*. Johannesburg: Lightstone

Mahida, E.M., 1993. History of Muslims in South Africa: A Chronology.

McCluskey, J. and Rausser, G. (2001). Estimation of Perceived Risk and Its Effect on Property Values. Land Economics, 77(1), pp.42-55.

McCluskey, J.J. and Rausser, G.C., 2001. Estimation of perceived risk and its Effect on Property Values. *Land Economics*, *77*(1), pp.42-55.

McGarrigle, J., 2016. Islam in Urban Spaces: The Residential Incorporation and Choices of Muslims in Lisbon. *Journal of Ethnic and Migration Studies*, *42*(3), pp.437-457.

McKay, T., Simpson, Z. and Patel, N., 2017. Spatial politics and Infrastructure Development: Analysis of Historical Transportation Data in Gauteng-South Africa (1975–2003). *Miscellanea Geographica*, *21*(1), pp.35-43.

Melanda, E., Hunter, A. and Barry, M., 2016. Identification of Locational Influence on Real Property Values Using Data Mining Methods. *Cybergeo: European Journal of Geography*.

Mhlanga, D. (2014). *Buying Close to Schools and Churches - Property24.com*. [online] Property24.com. Available at: https://www.property24.com/articles/buying-close-to-schools-and-churches/20162 [Accessed 13 Sep. 2017].

Millington, A. (2014). An Introduction to Property Valuation. 2nd ed. London: Taylor & Francis.

Mills, E.S., 1972. Studies in the Structure of the Urban Economy.

Monson, M., 2009. Valuation Using Hedonic Pricing Models. *Cornell Real Estate Review*, *7*(1), p.10.

Mulliner, E., Malys, N. and Maliene, V., 2016. Comparative Analysis of MCDM Methods for the Assessment of Sustainable Housing Affordability. *Omega*, *59*, pp.146-156.

Mulugeta, S. (2009). *The silent mosque | Brand South Africa*. [online] Brand South Africa. Available at: https://www.brandsouthafrica.com/people-culture/arts-culture/the-silent-mosque [Accessed 27 Jun. 2017].

Muth, R.F., 1969. Cities and Housing; The Spatial Pattern of Urban Residential Land Use.

Netusil, N.R., Levin, Z., Shandas, V. and Hart, T., 2014. Valuing Green Infrastructure in Portland, Oregon. *Landscape and Urban Planning*, *124*, pp.14-21.

Nijënstein, S., Haans, A., Kemperman, A.D. and Borgers, A.W., 2015. Beyond Demographics: Human Value Orientation as a Predictor of Heterogeneity in Student Housing Preferences. *Journal of Housing and the Built Environment*, *30*(2), pp.199-217.

Oloke, C.O., Simon, R.F. and Adesulu, A.F., 2013. An Examination of the Factors Affecting Residential Property Values in Magodo Neighbourhood, Lagos state. *International Journal of Economy, Management and Social Sciences*, *2*(8), pp.639-643.

Páez, A., 2009. Recent Research in Spatial Real Estate Hedonic Analysis.

Pagourtzi, E., Assimakopoulos, V., Hatzichristos, T. and French, N. (2003). Real estate appraisal: a review of Valuation Methods. *Journal of Property Investment & Finance*, 21(4), pp.383-401.

Peterson, S. and Flanagan, A., 2009. Neural network hedonic pricing models in Mass Real Estate Appraisal. Journal of Real Estate Research.

Petkar, A.S. and Macwan, J.E., 2016. Identifying Urban Zonal Preferences: Planners' Perspective. *Proceedings of the Institution of Civil Engineers-Urban Design and Planning*, *170*(1), pp.1-22.

Pisanello, L. (2017). *Sunny Shell reopens following months of ensuring there is no risk of water contamination | Rosebank Killarney Gazette*. [online] Rosebank Killarney Gazette. Available at: https://rosebankkillarneygazette.co.za/216366/sunny-shell-reopens-following-months-of-ensuring-there-is-no-risk-of-water-contamination/ [Accessed 2 Nov. 2017].

Rahadi, R.A., Wiryono, S.K., Koesrindartoto, D.P. and Syamwil, I.B., 2013. Attributes Influencing Housing Product Value and Price in Jakarta Metropolitan Region. *Procedia-Social and Behavioral Sciences*, *101*, pp.368-378.

Revington, N., 2015. Gentrification, Transit, and Land Use: Moving Beyond Neoclassical Theory. *Geography Compass*, *9*(3), pp.152-163.

Ricardo, D., 1821. The principles of taxation and political economy. *JM Dent, London*. Available at: https://books.google.co.za/books/about/On_the_Principles_of_Political_Economy_a.html?id=cUBKAAAAYAAJ&redir_esc=y[Accessed 2 Apr. 2017]

Richardson, H.W., 1977. A generalization of residential location theory. *Regional Science and Urban Economics*, *7*(3), pp.251-266.

Rosiers, F.D., Lagana, A. and Theriault, M., 2001. Size and proximity effects of primary schools on surrounding house values. *Journal of Property Research*, *18*(2), pp.149-168.

Ryan, R.M. and Deci, E.L., 2001. On Happiness and Human Potentials: A Review of Research on Hedonic and Eudaimonic Well-Being. *Annual review of psychology*, *52*(1), pp.141-166.

Saint-Blancat, C. and Schmidt di Friedberg, O., 2005. Why are Mosques a Problem? Local politics and fear of Islam in northern Italy. *Journal of ethnic and Migration Studies*, *31*(6), pp.1083-1104.

Scatigna, M., Szemere, R. and Tsatsaronis, K., 2014. Residential Property Price Statistics Across the Globe.

Scott, A.J., 2000. Economic geography: the great half-century. *cambridge Journal of Economics*, *24*(4), pp.483-504.

Shavit, U. and Spengler, F., 2016. For Whom the Bell Tolls? Contesting the Adhan s in Majority Non-Muslim Societies. *Journal of Muslim Minority Affairs*, *36*(4), pp.447-464.

Simons, R.A. and Seo, Y., 2011. Religious Value Halos: The Effect of a Jewish Orthodox Campus on Residential Property Values. International Real Estate Review, 14(3), pp.330-353.

Sirmans, S., Macpherson, D. and Zietz, E., 2005. The composition of Hedonic Pricing Models. Journal of real estate literature, 13(1), pp.1-44.

Sirmans, Stacy, C. Sirmans, and John Benjamin. "Determining Apartment Rent: The Value of Amenities, Services and External Factors." Journal of Real Estate Research (2009).

Strand, J. and Vågnes, M., 2001. The Relationship Between Property Values and Railroad Proximity: A Study Based on Hedonic Prices and Real Estate Brokers' appraisals. *Transportation*, *28*(2), pp.137-156.

Straszhem, M., 1987. The theory of urban residential location. In *Handbook of regional and urban economics* (Vol. 2, pp. 717-757). Elsevier.

Sumaryanto, T., 2016. Planning for The Smart Mosque as Islamic Learning Resources Center. *Indonesian Journal of Islamic Literature and Muslim Society*, *1*(2), pp.167-180.

Sunak, Y. and Madlener, R., 2016. The Impact of Wind Farm Visibility on Property Values: A Spatial Difference-In-Differences Analysis. *Energy Economics*, *55*, pp.79-91.

Tayob, A.I., 1999. Islam in South Africa: Mosques, Imams, and Sermons.

Thompson, e., Butters, r. and Schmitz, b. (2011). The Property Value Premium of a Place of Worship. *Contemporary economic policy*, 30(2), pp.215-222.

Thrall, G.I., 1998. Common Geographic Errors of Real Estate Analysts. *Journal of Real Estate Literature*, 6(1), pp.45-54.

Tse, R.Y., 2002. Estimating Neighbourhood Effects in House Prices: Towards a New Hedonic Model Approach. *Urban studies*, *39*(7), pp.1165-1180.

van Duijn, M. and Rouwendal, J., 2013. Cultural Heritage and the Location Choice of Dutch Households in a Residential Sorting Model. *Journal of Economic Geography*, *13*(3), pp.473-500.

Vandell, K.D., 1995. Market Factors Affecting Spatial Heterogeneity Among Urban Neighborhoods. Housing Policy Debate, 6(1), pp.103-139.

Widlak, M., Waszczuk, J. and Olszewski, K., 2015. Spatial and hedonic analysis of house price dynamics in Warsaw.

Xiao, Y., 2017. Hedonic Housing Price Theory Review. In *Urban Morphology and Housing Market* (pp. 11-40). Springer Singapore.

Yamada, H., 1972. On the theory of residential location: Accessibility, space, leisure, and environmental quality. *Papers in Regional Science*, *29*(1), pp.125-135.

Zhang, C., 2012. Essays on the Use of Hedonic Price Models to Measure Welfare for Quality Changes in the Public Goods (Doctoral dissertation, Virginia Polytechnic Institute and State University).

Zuk, M., Bierbaum, A.H., Chapple, K., Gorska, K. and Loukaitou-Sideris, A., 2017. Gentrification, Displacement, and the Role of Public Investment. *Journal of Planning Literature*, p.0885412217716439.

APPENDIX A: ABSA Housing Index

Copyright 2017 Quantec EasyData

Download Date: 2017-10-30

Selection: None

Frequency: Monthly

title	Middle class houses: Large - Index
unit	2000=100
Source	Absa
code	ABS-ABSAHPIL
2000/01/31	91,49467
2000/02/29	94,10839
2000/03/31	96,22829
2000/04/30	97,61478
2000/05/31	98,40778
2000/06/30	99,02332
2000/07/31	99,9531
2000/08/31	101,3865
2000/09/30	103,196
2000/10/31	105,0105
2000/11/30	106,3841
2000/12/31	107,1925
2001/01/31	107,5569

2001/02/28	107,8599
2001/03/31	108,5241
2001/04/30	109,7895
2001/05/31	111,507
2001/06/30	113,4482
2001/07/31	115,381
2001/08/31	117,1256
2001/09/30	118,7371
2001/10/31	120,3047
2001/11/30	121,8156
2001/12/31	123,1398
2002/01/31	124,3444
2002/02/28	125,5665
2002/03/31	126,8715
2002/04/30	128,5467
2002/05/31	130,7457
2002/06/30	133,4454
2002/07/31	136,3778
2002/08/31	139,1878
2002/09/30	141,6434
2002/10/31	143,768

2002/11/30	145,8699
2002/12/31	148,1007
2003/01/31	150,5118
2003/02/28	152,9948
2003/03/31	155,5186
2003/04/30	157,9308
2003/05/31	160,2035
2003/06/30	162,3758
2003/07/31	164,6123
2003/08/31	167,212
2003/09/30	170,2397
2003/10/31	173,6439
2003/11/30	177,4491
2003/12/31	181,7437
2004/01/31	186,5431
2004/02/29	191,6491
2004/03/31	196,8653
2004/04/30	202,0661
2004/05/31	207,3222
2004/06/30	212,5438
2004/07/31	217,5952

2004/08/31	222,2951
2004/09/30	226,5887
2004/10/31	230,6563
2004/11/30	234,5527
2004/12/31	238,4678
2005/01/31	242,7347
2005/02/28	247,7072
2005/03/31	253,3811
2005/04/30	259,2743
2005/05/31	264,6076
2005/06/30	269,0667
2005/07/31	272,6154
2005/08/31	275,5418
2005/09/30	278,3571
2005/10/31	281,4179
2005/11/30	285,0386
2005/12/31	289,0692
2006/01/31	292,7702
2006/02/28	295,628
2006/03/31	297,5671
2006/04/30	299,0113

2006/05/31	300,5149
2006/06/30	302,5811
2006/07/31	305,5866
2006/08/31	309,8266
2006/09/30	315,194
2006/10/31	321,1281
2006/11/30	326,9035
2006/12/31	332,3182
2007/01/31	337,4327
2007/02/28	342,1899
2007/03/31	346,8921
2007/04/30	351,8682
2007/05/31	357,1096
2007/06/30	362,4001
2007/07/31	367,1674
2007/08/31	371,1456
2007/09/30	374,1788
2007/10/31	376,6294
2007/11/30	378,869
2007/12/31	380,7358
2008/01/31	382,2286

2008/02/29	383,5007
2008/03/31	383,9855
2008/04/30	383,4204
2008/05/31	382,3855
2008/06/30	381,2409
2008/07/31	380,4564
2008/08/31	380,1338
2008/09/30	379,9592
2008/10/31	379,5799
2008/11/30	378,3317
2008/12/31	376,3289
2009/01/31	374,0639
2009/02/28	372,3229
2009/03/31	371,9244
2009/04/30	373,3769
2009/05/31	376,3505
2009/06/30	380,2492
2009/07/31	384,2255
2009/08/31	387,102
2009/09/30	388,478
2009/10/31	388,6782

2009/11/30	388,8129
2009/12/31	389,6405
2010/01/31	391,6453
2010/02/28	394,7818
2010/03/31	398,4904
2010/04/30	401,5657
2010/05/31	402,8192
2010/06/30	402,0331
2010/07/31	399,4209
2010/08/31	396,0675
2010/09/30	393,7059
2010/10/31	393,4517
2010/11/30	395,3781
2010/12/31	399,0598
2011/01/31	402,984
2011/02/28	405,677
2011/03/31	406,7243
2011/04/30	406,167
2011/05/31	405,0973
2011/06/30	404,7118
2011/07/31	405,9981

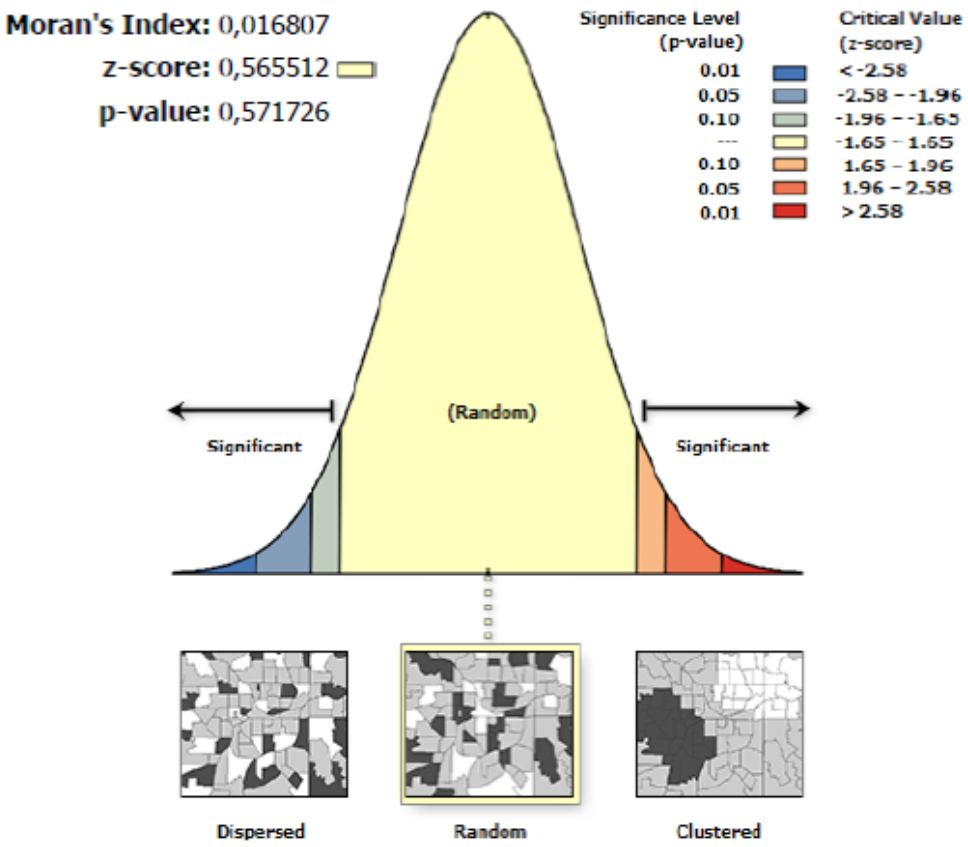
2011/08/31	408,807
2011/09/30	412,029
2011/10/31	414,4146
2011/11/30	415,1135
2011/12/31	414,0393
2012/01/31	411,9833
2012/02/29	409,818
2012/03/31	407,8885
2012/04/30	407,4458
2012/05/31	408,5582
2012/06/30	410,8564
2012/07/31	414,0992
2012/08/31	418,0369
2012/09/30	422,225
2012/10/31	426,9373
2012/11/30	432,2239
2012/12/31	437,103
2013/01/31	441,408
2013/02/28	445,6303
2013/03/31	449,8571
2013/04/30	453,2599

2013/05/31	456,0068
2013/06/30	458,5541
2013/07/31	460,9625
2013/08/31	463,6384
2013/09/30	466,4828
2013/10/31	469,1748
2013/11/30	472,1579
2013/12/31	476,1187
2014/01/31	480,239
2014/02/28	483,8074
2014/03/31	487,6017
2014/04/30	491,8701
2014/05/31	495,957
2014/06/30	498,7823
2014/07/31	500,2867
2014/08/31	501,1423
2014/09/30	502,2942
2014/10/31	503,5461
2014/11/30	504,209
2014/12/31	504,5034
2015/01/31	505,4719

2015/02/28	507,4322
2015/03/31	509,952
2015/04/30	513,2456
2015/05/31	517,972
2015/06/30	523,8787
2015/07/31	529,8737
2015/08/31	534,344
2015/09/30	536,9499
2015/10/31	538,585
2015/11/30	540,2352
2015/12/31	542,2962

APPENDIX B: Spatial Autocorrelation Report OLS

Spatial Autocorrelation Report



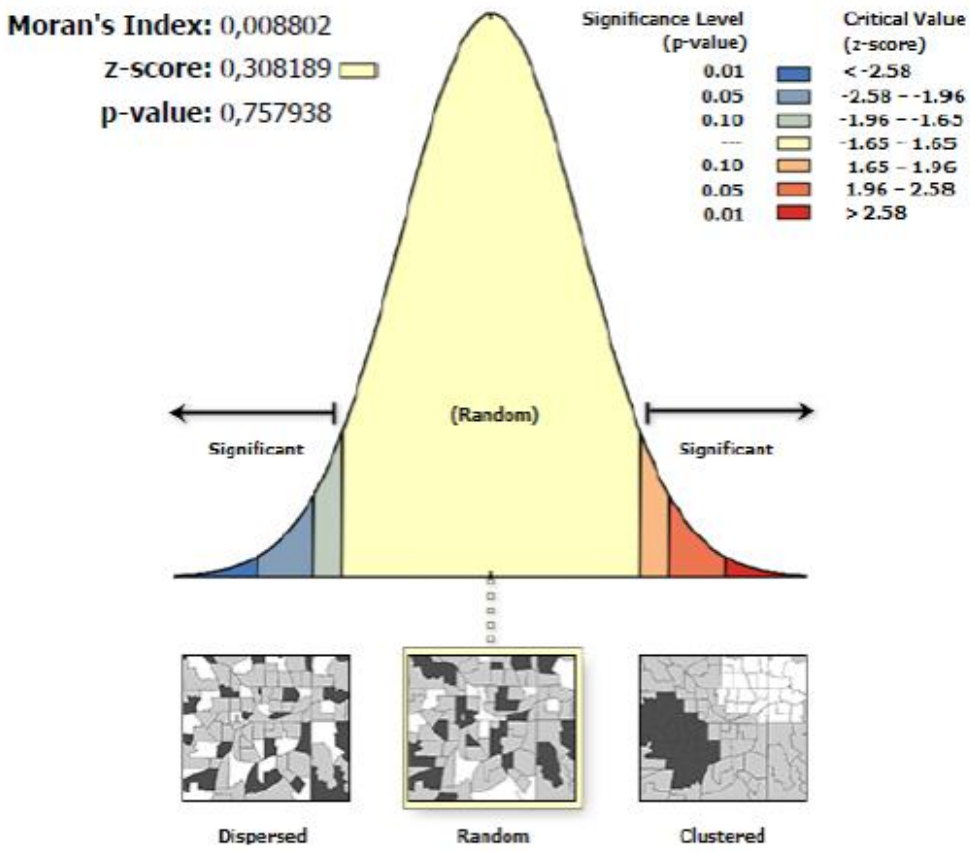
Given the z-score of 0.565511852614, the pattern does not appear to be significantly different than random.

Global Moran's I Summary

Moran's Index:	0,016807
Expected Index:	-0,000789
Variance:	0,000968
z-score:	0,565512
p-value:	0,571726

APPENDIX C: Spatial Autocorrelation Report GWR

Spatial Autocorrelation Report



Given the z-score of 0.30818930471, the pattern does not appear to be significantly different than random.

Global Moran's I Summary

Moran's Index:	0,008802
Expected Index:	-0,000789
Variance:	0,000969
z-score:	0,308189
p-value:	0,757938

APPENDIX D: Ethics Clearance Certificate

SCHOOL OF ARCHITECTURE AND PLANNING
HUMAN RESERCH ETHICS COMMITTEE

CLEARANCE CERTIFICATE
PROTOCOL NUMBER: SOAP085/07/2017

PROJECT TITLE:	Domes and Minaretes: A study on the effect of Musjid-ur-Rahma on surrounding property
INVESTIGATOR/S:	Yaseen Lockhat (Student no #570876)
SCHOOL:	Architecture and Planning
DEGREE PROGRAMME:	Master of Science in Development Planning (MScDP)
DATE CONSIDERED:	15 August 2017
EXPIRY DATE:	15 August 2018
DECISION OF THE COMMITTEE:	APPROVED

CHAIRPERSON AWilliamson
(Professor Daniel Irurah) pp A.K. Williamson

DATE:

cc: Supervisor/s: Aly Karam

DECLARATION OF INVESTIGATORS

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to endure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

Signature **Date** 01/08/2017