Determining the impact of affordable housing development on property prices of adjacent neighbourhoods in South Africa

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"There is no substitute for excellence"

- Prof Fika Janse van Rensburg

"Whether you think you can or whether you think you can't, you're right."

- Henry Ford

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ABSTRACT

The urban settlement patterns of today are still influenced by urban planning policies from the past era, whatever great strides have been made to deliver adequate and affordable housing in well-located areas. Section 26 of the Constitution of South Africa states that every citizen has the right to adequate housing.

It is for this reason that the JB Marks Municipality, located in the North West province, recommended a housing development programme for the inner-city parks and existing open spaces in Potchefstroom to combat the deficit supply of affordable housing and to provide access to urban amenities and places of employment. However, there is growing concern about the effect on residential property prices, infrastructure restrictions and capacity of such development on the existing, adjacent neighbourhoods.

This dissertation investigates the effects of a new affordable housing development on the property prices in an existing adjacent neighbourhood. The effects are measured by evaluating similar and existing case studies in South Africa and the results provide policy and development recommendations for the proposed affordable housing development program in Potchefstroom, North West province.

A hedonic price model provides insight into how the structural and location characteristics of the properties in the adjacent neighbourhood could indicate whether the location is ideal for such a development. The results indicate that it is possible to integrate an affordable housing project with an existing neighbourhood without negatively influencing the property prices if the structural characteristics of these areas align.

Keywords: property price, affordable housing, hedonic pricing model, one-way analysis of variance.

OPSOMMING

Die stedelike nedersettingspatrone van vandag word steeds beïnvloed deur die stadsbeplanningsbeleid uit die verlede, ongeag die groot vordering wat gemaak is om voldoende en bekostigbare behuising in goed geleë gebiede te lewer. Artikel 26 van die Grondwet van Suid-Afrika bepaal dat elke burger die reg op voldoende behuising het.

Dit is om hierdie rede dat die JB Marks-munisipaliteit, geleë in die Noordwes-provinsie, 'n behuisings-ontwikkelingsprogram vir die middestad en bestaande oop ruimtes in Potchefstroom aanbeveel het om die tekort aan bekostigbare behuising te bekamp en toegang tot stedelike gerieween werksgeleenthede te bied. Daar is egter 'n toenemende kommer oor die uitwerking op die prys van huiseiendomme, infrastruktuurbeperkings en die kapasiteit van sodanige ontwikkeling op die bestaande aangrensende woonbuurte.

Die navorsingsprojek ondersoek die gevolge van 'n nuwe bekostigbare behuisingsontwikkeling op die eiendomspryse in 'n bestaande aangrensende woonbuurt. Die gevolge daarvan word gemeet deur soortgelyke en bestaande gevallestudies in Suid-Afrika te evalueer, en die resultate bied beleids- en ontwikkelingsaanbevelings vir die voorgestelde bekostigbare behuisings-ontwikkelingsprogram in Potchefstroom, Noordwes.

'n Hedoniese prysmodel bied insig in hoe die strukturele en liggingseienskappe van die eiendomme in die aangrensende woonbuurt kan aandui of die ligging ideaal is vir so 'n ontwikkeling. Die resultate dui daarop dat dit moontlik is om 'n bekostigbare behuisingsprojek met 'n bestaande woonbuurt te integreer sonder dat die eiendomspryse negatief beïnvloed word as die struktuureienskappe van hierdie gebiede in lyn is.

Sleutelwoorde: eiendomsprys, bekostigbare behuising, hedoniese prysmodel, eenrigting-afwykingsontleding.

LIST OF ABBREVIATIONS

ANOVA: A one-way analysis of variance

BLUE: Best Linear Unbiased Estimators

BNG: Breaking New Policy

CLRM: Classical Linear Regression Model

CVM: Contingent Valuation Method

FLISP: Finance Linked Individual Subsidy Programme

GDP: Gross Domestic Product

GIS: Geographic Information Systems

GNI: Gross National Income

HAD: Housing Development Agency

HIS: International Housing Solutions

HPI: House Price Index

HPM: Hedonic Pricing Model

IRDP: Integrated Residential Development Programme

IUDF: Integrated Urban Development Framework

NDoH: National Department of Housing

NDP: National Development Plan

NIMBY: Not in My Backyard

OLS: Ordinary Least Square

PSDF: Provincial Spatial Development Framework

RDP: Reconstruction and Development Programme

RUM: Random Utility Model

SHS: Sustainable Human Settlements

SPSS: Statistical Package for the Social Sciences

TCM: Travel Cost Method

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CHAPTER 1

1.1 Introduction

The past regime fractured the shape of geographical spaces in South Africa and constructed spatially segmented cities (Day, Rao & Tiwari*,* 2016:7). Throughout the past era, the urbanisation rate was virtually zero (Day *et al.,* 2016:7). This changed after the past with a movement from rural to urban areas that is expected to result in an urbanisation rate close to 71% by 2030 (South African Cities Network, 2016:196).

The rate of urbanisation in South Africa has led to an increase in informal settlements. This trend is driven by individuals in search of better employment, sustainable human settlements and improved quality of life, placing direct pressure on urban centres to provide sufficient infrastructure to accommodate the residential demand (Mohale, Geyer & Geyer, 2016:218). The unregulated growth of informal settlements is among other things caused by the imbalanced market forces of the formal housing market which compel the previously disadvantaged to create their own living spaces in cities (Mohale *et al.,* 2016:218).

Informal settlements in South Africa due to the rural–urban migration of the unemployed has been a growing concern since the fall of the past. It is one of the greater issues facing the South African government in the present day (Marutlulle, 2017:2). The United Nations Habitat (2015:1) defines an informal settlement as a residential area or squatter camp generally located in a hazardous environmental space that lacks basic public services and does not comply with architectural housing plans.

The 2001 Census recorded approximately 1,11 million households living in informal settlements (Housing Development Agency, 2012:22). The democratic government has made a commitment to provide low-cost housing to households in South Africa (Goebel, 2007:291). Despite the fact that government had delivered three million subsidised houses for people living in informal settlements by 2011 (Housing Development Agency, 2012:8), the 2011 Census indicated that 1,10 million households lived in areas demarcated as informal settlements (Housing Development Agency, 2013:14).

The extent of the housing crisis became more evident in 2016 after Statistics South Africa released the General Household Survey, reporting that 13,9% of 56 million South Africans lived in informal dwellings and 5,9% lived in traditional dwellings (Socio-economic Rights Institute of South Africa, 2018:6). This proves that a serious housing problem in South Africa persists.

The national housing problem is partially attributable to urbanisation, corruption and mismanagement of housing policies (Day *et al.,* 2016:6). There is emerging consensus on the existence of large housing backlogs in South Africa (Blaauw *et al*., 2016:171) and in an effort to address this backlog, government aims to provide 750 000 low-income households with a better and sustainable living environment by 2019 (National Treasury, 2018:3).

The North West province is focussed on delivering public housing, restructuring cities and eradicating informal housing to zero per cent by 2030 (Provincial Development Plan, 2013:53). In this regard, it becomes important to fully understand the growing population's need for housing and the effect of housing development on the surrounding areas and the environment. Developing and providing integrated housing opportunities is an important service provided by local municipalities (SAHRC, 2018:3).

In response to the housing backlog and continued new growth in demand for housing, the JB Marks City Council has recommended a housing development programme for the inner-city parks and vacant areas in Potchefstroom. The programme is aimed at using existing open greenfield areas that have not yet been developed for affordable housing developments (Leshage, 2018).

The aim of these residential developments is primarily to address the growing need for housing in the lower-income segment of the local market. The city of Potchefstroom has, for some time, experienced high population and household growth due to urbanisation and an increase in student migration. This has put a strain on the provision of sufficient houses by the private sector. *Figure 1-1* illustrates the continued annual growth in new households for the municipal area in relation to the private sector supply.

The demand represents the additional annual households in the market (the blue bars), while supply (the red line) is the annual new residential unit completions by the private sector for the market. Both demand and supply has had positive growth rates from 1999 to 2015, indicating a growing population and urbanisation. However, the private sector supply of new houses has never met the demand, indicating a market gap[1] in Potchefstroom. A shortage in residential supply from the private sector is evident in *Figure 1-1*.

[1] A market gap is an unmet consumer need that provides an opportunity to deliver a service/product that is not available yet (Business Dictionary, 2019).

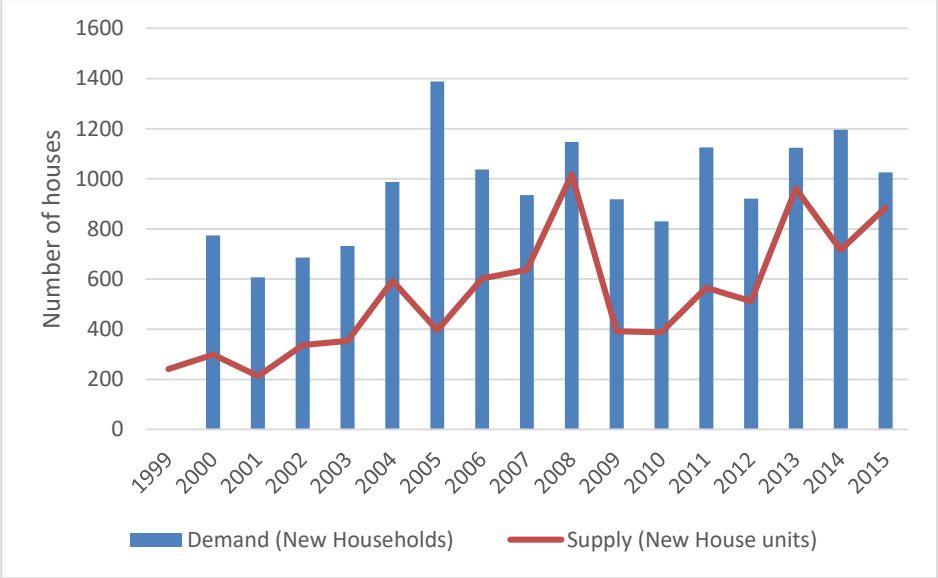

Figure 1.1: The housing market gap in Potchefstroom.

Source: Author's own construction, Stats SA, 2019.

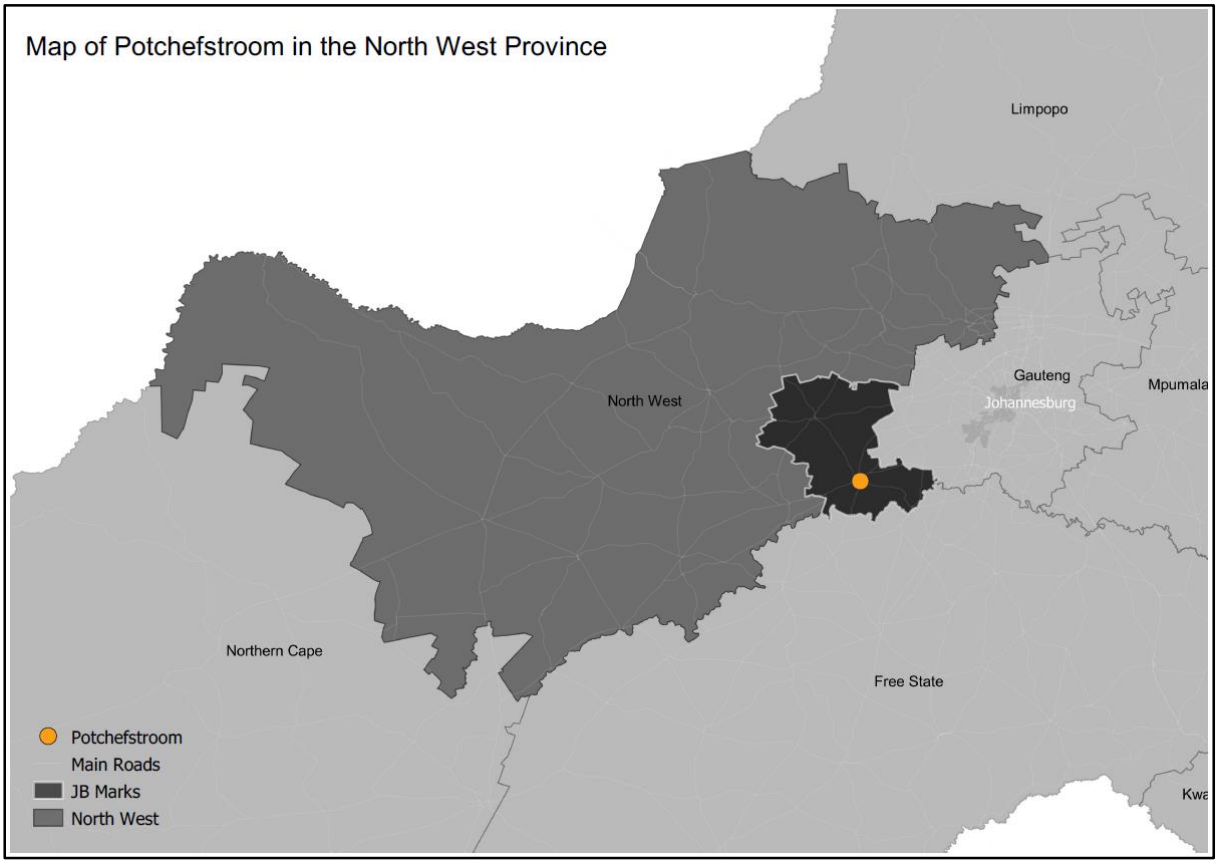

Figure 1.2: Potchefstroom within the North West province.

Figure 1-2 shows the location of Potchefstroom in the provincial context. Potchefstroom is a city located in the North West province of South Africa, roughly 120 km West-Southwest of

Johannesburg. It is one of several towns situated on the eastern side of the province, which is characterised by a higher density population compared to the western parts of the province. Potchefstroom has a population size of 168 268 individuals of all population groups and is 162,4 km² in size (Quantec, 2018).

Moving forward, South Africa should focus on gradually reintegrating fragmented cities and societies through inclusive growth to resolve pre-1994 inequalities (Day *et al.,* 2016:7) and one approach would be through the provision of housing. Housing initiatives are important tools to achieve social integration and at the same time establish a critical input for the measurement of economic growth and development in South Africa.

1.2 Literature

An important part of the 2030 Agenda for Sustainable Development is to provide access to safe and affordable housing (NPC, 2012:308). The number of individuals migrating to urban developed areas have increased proportionally over the last two decades (Blaauw *et al*., 2016:169). South Africa is not exempt from this unplanned urbanisation and needs a model to address the low-to-middle cost housing market (Blaauw *et al*., 2016:169).

There are various reasons for the affordable housing development phenomenon receiving attention in recent literature. Firstly, South Africa has a shortage in affordable housing in urban areas and secondly, these types of developments provide residents with access to opportunities in an economic active area (Du Preez & Sale, 2012:1). Section 1.2 briefs the reader about the different types of affordable housing as well as the difference between property value and property price. After gaining a better understanding of what the different types of residential properties are Chapter two or better known as the literature study chapter, discusses important concepts such as the determinants of property price, property location and open spaces, and highlights South Africa's current housing backlog situation.

1.2.1 Affordable housing

Section 26 of the Constitution of the Republic of South African (from here onwards "the Constitution") states that every individual has the right to adequate housing (SAHRC, 2018:2). Housing in the South African context is, therefore, a public and social good, as well as a basic need of all individuals. The Reconstruction and Development Programme (RDP) was launched in 1994 to provide adequate housing and serve as a platform to promote free basic housing for all South Africans (Malete, 2014:20).

In 2004, the National Department of Housing (NDoH) designed the Breaking New Policy (BNG) to develop sustainable human settlements (SHS) and to increase the delivery of well-located housing in South Africa. Considering that the demand for residential property in South Africa has surpassed the supply, government has implemented the Integrated Residential Development Programme (IRDP) as a component of the BNG to focus on the delivery of SHS in the urban core.

The IRDP provides four different affordable housing typologies to social housing tenants: government subsidy housing (RDP), social housing, the finance linked individual subsidy programme (FLISP) and bonded segment housing. Affordable housing can be termed as a house provided by a social housing government institution or an accredited social housing project, built in a designated restructuring zone for low- to middle-income earners (Social Housing Policy for South Africa, 2018:1). For the purpose of this study the emphasis is on social housing and FLISP initiatives, from here onwards referred to as affordable housing.

1.2.1.1 Government subsidy housing or RDP housing

RDP housing is characterised as fully state-subsidised housing and is free for the beneficiaries (South Africa, 2019).

1.2.1.2 Social housing

Social housing is classified as medium density affordable housing for beneficiaries with a monthly income between R1 500 and R15 000.

1.2.1.3 FLISP housing

FLISP housing's initial purpose was to close the gap in the market where some households earned too much to be eligible for an RDP house, yet not enough for a decent loan. These households earn between R3 500 and R22 000 (Centre for Affordable Housing Finance in Africa, 2019).

1.2.1.4 Open market housing

Bonded segment housing are stand-alone units for beneficiaries earning above R22 000 per month (South Africa, 2019).

Affordable housing programmes enable inhabitants to access opportunities in economically active areas (Du Preez & Sale, 2012:1). However, there is a growing concern regarding the social and environmental sustainability of these completed housing programmes and the effect they have on the property values in the adjacent neighbourhoods (Goebel, 2007:293).

1.2.2 Property values

1.2.2.1 Property value versus property price

In a recent article, Phakgadi (2019) highlighted that the Constitutional Court ruled for potential new subsidised affordable housing developments to be disapproved if the "proposed property could disfigure the area, or reduce the value of the adjacent properties". Housing problems and housing developments in South Africa is a contentious issue.

The term "property value" refers to the intrinsic value of the residential property given the future rental income and the depreciation rate (Pirounakis, 2013:384). The property price or market price is the actual price of the property on which the consumer and the buyer agree (Pirounakis, 2013:384). The value of a property considers both micro-economic and macro-economic factors. Micro-economic factors represent how individuals and firms are expected to behave. For instance, homeowners and potential buyers value house characteristics differently (Ball, Lizieri & MacGregor, 2012:13).

Macro-economic factors are more structured and include well-developed concepts such as property price inflation and business cycles (Adams & Füss, 2010:3). An accurate property value includes the current market conditions, property price inflation rates, and the stance of economic growth (Pirounakis, 2013:384).

In the absence of the actual sales price, the estimated value of the asset at the time is also used to measure performance, since the valuation of a property happens prior to the investment or transaction (Pirounakis, 2013:384). Although the actual sales price of a property is used most frequently, there are alternatives such as assessed property value or municipal valuation (Sale & du Preez, 2014:35).

There are clear differences between the assessed property price and the actual sales price, with the assessed property price on average being higher than actual sales price (Sale & du Preez, 2014:44). Though the assessed property price has more advantages, such as the data being more readily available, the actual sales price reflects the true market conditions more accurately (Sale & du Preez, 2014:44).

Property values indicate whether a neighbourhood is a good area in which to reside. Therefore, raising property values attract potential buyers and investors (Mnisi, 2018:16). The outlook of homeowners who fear that the development of subsidised affordable housing in close proximity to their homes will negatively affect the neighbourhoods' property prices are not in my backyard (NIMBY) homeowners. The term NIMBY is broadly discussed in Chapter 2.

1.2.3 The residential location factor

There have been a few contributions in the literature that evaluate consumer preference for a particular location. Tiebout's invisible foot theory (1956:418) holds that households move between locations that best match their own preference, therefore the marginal benefit obtained from locational amenities are similar for households living in the same location (Hoyt & Rosenthal, 1997:161).

Location imparts a monopoly element of uniqueness or exclusiveness, such as the cost advantage of access to different amenities, or the social connection of growing up in a neighbourhood (Pirounakis, 2013:3). Households will choose a neighbourhood based on their socio-cultural background or will choose to live where their neighbours are of the same cultural background (Oyebanji, 2003:10). This brings one back to the invisible foot theory of the concentration of individuals or households with similar preferences for a feeling of security.

The location factor that is considered when choosing a residential property reflects the individual's preferences and choice of the surrounding neighbourhood. It has an impact on the household's well-being and quality of life (Uchenna, 2014:24). Location factors can include the quality of schools. Good schools increase the property value of the neighbourhood, as do the style of the structures, appearances, and the proximity to economic active areas (Uchenna, 2014:3).

Several studies are concerned with estimating the complex relationship between property prices and locational characteristics or nonmarket attributes, such as the proximity to waste sites and water pollution (Nelson, Genereux & Genereux, 1992:359). A study conducted on the Nelson Mandela Bay township by Du Preez and Sale (2013:463) reports that locational characteristics (the distance a property is located from the affordable housing development) had a significant negative influence on the property prices in the affluent Walmer neighbourhood. Also noteworthy was households' willingness to pay for a finite change in the distance to the affordable housing development, indirectly increasing the property value of houses located 500m further away from the development (Du Preez & Sale, 2012:464).

1.3 Problem statement and research question

The effect of past city planning is evident in the shortage and backlog of residential units and houses in South Africa (Napier, 1993:26). In order to correct the imbalances that previously occurred, integrated residential developing programmes and sound housing policies should be put in place.

The JB Marks City Council in Potchefstroom, North West, recommended a residential development programme in open spaces to cater for a residential market where supply is lacking. It can solve the housing problem. However, the type of development can have an effect on the surrounding areas.

Developing residential housing in greenfield areas could be motivated by economies of scale and an affordability principle. However, the possible effect of such a development on the residential prices and the infrastructure restrictions and capacity adjacent neighbourhoods comes to mind.

For this reason, the following research question was formulated:

“What is the effect of a new affordable housing development on the property prices of an existing adjacent neighbourhood?”

1.4 Research aim and objectives

1.4.1 Research aim

The purpose of this study is to analyse the aggregate impact of an affordable housing development in open spaces on the residential market of the surrounding areas.

1.4.2 Research objectives

1.4.2.1 General objective

The study addresses the housing issue in South Africa, while emphasising the influence of developing affordable residential housing in the Fleurhof and Birch Acres region.

1.4.2.2 Specific objectives

The specific objectives of the research study are:

- To determine the effect of a new affordable housing development on the property prices of an existing neighbourhood;
- To establish whether the structural and locational characteristics of the neighbourhood change in value after an affordable housing project is developed; and
- To identify which areas in Potchefstroom could be considered a good fit for an affordable housing project.

1.5 Research methodology and data

1.5.1 Research study locality

The research study measures the effect of an affordable housing development on the market prices of the adjacent neighbourhood. The hedonic pricing model is the most common method to determine the value of a property since it determines the implicit price of a specific good with the set of attributes it possesses (Selim, 2011:66). Empirical research studies usually apply a hedonic pricing model to achieve the appropriate valuation of residential housing. In housing market research, a hedonic pricing model provides a framework for market valuation of goods and their utility-bearing characteristics (Selim, 2011:66).

As a starting point, this study analysed examples of properties located in proximity to affordable housing where possible effects were likely to occur. Fleurhof, located in Randburg, and Birch Acres in Kempton Park were selected as separate case studies. Both areas are embedded in a specific open space context and affected by an integrated residential development. The results of this analysis are applied to Potchefstroom as a next step in the research.

The policy recommendation is targeted at Potchefstroom in reaction to the JB Marks Municipality's recommended housing development programme in the inner-city parks and vacant areas of Potchefstroom. If the characteristics of an affordable housing development match the immediate neighbourhood, any negative effects on the residential market property prices will be minimised.

1.5.2 The type of data used in the research

The research study used secondary data to determine the impact of a social housing development on the adjacent neighbourhood. The study used the following secondary data sources: Property 24®, Lightstone Property®, the First National Bank (FNB) property price index and information from existing documents and diagrams.

1.5.3 Nature of the scientific method used

1.5.3.1 Model specification

An empirical study can be conducted using either time series or cross-sectional data. Time series data consist of chronological observations collected over a period of time, while cross-sectional data are used when observations are gathered from individuals or a group with similar characteristics at a given point (Asteriou & Hall, 2016:27). For the purpose of this study, the cross-

sectional data series shed light on the determinants of property values, including structural and locational characteristics, prior to and after the development of affordable housing.

1.5.3.2 Different methods used in the research study

The study focussed on different quantitative research methods, more specifically the hedonic pricing model (HPM), a one-way analysis of variance (ANOVA) and paired sample t-test. The HPM was applied to two time periods, once before the development of an affordable housing project and then again after the project had been completed.

In addition to the HPM an ANOVA analysis was done to determine where the differences in variance between independent variables such as year, number of bedrooms, number of bathrooms, erf size, number of garages, pool dummy and distance occur. This revealed which level of the independent variable had a significant influence on property prices. A paired sample t-test, referred to as repeated measures, was especially useful for pre- and post-test experimental designs. The t-test compares the mean of the real price of each period to determine a significant difference between the pre- and post-period. Using the t-test, an ETA coefficient was determined to establish the effect size of the development.

In summary, the study used the HPM, the ANOVA, t-test and ETA square to determine the effect size of the impact on property prices before and after the development of affordable housing in a neighbourhood.

1.5.4 Application for Potchefstroom

The results from the Fleurhof and Birch Acres case studies were used to provide strategic input on how best to develop affordable housing in open spaces in Potchefstroom. Ideally, the pricing of the affordable housing development should be similar to the existing neighbourhood's property prices.

1.6 Limitations

The HPM requires all the participants to have prior knowledge of any positive or negative externalities regarding the purchase of a property. This includes knowledge of any housing developments that may be constructed in close proximity to their property and how this may or may not affect them (Wheatley, 2011). The model can only be applied if a good number of properties is used in the regression.

Secondly, there are market limitations, such as that the preferred type of housing is not always available for purchase, or the market does not supply the desired type of housing in a specific location, for instance, a medium to large house with a garden in the middle of the city. Lastly, the HPM assumes that market price adjustments are in line with the changes in attributes. However, in reality a lag is associated with price changes (Wheatley, 2011).

1.7 Conclusion

The chapter presented the problem statement, research question, as well as the different methods that can be used to find a solution to the housing problem. If such a solution can be found, homeowners, investors, estate agencies, developers and municipalities will have a better understanding of the impact of affordable housing on the property prices in the adjacent neighbourhood, and of how the perceived negative effect can be minimised.

1.8 Chapter outline

The study is structured as follows:

Chapter 1: Introduction and background

Chapter 1 outlines the background and the overall aim of the study. The chapter serves as an introduction to the field of study.

Chapter 2: Literature review

The second chapter explores similar studies on the topic and focusses on general theories, such as the HPM, and definitions and concepts.

Chapter 3: Methodology

The third chapter presents the different approaches and methods used in the study. The chapter also gives some background and a visual representation of the two case studies, Fleurhof and Birch Acres. This creates familiarity with the neighbourhoods and shows the distances the properties are located from the integrated residential developments.

Chapter 4: Empirical results

Chapter 4 presents the research results, followed by a detailed analysis and evaluation. These results are applied to the Potchefstroom case to determine the implications for the proposed affordable housing initiative in Potchefstroom.

Chapter 5: Conclusion

This chapter concludes the study with limitations, recommendations for future research and improvements to the current conducive.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Literature examining the effect of affordable housing on neighbourhood property prices can be divided into first and second wave studies. The first wave of early studies reduced the fear of declining property values. However, it lacked methodological consistency (Nguyen, 2005:17). Prior to 1990, literature suggested the use of the test versus control area method, which entails locating neighbourhoods with comparable characteristics with one of the two neighbourhoods comprising an affordable housing development and then comparing property values between the two neighbourhoods (Nguyen, 2005:17). This method by Nguyen, however, did not control for any macro-economic factors that may influence housing values, nor provide information about housing trends over time (Nguyen, 2005:18).

The majority of the first studies used cross-sectional data that captured an exact moment in time, thus lacking evidence of property trends before the development of affordable housing. This means that these studies probably captured the local market trends and not the effect of affordable housing on property prices (Nguyen, 2005:18).

The second wave of literature spurred from more accessible data and advanced geographic information systems (GIS). These studies determine a more accurate relationship between affordable housing and nearby property prices due to better-controlled regression techniques, such as the HPM (Nguyen, 2005:18).

Extant research indicates that locating near affordable housing can have a negative effect on property prices. However, the effect can be minimised by ensuring that the affordable housing unit has quality design and management when compared with the host neighbourhood and that they are not scattered among other affordable housing. The literature study by Santiago, Galster and Tatian (2001:16) prove that well-maintained affordable housing programmes can raise the property prices of the houses surrounding the development.

The remainder of Chapter 2 is structured as follows: Section 2.2 and 2.3 examine the utility theory, together with the consumer behaviour theory of valuing property and location. Section 2.4 discusses income-based affordable housing and Section 2.5 types of open space.

Section 2.6 explains different empirical methods and Section 2.7 refers to previous international and local studies of affordable housing. Section 2.8 provides insights into the housing backlog

South Africa faces and illustrates the different social housing typologies. Section 2.9 concludes the literature review with specific reference to the Potchefstroom case study.

2.2 The utility theory

The word hedonic is a Greek term, *hēdonikos,* meaning pleasure or utility (Nguyen, 2012:7). In the hedonic modelling context, consumers value residential properties for their utility-bearing attributes or structural and locational characteristics (Rosen,1974:34). The housing market offers different types of houses with different characteristics, since homebuyers have unique utility functions and therefore value characteristics differently (Sirmans, Macpherson & Zietz, 2005:3). As a result, the same house with a given set of attributes can be valued differently by different homebuyers.

In economic terms, satisfaction is better known as "utilisation". Therefore, as the number of attributes a property possesses increases, so would the utilisation an individual or household could gain from the property. Furthermore, as the attributes increase, the price of the property will increase *ceteris paribus*. Therefore, an individual or household would gain maximum utility from a property. If they balance the satisfaction, they expect to gain from it with the money they expect to pay for it.

Lancaster (1966:134) developed an approach of consumer theory with the following assumptions: First, consumers get utility from the characteristics embodied in products, not the product itself; and second, a product will possess numerous characteristics, and numerous characteristics will be shared by more than one product. Lancaster's approach sheds light on the different characteristics a house can possess and the utility the household gains from living in the house.

Households choose a house with a specific set of attributes, including structural and locational characteristics, that would maximise their utility and is well in line with their budget constraints. Similarly, the theory of consumer behaviour by Koutsoyiannis (1975:14) assumes that consumers are rational and will pursue the maximum satisfaction or utility within their budget constraints. Market equilibrium occurs where the offer and bid functions for housing bundles are equal (Witte *et al.,* 1979:1153). Witte *et al.* (1979:1170) conclude that higher-income households have a higher bidding price for housing quality and larger households bid higher prices for dwelling space.

Income and substitution effects also explain consumer behaviour in property economics, with the income effect describing a consumer's buying habits. A consumer will buy less of a normal good if the price increases *ceteris paribus,* and the substitution effect explains in addition that the consumer will substitute the relatively cheaper good for the relatively expensive good (Pirounakis,

2013:27). There are three types of economic goods, namely a normal good, a luxury good and an inferior good. An increase in the consumer's income will lead to higher demand for normal goods. In the case of a consumer earning more income, they often tend to spend a higher percentage of their income on luxury goods, such as expensive sport cars. Inferior goods are usually inexpensive substitutes with a lower demand as the consumer's income increases. This means that a consumers' buying behaviour is influenced by the level of income the consumer earns and in effect the responsiveness of demand to the change in income.

An increased price for owner-occupied housing and a decrease in the consumer's available budget for housing will lead to a decrease in the type of utility-bearing house bought. Consumers will possibly buy smaller types of owner-occupied housing with fewer amenities or in an inconvenient area. For example, the income effect or the form of housing can shift from owner occupation to renting; i.e. the substitution effect (Pirounakis, 2013:30).

The type of housing good is subject to a consumer's income. A house is characterised as a normal good when the demand increases with the increase of consumer income, while rented housing is an inferior good when an increase in consumer income does not increase the demand for rented housing, but rather owner-occupied housing, *ceteris paribus* (Pirounakis, 2013:30).

The living conditions survey 2014/15 states that the average South African households spend 32,6 % of their total annual household consumption expenditure on housing. This verifies the positive direct relationship between an increase in income and an increase in the portion of the household budget spent on housing (StatsSA, 2014:3). Higher-income groups spend the majority of their incomes on owner-occupied housing consumption, compared to lower-income groups spending more on non-housing expenditure groups (StatsSA, 2014:3). Different income groups value housing differently, either as a normal or an inferior good.

Taking the above discussion into consideration, a utility-maximising consumer will choose a house with a bundle of attributes within their budget. The price of a house is determined by many factors; reflecting the implicit prices of the separate attributes making up the property.

2.3 Property value

A neighbourhood with relatively high property values suggests that the neighbourhood is a desirable residential area, increasing the attractiveness to potential buyers (Kotulla *et al.*, 2019:2). These properties reflect the quality of life, which is difficult to measure as it is subjective to the unique amenities a consumer weighs when deciding to buy a property (Kotulla *et al*., 2019:3).

In an effort to define property price, Pirounakis (2013:27) describes it as the value generated from the actual price of the property the consumer and seller agree upon when making a property transaction deal. This definition assumes that both the seller and the buyer have sufficient knowledge of the property and the property market.

2.3.1 The determinants of property price

The price of a property considers both macro-economic and micro-economic factors. The most common macro-economic factors determining the price of a residential property is gross domestic product (GDP), unemployment and disposable income (Adams & Füss, 2010:38). An increase in economic activity or GDP per capita will increase the demand for housing. However, the supply of housing cannot change in the short run, and this causes an increase in rent, which leads to an increase in housing prices (Adams & Füss, 2010:38).

When a country experiences economic growth, the GDP per capita will increase and create employment opportunities, contributing to higher gross national income (GNI) and an increase in the individual's demand for better located and higher quality housing (Taltavull De La Paz, 2003:111).

Property prices are also influenced by financial factors such as interest rates and business cycles. Higher interest rates increase the cost of property loans (Adams & Füss, 2010:39), while changes in a business cycle also affect the demand for housing and new houses. As a result, changes in property prices occur (Hort, 1998:93;).

Micro-economic factors refer to how homeowners and potential buyers value structural and locational house characteristics differently (Ball *et al.,*2012:13).

In real estate valuation and house market research, property prices and rental value are generally analysed based on micro-economic factors (Selim, 2008:65). Micro-economic determinants focus more on the perceived residential market value, a reflection of the physical characteristics of the property and the circumstances under which the given property would most likely trade in the open market (Pagourtzi *et al*., 2003:283).

2.3.2 The relationship between a property's price and its characteristics

Residential property is valued as a heterogeneous product that comprises of a bundle of inherent attributes or characteristics that may not be separated from each other as these components refer to the implicit price of the property (Woo, 2014:84). The implicit market price of a property can be

expressed as a function of attributes, such as the property's structural and locational attributes (Randeniya, Gayani & Amarawickrama, 2017:113).

The characteristics of a house can be divided into structural characteristics and location characteristics. Structural characteristics refer to the physical appearance of a property, including the number of bedrooms, number of bathrooms, property age and area size, and its immediate surroundings. Locational characteristics refer the location unique to a house, proximity to police stations, schools, clinics and retail centres (Goodman, 1977:475).

For the purpose of this research study, locational and structural characteristics are highly valued. Locational characteristics refer to the immediate surroundings of the residential property, such as surrounding houses (Can, 1992:454).

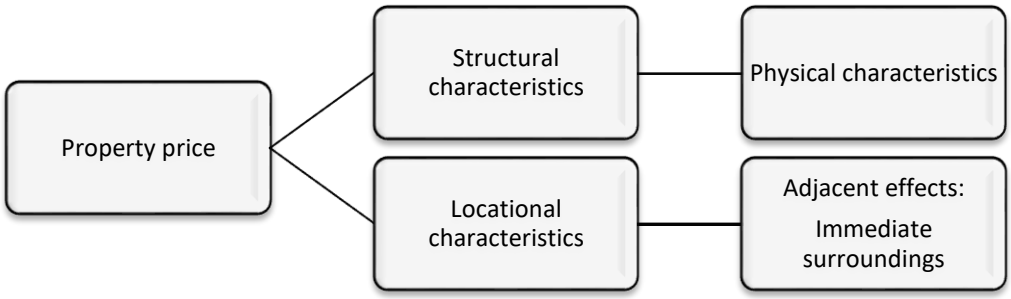

Figure 2.1: Differences between structural and locational characteristics.
Source: Author's own construction

The characteristics theory was developed by Kelvin Lancaster in 1966. He determined that consumers base their preference on the price of a good, their income or budget constraint, and the measurable characteristics of the good (Pirounakis, 2013:33). The visual and quantifiable characteristics, such as the dwelling type, location, garage type and a number of rooms, usually carry the most weight when selecting a dwelling, subject to a given budget constraint (Pirounakis, 2013:33).

Sirmans *et al.* (2005:4) have summarised the top 20 physical characteristics of a house by examining approximately 125 studies and dividing them into eight different categories: internal and external house features, construction and structure, natural-, location and neighbourhood-environment, public service environment, occupancy and selling, and financial and marketing. *Table 2-1* summarises the top 20 characteristics and indicates their significance.

Table 2.1: The top twenty characteristics

VARIABLE	APPEARANCES	TIMES POSITIVE	TIMES NEGATIVE	TIMES NOT SIGNIFICANT
Age	78	7	63	8
Time on the market	18	1	8	9
Lot size	52	45	0	7
Ln lot size	12	9	0	3
Square feet	69	62	4	3
Ln square feet	12	12	0	0
Brick	13	9	0	4
Fireplace	57	43	3	11
Basement	21	15	1	5
Air-conditioning	37	34	1	2
Garage spaces	61	48	0	13
Deck	12	10	0	2
Pool	31	27	0	4
Bedrooms	40	21	9	10
Number of stories	13	4	7	2
Number of bathrooms	40	34	1	5
Full baths	37	31	1	5
Number of rooms	14	10	1	3
Distance	15	5	5	5
Time trend	13	2	3	8

Source: Sirmans *et al.,* 2005:10.

The 125 studies revealed that the variables of the age of the property and the time it has been on the market were frequently used and had a significant negative effect on property prices, followed by square footage with an expected positive effect on the selling price. Garage, fireplace and lot size all had an expected positive effect. The number of bedrooms can have a negative effect, but the number of bathrooms is positive. Basement and swimming pool do not have a negative effect, brick exterior is positive and the distance variables, air-conditioning, hardwood floors, deck, number of housing stories differ (Sirmans *et al.,* 2005:9).

Table 2-1 illustrates that the variable lot size, square feet and garage space were in the majority of cases positive, while the age variable was mostly reported as negative, bedrooms, as well as garage space, were regarded as insignificant. Seventeen of the top twenty characteristics represented structural characteristics.

Locational characteristics either have a positive or negative impact on the price of a property. Negative externalities (such as social, physical and visual) and positive externalities (such as greenery and status) usually influence the property value more than other specific aspects (Kauko, 2003:250). Nguyen (2002:16) analysed fourteen different studies that revealed to what extent proximity to affordable housing detrimentally affects property values, and found that it depends on a variety of factors, such as the design and structure of affordable housing, characteristics of the host neighbourhood, compatibility between affordable housing and the host neighbourhood, and the concentration of affordable housing (Nguyen, 2005:16). Specifically, thirteen out of fourteen studies found no significant negative effect on property prices.

2.3.3 Property and location

The physical structure of a house depreciates over time, while the location of the physical structure appreciates in value, highlighting the importance of a property's location (Jordaan, Drost & Makgata, 2004:534). The location theory describes the direct relationship between a property and the locational characteristics of the property. In effect, a property will have a significantly higher value if the property is located in an attractive neighbourhood with access to positive elements in the area (Jordaan *et al.,* 2004:533).

The location of a property adds to the property value as well as the investment profitability, consequently revealing the consumer's preference for a property (Hoe *et al.,*2018:61). According to Tiebout's "invisible foot theory", consumers tend to move to a neighbourhood that satisfies their preferences and lifestyles. In the early 1960s, the invisible foot theory explained why certain population groups lived in certain districts of the city (Slater, 2013:373), and why individuals are often content to locate to a neighbourhood that coincides with their socio-economic background (Jordaan *et al.,* 2004:538).

Households of the same socio-cultural background tend to concentrate together in the same neighbourhood for a feeling of security (Uchenna, 2014:27). Households' preference for residence type inherently reflects their choice of the surrounding neighbourhood, which as a result has an impact on their well-being and quality of life (Uchenna, 2014:28). Therefore, any change in the consumer's preference can result in the consumer moving away from the neighbourhood towards a neighbourhood that best addresses his or her preference (Tiebout, 1956:418).

The general question of how an individual or household determines a residential location to reside in arises. *Table 2.2* summarises the relevant place-specific and socio-cultural factors relating to consumer choice when deciding on a residential location (Uchenna, 2014:24).

Table 2.2: Consumer choice

PLACE-SPECIFIC CHARACTERISTICS	• **Individual's income level.**
	• The physical appearance of the property.
	• Accessibility.
	• Access to job opportunities.
	• Security and crime rate.
	• Environmental quality.
SOCIO-CULTURAL CHARACTERISTICS	• Housing stock or site characteristics: number of bedrooms, number of bathrooms, the design or style of the property.
	• Neighbourhood amenities: accessibility of the police station, shopping malls, sports facilities, public transport, and quality of schools.
	• Accessibility characteristics: accessibility or the ease of access to places of employment, shopping centres, and places of worship, recreation sites and the airport.
	• Household characteristics: size of the family, and age of the head of the household.

Source: Uchenna, 2014:24.

2.4 Affordable housing, household income and not in my backyard

2.4.1 Affordable housing

According to section 26(1) the Constitution (1996), every South African citizen has the right to access adequate housing. Adequate housing has to comply with a framework of factors, such as the location, proximity to amenities, availability of services, spaciousness, physical security and affordability.

The term affordability is perceived differently by different income groups and in the same way, affordable housing has different connotations to different places (KPMG, 2010:5). Several studies measured affordable housing against the low- to middle-income bracket of households, which are either renting or owning a property for an amount up to 30% of their total household income (KPMG, 2010:5).

Many countries, including South Africa, are challenged by a deficit supply of adequate and affordable housing in well-located areas that provide access to urban amenities and places of employment. This is aggravated by the negative perception regarding affordable housing built in well-developed neighbourhoods.

Property owners have a common belief that affordable housing development located in close proximity to their homes will automatically decrease their property's value and the neighbourhood's aesthetic qualities. The latter belief is based on the idea that affordable housing will be visually unattractive and poorly maintained and managed, which will also, in turn, increase traffic and the level of crime in an area (Habitat for Humanity, 2017). The attractiveness of a neighbourhood is dependent on five major characteristics (Segal,1979:214):

- Physical characteristics and structures, such as the number of bedrooms and bathrooms and erf size;
- Socio-economic characteristics such as the race ratio residing in the neighbourhood;
- Environmental qualities such as the landscape and open spaces;
- Public services, for example the quality of the neighbourhood school; and
- Accessibility of household's daily commutes.

The design of the affordable housing typology should be appealing in a manner that it is conducive to the local market's aesthetic qualities as well as creating a space where low- to middle-income households can take an interest in creating better living conditions for themselves. However, there is growing concern about the social and environmental sustainability of these housing programmes and the impact on the adjacent neighbourhood's residential property prices (Goebel, 2007:293).

2.4.2 Household income

Recently, the provision of income-based affordable housing developments in open spaces has been proposed to restructure social and spatial dysfunctionalities in South Africa. An integral part of the requirements to qualify for social housing includes individuals being mobile and flexible, not being able to afford inner-city formal housing and currently living in informal settlements (Du Preez & Sale, 2013:453).

Kasongo and Ocran (2017:1) define a single household's income as the combined earnings from all internal and external sources in a specific period. In the South African context, affordable housing is defined as housing for individuals whose combined annual income is below R42 000 or R3 500 monthly.

This study emphasises household income brackets, instead of personal income brackets. South Africa is classified as an upper-middle-income country (World Bank, 2019). Upper-middle-income economies have a gross national income (GNI) per capita between $3 896 and $12 055 (World Bank, 2019). *Table 2-3* depicts the different South African household income segmentations in 2016.

Table 2.3: Household income segmentation in 2016.

HOUSEHOLD INCOME GROUPS	2016 INCOME BRACKETS, P.A.	% OF POPULATION	DESCRIPTION
Group 1	R0–R20 500	18,9	Lowest
Group 2	R20 501–R89 000	43,4	Second lowest
Group 3	R89 001–R202 500	16,3	Low emerging middle
Group 4	R202 501–R 412 000	10	Emerging middle
Group 5	R412 001–R707 000	5,9	Realised middle
Group 6	R707 001–R1 512 000	4,3	Emerging affluent
Group 7	R1 512 001–R2 414 000	0,8	Affluent
Group 8	R2 414 001 +	0,4	Wealthy

Source: Standard Bank, 2016.

Within the South African context, 62,3% of the population is classified as low-income earners (Groups 1 to 2), 32,2% of the population are middle-income earners (Groups 3 to 5) and 5,5% of the population are classified as affluent (Groups 6 to 8) (Standard Bank, 2016). Other sources also confirm this income distribution (Burger *et al*., 2017; De Clerq, Tonder & Van Aardt, 2017).

2.4.3 Not in my backyard (NIMBY)

The opposition to income-based affordable housing programmes in well-located areas comes from homeowners' fear that their property values will decline (Nguyen, 2005:16). The neighbourhood residents are more likely to follow the "not in my backyard" or NIMBY approach, being apprehensive about the quality and design of affordable housing and having negative externalities such as excess traffic congestion and a change to the physical appearance of the neighbourhood (Nguyen, 2005:16).

This protectionist view is a reaction to attempts to build subsidised affordable housing developments in well-located areas since NIMBY homeowners feel that the development is an invasion of their communities by unwanted residents who aim to undermine their quality of life,

security and specifically their property values. Property homeowners are worried that the development of affordable housing will affect the sale price of adjacent properties (Scally & Tighe, 2015:751).

There are various perspectives on the NIMBY attitude. Pendall (1999:112) views the concept as a protective approach by individuals who rightfully want to protect their belongings and who may reject any unwanted development that occur in their neighbourhoods. Other views of property owners with a NIMBY attitude are that the development of affordable housing in their neighbourhoods will accommodate low-income individuals, who are perceived to increase crime levels, traffic and essentially, place an additional financial burden on local governments and schools (Usrey, 2012:1).

These homeowners also believe that such development will lead to a devaluation of the neighbourhood's aesthetic qualities and eventually property prices, since residents of affordable housing developments may not maintain their houses in the same way that bonded property owners do (Usrey, 2012:1). The NIMBY theory is frequently used by local neighbourhoods with negative preconceptions about social housing. However, several international HPM studies conclude that social housing developments may, in fact, lead to improvement of surrounding property values (Du Preez & Sale, 2013:451).

The location for a housing development can be identified as either brownfield or greenfield land (WEF, 2019:19). Acquiring greenfield land has a cost advantage, allows for larger sized houses and achieves economies of scale (WEF, 2019:19). Greenfield land is described as unused land that has not been previously developed, while brownfield land is any previously developed land that is currently not in use. Brownfield land is known for pollution or soil contamination but encourages land reuse and high-density living (WEF, 2019:19). Both strategies focus on urban spread and realises economies of scale by delivering city services and concentrating the population (WEF, 2019:19).

2.5 Open space

Traditionally, open spaces are characterised as green spaces in a community, such as public parks, sports fields and highly landscaped areas (South African Cities Network, 2016:191). According to Irwin and Bockstael (2001:698), there are two types of open spaces, namely a protected open space, such as public parks and land under conservation, and developable open space, such as privately-owned agricultural land.

An open space also refers to scenic views or recreational spaces free from disamenities associated with development activity (Irwin *et al.,* 2001:698). It contributes to the ecological and social features of a city, nonetheless, the public good generally lacks viable planning and maintenance, which results in under-utilised space and in extreme cases used as a haven for criminals (South African Cities Network, 2016:191).

The negative effects of urban sprawl in the United States led to the formulation of "smart growth" policies, defined as development initiatives protecting open space, providing affordable housing and more variety of transportation focussed on compact development (Cho *et al*., 2010:764). The smart growth policies rely on either preserving or enhancing open spaces by increasing housing density or substituting open spaces for larger residential lots in the form of low-density housing (Cho *et al.,* 2010:764).

Research suggests that achieving compact housing through the smart growth policy is challenging, since higher-income households prefer to live in low-density areas with abundant shared open space. However, high-density housing is achievable when communities can replicate the factors that increase or resemble amenities from shared open space (Cho *et al.,* 2010:764*)*. Cho and Roberts (2007:579) contend that urban sprawl is subjected to spatial variation and growth policies should promote the trade-off between neighbourhood density and property lot size at location-specific levels.

The difference between location-specific property prices and the ratio of density-to-lot-size identifies areas where households are willing to pay more for a smaller property lot size in lower density neighbourhoods. Consequently, the neighbourhood's housing density and lot size are substitutable at different rates in different areas. This offers important information for improving the implementation of smart growth policies where high-density housing development is encouraged in preferred lower density neighbourhoods (Cho & Roberts, 2007:579).

An integral part of deciding whether the public good should be preserved or land-use policies should be upgraded is for city and regional planners to know exactly how the neighbourhood's residents value the open space (Anderson & West, 2006:774). The trade-off between the value the neighbourhood assigns to shared open space and property size is important. Some homeowners consider them substitutes – either for larger residential lots or abundant shared open space in the neighbourhood, others view the residential lot size and open space as components of a larger bundle of housing attributes (Cho *et al.,* 2010:764).

Potential homebuyers will bid the highest possible price for residential properties with desirable surroundings in a competitive housing market. Therefore, indirectly capitalising on externalities

generated by proximity to public open spaces. Urban planners and policy designers should consider the spatial context when deciding to either provide or protect open spaces. The effect of open space on home values also depends on neighbourhood income, crime rates and families with children (Anderson & West, 2006:787).

2.6 Empirical methods

Open spaces, such as parks, are nonmarket goods and not directly traded in private markets, making the valuing of benefits difficult. Other environmental benefits provided by open space, such as the value of crops in agricultural land, can be traded in markets and are more easily valued.

The first type of nonmarket benefit derived from open space is the value of using the open space, better known as use value. The benefit is related to viewing the scenic landscape, clean air and using the open space, while the second benefit is referred to as no-use or passive use values where people gain utility or satisfaction from knowing the open space exists without visiting the area (McConell & Walls, 2005:5). The nonmarket benefits are difficult to assess and measure due to the non-commodity and non-priced nature of the benefits.

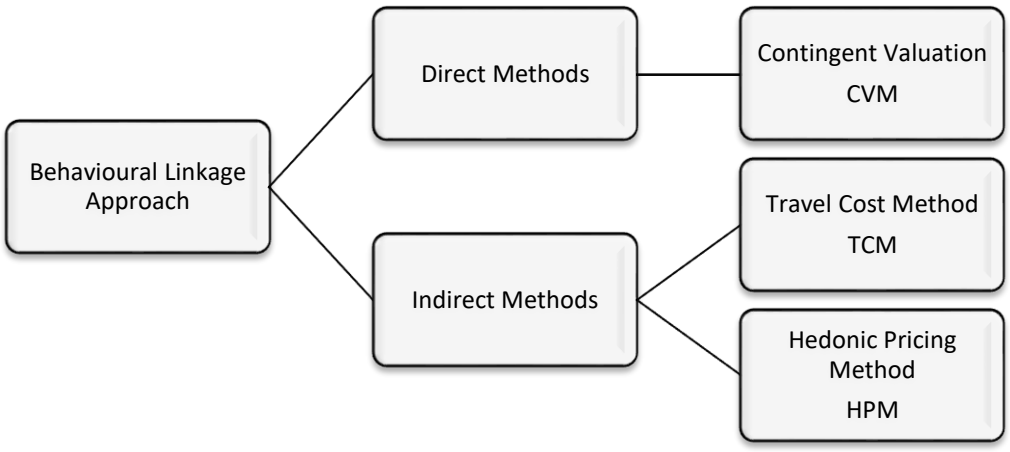

Figure 2.2: The various methods for valuing nonmarket goods.
Source: Thomas & Collan, 2010:154.

Consumer preference is fundamental when determining the willingness to pay for an environmental benefit, better known as a behavioural approach (Thomas & Callan, 2010:154). The diagram above illustrates the behavioural approach between direct and indirect methods of observing the actual behaviour in non-markets (Thomas & Callan, 2010:155). Direct methods estimate the monetary value of environmental benefits by means of the actual price paid or survey responses, i.e. the contingent valuation method (CVM), while indirect methods value the

willingness to pay by means of the travel cost method (TCM) and the hedonic price method (Thomas & Callan, 2010:155).

The indirect method is best explained by a case study in Nelson Mandela Bay on the recreational value of beaches (Du Preez, Hosking & Lee, 2011:1). The TCM was used to determine the relative value of the Nelson Mandela Bay beaches since no data have been recorded of the nonmarket good. The study determined what individuals were willing to pay to visit the beach, reaching amounts such as R44.73, R24.61, R37.85 and R2.68 per person per trip to King's beach, Humewood Beach, Hobie Beach and Wells Estate Beach respectively (Du Preez *et al.,*2011:1).

The HPM is used when valuing attributes that have a significant welfare impact, like environmental noise level and air quality (Pirounakis, 2013:394). The method reflects the value of a good's characteristics by observing an individual's spending patterns, rather than asking them how much they are willing to spend. Economists make use of the HPM approach to value different types of nonmarket values from open space (McConell & Walls, 2005:5).

2.6.1 The hedonic pricing model

2.6.1.1 Rosen's hedonic pricing model theory

The hedonic price theory was historically used as part of an econometric application for the valuation of automobiles with heterogeneous attributes in 1961 (Els & Von Fintel, 2010:420). Rosen (1974:34) derived the hedonic price theory to analyse housing markets by designing a theoretical foundation that includes a consumer's bid price (φ) and the producer's offer function (o) at a certain level of utility.

Figure 2-3 illustrates the bid price (φ), the maximum amount the consumer is willing to pay for a good, the producer's offer function (o), and the minimum amount the producer is willing to receive for the good.

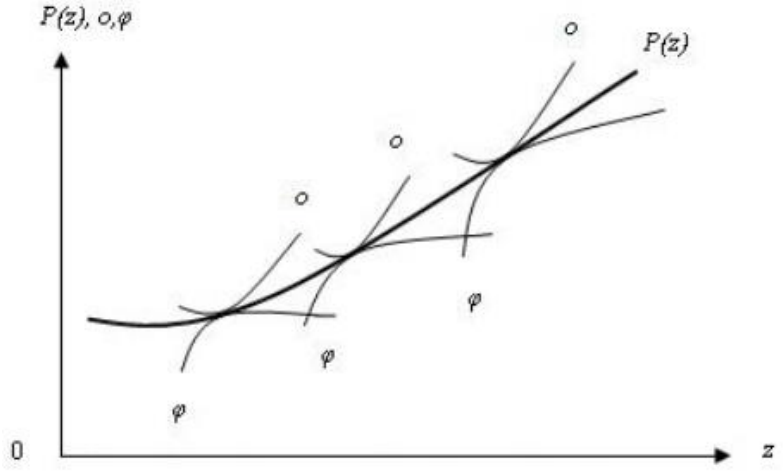

Figure 2.3: The hedonic pricing model

Source: Rosen, 1974:34.

Rosen's model illustrates the competitive equilibrium pane on which both buyers and sellers locate. Products are described by the numerical value z, which consists of a vector of attributes (Rosen, 1974:34). The price of a product, P(z), is defined at any point on the pane and guides both the consumer and producer to base their locational and quantity decision on maximising utility behaviour at equilibrium prices (Rosen, 1974:35). The classical consumer theory, i.e. the utility approach, contributes to the HPM. In 1966 residential properties in itself were regarded as determinants of their utility (Mohale *et al.,*2016:223). Neoclassical urbanists describe the "consumer sovereignty" concept as the choices made by individual consumers to maximise their utility, subject to their available resources (constraints) (Slater, 2013:374). The competitive property market then attempts to satisfy the needs of the utility-maximising consumers (Slater, 2013:374).

2.6.1.2 Epple's hedonic pricing model theory

Epple (1987:60) redefined the hedonic price aspects of Rosen's theory. The hedonic price theory arises from the relationship between the individual consumer and the competitive suppliers of the good (Epple, 1987:60). A generic good possesses a vector of attributes $\boldsymbol{z}$, of which the hedonic price, $\rho(\boldsymbol{z})$, provides the market price or actual sales price of the commodity with the specific vector of attributes $\boldsymbol{z}$ (Epple, 1987:60). Individual consumers who purchase the generic goodwill have the following utility function (Epple, 1987:60):

$$U = f(z, x, \propto),$$

$z =$ Vector of characteristics of the good

$x =$ Numeraire good

$\propto =$ Vector of characteristics of the individual consumer

Consumers are price takers $\rho(\boldsymbol{z})$. Nonetheless, they are subject to a budget constraint (Epple, 1987:61):

$$y = \rho(\boldsymbol{z}) + x,$$

y = Individual consumer's income

Consumers have unique utility functions since they value characteristics differently (Sirmans *et al.,* 2005:3). For the sake of perspective, one homebuyer assigns greater value to a set of house characteristics compared to another potential buyer (Sirmans *et al.,*2005:3). Therefore, the HPM assumes that individual consumers derive utility from a bundle of housing attributes and the maximising utility can be priced within the consumer's budget constraint (Sirmans *et al.,* 2005:4).

2.6.1.3 Hedonic pricing model functional form

The equation below states that the price of a property is a function of the property's physical or on-site characteristics and its immediate surroundings, such as the distance to the neighbourhood school (Sirmans *et al.,* 2005:4). A study conducted by Sirmans *et al.,* (2005:9) analysed 125 HPM case studies and found the following top 20 significant characteristics: lot size, square feet, brick, age, number of stories, number of bathrooms, number of bedrooms, full baths, fireplace, air-conditioning, basement, garage, deck, pool, distance, time on market and the time trend. The hedonic pricing model (HPM) are further explained in Section 3.4.1.

$$Price = f(Physical\ characteristics, location\ characteristics).$$

Goodman (1977:483) categorises these housing attributes into two categories: the physical structure of a house and its locational characteristics. Locational characteristics are divided into adjacent effects and neighbourhood effects (Can, 1992:453). In essence, the adjacent effects focus more on the immediate surroundings of the residential property (such as surrounding houses).

Neighbourhoods with attractive surroundings, such as trees and forests, are more likely to influence property prices, since the environment is a more pleasant place to live, work and spend

leisure time (Liu & Hite, 2013:3). Attractive environmental amenities, such as open space, contribute to the value of real estate and are generally estimated using the HPM to reflect the benefits home buyers attach to the property and the surrounding neighbourhood (Liu & Hite, 2013:3).

In housing market research, a HPM provides a framework for market valuation of goods and their utility-bearing characteristics (Selim, 2011:66). All the attributing characteristics of a house are used as a set or a bundle contributing to the final property price (Day, 2001:174). The latter highlights why the HPM is the preferred method, firstly to determine how the specific set of utility-bearing characteristics possessed by a house explain different property prices, and secondly to examine demand and supply for house characteristics (Rosen, 1974:42).

Different econometric methods have been employed to address the problem of property valuation. The HPM is the most frequently used method to explain property value or proximity effectively. Several case studies also include other approaches, but a hedonic function was used in this study since previous study results are sufficient for the problem this research study aims to address. The HPM is supported by an ordinary least square (OLS) regression approach.

The price model will include an independent variable *DISTANCE,* which indicates the distance a house is located from the affordable housing development. McConell and Walls (2005:10) analysed 40 published studies between 1967 and 2003 that measured the relationship between property prices and general open space value. Using the HPM, they concluded that houses further away from general parks are more valuable, showing a significant positive correlation between property price and distance (McConell & Walls, 2005:10).

In essence, the results also contribute to the first research question, the effect on real estate prices as distance from the affordable development increases.

2.6.2 Sense of place and its relevance to Potchefstroom

If the affordable housing is poorly designed and managed and it is not compatible or comparable with the host neighbourhood, this can lead to diminishing property prices (Nguyen, 2005:19). The importance of aesthetic quality design is highlighted, including the building structure, orientation and landscaping of affordable housing.

Lyons and Loveridge (1993:93) reveal that affordable housing tends to have no impact on higher-income neighbourhoods if the affordable housing development is of high quality, well managed and aesthetically attractive. The question, however, remains what effect distance has on the real estate price of an existing neighbourhood?

Nasar (1994:337) conducted a study specifically on the building exterior, which fits with the way psychologists have used aesthetic response (Nasar, 1994:379). The study concluded that certain formal and symbolic attributes will likely enhance urban design aesthetics. Design review should encourage pleasantness by familiar and historical elements, moderate complexity, popular styles and reductions in artificial nuisances. The design review can also encourage higher complexity for interest and excitement or encourage natural materials for more relaxing environments (Nasar, 1994:398). Studies such as Ulrich (1983:87) and Wohlwill (1974:37) define aesthetic response as a favourable emotional appraise or evaluation. This definition links with the two different aesthetic variables in urban design, namely formal aesthetics, which the structure attributes, and symbolic aesthetics, which is the study of human responses (Nasar, 1994:379).

Affordable housing development, like any other land use, has an impact on the surrounding neighbourhood. Different housing typologies have different impacts on the neighbourhood due to different types of zoning regulations (Botein & Freeman, 2002:360).

Several studies conducted on the impact of affordable housing development on adjacent property prices produced insignificant results. Negative externalities, such as undesirable noise and traffic while building the affordable housing development, as well as positive externalities, such as increased property prices and a feel of revitalisation among community members, have been documented previously (Cummings & Landis, 1993). According to Botein and Freeman (2002:360), affordable housing development can increase the neighbourhood's property values if it is built in a neighbourhood with similar socio-economic characteristics.

Figure 2.4 illustrates an interactive aesthetic response model between humans and their environment. The model design illustrates different probabilities associated with different building attributes given a set of circumstances, for instance at a point in time and for a specific group of people. The following attributes of formal aesthetics highlight the importance of enclosure, complexity and order (Nasar, 1994:384):

- Enclosure: openness, spaciousness, density and mystery
- Complexity: diversity, visual richness and information rate
- Order: unity and clarity

Several studies indicate that households either prefer to live in wide-open spaces or in highly enclosed spaces (Nasar, 1994:384). By examining the formal and symbolic attributes as development criteria, affordable housing can be designed to satisfy the quality and appearance of the host neighbourhood.

In the case of Potchefstroom, the city is forced use space optimally since it has difficulties with dolomite (Smit, 2017:1). Ikageng, a township bordering Potchefstroom's industrial area, is over-crowded, causing the municipality to turn to the city of Potchefstroom to develop on government-owned grounds, more specifically, parks (Leshage, 2018). Socio-demographic diversity is on the forefront of the JB Marks City Council's housing development priorities, with the focus on recommended affordable housing development in Van der Hoff Park, Baillie Park, Miederpark and Dassierand. Kgotso Khumalo, the executive mayor, mentions that housing space was last developed for this particular income group in 1996 (Leshage, 2018).

If development and restructuring are approved, the city of Potchefstroom will be forced to impose significant controls, such as the use of environmental or conservation servitudes, in order to ensure that the area's ecosystem is protected and not adversely affected by development activities (South African Cities Network, 2016:191). The results derived from the application HPM were applied to Potchefstroom. The conclusion is that the characteristics of the development of affordable housing should be inline or similar to that of the neighbourhood for the property prices to remain unchanged. Another of the key factors that can influence the success of affordable housing is the nature of the physical characteristics, including design and layout for medium density mixed housing (Landman, Matsebe & Mmonwa, 2019:15).

Landman *et al.* (2019:18) identified a tool to measure the physical characteristics of mixed housing developments in South Africa in a quantitative and qualitative manner. The tool offers a descriptive and objective assessment by rating a set of principles (Landman *et al.,* 2019:18):

- Integration
- Accessibility
- Efficiency
- Image and aesthetics
- Surveillance
- Ownership and territoriality
- Target hardening and access

The image and aesthetic factor can be satisfied by high-quality buildings, open spaces and facilities (Landman *et al.,* 2019:19). In addition, the affordable housing should provide a sense of desirability, improving neighbourhood quality and diversity (Landman *et al.,* 2019:19).

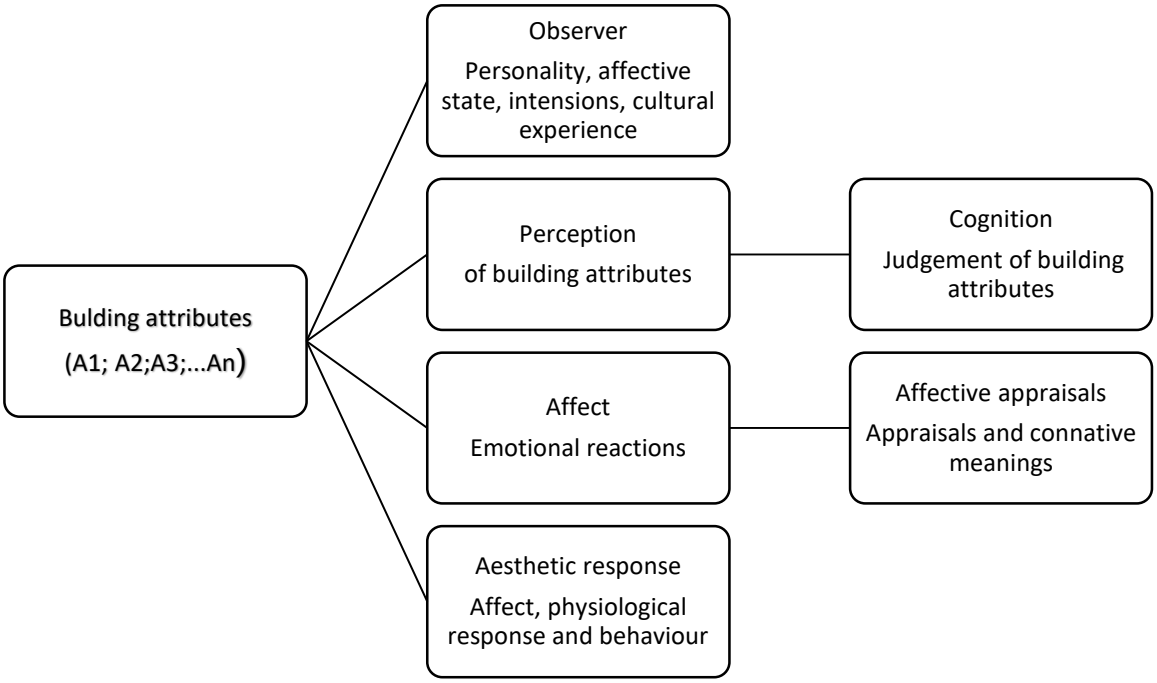

Figure 2.4: Aesthetic response to building attributes.
Source: Nasar, 1994:381.

2.7 Affordable housing case studies

2.7.1 Affordable housing in Walmer, Nelson Mandela Bay.

A study by Du Preez and Sale (2012:2) on affordable housing in cities and suburbs identified a dearth of studies that deal with the impact of a new social housing development on adjacent existing residential property prices. They found a case study in the affluent Walmer neighbourhood, which is located next to an informal settlement, called Walmer Township.

Du Preez and Sale (2012:3) applied a random utility model (RUM), which was previously preferred when single market data were used (Cropper *et al*., 1993:226) to analyse an individual's choice to purchase a property with different house characteristics as opposed to other alternatives. Therefore, the RUM idealises the choice as a stochastic and utility-maximising choice (Haab & McConnell, 2003:80).

The abovementioned authors conclude that the probability of choosing a house increases if the property has a swimming pool, electric fence and is located near a school (Du Preez & Sale, 2012:7). The Walmer Township in Nelson Mandela Bay had a significant negative effect on the surrounding neighbourhood of Walmer and more specifically, the residents would be willing to pay extra to move a few metres away from the township.

Du Preez and Sale (2013:454) subsequently conducted a similar study by means of the HPM. The model included house attributes such as the number of bedrooms and bathrooms and nonmarket induced attributes, for example air pollution or distance to an airport (Du Preez & Sale, 2013:454).

The results of the study indicated that affordable housing development had a statistically significant negative effect on the adjacent Walmer residential property values, more specifically that the average household is willing to pay between R10 092 and R48 459 to move 200m further away from the Walmer Township. A house located 500m away before the development will increase by 49% in value if that same house is located 3 200m away post-development, indicating that the adjacent neighbourhoods' property price would increase every metre away from the township (Du Preez & Sale, 2013:464).

2.7.2 Affordable housing in Maryland, United States

A study conducted by Irwin (2002:478) measured the influence of an open space on residential property values using the HPM in central Maryland in the United States. He found that an open space significantly affects the residential sales price of the adjacent neighbourhood and confirmed that different types of open space have different outcomes on property values. The results reported that the marginal benefits of preserving open space is the function of the number of residents in the neighbourhood, alongside resident preferences and relative scarcity of open space in the region (Irwin, 2002:479).

A similar study conducted by Geoghegan, Lynch and Bucholtz (2003:44) confirms that preserved or protected open space increased the adjacent neighbourhood's property values in Maryland. However, further research is needed to confirm what factors contributing to open space residents are willing to pay for. Several willingness-to-pay studies have recognised the positive amenity value of open spaces (Irwin & Bockstael, 2001:698). Given Maryland's high population rates and land inequality, one household's marginal benefit to preserve an open space ranged from $994 to $3 307 per acre, depending on whether it is publicly or privately owned. Nevertheless, the aggregated marginal benefit spill-over to the community was lower compared to the direct neighbourhood (Irwin, 2002:479).

2.7.3 Affordable housing in New Jersey, United States

There are general concerns about developing affordable housing in cities and suburbs and about the possible negative effect on the surrounding community and on the adjacent neighbourhood's property prices (Albright, Derickson & Massey 2013:89). This was similar for an affordable

housing programme in New Jersey that repeatedly received criticism from community members who expressed their concerns about the negative externalities expected to follow with this type of development. Nonetheless, the development received the title of “The affordable housing complex that works” (Albright et al., 2013:89).

The affordable housing programme in New Jersey comprises of a 140-unit affordable housing complex known as the ELH, located next to a luxurious, single-family home neighbourhood (Albright et al., 2013:94). The affordable housing structure consists of one-, two-, and three-bedroom, two-story townhouses for lower-income groups, more specifically those who spend 30 per cent of their income on rent and utilities and only receive an income below 80 per cent of the regional median income (Albright, 2013:94).

Albright et al. (2013:107) found by estimating simple OLS regressions that affordable housing can indeed be developed in an affluent suburban community without increasing social disorganisation or producing negative externalities in terms of crime, property values, or taxes. The study focussed on two separate time periods, namely before the opening of ELH and after the opening of ELH, and the local municipality revealed no significant differences between the two periods (Albright et al., 2013:107).

2.8 South Africa’s housing backlog

The urban settlement patterns of today are still influenced by the urban planning policies of the past era, although large strides have been made to change this and encourage integrated mixed-use development (Smith, 2003:2). Since 1994, various approaches have been taken by the government to support the increasing demand for residential property and to provide affordable housing, as the periphery was the only land available for low-income earners at affordable prices (Schoonraad, 2000:224).

Urbanisation was reinforced by the Housing Development Agency (HDA), which aimed to combat the housing backlog and provide social housing programmes. However, these housing projects were located on the outskirts of urban cities and disconnected from economic networks, hindering sustainable livelihoods and opportunities for residents (COGTA, 2016:63). Gradually, individuals migrated to large urban areas seeking employment, increasing the urban population, as well as the demand for residential property, and exacerbating the shortage of affordable housing (Mafukidze & Hoosen, 2009:380).

Housing is an important requirement to connect cities and create desirable urban environments. Nevertheless, South Africa is spatially challenged by a lack of sufficient social and rental housing

for low-income earners in well-located areas, imposing the latter to reside in high-density housing around the major metropolitan areas in South Africa (COGTA, 2016:62). As a result, the Integrated Urban Development Framework (IUDF) was designed to address fragmented settlements, restructure urbanisation and promote integration and inclusion in cities (COGTA, 2016:5).

The IUDF's focus is on improving the existing built environment and city footprint to yield social and economic outcomes set out in the National Development Plan (NDP) (COGTA, 2016:35). The long-term objective of the IUDF is to identify economic nodes and areas for residential housing that could stimulate integrated human settlements (COGTA, 2016:35).

In addition, the National Housing Code (2009:9) promotes mixed integrated housing developments in economically advanced areas to address settlement inefficiencies through the development of sustainable human settlements (SHS), as well as social and economic interaction and the integration of individuals from different income groups.

2.8.1 Affordable housing typologies in South Africa

The new housing plan in South Africa outlined in the Development of Sustainable Human Settlements (2004), more commonly known as "Breaking New Ground" (BNG), promotes the development of medium density and mixed housing developments. The real estate rental market comprises of government-owned social housing and private rental housing (Andrews, Sánchez & Johansson, 2011:43). Social housing is housing owned and supplied by the central government and other independent companies in the form of housing associations. Some are let at below-market prices (Andrews *et al.,* 2011:43).

Social housing structures vary across countries, but the dominant concept generally consists of rental dwellings and ultimately homeownership (Andrews *et al.,* 2011:44). Based on an OECD questionnaire, social housing systems can be divided into two models: the broad-based model is prevalent in countries where social housing is available to all citizens and it operates with the private rental sector, while the one-targeted model operates independently and homes are allocated to eligible tenants on the base of income threshold or the most vulnerable households (Andrews *et al.,* 2011:44).

The decline in housing affordability and the increase in housing prices is apparent from the increased demand for social housing across countries. At the same time the stock of social housing has tightened and the allocation process converts into backlog housing (Andrews *et al.,* 2011:45). Andrews *et al.* (2011:45) reason that governments should reassess the eligibility for

social housing and if the household's situation has changed for the better, they should offer the opportunity to the next household (Andrews *et al.,* 2011:44).

Government involvement in these types of rental housing include building, taxation, rental regulations and rent allowances (Andrews *et al.,* 2011:44). Schuetz (2007:6) argues that supply constraints such as land use and zoning restrictions reduce the supply of low- to medium-cost private rental housing. Historically, social housing has not been spread uniformly across urban land, but rather concentrated on the outskirts of cities or low-cost land (Andrews *et al.,* 2011:45). The concentration of social housing makes it harder to achieve social mixes in neighbourhoods (Andrews *et al.,* 2011:45).

Urban planners are encouraged to achieve a social mix of residents in neighbourhoods. Social mix is determined by three factors (Galster, 2013:2):

- Composition: The composition of people in terms of ethnicity, race, religion and income.
- Concentration: What is the level of concentration? Which groups comprise the ideal mix for desired outcomes?
- Scale: At what scale should the social mix be measured geographically?

Foregoing studies suggest that social mixes result in little social interaction or networking between high-income and lower-income households, and members of the lower-income group usually do not take advantage or enhance the resource-producing potential, restricting their network channels to the previous neighbourhood (Galster, 2010:14).

There are four types of affordable housing typologies in South Africa: Free basic house/RDP housing; GAP/FLISP housing; social housing and open market housing (Demacon, 2017:25):

2.8.1.1 Free basic house/RDP housing

The RDP is a South African socio-economic policy framework. It offers fully state-funded housing for households or individuals earning up to R3 500 per month. The household is not expected to make any financial contribution towards the house or the registration cost of the property. A free basic unit is valued at approximately R160 000 for 40m^2 and categorised as a freestanding or semi-detached single-storey building.

Figure 2.5: Single-storey RDP building

Source: Demacon, 2017:25.

2.8.1.2 GAP/ FLISP housing

The FLISP or GAP housing is intended to assist households to access housing by providing partially subsidised housing that can be used to pay the deposit on a house or to decrease the size of the home loan. Financially employed individuals who can afford personal loans up to R300 000 are eligible for FLISP housing. FLISP or GAP housing exceeds 40m^2 and is characterised as a detached, semi-detached single or double-storey building.

Figure 2.6: Semi-detached single-storey housing

Source: Demacon, 2017:25.

2.8.1.3 Social housing

Social housing is available for individuals earning between R1 500 and R15 000 per month, to rent. The amount of rent paid must not exceed 30% of the gross income of the tenant. Each unit is between 30m^2 and 45m^2 and comprises of one or two bedrooms, usually in three- or four-storey buildings in an access-controlled complex. It is owned by an accredited social housing institution for the first 15 years and may either be refinanced or sold thereafter.

Figure 2.7: Social housing

Source: Demacon, 2017:25.

2.8.1.4 Open market housing

Open market houses are valued above R400 000, available to tenants who earn more than R15 000 per month. They are characterised by alone standing units in the GAP market.

Figure 2.8: View of gradient housing typologies

Source: Demacon, 2017:25.

For the purpose of this study, the emphasis is on social housing and FLISP housing. Two case studies are specifically suitable in this regard, Fleurhof in Randburg and Birch Acres in Kempton Park. Both developments are embedded within a specific open space context that has been converted into a type of affordable housing.

The research study measured the possible impact of affordable housing development on the market prices of the adjacent neighbourhood. If the characteristics of an affordable housing development are similar to the immediate neighbourhood's, the impact on the residential market property prices will be insignificant and even negligible. The HPM was applied to two time periods,

once before the development of an affordable housing project, and then again after the project has been completed.

2.9 Conclusion

In conclusion, Chapter 2 aimed to provide the theoretical background behind affordable housing and the impact on adjacent neighbourhood prices. Different theories, such as the consumer utility theory, NIMBY, open space and the HPM theory formed the base of the theoretical background. Several case studies were discussed to illustrate the possible effect of affordable housing on the neighbourhood, as well as how the perceived negative impact can be minimised.

According to Nguyen (2005:24), property values will decline as a result of proximity to affordable housing if the type of affordable housing is poor in quality and design, clustered and located in neighbourhoods with a disadvantaged or low-income populace. Affordable housing situated in vibrant neighbourhoods with similar neighbourhood structures and qualities have no effect on the adjacent neighbourhood's price.

The dispersed nature of urban sprawl in South Africa is challenging, as unplanned development of houses beyond the existing urban periphery intensifies (Yusuf & Allopi, 2010:415). The increasing cost of providing public infrastructure and development on the periphery forces government to develop government-owned land; promoting urbanisation by developing affordable housing in available open spaces.

Chapter 3 evaluates two separate case studies, Fleurhof and Birch Acres, where existing open spaces were developed for affordable housing. The chapter analyses the impact on property prices using the HPM and residential market property prices. The results are used as policy recommendations for Potchefstroom regarding the type of affordable housing that would fit best in the different neighbourhoods.

CHAPTER 3
METHODOLOGY AND CASE STUDIES

3.1 Introduction

Housing initiatives are an important tool to achieve social integration and at the same time establish a critical input for the measurement of growth and development in South Africa. Lately, the provision of affordable housing developments in open spaces was proposed (Leshage, 2018) to restructure social and spatial dysfunctionalities in South Africa. This, according to a recent Constitutional Court ruling, should be done without disfiguring the area or reducing the value of the adjacent properties (Phakgadi, 2019).

Developing residential housing in open spaces could be motivated by economies of scale and an affordability principle. However, the possible effect on residential prices, infrastructure restrictions and capacity of such development on the existing, adjacent neighbourhoods should be considered. Several research studies have proved that there is an effect on the pricing on adjacent neighbourhoods with affordable housing developments (Botein & Freeman, 2002; Du Preez & Sale, 2013). However, there are limited studies in the South African context, since residential property information is not readily available to the public (Mnisi, 2018:50).

The purpose of this chapter is to outline the methodology applied to analyse the effect of affordable housing development in open spaces and parks on the residential market of the surrounding areas. In addressing the research question, the methodology is divided into two parts. The first phase of the research determined the relationship between the property's prices and its unique attributes to identify the importance of distance away from an affordable housing development. The second phase applied the results of the first phase to Potchefstroom to identify the best approach.

This chapter outlines the necessary methods needed to measure the impact of affordable housing developments on the market prices of these adjacent neighbourhoods. Section 3.1 is an introductory segment in the chapter, followed by the discussion of the research type in Section 3.2 and research method and design in Section 3.3.

Section 3.4 provides insight into the theoretical background of the research methods used. Section 3.5 gives a case study overview of two different areas, Fleurhof and Birch Acres, where existing open space in the neighbourhood was transmuted into an affordable housing development. Section 3.6 discusses the data collection and the variables used in the study and predicts the relationship between the independent and dependent variables. Section 3.7 concludes the chapter.

3.2 Research types and approaches

Research is a process of analysing and examining available information to address contemporary concerns and increase subject-related knowledge (Neville, 2007:1).

The type of research is dependent on the type of study undertaken. There are four different types of research, namely exploratory-; descriptive-; analytic- and predictive research. Exploratory research is undertaken when the researcher is the first to study the subject and analyse patterns in the data using case studies and observations (Neville, 2007:2). Descriptive research is used when elements of an existing subject are examined and summarised through quantitative research techniques (Neville, 2007:2).

Researchers studying the reason or underlying causes of an event do analytical research. Analytical research often expands on the descriptive approach, identifying and locating variables involved in the study. Last of all, predictive research predicts cause-and-effect relationships and predicts future possibilities based on close analysis of available evidence (Neville, 2007:2).

Different research approaches include quantitative or qualitative, basic or applied, and deductive or inductive research. A *quantitative approach* collects and analyses numerical data, measures frequency, median and range, and presents the results statistically (Neville, 2007:3). A *qualitative approach* analyses and summarises more tangible research subjects such as the perceptions of consumers (Neville, 2007:3).

A *basic research approach* primarily improves the subject-related knowledge of a research field, while an *applied research approach* applies the results of a study to a particular situation (Neville, 2007:3). *Deductive reasoning* is a rationalist approach based on logical arguments to develop a sound conclusion (Walliman, 2017:19) and offers a systematic way of testing established ideas on a range of people. The research is based on general theories and applied to a specific situation to provide a deductive approach (Neville, 2007:3). *Inductive research* approaches analyse and summarise specific situations to make a broad statement or to deduce a general theory (Neville, 2007:3). Various research studies combine different research approaches.

This study followed a combined research approach. Firstly, the study made use of a quantitative research approach by using an HPM. The residential property data on property prices, structural characteristics and locational characteristics are quantifiable variables. Secondly, the study made use of the applied research approach to apply the findings of the case studies, Fleurhof and Birch Acres, to the proposed housing development in Potchefstroom, with the purpose of identifying the typology that best suits the residential market value of a specific neighbourhood. Finally, the study

follows a deductive approach as the study took theories motivated in the literature and applied them to the case studies.

3.3 Research method and design

The term methodology refers to the research process as a whole and is concerned with why the data were collected, what type of data were collected, where it was collected, how the data were collected and lastly, how the data were analysed.

There are two main research philosophies that could underlie any research study: a positivistic philosophy and a phenomenological philosophy. The research philosophy adopted affects the methodology of the study. However, both philosophies can arise from the same study (Neville, 2007:5). The positivist philosophy is a quantitative and objectivist approach, while the phenomenological philosophy is a qualitative and subjectivist approach (Neville, 2007:5).

A positivist approach is based on facts or the causes of any social phenomenon in a systematic way and includes surveys, experimental studies, cross-sectional studies and longitudinal studies (Neville, 2007:7). The phenomenological approach is particularly concerned with understanding and interpreting the behaviour of the participants own subjective frames of reference (Neville, 2007:7). The latter includes case studies, ethnography (participation observation) and grounded theory (Neville, 2007:7).

In an effort to determine the impact on residential property prices adjacent to affordable housing development in the two case studies, Fleurhof and Birch Acres, the phenomenological approach with case studies was used to formulate a general theory, and the positivist approach with a cross-sectional study was applied to the quantitative data collected from both case studies.

Case studies are useful to gather information and seek patterns from groups to identify underlying issues, such as those related to the building of affordable housing adjacent to the group. Explanatory case studies use theories as a basis for understanding the procedure. Cross-sectional studies also involve an in-depth analysis of the similarities between groups at any particular point in time (Neville, 2007:8).

3.3.1 Research method

The output data of a research method can be either quantitative or qualitative. The quantitative research method aims to quantify things by means of statistical analysis, surveys or collecting numerical data in an attempt to describe the observed, and the quantitative method aims to give

a detailed description of the observed by means of an interpretive analysis and gathering primary data (MacDonald & Headlam, 2008:10).

This research study follows a quantitative method since the method is objective, statistical and represents the population of interest. The study also includes numerical information such as the actual property price, house attributes and measurable distances.

3.3.2 Research design

A research study refers to the overall research design and method used to answer the research question. Different research methods are related to different types of research designs. Subsequently, a research design indicates which research method is appropriate to solve the inherent research question of the study (Walliman, 2017:14).

The research design is used as a tool to address the research problem in a logical manner and to provide a framework for the collection and analysis of data (Walliman, 2017:10). The differences between research designs stem from the peculiarities in each type of design. Levin (2005:78) distinguishes between observational versus experimental research designs.

Depending on the type of study, an observational research design is used when researchers observe the situation rather than intend an outcome and experimental research designs examine the effect on the outcome of interest (Levin, 2005:78). The way in which data are collected differentiates between prospective and retrospective dimensions.

A prospective manner includes collecting data forwards in time (observational) or assessing the effectiveness of an outcome (experimental study); while a retrospective manner collects past information from the population of interest through surveys and interviews. *Table 3.1* summarises the advantages of the research designs and the type of data collected (Levin, 2005:78).

Table 3.1: Differences between the research designs

RESEARCH DESIGN	ADVANTAGES	DATA COLLECTED
Observational	Data is available	Prospective or retrospective
Experimental	Study and research question specific	Prospective

Source: Levin, 2005:78.

A number of studies distinguish between the following research designs: a descriptive research design that relies on observations as a means of collecting data, a correlation research design that focusses on the relationship between components; and lastly a comparative design compared to the past and the present of parallel situations (Walliman, 2017:10). The research design for this study is observational, with both prospective and retrospective dimensions.

3.4 Theoretical framework

3.4.1 The hedonic pricing model

Any residential property has a bundle of characteristics (including structural and locational). The bundle of characteristics is described by a vector Z:

$$Z = (z_1, z_2, \dots, z_n).$$

Individual households maximise utility (U) from the vector Z. Assume utility is determined by the utility derived from consuming the commodity X and the vector Z (Ham, Maddison & Elliot, 2013:117).

$$U = U(X, Z).$$

Individual households maximise their utility, subject to a budget constraint where M presents the household's source of income (Ham *et al.,* 2013:117):

$$M - P(Z) - X = 0.$$

The willingness to pay for a bundle of characteristics (Z) is determined by the first-order condition with respect to housing characteristics z_j (Ham *et al.,* 2013:117):

$$\frac{\partial U/\partial z_j}{\lambda} = \frac{\partial P(z)}{\partial z_j},$$

where λ is the marginal utility of the household's income. The willingness to pay for a residential property's bundle of characteristics Z, should be equal to the implicit price of an additional unit of the housing characteristics z_j (Ham *et al.,* 2013:117). The demand curve for z_j requires additional information on the situation and how socio-economic characteristics would react to a different set of implicit prices (Ham *et al.,* 2013:117).

The HPM determines the price of a property by valuing the property's unique attributes and assumes that individual households have full information concerning the price and the unique attributes of the residential property (Ham *et al.,* 2013:117). The HPM measures the marginal

costs of the characteristics consumers consider when buying the residential property. Therefore, the HPM estimates the dependent variable (price) by means of measuring the utility derived from the independent variables of that property (bundle of characteristics) (Woo, 2014:84).

The price of a property estimated by the HPM reflects the value of the house based on the set of attributes (Z) the household would consider important or desirable when purchasing that property. Both theories by Rosen and Lancaster describe the direct relationship between a product's price and the features that a product would have. Rosen (1974) describes a property as a heterogeneous product of the total value, which is composed of the sum of the property's attributes. The attributes have own unique value, so the HPM is not linear as stated by Lancaster (1966). Lancaster's HPM is more suited for consumer goods and assumes a linear relationship between the price of a good and the attributes of the good (Chin & Chau, 2003:145).

Theoretically, the HPM equation states that the market price of a property (the independent variable) is expressed as a function of the structural and locational characteristics (dependent variables) (Woo, 2014:84). The pre-development period is the period before the affordable housing construction adjacent to the neighbourhood and the post-development period is the period after the affordable housing construction adjacent to the neighbourhood. The HPM used in the study was as follows:

$$(Ppre) = f(S, L) + \varepsilon \text{ and}$$

$$(Ppost) = f(S, L) + \varepsilon,$$

where;

$P =$ a vector of observed property prices,

$S =$ a matrix of bedrooms, bathrooms, property age, area size, floor size, garage and pool, and

$L =$ distance located from an open space, pre (greenfield), post (build-up).

The HPM is based on key assumptions, namely:

- There is perfect competition in the market and all market participants have perfect knowledge and information regarding the property's price and attributes (Chin & Chau, 2003:6).

- Although there are market imperfections in the residential property market, the HPM assumes there is market equilibrium (Xiao, 2017:54).
- The implicit prices of a property's attributes vary throughout different neighbourhood areas and property typologies (Xiao, 2017).

The HPM controls for all the unique attributes affecting the price of the property. However, the theory does not provide an extensive list of relevant housing attributes. The price of the property represents the aggregate price a consumer is willing to pay for the attributes (Chin & Chau, 2003:4). The latter increases the risk of inefficiency by omitting attributes (Ham *et al.,* 2013:117). The cross-sectional data used in the HPM will display spatial autocorrelation between important omitted variables if they are spatially correlated (Ham *et al.,* 2013:117).

Different econometric techniques are used to estimate and explain how different factors influence the outcome of interest. Of these techniques, the OLS method is best for performing a regression analysis and producing optimal results if the analysis satisfies the statistical assumptions (Pedace, 2013:59). These assumptions are known as the classical linear regression model (CLRM).

The CLRM requires that the regression model or the HPM in the current study meets a certain requirement (Asteriou & Hall, 2016:30). The variables included in the regression are also important for the model to be valid. Therefore, the CLRM examines the nature and form of the relationship between the independent and dependent variables (Asteriou & Hall, 2016:30). Violating the assumptions may imply misspecification, non-linearity, changing parameters, autoregression, autocorrelation, heteroscedasticity and multicollinearity (Asteriou & Hall, 2016:37).

The CLRM has eight assumptions about the ways in which the observations are generated. The CLRM assumptions were applied to the research;

Table 3.2: CLRM assumptions and violations

CLRM ASSUMPTIONS	SPECIFICATION	VIOLATIONS
1. A linear relationship between the dependent and independent variables with an error term	$Y = \alpha+\beta Xt+ut$	Non-linearity and wrong regressors
2. X_t has variation and is not equal to zero	$Var(Xt) \neq 0$	Errors in variables
3. The observation, X_t, is non-stochastic and has fixed values in repeated samples. For all s and t = 1,2,3, n, indicating that Xt and ut are uncorrelated.	$Cov(Xs,ut) = 0$ for all s and t = 1, 2, …, n	Autoregression
4. The expected value of the disturbance term is zero	$E(ut) = 0$	Biased intercept
5. The error term is required to have the same variance, indicating homoscedasticity	$Var(ut)=\sigma^2$	Heteroscedastisity
6. Serial independence; if the independent variables are correlated with the error terms, the estimates are invalid	$Cov(ut,us) = 0$ For all $t \neq s$	Autocorrelation
7. The residuals are normally distributed with a common variance and a mean of zero	$ut \sim N(\mu,\sigma^2)$	Outliers
8. No multicollinearity; i.e. no linear relationship between the dependent variables and more than two observations		Multicollinearity

Source: Asteriou & Hall, 2016:37.

Based on the Gauss–Markov theorem, if the regression is linear and satisfies the first six CLRM assumptions in *Table 3–2*, the study can prove that the OLS estimators are the best linear unbiased estimators (BLUE) (Asteriou & Hall, 2016:38). The BLUE estimators are the properties the regression would favour, being that the regression produces unbiased estimators that have the smallest variance of all possible linear estimators.

The empirical analysis requires the multicollinearity and heteroscedasticity tests to prove the validity of the regression models (Ham *et al.,* 2013:117). The transformation of statistical data is

supported by two assumptions: the error terms are normally distributed, and the variance of the variables are constant over the observed range of some other variable (Sirmans & Zietz, 2010:2).

The indication of an unequal variance of error term is known as heteroscedasticity. Due to heteroscedasticity, confidence intervals occur and hypothesis tests can be unreliable. In the presence of heteroscedasticity, the OLS estimator cannot function as the best linear unbiased estimator (BLUE) (Aseriou & Hall, 2016:32).

To a certain degree, variables can be predicted from other variables. This occurs when two or more explanatory variables correlate in a regression, which is known as multicollinearity (Asteriou & Hall, 2016:104). A hedonic models' efficiency can be affected by multicollinearity, which increases the uncertainty of the true parameter value. Particularly, structural characteristics such as bathrooms and bedrooms are potential variables that can cause multicollinearity problems, being an expected number of bathrooms in correlation to the number of bedrooms of a house.

3.4.2 One-way analysis of variance

ANOVA describes the variability in scores between different groups with the variability within each of the groups (Pallant, 2013:258). An ANOVA analysis involves using an independent variable with three (minimum) or more different levels to compare the mean scores of more than two variables (Pallant, 2013:258).

In order to conduct the analysis, the following variables are required:

- A categorical independent variable with three or more distinct categories;
- A continuous dependent variable.

Furthermore, the ANOVA identifies the significant differences in the mean scores of the dependent variable across the three groups. If the significance or p-value in the ANOVA output is less than or equal to 0.05 (*Sig* lower than 0.05), there is a significant difference in the mean scores of the dependent variable for the three groups. The difference is provided in the multiple comparison table (Pallant, 2013:262).

The multiple comparison output shows the post hoc test results. The post hoc test identifies exactly where the differences occur (Pallant, 2013:263). The F-ratio represents the variance between the groups divided by the variance within the groups (Pallant, 2013:258). If the F-ratio is significant (p lower than 0.005), the null hypothesis of assuming equal means is rejected. However, the F-ratio cannot identify which groups differ, therefore a post hoc test is used to detect differences (Pallant, 2013:259).

In the column labelled mean differences, values with an asterisk (*) indicate that the two groups being compared are significantly different from each other (Pallant, 2013:263). Homogeneity of variance is an ANOVA assumption.

In order to calculate the effect size of the ANOVA result, an ETA squared test was performed. Effect sizes indicate whether the difference between variable groups is statistically significant, or in other terms which variables are statistically significant and did not likely occur by change (Pallant, 2013:217).

The effect size can also be termed as the strength of association, since the ETA squared shows the degree to which variables are associated with each other. Also, it indicates the magnitude of the variance in the dependent variable that is predicted from the different levels of independent variables (Pallant, 2013:217). The ETA squared is formulated as:

$$Eta\ squared = \frac{Sum\ of\ squares\ between\ groups}{Total\ sum\ of\ squares}.$$

The IBM SPSS computer programme calculates partial ETA square together with the ANOVA result output. However, the formula is used to calculate the effect size. In order to interpret the effect size, Cohen (1988; 284) classifies the effect as small (0.01) medium (0.06) and large (0.138) (Pallant, 2013:264).

3.4.3 Paired sample t-test

A paired sample t-test is also referred to as repeated measures and is especially useful for pre- and post- test experimental designs. To conduct a paired sample t-test, the following is necessary (Pallant, 2013:252);

- One categorical independent variable; in this case it is the different time periods (pre _ post);
- One continuous dependent variable measured on the two different occasions or conditions (price).

The paired sample t-test will identify if there is a significant difference between the mean value of the dependent variable in the pre- and post-development period. An ETA squared test is calculated to determine the size of the effect;

$$Eta\ squared = \frac{t^2}{t^2 + (N - 1)};$$

where Cohen (1988:284) classifies a small effect as 0.01; a moderate effect as 0.06 and a large effect as 0.14.

3.5 Case study overview

The government on its own does not have the capacity to supply in the increased demand for affordable housing (Alexander, 2010:25). The latter is affected by the lack of resources available to the government. This highlights the importance of public-private partnerships (PPPs) to supply basic services, such as affordable housing (Dube, 2013:1).

Similar to the proposed project of the city council in the North-West province to develop housing for middle-income community members in well-established suburbs, other integrated residential housing projects in Nelson Mandela Bay (Du Preez & Sale, 2013:451), Fleurhof and Birch Acres have already been completed.

For the purpose of the study's objectives, Fleurhof and Birch Acres were selected as the case study locality. These developments were chosen since both case studies are embedded in a previously open space context and were developed through PPPs.

Both case studies have affordable housing typologies that have been developed next to an existing neighbourhood, characterised by bonded (middle- to higher-income) housing. Since the residential developments in both case studies have already been completed, they are ideal case studies to analyse and their effect on the neighbourhood residential market would provide valuable insight into the Potchefstroom case. From these case studies an overarching outcome will be derived and applied to Potchefstroom's identified locations.

3.5.1 Fleurhof, Randburg

Next to the exiting Fleurhof neighbourhood, a 440ha integrated housing development was developed in 2013 as part of a partnership between Calgro M3 holdings, FNB, the City of Johannesburg municipality and International Housing Solutions (IHS) (Dube, 2013:63). The aim was to develop a residential project that will be known as a premier integrated housing project throughout South Africa (Calgro M3, 2016).

The Fleurhof project is located in the South-Western part of Johannesburg, between formally established suburbs with the necessary services in place and adjacent to the existing neighbourhood with the same name (Dube, 2013:62). Fleurhof is strategically located as it considers the City of Johannesburg's development plans to develop the East-West and North-South corridors of the city (Mnisi, 2018:55). The suburb forms a link between two segregated

areas, that is, a new access point into Soweto and the R41, providing residents greater opportunities and housing for residents and labourers in the mining sector (Khan, 2014:63).

The affordable housing development covers 291ha of land, including different housing typologies: fully subsidised RDP/BNG housing units, GAP, social rental and affordable housing (Dube, 2013:62).

This mixed human housing development is appealing to different markets and users, allowing people from all classes, races and financial backgrounds to integrate in a once-segregated city (Calgro M3, 2016). Additionally, the development provides more integration between various income earners as the development has introduced high-density residential and mixed land uses on the site (Mnisi, 2018:56).

The integrated affordable housing development is in line with the BNG housing policy, which aims to improve integrated communities and bring them closer to areas of economic opportunities (Dube, 2013:63). Figure 3-1 contains two snapshots from Google Earth. The first image was captured in 2007, notice the open space compared to the second image captured in 2019.

Figure 3-1: Fleurhof 2007 versus 2019

Source: Google Earth, 2019.

The development addresses the region's affordable housing needs and changes the way communities in the region are built. Fleurhof comprises of freestanding and semi-detached housing typologies, providing housing for an estimated 83 000 people (Calgro M3, 2016). Images of the different housing types can be seen in Figure 3-3 below. Each residential house type consists of a different size, plan and price (Calgro M3, 2016).

Freestanding units and apartments were initially sold for R279 000 and R289 000 respectively (Calgro M3, 2016). Freestanding and semi-detached typologies have a size ranging from 40 m^2 to 50 m^2, have two bedrooms and one bathroom, while freestanding typologies have a size ranging from 60 m^2 to 70 m^2 and have three bedrooms and one bathroom. Finally, a freestanding house with a 99 m^2 size has four bedrooms and two bathrooms (Calgro M3, 2016).

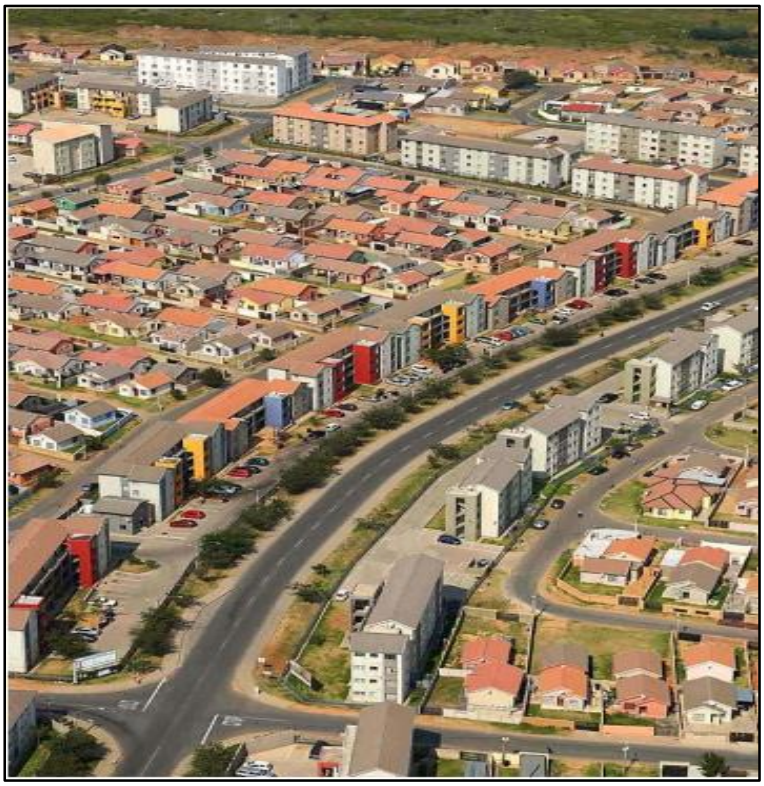

Figure 3-2: Fleurhof integrated residential development
Source: Sibanda, 2017:1.

Figure 3-2 was analysed as the first case study to determine the effect of the affordable housing development on the residential market of Fleurhof.

3.5.2 Birch Acres

The second case study is Birch Acres, an integrated housing project in the existing suburb of Birch Acres, providing subsidised, social and FLISP housing units (Demacon, 2017:55).

Figure 3-3 shows the Birch Acres area in Kempton Park. Two snapshots were taken from Google Earth, the first image was captured in 2002 and the second image was captured in 2019. The demarcated areas shed light on the affordable housing development built over this period in Birch Acres.

Figure 3-3: Birch Acres in 2002 versus 2019

Source: Google Maps, 2019.

The development in Birch Acres was mainly aimed at FLISP housing. The FLISP or GAP housing intend to assist households to access housing by providing partially subsidised housing that can be used to pay the deposit on a house or to decrease the size of the home loan. Employed individuals who can afford personal loans up to R300 000 are eligible for FLISP housing units. FLISP or GAP housing are more than 40m^2 in size and characterised as a detached, semi-detached single or double-storey building.

3.5.3 Study locus

Both Fleurhof and Birch Acres were assessed using the HPM and over two time periods to identify what the effect of these developments has been on the market of the existing adjacent neighbourhoods. The results of the analysis were thereafter applied to the following neighbourhoods as identified by the city council in Potchefstroom; Bailie Park, Miederpark, Van der Hoff Park and Dassierand. The results are discussed in Chapter 4 and can provide statistic guidance for the proposed affordable housing initiative for Potchefstroom. In addition, Chapter 4 discusses the implications for Potchefstroom.

3.6 Data collection

3.6.1 Data collection

The researcher collected residential property data from reliable South African property research engines, such as Property 24® and Lightstone Property. These platforms provided the study with property prices, number of bedrooms, number of bathrooms, area size, property age, garage and

pool. Residential housing data within a 400m radius around the affordable housing development were documented on an Excel spreadsheet.

The data were used to do a cross-sectional analysis of Fleurhof and Birch Acres. In addition, Google Earth ® (2019) was used to measure the distance between the affordable housing developments and the adjacent properties. Each house address is measured separately for accuracy in the regression model. The distance located from an open space is recorded as greenfield and distance from the affordable housing is recorded as build-up.

3.6.2 Overview of data

Table 3.3: Abbreviations for the dependent and independent variable

VARIABLE	ATTRIBUTE	ABBREVIATION
Price	Price of residential property	Real price
Time on Market (TOM)	Market timing variable (year the property was sold)	Year
Structural attributes (SA)	Number of bedrooms	Bed
	Number of bathrooms	Bath
	Number of garages	Garage
	Erf size	Erf
	Property age	Prop_age
	Pool dummy	Pool
Locational attributes (LA)	Distance from affordable housing development	Distance

Source: Author's own construction.

3.6.3 Overview of the study

The aim of this study is to determine the impact of affordable housing development in open spaces and parks on the residential market of the surrounding areas. Two different locations (or case

studies) were examined to prove that the type of affordable housing will have no impact on property prices if the type of affordable housing attributes are similar to the surrounding areas. The study analysed two mainstream models, namely time and distance.

3.6.3.1 Time

Table 3.4: The different time periods for each case study

Pre-development	The period before the affordable housing construction adjacent to the neighbourhood.
Post-development	The period after the affordable housing construction adjacent to the neighbourhood.

Source: Author's own construction.

The relationship between the dependent variable (property price) and the independent variables (structural and locational characteristics) are assessed using the HPM over two time periods to identify what the effect these developments have had on the market of the existing adjacent neighbourhoods.

3.6.3.2 Distance

The distance variable measures the impact on property prices in close proximity to the affordable housing development, more specifically analysing if a property located closer to the greenfield (pre-development) has been negatively affected. They also evaluate whether a property located close to the integrated residential housing (post-development) was negatively affected.

3.6.4 Data analysis

The data were applied to the regression models using the Statistical Package for the Social Sciences (SPSS). In order to estimate the impact of an affordable housing development on the neighbourhoods' market prices in each case study, a simple regression with a HPM was done.

The results were examined for statistical significance by means of the following measures, the coefficient of determination the adjusted R-squared (adj R^2) and the F-value. The adjusted R^2 was used to identify the percentage significant response variable variation in the regression. The percentage ranges between 0% and 100%, meaning that the higher the adjusted R^2, the better the model fit the data. However, the latter was not enough to prove the regression is adequate. The F-value was used to ensure that the independent variables were significant and supported the regression (Aseriou & Hall, 2016:27). The discussion of the results follows in Chapter 4.

3.7 Conclusion

Different research methods are related to different research designs. A research design determines which research method is appropriate to solve the inherent research question of the study (Walliman, 2017:14). Research methods can be divided into two types, namely quantitative or qualitative, and is inherent to a research question and the research approach of a study (MacDonald & Headlam, 2008:8). Chapter 3 outlined the methods used to measure the effect of affordable housing development on the market prices of the adjacent neighbourhood.

This research study addressed a relational research question and followed a correlation research design since the relationship between the dependent variable and the independent variable was examined. In addition, the research study also addressed a comparative design strategy as the study compared the determinants of property prices adjacent to an affordable housing development in two time periods, pre- and post-development. The research study used a deductive reasoning approach to support the literature review in Chapter 2 and to develop a conclusion based on the quantitative data collected.

In conclusion, the results of the analysis were applied to neighbourhoods in Potchefstroom. The results are discussed in Chapter 4 and offer statistic guidance for the proposed affordable housing initiative in Potchefstroom.

CHAPTER 4
EMPERICAL ANALYSIS AND RESEARCH FINDINGS

4.1 Introduction

This chapter presents the results obtained from the application of the hedonic price model (HPM) and provides guidance for the proposed affordable housing initiative in Potchefstroom. The case study analysis is examined to ensure that the classical linear regression model (CLRM) estimates have not been violated. The validity tests include testing for heteroscedasticity and multicollinearity. The study aims to determine whether the development of affordable housing will have a significant devaluing effect on the residential market property prices of the surrounding neighbourhoods.

Generally, the public's perception of affordable housing developments in close proximity to existing neighbourhoods is that it would detrimental to the area, more specifically, raising the concern about an upsurge in crime due to construction, overcrowding and general disturbance of peace (Du Preez & Sale, 2013:459). In order to evaluate the effect of an affordable housing project on existing neighbourhoods and whether or not there is an effect on their market prices, a case study analysis was conducted.

The two case studies, Fleurhof and Birch Acres, were analysed within two time periods, each with its own model. A *pre-development model* was used to evaluate the property prices prior to the development, in other words, the area adjacent to the neighbourhood is considered a greenfield, undeveloped open space, and a *post-development model* was used to evaluate the property price of the adjacent neighbourhood during the construction of the affordable housing development.

The models allow the researcher to analyse how the bundle of characteristics influence the property prices before and after the construction of an affordable housing development. The HPM was applied to each case study to ascertain the determinants from which consumers gained maximum utility. In addition, the Birch Acres case study allowed for an additional analysis of property prices for the adjacent neighbourhood a few years after the completion of the affordable housing project. This is referred to as the post-post model and it reflects the period from 2010 to 2018.

The ANOVA identified which structural and locational characteristics had a significant and positive or negative effect within each time period. A paired sample t-test was used to determine if there was a difference in variance between the mean value of property prices before the development and the mean value after the development.

The chapter is structured as follows: Section 4.2 describes the variables used in the analysis, as well as the adjustments made to the secondary data. Section 4.3 and 4.4 presents the results of the application of the HPM on the Fleurhof and Birch Acres case studies during the pre- and post-development period. Section 4.5 analysed the Birch Acres post-post model. Section 4.6 tested for the difference in property prices between the time periods with the t-test. The implication of the results for Potchefstroom are discussed in Section 4.7, and Section 4.8 concludes the chapter.

4.2 Data description

Secondary data provided by Lightstone Property® were exported to a Microsoft Excel sheet and analysed using the IBM SPSS computer program.

4.2.1 Adjusted data

The pre-development period for both case studies consisted of the period before the affordable housing development with greenfield areas adjacent to the neighbourhood in question. The pre-development period for Fleurhof was the period 2000 to 2012, whereas the pre-development period for Birch Acres was 2000 to 2003.

The post-development period for both case studies included the year in which the construction started, since this represents a change in the physical attributes of the neighbourhood, up until a few years after the construction had been completed to review the effect of the type of affordable housing development on the adjacent neighbourhood. The integrated residential development in Fleurhof completed construction in 2016 and the FLISP housing in Birch Acres was already completed in 2006. Therefore, the post-development period for Fleurhof was the period between 2013 to 2018, whereas the post-development period for Birch Acres was the period between 2004 to 2009.

The property prices for each model and period have been adjusted for inflation by using the House Price Index (HPI) from FNB and Statistics South Africa.

4.2.2 Empirical analysis

The model used to determine the real price of a property is given as:

$$Real\_Price = \alpha + \beta_0 + \beta_1 lnYear + \beta_2 lnBedrooms + \beta_3 lnBathrooms + \beta_4 lnGarage + \beta_5 lnErfsize + \beta_6 lnProperty\_age + \beta_7 Pool + Z_1 lnDistance,$$

where the dependent variable in the HPM, Real_Price, represents the individual property sales price, β_1 to β_7 represents the independent variables or structural attributes of each individual

property, and Z_1 represents the distance between the individual property and the open space (pre-development), as well as the proximity between the property and the affordable housing development (post-development).

4.2.2.1 Dependent and independent variables

Table 4.1: Description of dependent and independent variables

DEPENDENT VARIABLE:		
Real purchase price (Sell price)		Property price adjusted for inflation
INDEPENDENT VARIABLES:		
Structural characteristics	Year	The year the property was sold.
	Bedrooms	The number of bedrooms
	Bathrooms	The number of bathrooms
	Garage	The number of garages
	Erf size	The erf size in m^2.
	Property age	The age of the property.
	Pool	0: Property does not have a pool.
		1: Property has a pool.
Locational characteristics	Distance	Pre: Proximity to the open space in metres (greenfield).
		Post: Proximity to the affordable housing development in metres (build-up).

Source: Author's own construction.

The pre- and post-model for each suburb is discussed separately in the following sub-section. Each model is introduced with descriptive statistics, including the minimum, mean and maximum values for each variable, followed by the HPM results and the ANOVA results. A summary of the main results concludes each case study.

4.3 FLEURHOF

4.3.1 Descriptive statistics

The pre-development period for Fleurhof ranges from 2000 to 2012, with the descriptive statistics reported in *Table 4-2.* A total of 124 observations within a 400m radius was used. The average

property price for Fleurhof was R583 845.00 in 2012 (adjusted for inflation), and 31 years of age. The suburb had an average of three bedrooms and two bathrooms per house, while the average erf size was 848m^2, with the smallest property being 281m^2 and the largest 1 423m^2.

Table 4.2: Descriptive statistics for Fleurhof Pre-development

		Realprice	Year	Bed	Bath	Garage	Erf	Pool	Prop_age	Distance
N	Valid	124	124	124	124	124	124	124	124	124
Mean		583 845	2004	3	2	1	848	0	31	230
Minimum		43 600	2000	1	1	0	281	0	20	47
Maximum		1 458 300	2012	6	5	3	1,423	1	40	399

Source: Adapted from Lightstone Data.

The post-development period for Fleurhof ranged from 2013 to 2018, with the descriptive statistics reported in *Table 4-3.* A total of 68 observations within a 400m radius was used after cleaning and organising the data. The average property price for Fleurhof was R942 683 in 2018 (adjusted for inflation), and 31 years of age. The average property in the suburb had three bedrooms and two bathrooms, while the average erf size was 844m^2 with the smallest property being 281m^2 and the largest 1,423m^2.

Table 4.3: Descriptive statistics for Fleurhof post-development

		Realprice	Year	Bed	Bath	Garage	Erf	Pool	Prop_age	Distance
N	Valid	68	68	68	68	68	68	68	68	68
Mean		942 684	2015	3	2	1	844	0	31	259
Minimum		248 900	2013	1	1	0	281	0	20	70
Maximum		1 823 200	2018	6	6	3	1423	1	41	400

Source: Adapted from Lightstone Data.

4.3.2 Hedonic pricing model regression analysis

A multiple regression analysis was done to estimate the perceived disamenity of the distance a house is located from the affordable housing development. *Table 4-4* depicts the significance of each independent variable in determining the real purchase price of properties before and after the construction of affordable housing.

Table 4.4: Fleurhof pre- and post- development

Model		Unstandardised Coefficients		t	Sig.
		B	Std. Error		
FLEURHOF PRE	(Constant)	-38445424.13	11871627.10	-3.24	0.00
	YEAR	19 361.61	5913.87	3.27	0.00
	BED	51 395.05	24166.16	2.13	0.04
	BATH	19 456.49	28982.35	0.67	0.50
	GARAGE	63 963.81	23566.35	2.71	0.01
	ERF	-86.13	106.91	-0.81	0.42
	POOL	-13.503	2826.671	-0.004	0.996
	PROP_AGE	116 804.55	57220.955	2.041	0.043
	DISTANCE	-23.96	177.49	-0.13	0.89
FLEURHOF POST	(Constant)	35519420.66	32403110.06	1.10	0.28
	YEAR	-17 025.66	16074.95	-1.06	0.29
	BED	-53 195.78	32718.03	-1.63	0.11
	BATH	78 544.16	33601.30	2.34	0.02
	GARAGE	13 625.43	37927.04	0.36	0.72
	ERF	-134.65	137.21	-0.98	0.33
	POOL	15 273.03	62133.03	0.25	0.81
	PROP_AGE	350.53	4115.91	0.09	0.93
	DISTANCE	-782.39	262.54	-2.98	0.00
Model summary					
Model	R-square	Adjusted R-square	Std. Error of the Estimate	F	Sig.
FLEURHF PRE	0.232	0,179	216487,019	4,357	.000
FLEURHOF POST	0,281	0,184	214974,912	2,885	.009

Source: Adapted from Lightstone data.

The Fleurhof pre-development model has an adjusted R-square of 17.9%; therefore 17.9% of the variance in real price is determined by the structural and locational characteristics. The F-stat is 4.357 and significance 0.000, suggesting that the regression as a whole is significant in explaining real price (y). The Fleurhof post-development model has an adjusted R-square of 18.4%; therefore 18.4% of the variance in real price is determined by the structural and locational attributes. The F-stat is 2.885 with a significance of 0.009, suggesting that the regression as a whole is significant in explaining real price (y).

4.3.2.1 Fleurhof pre-development results

4.3.2.1.1 Structural characteristics

The pre-development model shows that three of the independent variables are significant at the 95% level of certainty, including the year the property was sold, garage and the age of the property. Property prices tend to increase annually and this would explain why the year it was sold is significant. Each year the price of the property would increase by R19 361. Every additional garage increases the property price with R63 963, while older, more established houses increase the value by R116 804. This could be an indication that older properties may include more amenities or have larger erf sizes.

Although the other structural independent variable does not show similar levels of significance, their results are still relevant. Bedrooms and bathrooms have a positive coefficient with a property price increasing by R51 395 with an additional bedroom and R19 456 with an additional bathroom.

4.3.2.1.2 Locational characteristic

The locational characteristic of distance shows a negative value, illustrating that properties located further away from the open space have lower prices. This decrease is marginal, as a property located 100m further away from the open space will decrease by R2 400.

Distance is of particular importance for this study, necessitating a closer look at the relationship between distance and property prices. The relationship between property price and distance is illustrated in *Figure 4-1*. Although the model indicates a negative coefficient (i.e. property price decreases as distance from the open space increases) a micro-level assessment shows that within the first 160m from the open space, the relationship is positive. This means that prices increase as distance increases away from the open space.

This analysis does not consider the house characteristics, but rather refers to the general observed trend in property prices. Once houses locate further than 160m from the greenfield are added to this relationship the trends become negative to reflect the result in the model (*Table 4-4*). This seems to indicate that on a micro-level that the greenfield might be perceived as a risk that lowers price. However, the ratio changes for data points in at 160m (*Figure 4-1*), indicating other possible factors affecting property prices before the affordable housing development.

4.3.2.2 Fleurhof post-development results

4.3.2.2.1 Structural characteristics

The regression output for the time period 2013 to 2018 (Fleurhof post) shows that the following variables significantly determined a property's price at the 5% level: number of bedrooms, number of bathrooms, and distance to the affordable housing development.

The number of bedrooms had a negative unstandardised beta coefficient, indicating that every additional bedroom will decrease the property's price by R62 134. This is an unexpected finding and could be explained by a possible change in market preference. In other words, after the development of the affordable housing development, households considering residing in Fleurhof searched for properties within a certain price range with specific structural characteristics. Therefore, properties that did not fall within this specific category was likely perceived as over-priced.

This result coincides with the finding of Pirounakis (2013:30) that a decrease in the consumer's budget spent on housing will lead to a decrease in the type of utility-bearing house bought, possibly buying smaller types of owner-occupied housing with fewer amenities or in an inconvenient area. The number of bathrooms had a significant positive effect on determining a property's price. Every additional bathroom increased the real purchase price by R85 023, indicating a high demand for extra bathrooms in a house.

4.3.2.2.2 Locational characteristic

The locational characteristic, distance to the affordable housing development, had a negative coefficient, indicating that property prices declined with each metre the property was located further away from the affordable housing. The distance value has changed from R2 400 per 100m prior the development to R78 239 per 100 metres after the development.

Although the model indicates a negative coefficient (i.e. property price decreases as distance increases from the open space), a micro-level assessment shows that within the first 140m from the open space, the relationship is positive. This means that prices increase as distance away from the open space increase in *Figure 4-2.*

Figure 4.1: Distance up to 140m

Source: SPSS, 2019.

Consequently, the affordable housing development had a positive effect on property values in Fleurhof *(Figure 4-1 and 4-2)*. The further away a property was located from the development, the more the property's value decreased, and the average sale price of properties increased from 2012 to 2018. After observing property prices and distance separately, results indicated that there is a correlation between the proximity of the property to the development and the proximity of the property to the open space.

To conclude, the fact that distance located further away has a higher negative value, post-development suggests that the affordable housing project fits with the existing property market and did not negatively affect property prices.

4.3.3 One-way analysis of variance

To further investigate, an ANOVA was conducted to provides an F-ratio to assess how well a regression model fits the data (Field, 2013:431). The latter compares the variability in scores between the different levels of one factor.

4.3.3.1 Fleurhof pre

Table 4.5: Fleurhof pre-development ANOVA

YEAR		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
2000 - 2003	2004 - 2006	-49181,429	52559,101	0,786	-186118,78	87755,92
	2007 - 2009	-167845.652*	60085,544	0,031	-324392,38	-11298,92
	2010 - 2012	-81225,000	68499,037	0,637	-259692,22	97242,22
BED		**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
1 - 2 BEDROOMS	3 - 4 BEDROOMS	-109623,556	50731,554	0,082	-230004,58	10757,47
	5 - 6 BEDROOMS	-255794.540*	80725,270	0,005	-447347,72	-64241,36
BATH		**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
1 - 2 BATHROOMS	3 - 4 BATHROOMS	-181235.511*	55551,535	0,004	-313053,88	-49417,15
	5 - 6 BATHROOMS	-75688,542	98898,763	0,725	-310365,65	158988,56
GARAGE		**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
1 GARAGE	2 GARAGES	-90400,218	54823,059	0,355	-233236,08	52435,65
	3 GARAGES	-123318,823	54823,059	0,116	-266154,69	19517,04
	4 GARAGES	-333994.792*	104467,941	0,009	-606175,31	-61814,27

Source: SPSS Output, adapted from Lightstone data.

The variables highlighted in *Table 4-5* reveal the differences in means between the levels of the different variables. There was a significant difference between the different levels when taking into account the variables: year, bedrooms, bathrooms and garage variable at $p\ lower\ than\ 0.05$.

The *post hoc* test indicated that the years 2000 to 2003 was significantly different from the years 2007 to 2009 at *F-stat* (2.674), $p = 0.05$. The mean difference showed a negative coefficient for the years 2007 to 2009, signifying the financial crisis. The effect size, calculated using ETA squared, was 0.06 and indicates a medium effect.

Furthermore, results indicate a negative significant difference between one to two bedrooms and five to six bedrooms at *F-sta*t (5.320), $p = 0.05$ and a negative difference between the bathroom levels one to two bathrooms and three to four with a *F-stat* (5.413), $p = 0.05$. The effect size for both bedrooms and bathrooms was 0.08, indicating a medium effect. Three garages also have a negative coefficient compared to one garage. The ETA squared calculated as 0.09 reflected a medium effect.

4.3.3.2 Fleurhof post

Table 4.6: Fleurhof post-development ANOVA

YEAR		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
2013 - 2014	2015 - 2016	185799.234*	68611,062	0,023	21232,20	350366,27
	2017 - 2018	86350,794	73445,783	0,472	-89812,56	262514,15
ERF		**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
< 800M ERF SIZE	< 700M ERF SIZE	159829,412	161275,019	0,858	-293087,19	612746,02
	< 900M ERF SIZE	-89864,588	58396,504	0,542	-253862,38	74133,20
	< 1000M ERF SIZE	47854,412	117163,585	0,994	-281181,87	376890,70
	> 1000M ERF SIZE	383479.412*	133496,870	0,043	8573,55	758385,27
< 900M ERF SIZE	< 700M ERF SIZE	249694,000	162879,785	0,545	-207729,35	707117,35
	< 800M ERF SIZE	89864,588	58396,504	0,542	-74133,20	253862,38
	< 1000M ERF SIZE	137719,000	119362,885	0,777	-197493,69	472931,69
	> 1000M ERF SIZE	473344.000*	135431,189	0,008	93005,90	853682,10
DISTANCE		**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
0 - 80M	81 - 160M	-70029,167	144969,159	0,963	-452434,42	312376,09
	161 - 240M	19291,667	148735,219	0,999	-373047,85	411631,18
	241 - 400M	112884,685	138320,944	0,847	-251983,65	477753,02
81 - 160M	0 - 80M	70029,167	144969,159	0,963	-312376,09	452434,42
	161 - 240M	89320,833	87992,942	0,741	-142790,35	321432,02
	241 - 400M	182913.851*	68944,007	0,048	1050,68	364777,02

Source: SPSS Output, adapted from Lightstone data.

The Fleurhof post-development ANOVA showed a statistically significant difference in the variables: year, erf size and distance variable at $p\ lower\ than\ 0.05$. The years 2013 to 2014 were significantly different from the years 2015 to 2016 at F-stat (3.778) and $p = 0.028$. The effect size, calculated using ETA squared, was 0.10, indicating a small effect.

Furthermore, the results indicated a significant negative difference between the following levels of the erf size: <800m^2 and >1000m^2, as well as <900m^2, and >1000 m^2 at *F-stat* (3.553) and $p = 0.011$. The effect size, calculated using ETA squared for the different levels of erf size, depicts a small effect. The ANOVA identified differences in the variance of the variable of interest, the distance to the affordable housing between 81 to 160m and 241 to 400m.

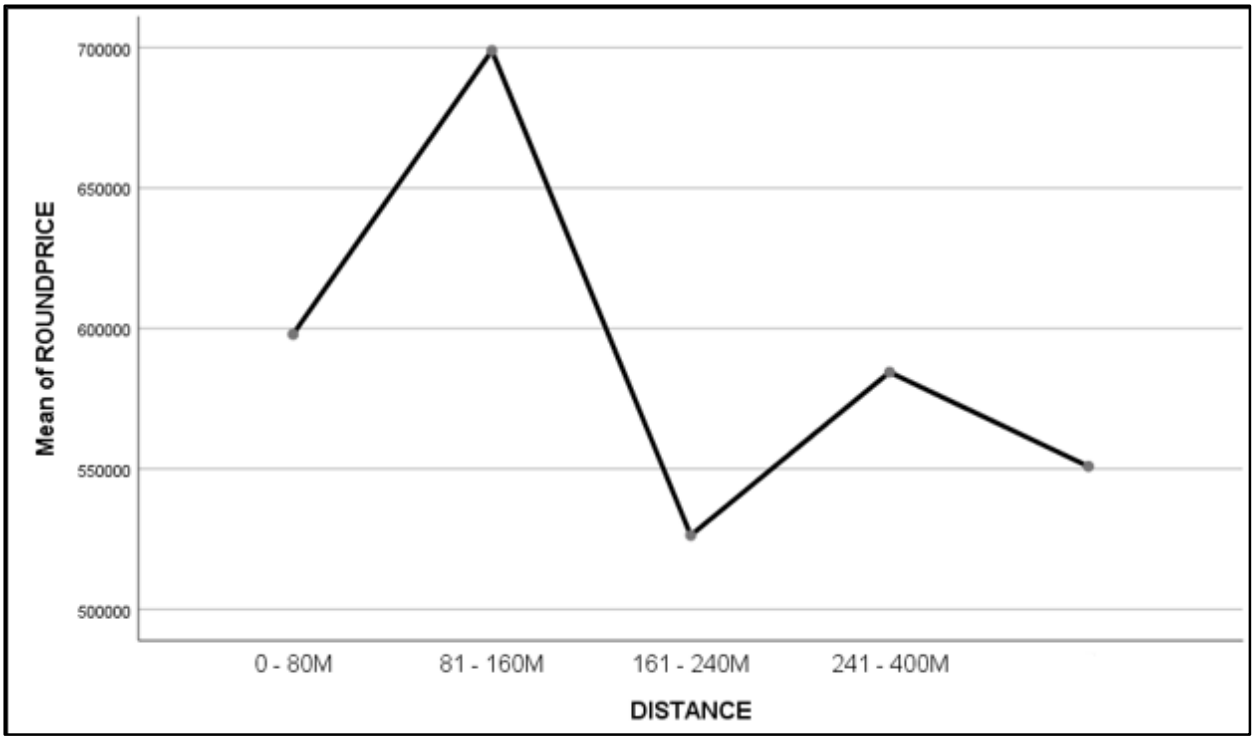

Figure 4.2: Fleurhof mean plot of real price and distance.

Source: SPSS, 2019.

Figure 4-3 showed that as distance increase to 160m from the affordable housing development, the price of houses increased. This is in line with what was illustrated in *Figure 4-1 and 4-2*; within a 140m radius property prices increased as distance from the open space increased prior to the development. Similarly, post-development prices of properties increased in a 160m radius when the property was located further away from the affordable housing. This positive relationship changes after 241m, where property prices decreased the further away, they were located from

the integrated residential housing development. Also noteworthy, the properties located between a 0 to 160m radius still had the highest property values.

4.3.4 Paired sample T-test for Fleurhof

The paired sample t-test identifies whether there is a significant difference in the mean scores of the independent variable (pre- and post-development).

Table 4.7: Fleurhof paired samples statistics

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
FLEURHOF	PRICE - PRE_POST	716141,828	317211,726	22892,784	670986,681	761296,975	31,282	191	0,000

Source: SPSS Output, adapted from Lightstone data.

The significance (***Sig***) should be smaller than or equal to $p\ lower\ than\ 0.05$. for the t-test value to be significant and to reject the null hypothesis. The paired samples test calculates two-tailed p-values and indicates if the means of two conditions means differ significantly. *Table 4-7* depicts a significance of 0.000, suggesting that the two different time periods (pre-development and post-development) possibly affect property prices. The test revealed that there is a statistically significant difference between the two conditions and that the means are not likely to change.

Even though the results of the paired sample t-test indicated a significant difference in the mean (716141,828), it does not explain the magnitude of the effect between the two different time periods. The magnitude of the differences in the mean for Fleurhof was large; the ETA square (0.84) indicated that property prices differed from the pre-development to the post-development period.

4.3.5 Model summary

- Most of the independent variables prior to the development reflect the correct symbol with bed, bath, garage and pool as positive. Although the distance variable is negative, it is a very small value and indicates that being located close to an open space does not significantly increase the value of a property in the Fleurhof neighbourhood.
- After the construction of the affordable housing, the distance variable continued to be negative, suggesting that the affordable housing typology and price range is in line with Fleurhof's residential market pricing trends. It should be noted that even though distance is significant, the number of property sales in close proximity to the project is low. Sales activity was mostly observed further away from the streets bordering the project. The value of the distance variable increased considerably from R24 p/m prior the development to R782 p/m after the development. This is an indication that market prices could be influenced by aspects not considered during the analysis and located further away from the new development.
- An increase in bedrooms has the opposite effect on pricing compared to the pre-development model. Dodds (2010:11) states that as the number of bedrooms and bathrooms of a property increases, so does the price of the property. Contrastingly, the number of bedrooms had a negative influence on property prices in the Fleurhof post-period. One possible explanation for the contradiction could be a changing target market so that consumers prefer smaller houses, such as young couples. It could also indicate a possible shift in demand for smaller houses that are more affordable, whereas larger houses with more bedrooms are seen as more expensive.
- The visual and quantifiable characteristics, such as the dwelling type, location, garage and number of bedrooms, usually have the most weight when selecting a dwelling subject to a given budget constraint (Pirounakis, 2013:33). The Fleurhof pre-model recorded the number of garages as positive and significant and the Fleurhof post-model recorded the number of bedrooms as negative and significant.
- The 125 HPM studies by Sirmans *et al.* (2005:4) summarised the top twenty physical characteristics of a house and found that age and year variables had a significant negative effect on property prices. However, the year and property age variable had a positive effect on Fleurhof's property prices. One reason for the contradicting results could be that homeowners are preferring older well-maintained properties. A parabolic relationship can also be considered between property price and property age since properties over 100 years old were possibly built with unsafe and illegal materials (Clever, 2019).

- South African real estate exhibited a housing boom from 2000 to 2006 as property prices increased by 20% annually. However, the boom ground to a halt following the global financial crisis and bounced back in 2012 with property prices rising by 3.2% in real terms (Global Property Guide, 2019). This could support the positive impact of the year variable on property prices during 2000 to 2012. The magnitude of the differences in the mean for Fleurhof was large; the ETA squared indicated that there was a statistically significant difference in property prices from the pre-development to the post-development period.

The findings of the Fleurhof case study established a positive relationship between property price and the distance, specifically, if the property is located within a 160m radius from the greenfield and 140m from the build-up or affordable housing project. Therefore, it appears as if the Fleurhof integrated residential development has not negatively affected the existing residential market, but rather aligned with the current market prices, especially for properties located more than 140m from the development.

4.4 BIRCH ACRES

The affordable housing development started in 2004 with incremental development that lasted up to 2009. The period between 2000 to 2003 represent the pre-development period, while the 2004 to 2009 represent the post-development period.

4.4.1 Descriptive statistics

The pre-development period for Birch Acres spanned 2000 to 2003, with the descriptive statistics reported in *Table 4-8.* A total of 168 observations within a 400m radius was used. The average property price for Birch Acres was R190 857 in 2003 (adjusted for inflation), and 26 years of age. The average property in the suburb had three bedrooms and two bathrooms, while the average erf size was 924m^2, with the smallest property being 722m^2 and the largest 1 419m^2.

Table 4.8: Descriptive statistics for Birch Acres pre

		Roundprice	Bed	Bath	Garage	Erf	Pool	Prop_age	Year	Distance
N	Valid	168	168	168	168	168	168	168	168	168
Mean		190 857	2	2	1	942	0	26	2001	252
Minimum		23 900	1	1	0	722	0	20	2000	87
Maximum		307 200	6	4	5	1,419	1	43	2003	400

Source: SPSS Output, adapted from Lightstone data.

A total of 193 observations within 400m from the affordable housing development was used for the analysis during the post-development period. The average property price was R475 750 in 2018 (adjusted for inflation), with an average house age of 25 years. The suburb had an average number of three bedrooms and two bathrooms per house, while the average erf size was 887m^2, with the smallest property being 476m^2 and the largest 1 419m^2.

Table 4.9: Descriptive statistics for Birch Acres post

		Roundprice	Year	Bed	Bath	Garage	Erf	Prop_age	Pool	Distance
N	Valid	193	193	193	193	193	193	193	193	193
Mean		475 750	2005	2	1	1	887	25,66	0	217
Minimum		33 400	2004	1	1	0	476	12	0	36
Maximum		811 900	2009	5	5	5	1,419	46	1	386

Source: SPSS Output, adapted from Lightstone data.

4.4.2 Hedonic pricing model

Table 4.10: Birch Acres pre- and post-development

Model		Unstandardised Coefficients		t	Sig.
		B	Std. Error		
BIRCH ACRES PRE	(Constant)	-7029546.58	7155639.963	-0.982	0.327
	YEAR	11 560	6788.387	1.703	0.091
	BED	6044.99	6154.298	0.982	0.327
	BATH	14 253.23	4202.016	3.392	0.001
	GARAGE	102.59	39.521	2.596	0.01
	ERF	39 302.60	15548.903	2.528	0.012
	PROP_AGE	2 542.86	896.701	2.836	0.005
	POOL	3 481.34	3572.702	0.974	0.331
	DISTANCE	97.60	43.205	2.259	0.025
BIRCH ACRES POST	(Constant)	-33861378.32	13992142.93	-2.42	0.016
	YEAR	16 888.64	6974.752	2.421	0.016
	BED	4 619.83	21394.147	0.216	0.829
	BATH	13 953.43	17510.003	0.797	0.427
	GARAGE	11 797.49	11155.799	1.058	0.292
	ERF	209.35	77.284	2.709	0.007
	PROP_AGE	5 459.50	1988.127	2.746	0.007
	POOL	62 428.02	40804.199	1.53	0.128
	DISTANCE	354.35	117.06	3.02	0.003
Model Summary					
Model	R-square	Adjusted R-square	Std. Error of the Estimate	F	Sig.
BIRCH ACRES PRE	0,286	0.25	51801.187	7.962	.000
BIRCH ACRES POST	0,339	0.31	144859.33	11.773	.000

Source: SPSS Output, adapted from Lightstone data. The Birch Acres pre-development model has an adjusted R-square of 25%; therefore 25% of the variance in real price is determined by the structural and locational characteristics. The F-stat is 7.962 with a significance 0.000, suggesting that the regression as a whole is significant in explaining real price (y).

The Birch Acres post-development model has an adjusted R-square of 31%; therefore 31% of the variance in real price is determined by the structural and locational attributes. The F- stat is 2.885, with a significance of 0.009, suggesting that the regression as a whole is significant in explaining real price (y).

4.4.2.1 Birch Acres pre-development results

4.4.2.1.1 Structural characteristics

The regression output for the period 2000 to 2003 (Birch Acres pre) that the number of bathrooms was significant at a 1% level of significance and the number of garages, erf size, property age and distance was significant at the 5% level in determining a property's price before the affordable housing development. The year the property was sold is significant at the 10% level of significance.

The abovementioned variables had a positive influence on determining property prices during the 2000 to 2003 period. Every additional garage and year of property age in the Birch Acres area would increase the real price with R102 and R2 542, respectively *ceteris paribus*. A property with a larger erf size also had a higher asking price.

4.4.2.1.2 Locational characteristic

The distance to the greenfield significantly determined property prices prior to the affordable housing development. As the distance increased, the value of the house increases. A house located one metre further away increased with R97.60 hence, properties located closest to the greenfield had a lower residential price and it could be assumed that households perceived the greenfield space negatively.

This result is in line with previous findings in the literature as McConell and Walls (2005:10) concluded that houses further away from general parks are more valuable, showing a significant positive correlation between property price and distance.

4.4.2.2 Birch Acres post-development results

4.4.2.2.1 Structural characteristics

The regression output for the time period 2004 to 2009 (Birch Acres post) shows that erf size, property age and distance had a positive effect on determining property prices and are significant at the 1% level. The year the property was sold is positive and significant at the 5% level indicating that year has a positive effect on determining property prices. Results determined that if the erf size of a property increases, the property price will increase with R209 p/m *ceteris paribus*. Property age, on the other hand, indicated that if the age of the property increased, price increased with R5 459.

4.4.2.2.2 Locational characteristic

The variable *distance* from the affordable housing development is significant in determining property prices. The further away a property was located, the higher the property price; a house located one metre further away, increased with R354, indicative of the negative perception of affordable housing. This finding is aligned with the NIMBY literature of homeowners or individuals who oppose unwanted development that can devalue the neighbourhood.

The property price change is higher post-development, indicating that the affordable housing development and existing neighbourhood characteristics differ. Also, affordable housing had a larger negative effect on the residential market compared to the open space. The willingness to pay to reside further away increased post-development.

4.4.3 One-way analysis of variance

To further investigate the results, an ANOVA was conducted to provide an F-ratio to assess how well the regression model fits the data (Field, 2013:431). The latter compares the variability in scores between the different levels of one factor.

4.4.3.1 Birch Acres pre

Table 4.11: Birch Acres pre-development ANOVA

BED		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
2 BEDROOMS	1 BEDROOM	13700,000	30751,264	0,970	-66116,97	93516,97
	3 BEDROOMS	-31733.036*	11178,533	0,026	-60747,67	-2718,40
	>3 BEDROOMS	-43868,750	17530,918	0,063	-89371,42	1633,92
BATH		**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
1 BATHROOM	2 BATHROOM	-32480.438*	10957,358	0,018	-60921,00	-4039,88
	3 BATHROOM	-35104.457*	13227,344	0,043	-69436,92	-772,00
	>3 BATHROOM	-27887,791	30607,600	0,799	-107331,87	51556,29
GARAGE		**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
NO GARAGE	1 GARAGE	-44888.906*	10917,823	0,001	-75006,30	-14771,51
	2 GARAGE	-50259.498*	10407,734	0,000	-78969,79	-21549,21
	3 GARAGE	-80675.862*	25774,104	0,017	-151775,10	-9576,62
	>3 GARAGE	-54050,862	28586,709	0,326	-132908,82	24807,10
ERF		**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
<900 m^2	<800 m^2	-15544,654	33759,887	0,967	-103170,71	72081,40
	<1000 m^2	-30718.674*	10423,314	0,019	-57773,09	-3664,26
	>1000 m^2	-51763.593*	11601,847	0,000	-81876,97	-21650,22

Source: SPSS Output, adapted from Lightstone data.

The variables highlighted in *Table 4-11* depict the differences in means between the levels of the different variables. It was established that there was a significant difference between the levels when taking into account the variables bedrooms, bathrooms, garage and erf size, variable at $p\ lower\ than\ 0.05$. The *post hoc* test indicated that two bedrooms was significantly different from three bedrooms at *F-stat* (3.845), $p = 0.01$. The same was true for one bathroom compared to two bathrooms and for one and three bathrooms at *F-stat* (3.434), $p = 0.018$. The ETA squared for the different bedroom levels are calculated as 0.06 depicts a medium effect, whereas bathrooms (0.05) reflect a small effect.

Furthermore, the variable garage had a significant negative and large effect (0.16) when comparing no garages and one, two and three garages. Properties smaller than 900m^2 significantly differ from properties between 900 and 1000m^2. The different erf sizes have a large effect on property price. The effect size, calculated using ETA squared, was 0.11 and indicates a medium effect.

4.4.3.2 Birch Acres post

Table 4.12: Birch Acres post-development ANOVA

GARAGE		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
NO GARAGE	NO GARAGE	-85244,390	32836,964	0,075	-175691,65	5202,86
	1 GARAGE	-83146.265*	28398,769	0,031	-161368,81	-4923,73
	2 GARAGE	-138757,724	100083,367	0,637	-414430,77	136915,32
	3 GARAGE	-148549,390	87183,099	0,434	-388689,50	91590,72
ERF		**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
400-800 m^2	801-1000 m^2	-300830.152*	34957,553	0,000	-383407,85	-218252,45
	1001-1400 m^2	-346181.463*	39735,546	0,000	-440045,87	-252317,06
PROP_AGE		**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
20-30 age	31-40 age	-82694.641*	34493,856	0,046	-164176,98	-1212,30
	41-50 age	-155026,661	65926,068	0,051	-310759,04	705,72
DISTANCE		**Mean Difference**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
81-160 m	161-240 m	-221775.510*	39423,109	0,000	-330363,87	-113187,15
	241-320 m	-257074.359*	40861,854	0,000	-369625,65	-144523,07
	321-400 m	-316466.667*	42102,252	0,000	-432434,55	-200498,78
	> 400m	-319511.538*	39092,094	0,000	-427188,14	-211834,94

Source: SPSS Output, adapted from Lightstone data.

There was a statistically significant difference for the garage, erf size, property age and distance variables at $p\ lower\ than\ 0.05$. The resulting ETA squared for garage (0.06) had a medium effect, whereas erf size, property age and distance had large effects. The 81 to 160m distance group illustrates increasing property prices. However, the distance groups thereafter reflect higher property prices.

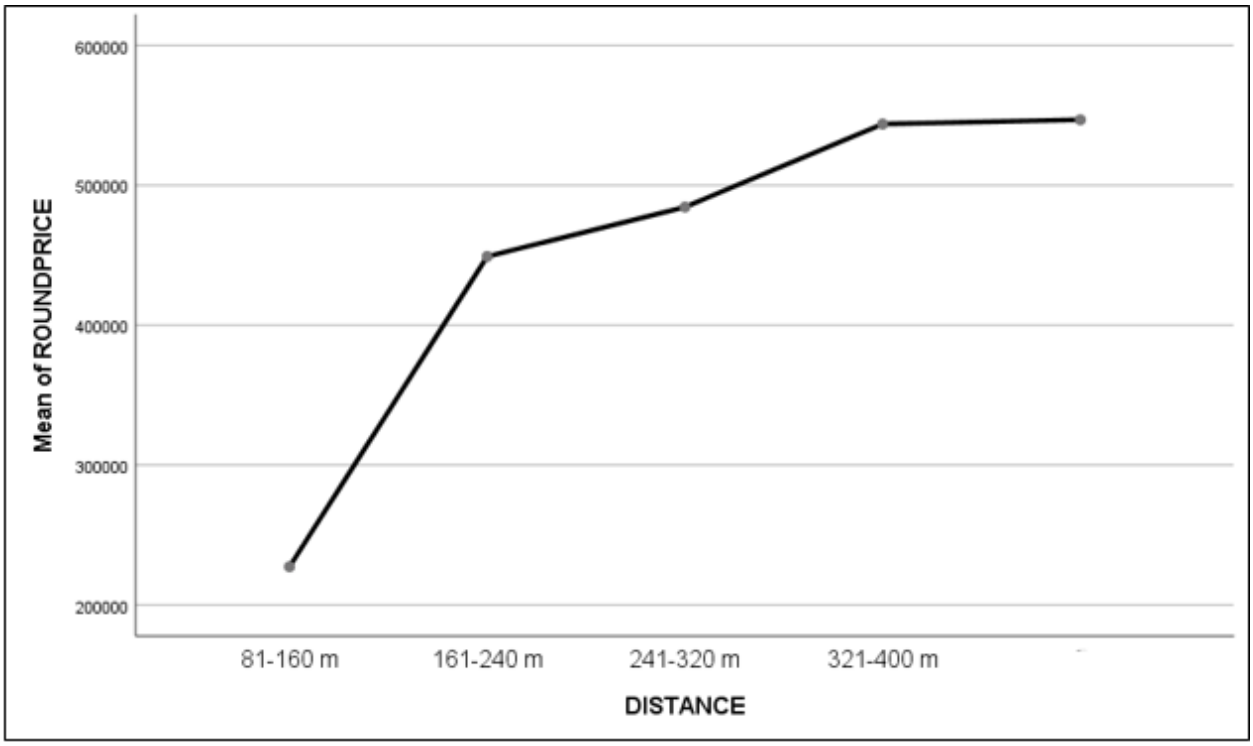

Figure 4.3: Birch Acres mean plot of real price and distance.
Source: SPSS Output.

The relationship illustrated in *Figure 4-4* shows that there is a steep increase in property prices when the property moves further away from the affordable housing project. The mean of the property prices reflects a sharp increase up to 160m. Thereafter, as the distance from the affordable housing increases, property prices increase at a lower rate. At 320m there is almost no more effect, confirming the HPM results that as homes increase in distance, the value of the house increases and this means that the property prices were negatively affected by the affordable housing development.

4.4.4 Paired sample t-test for Birch Acres

Table 4.13: Birch Acres paired samples statistics

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
BIRCH ACRES	PRICE - PRE_POST	343167,886	195255,569	10276,609	322958,160	363377,613	33,393	360	0,000

Source: SPSS Output, adapted from Lightstone data.

Table 4-13 shows a t-test value of 33.393 and 360 degrees of freedom with a significance of 0.000, suggesting that the two different time periods (pre-development and post-development) possibly affect property prices. The test proves that there is a statistically significant difference between the two conditions and that the means are not likely to change.

The magnitude of the differences in the mean (343 167,886) for Birch Acres was large; The ETA square (0.79) indicated that property prices differed from the pre-development to the post-development period.

4.4.5 Model summary of Birch Acres

- The Birch Acres case study revealed that the proximity of residential properties to open space and an affordable housing project does affect the market price of the existing neighbourhood.
- The results indicate that during the pre-development period properties located in close proximity to an open space were affected by the proximity to the open field. The price of a house would increase by R10 000 if it was 100m further away from the open area.

- Once the affordable housing development took place, this value increased significantly to R35 400 for every 100m further away. This is an indication that the market perceived the affordable housing as intrusive.
- The Birch Acres results align with the literature of Sirmans *et al.* (2005:9), who explain that the variables erf size and garage space reflect the majority of times statistically significant and positive when determining property prices. Sirmans *et al,* found that bathrooms appeared in 40 HPM studies, of which 34 cases reported the variable to have a significant positive effect. However, it is noteworthy to look at the variables erf and distance and compare them over the pre- and post-development period. Both variables are positive and significant in each period, though the variable erf size significantly diminished. A possible reason could be the trade-off between the neighbourhoods' value of shared open space and erf size. Some homeowners consider them substitutes – either larger residential lots or abundant shared open space in the neighbourhood. Others may view the residential lot size and open space as components of a larger bundle of housing attributes (Cho *et al.,* 2010:764).
- Property age is usually considered to affect property prices negatively, as reported by Sirmans et *al,* (2005:9). Property age appeared in 78 HPM studies, of which 63 cases reported a negative relationship. The average property age in Birch Acres was 26 before the development and 25 after the development, which means that the properties are fairly new. This indicates that properties in the area were built in the same period and probably with the same building material. Therefore, the properties' visual aesthetics could be similar, and consumers would view the age positively.
- The distance variable for both periods are negative, indicating that the households residing in Birch Acres viewed the greenfield and build-up in a bad light. However, the affordable housing had a larger negative effect on the residential market compared to the open space. One can assume that property owners have a common belief that affordable housing development located in close proximity to their homes will automatically decrease their property's value and the neighbourhood's aesthetic qualities (Wheatley, 2011).
- The magnitude of the differences in the mean for Birch Acres was large. The ETA square indicates that property prices differed from the pre-development to the post-development period.

4.5 Birch Acres post-post development

The FLISP housing development in Birch Acres started construction in 2004 and completed the project in 2006. The previous HPM conducted compared the years leading up to the construction of the housing development to the years of construction. The period between 2010 and 2018 will

possibly identify whether the market property prices adjusted after a few years had passed. If there is no significant effect when considering distance and property price during the Birch Acres post-post period, it means the type of affordable housing is fairly in line or similar to the residential market.

After applying the HPM (Appendix A), it was concluded that the distance variable does not significantly determine the property prices, although the effect that there was on the price of a property diminished. It seems the effect of the affordable housing project has been resolved. The distance variable also changed from a negative coefficient in the Birch Acres pre- and post-development model to positive in the Birch Acres post-post development model. This indicates that the perceived negative effect on property price for the existing neighbourhood was larger during construction than it was after the completion of the project. One possible reason is that price adjustment over time and market preferences have reduced this difference, in other words, property prices of the buffer area and affordable housing have converged.

4.6 Implication for Potchefstroom

4.6.1 Background

In the case of Potchefstroom, the city is forced to utilise space since it has difficulties with dolomite (Smit, 2017:1). Ikageng, a township bordering Potchefstroom's industrial area, is over-crowded, causing the municipality to turn to the city of Potchefstroom to develop on government-owned grounds, more specifically, open spaces such as parks (Leshage, 2018).

The majority of land in Potchefstroom is privately owned (87,34%), while the rest is owned by the municipality (3,44%) and other structures of state (9,22%) (NWDACERD, 2010:7). Recent residential developments in the eastern wing of Potchefstroom are mainly aimed at a higher-income group, whereas clustered informal housing to the west of Potchefstroom confirms the backlog of housing provision for low- to middle-income earners (NWDACERD, 2010:7).

The conservation of environmental features and the protection of open space areas should be considered when planning affordable housing. The Environmental Management Framework and Management Plan for Tlokwe (JB Marks) Local Municipality lists the protected areas as conservancies, dolomitic aquifers and dolomitic eyes, ridges, especially to the west of Potchefstroom, wetland areas, areas of high biodiversity, as well as agricultural land. Furthermore, Potchefstroom has three protected areas: Boskop Dam Nature Reserve; the Prozesky Bird Sanctuary and the Highveld National Park (NWDACERD, 2010:19).

The North West Provincial Spatial Development Framework (PSDF) identified Potchefstroom as a Priority One investment node (TLM, 2008:6) since the city has been one of a few high growth nodes in the province. The province is focussed on delivering public housing, restructuring cities and eradicating informal housing to zero per cent by 2030 (Provincial Development Plan, 2013:45). The JB Marks Municipality, therefore, aims to align with these frameworks, identifying economic nodes and introducing affordable housing development in open spaces in the city of Potchefstroom.

4.6.2 Development implications for Potchefstroom

4.6.2.1 Alignment with the locational and structural aspects:

The results from Fleurhof show a negligible impact on property prices before and after the construction of the affordable housing project, signifying that the integrated residential development did not negatively affect the existing residential market, but rather aligned with the current market prices. In the Birch Acres case study, there was a significantly higher effect on the price of houses.

Figure 4-6 considers that the price of a house is determined by various structural and locational aspects. This has an effect on the neighbourhood prices for various suburbs in Potchefstroom.

Figure 4.4: Average property price per bedroom in Potchefstroom.

Source: Author's own construction, Property 24, 2019.

In the Potchefstroom area, the prices align with both case studies. The average property price increases with every additional bedroom the property has. A property with one bedroom has an average price of R543 944 compared to a two- and three- bedroom property priced at R766 592 and R1 431 438, respectively. Properties with four and five bedrooms are almost double the average price, indicating that these properties are located in higher-income neighbourhoods. A property with four bedrooms has an average price of R2 120 518 and five bedrooms are priced at R3 066 917 (Property 24, 2019). The latter is not considered as suitable price range for an affordable housing development.

The following discussion aims to apply the results from the case studies to Potchefstroom to identify possible suburbs that could provide development options. *Figure 4-7* and *4-8* present the different suburb's average property price (blue bars) and number of bedrooms and bathrooms (red line).

Figure 4.5: Average property price and bedrooms

Source: Author's own construction, Property 24, 2019.

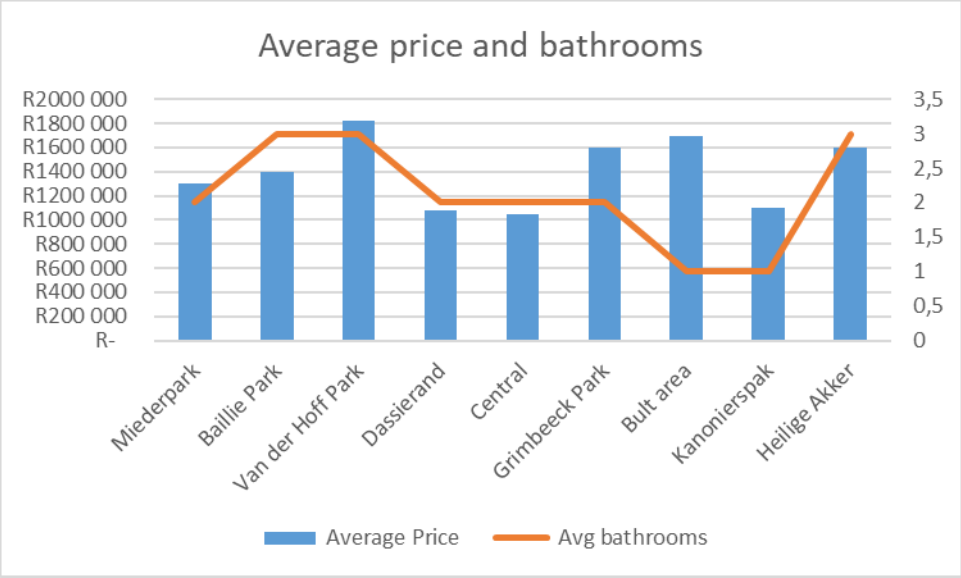

Figure 4.6: Average property price and bathrooms

Source: Author's own construction, Property 24, 2019.

Given *Figure 4-7* and *4-8*, a few areas could be considered for an affordable housing development. Properties in Dassierand and Potchefstroom Central have three bedrooms and two bathrooms on average and are listed at a lower price spectrum, indicating similar market prices and characteristics than an affordable housing development. Properties in the Bult area and Kanonierspark have the same number of bedrooms and bathrooms on average, nonetheless, the Bult's average property price is R200 000 higher than Kanonierspark. Close proximity to the North-West University could explain the higher price.

The remaining neighbourhoods in Potchefstroom consist of larger properties with a higher number of bedrooms and bathrooms and consequently has a higher property price. This includes Miederpark, the Heilige Akker, Grimbeeck Park and Van der Hoff Park.

Given *Figure 4-9*, some areas should not be considered for an affordable housing development since the property sizes and price differ from the representative high-density affordable housing. Miederpark, Grimbeeck Park, Van der Hoff Park, Baillie Park and the Bult area have erf sizes of 900m² and above, indicating that Kanonierspark, Dassierand and Potchefstroom Central with erf sizes of 800m² or less will be better neighbourhoods to develop a build-up.

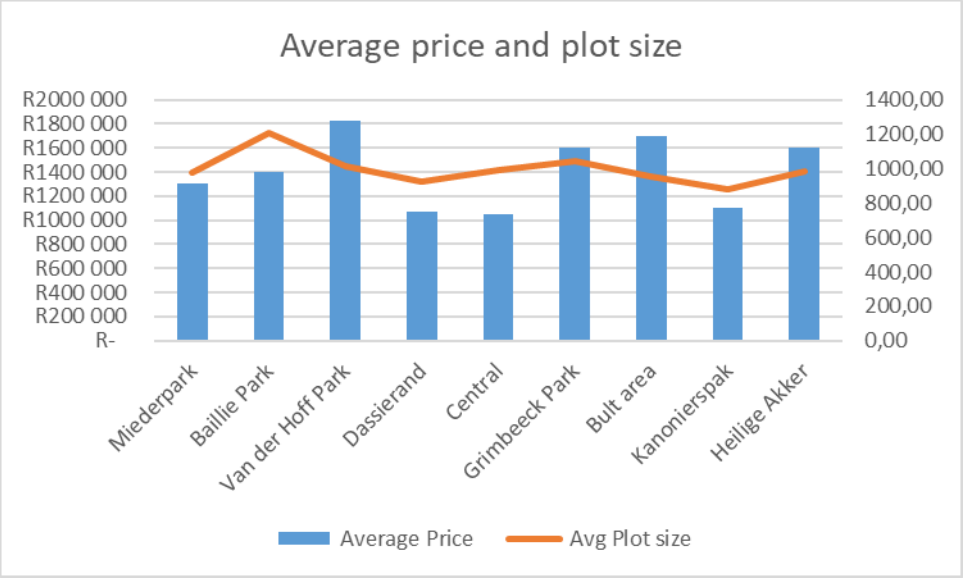

Figure 4.7: Average property price and plot size

Source: Author's own construction, Property 24, 2019.

4.6.2.2 Alignment with pricing

At the start of the construction of the affordable housing project, the average house price at Fleurhof was R583 845, while the average cost of a new house in the affordable development was R250 000. This shows that the difference in average price between the suburb and affordable housing project was approximately 43%.

In Birch Acres, the average house price was R190 857, while the average cost of a new house in the affordable development was approximately R67 000 (Demacon, 2017:57). This shows that the difference in average price between the suburb and affordable housing project was approximately 35%.

The results from the two case studies indicate a relatively good fit between an affordable housing development and Fleurhof with no significant negative effect on property prices, while Birch Acres on the other hand has shown a negative result. This point towards a potential tipping point where the existing neighbourhood property prices could be negatively influenced by the affordable housing project. The tipping point seems to be when there is a price difference somewhere below the 43% mark. Applying this variation to the existing Potchefstroom market indicates what the relative price of the affordable housing project should be for it not to have a negative impact on existing prices.

The different neighbourhoods in Potchefstroom are listed in *Table 4-14* to identify the average property price and average unique attributes. The average property trends and statistics for Potchefstroom reported by Property 24 recorded the average sale price in 2019 for houses and apartments are R1 050 000 and R524 000 respectively.

Table 4.14: Potchefstroom suburb characteristics

	Average dwelling property price	Average bedrooms	Average bathrooms	Average plot size
Miederpark	R 1 030 000	4	2	975 m²
Baillie Park	R 1 420 000	2	3	1209 m²
Van der Hoff Park	R 1 700 000	3	3	1010 m²
Dassierand	R 1 075 000	3	2	925 m²
Central	R 1 000 000	3	2	992 m²
Grimbeeck Park	R 1 485 000	3	2	1044 m²
Bult area	R 1 300 000	2	1	953 m²
Kanonierspark	R 1 100 000	2	1	879 m²
Heilige Akker	R 1 600 000	4	3	982 m²

Source: Author's own construction, Property 24, 2019.

Table 4.1: Proposed affordable housing prices

	Average dwelling price	Proposed affordable dwelling price	Average apartment price	Proposed apartment price
Miederpark	R 1 030 000	R442 900	R 575 000	R247 250
Baillie Park	R 1 420 000	R610 600	R 825 000	R354 750
Van der Hoff Park	R 1 700 000	R731 000	R 750 000	R322 500
Dassierand	R 1 075 000	R462 250	R522 500	R224 675
Central	R 1 000 000	R430 000	R 440 000	R189 200
Grimbeeck Park	R 1 485 000	R638 550	R 725 000	R311 750
Bult area	R 1 300 000	R559 000	R1032 500	R443 975
Kanonierspark	R 1 100 000	R473 000	R682 500	R293 475
Heilige Akker	R 1 600 000	R688 000	R1060 000	R455 800

Source: Author's own construction, Property 24, 2019.

Table 4-14 and *4-15* makes it clear that the Miederpark, Central Potchefstroom, Dassierand and Kanonierspark property values and characteristics align with Fleurhof and existing apartment prices align with Birch Acres, which indicate the areas where a higher portion of higher density units could be considered. The development should reflect a green buffer or playground between the existing neighbourhood and affordable housing project and the housing project typology layout should be done to ensure a gradual movement from the existing suburb property prices to more affordable units further away. This is in line with the Birch Acres result that shows no negative effect on property prices further than 360m.

4.7 Conclusion

The aim of the chapter was to analyse the different case studies, of Fleurhof and Birch Acres in two time periods, namely a pre- development and post-development period, and apply the results to Potchefstroom. The models allowed the researcher to compare the property prices before and after the construction of affordable housing project

An accurate property value includes the current market conditions, property price inflation rates and the stance of economic growth (Pirounakis, 2013:384). The property prices were adjusted for the property price index. The results of the Fleurhof case study revealed that market prices for residential properties were not affected by the affordable housing and that the affordable housing was in line with the aesthetic qualities of the area's typologies.

The paired sample t-test calculated the effect size for the difference in property prices before and after the development as 0.84, which indicates a large effect between the two means for each period.

The Birch Acres results showed that property prices were negatively affected during construction of the FLISP housing project, but after a few years the prices normalised due to price adjustment between the affordable housing and the neighbourhood.

The paired sample t-test calculated the effect size for the difference in property prices before and after the development as 0.79, which indicates a large effect between the two means for each period.

In terms of average bedrooms, Van der Hoff Park, Dassierand, Potchefstroom Central and Grimbeeck Park align with Fleurhof. In terms of bathrooms, Miederpark, Dassierand, Potchefstroom Central and Grimbeeck Park align with Fleurhof. Considering pricing, the Dassierand and Potchefstroom Central suburbs provide an opportunity to introduce the lowest cost affordable housing, while in Van der Hoff Park and Bailie Park affordable housing will be the

highest dwelling price. Regarding affordable apartment housing prices, the Bult area and the Heilige Akker will have the highest prices.

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This dissertation addressed the housing issue in South Africa and investigated the influence of developing affordable residential housing on the property prices of an existing neighbourhood. The effect of the past city planning is evident from the shortage and backlog of residential properties for low- to middle-income earners in South Africa. The increasing cost of providing public infrastructure and development on the periphery forces government to develop government-owned grounds; promoting urbanisation through developing affordable housing in available open spaces. In order to correct the imbalances that previously occurred, integrated residential developing programmes, as well as sound housing policies, should be put in place.

The JB Marks City Council in Potchefstroom, North West, recommended a residential development programme in open spaces to cater for a residential market where supply is lacking. The proposal can bring about a solution to the housing crisis. Developing residential housing in greenfield areas could be motivated by economies of scale and an affordability principle. However, the possible effect on residential prices, infrastructure restrictions and the capacity of such development on the existing, adjacent neighbourhoods should be considered. This study examined similar case studies in South Africa to determine the impact of affordable housing on property prices for Fleurhof in Roodepoort and Birch Acres in Kempton Park.

The integrated residential development of Fleurhof started construction in 2013 and was finished in 2016, whereas the Finance Linked Individual Subsidy Programme (FLISP) housing of Birch Acres was built from 2004 to 2009. Both case studies were considered in this study as it represents a built-up space that was previously an open space adjacent to the existing neighbourhood. Also, in these case studies the affordable housing is located in close proximity to the economically active areas of a suburb, meaning that they are not located on the periphery like previous subsidised government housing. Both case studies support the Breaking New Policy (BNP) and the Integrated Residential Development Programme (IRDP).

The data for both the case studies were collected from Lightstone Property®, cleaned and organised in an Excel sheet, adjusted for multicollinearity, and tested for heteroscedasticity in Statistical Package for the Social Sciences (SPSS). The study made use of the hedonic pricing model (HPM) to identify the variation of property prices in the two time periods. A one-way analysis of variance (ANOVA) was conducted to determine which structural and locational characteristics

had a significant positive or negative effect in each time period. The effect on property prices between the two periods was measured by means of an ETA squared test.

5.2 Addressing the research aim and objectives

The purpose of this study is to analyse the aggregate impact of affordable housing development in open spaces on the residential market of the surrounding areas. The objectives were applied to both case studies, of Fleurhof and Birch Acres in order to compare and report the findings. Both case studies successfully addressed the research objectives set out in the research study. *Table 5-1* discusses the specific study objectives, chapter reference and the method employed to address the objective.

Table 5.1: Addressing the research objectives

Research objective	Chapter reference	Method employed
To determine the effect of a new affordable housing development on property prices of existing neighbourhood.	Chapter 4, Section 4.3.3 Chapter 4, Section 4.4.3 Chapter 4, Section 4.3.4 Chapter 4, Section 4.4.5	Paired sample T-test and ETA squared test
To identify if structural and locational characteristics of the neighbourhood change in value after an affordable housing project is developed.	Chapter 2, Section 2.6.1 Chapter 3, Section 3.4.1 Chapter 4, Section 4.3.2 Chapter 4, Section 4.4.2	Hedonic Pricing Model
To identify which areas in Potchefstroom could be considered a good fit for an affordable housing project	Chapter 4, Section 4.7	Application on Potchefstroom

Source: Author's own analysis.

The study used the real price of properties, meaning that the price was adjusted for inflation, as well as structural and locational characteristics. The structural characteristics included the year in which the property was sold, the number of bedrooms and bathrooms, the erf size, the number of garages, pool dummy and the property age, whereas the locational characteristic reflected the distance a property is located from the greenfield or build-up.

In both case studies, the impact of the affordable housing development on property prices resulted in a large effect with the paired sample t-test significant at $p\ lower\ than\ 0.05.$ and ETA squared being reported as (0.84) and (0.79) for Fleurhof and Birch Acres respectively. The HPM identified whether structural and locational characteristics of the case studies changed in value after an affordable housing project is developed.

In the Fleurhof case study the variables, year and number of bedrooms' coefficient sign changed from a positive to negative post-development. Possible explanations are that the existing properties in the neighbourhood are older compared to the new development of housing adjacent to the neighbourhood and that the target market consumers prefer smaller houses, such as young couples. In addition, the negative impact each additional bedroom has on the property price can be indicative of a possible shift in demand for smaller houses that are more affordable as larger houses with more bedrooms are seen as more expensive.

The Fleurhof case study also revealed that the further away a property was located from the development the more the property's value decreased, and the average sale price of properties increased from 2012 to 2018. The value of the distance variable increased considerably, from R24 p/m prior the development to R782 per month (p/m) after the development. This suggests that the affordable housing project fits with the existing property market and did not negatively affect property prices since properties located further away had a higher negative value post-development.

In the Birch Acres case study, the coefficient signs of the variables remained positive in each time period. The results depicted that households residing in Birch Acres viewed the open space and affordable housing as negative. However, the affordable housing development had a larger negative effect on the residential market compared to the open space. Birch Acres shows a change in the value of the distance variable, from R95 p/m prior to the development to R354 p/m after the development. The Birch Acres post-post development model concluded that the value of the FLISP houses was in line with the adjacent neighbourhood's properties, and as such, limited the impact on market prices. The area's prices normalised a few years after the housing project had been completed.

5.3 Addressing the literature and the model results

Affordable housing has received much attention in literature since the World Economic Forum is committed to making affordable housing a reality in cities (WEF, 2019:1). The research study builds on previous literature studies on the topic. It is therefore prudent to analyse previous findings and compare them with the study's results. *Table 5-2* compares recent literature with the findings of Chapter 4.

Table 5.2: Addressing the literature and the results.

Literature	Case study findings
Affordable housing developments can increase a neighbourhood's property value if it is built in a neighbourhood with similar socio-economic characteristics (Botein & Freeman, 2002:360).	The affordable housing development had a positive effect on properties in Fleurhof since the further away a property was located, the more the property's value decreased, while the average sales price of properties increased from 2012 to 2018. This aligns with the studies done by Botein and Freeman (2002:360), Nguyen (2005:24), and Geoghegan, Lynch and Bucholtz (2003:44).
The development of affordable housing will have a significant devaluing impact on the residential market property prices of the surrounding neighbourhoods (Habitat for Humanity, 2017; Nelson & Genereux, 1992:359; Du Preez & Sale, 2013:463).	Considering the findings of the Fleurhof and Birch Acres case studies, the location of the affordable housing development coupled with the market pricing of the adjacent neighbourhood has a significant influence on prices. The results from this study show that when the affordable housing project fits in with the existing residential market pricing, there is no significant devaluing impact on property prices. However, in the case of Birch Acres, the affordable housing had a negative and devaluing impact on property prices.
A study done on the Walmer area in Nelson Mandela Bay indicated that affordable housing development had a statistically significant negative impact on the adjacent neighbourhood's residential property values (Du Preez & Sale, 2013:463).	The Birch Acres case study revealed that the proximity of residential properties to open space or an affordable housing project does affect the market price of the existing neighbourhood. The results indicate that during the pre-development period properties located in close proximity to an open space were affected by the proximity to the open field. The price of a house would increase by R10 000 for every 100m further away from the open area.

Source: Author's own analysis.

5.4 Assessing Potchefstroom's suburbs

The existing price trends of the adjacent suburbs play a role in the ease of integrating social housing development with the local market. Lower priced suburbs show better integration with social housing developments than a high-income suburb would. *Table 5-3* lists the suburbs in Potchefstroom and marks the characteristics that match the two case studies of Fleurhof and Birch Acres.

Table 5.3: Assessing Potchefstroom suburbs

Suburb	Price	Number of beds	Number of baths	Plot size
Miederpark	●	●	●	
Baillie Park				
Van der Hoff Park		●		
Dassierand	●	●	●	●
Central	●	●	●	
Grimbeeck Park		●	●	
Bult area				●
Kanonierspark	●			●
Heilige Akker				

Source: Author's own analysis.

In this table, each suburb in Potchefstroom's property price, number of bedrooms, number of bathrooms and plot size are compared to the average values of the previous case studies. The comparison is marked with a bullet if the value is similar to the case studies. Ideally, the suburb in Potchefstroom that is marked with a bullet for each characteristic would be the best location for the proposed affordable housing.

The only suburb in Potchefstroom that complies with the case study characteristics and has a similar open space between the existing neighbourhood and the township is Dassierand. The open spaces in the other areas are small and located in the town as parks. It could very well have a positive effect on price if the parks are negatively viewed due to crime rates and undesirable activities and if the affordable housing's characteristics are similar to the suburb. This highlights the importance of making sure that the affordable housing prices are in line with those of the neighbourhood. Birch Acres' post-post showed normalisation in residential market prices after a few years.

In summary, the results of the Fleurhof case study revealed that market prices for residential properties were not affected by the affordable housing and that the affordable housing was in line with the aesthetic qualities of the area's typologies. Whereas, the Birch Acres results showed that property prices were negatively affected during construction of the FLISP housing project, however after a few years the prices normalised due to price adjustment between the affordable housing and the neighbourhood. The final results indicate that it is possible to integrate an

affordable housing project with an existing neighbourhood without negatively influencing the property prices if the structural characteristics of these areas align.

5.5 Policy recommendations

The JB Marks Local Municipality should develop the areas that were identified in the research study, namely Dassierand, Miederpark, Potchefstroom Central and Kanonierspark for the affordable housing development to mitigate the perceived negative effect on property prices. The affordable housing development should have similar characteristics and amenities as the surrounding area to have a positive impact on the neighbourhood and to improve integration, accessibility, efficiency, image and ownership. Consequently, the developers of the affordable housing development should align the affordable development so that it does not negatively affect the existing neighbourhood pricing and structural characteristics.

The JB Marks Municipality should consult the property owners of the identified areas since an integral part of deciding whether the open space or park should be preserved or whether its land-use policies should be upgraded is for city and regional planners to know how the neighbourhood's residents value the open space.

In addition, urban planners and policymakers should consider the spatial context when deciding to develop affordable housing. Its effect on property values also depend on neighbourhood income, crime rates and families with children. Urban planners and the city council should include a green buffer or playground between the existing neighbourhood and affordable housing project and the housing project typology layout should be done in such a way that it ensures a gradual movement from the existing suburb property prices to more affordable units further away.

The local municipality should also define a strategy and implication plan that include short-term actions to address the effect of affordable housing on the adjacent neighbourhood's property prices and long-term measures to maintain and improve the affordable housing development.

5.6 Recommendation for further studies

Additional research building on the findings of this research study is needed. Other studies that relate to the research problem can address concepts such as the market differential analysis, minimum price analysis and socio-economic surveys. The market differential analysis is useful to determine the type of location characteristics and determine the type of housing suitable, whereas the minimum price analysis is used to estimate the lowest possible new residential unit price without negatively influence the market price of environs houses. The socio-economic survey can determine how the adjacent neighbourhood values the open space.

Limitations regarding this study includes that the HPM assumes that market price adjustments are in line with changes in attributes. However, there is in reality a lag associated with price changes. Further studies should address this limitation.

The research study addressed the research problem in a specific affordable housing context, further studies can address the same research in a different context or location, for example to determine the impact of developing a residential estate adjacent to a neighbourhood. The latter impact can be contrasted with these research study's findings.

Further studies can also expand the theory of the study, such as determining the impact on property tax income for the local authority.

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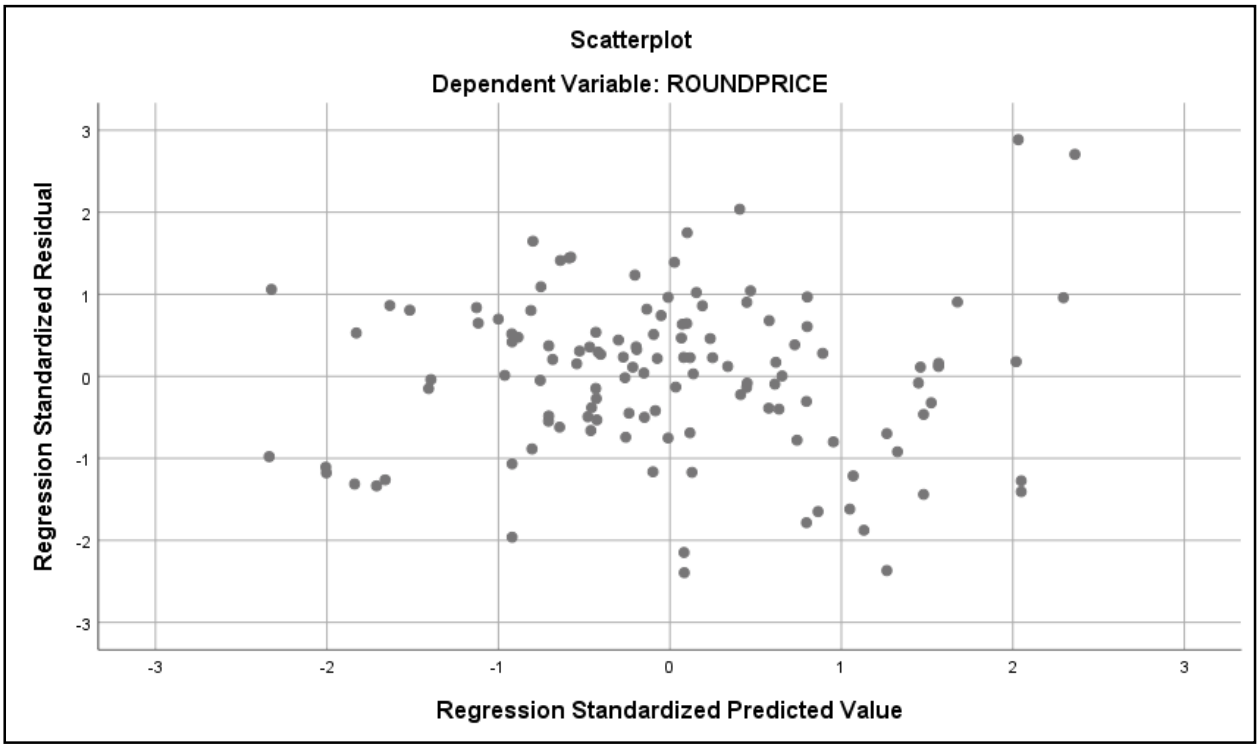
ANNEXURES

ANNEXURE 1: NATIONAL MARKET DATA: FNB SOUTH AFRICA AVERAGE PROPERTY PRICE INDEX

2000/12/31	101
2001/12/31	104,2332592
2002/12/31	118,1329722
2003/12/31	141,0289299
2004/12/31	188,6644215
2005/12/31	242,7797143
2006/12/31	283,2493118
2007/12/31	324,1199339
2008/12/31	320,8598426
2009/12/31	315,7664178
2010/12/31	329,4946431
2011/12/31	339,9477414
2012/12/31	357,4115065
2013/12/31	380,4126236
2014/12/31	409,6652361
2015/12/31	435,0615279
2016/12/31	459,3979553
2017/12/31	479,0388857
2018/12/31	497,1803861

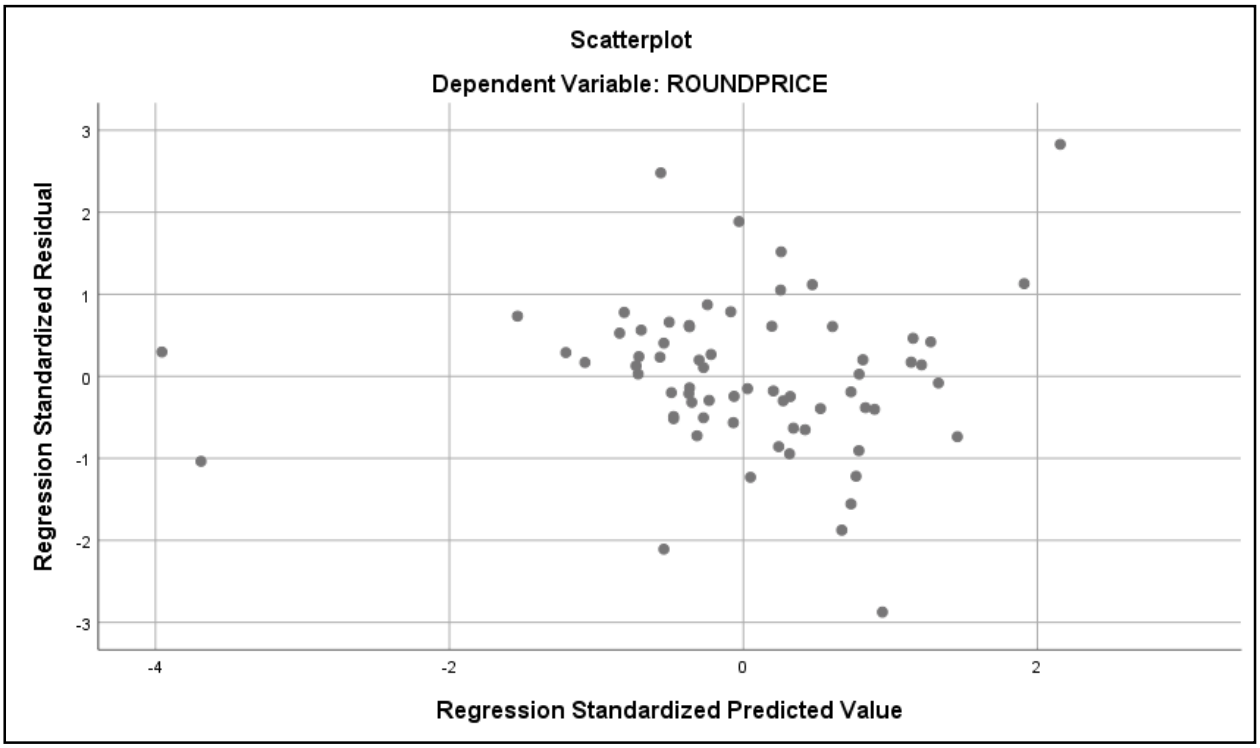
Source: FNB Property Price Index

ANNEXURE 2: HETEROSCEDASTICITY TEST FOR FLEURHOF PRE



Source: SPSS output

ANNEXURE 3: HETEROSCEDASTICITY FOR FLEURHOF POST



ANNEXURE 4: BIRCH ACRES POST-POST DEVELOPMENT

Model		Unstandardised Coefficients		t	Sig.
		B	Std. Error		
BIRCH ACRES POST-POST	(Constant)	-29770974,04	11466872	-2,596	0,01
	YEAR	15084,92	5699,509	2,647	0,009
	BED	25398,05	22535,26	1,127	0,261
	BATH	27554,99	21249,62	1,297	0,197
	GARAGE	27238,47	16141,99	1,687	0,094
	ERF	326,97	116,805	2,799	0,006
	PROP_AGE	-7729,69	2792,777	-2,768	0,006
	POOL	38212,59	46600,12	0,82	0,413
	DISTANCE	164,971	154,186	1,07	0,286
Model Summary[b]					
Model	**R-square**	**Adjusted R-square**	**Std. Error of the Estimate**	**F**	**Sig.**
BIRCH ACRES POST-POST	0,205	0,163	175077	4,927	.000

Source: Adapted from Lightstone Data.

ANNEXURE 5: DECLARATION OF LANGUAGE EDITING

cumlaude
language practitioners

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DECLARATION OF LANGUAGE EDITING

I, Christina Maria Etrecia Terblanche, hereby declare that I edited the research study titled:

Determining the impact of affordable housing development on property prices of adjacent neighbourhoods in South Africa

for **Aliska Ludick** for the purpose of submission as a postgraduate research study. Changes were indicated in track changes and implementation was left to the author.

Regards,

CME Terblanche

Cum Laude Language Practitioners (CC)

South African Translators Institute accr nr: 1001066

Full member of the Professional Editors Guild